

EUROPEAN COMMISSION

Directorate-General for Research and Innovation

Research & Innovation Outreach
Research & Industrial Infrastructures



GRANT AGREEMENT

NUMBER 871115 — ACTRIS IMP

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

the **European Union** ('the EU'), represented by the European Commission ('the Commission'),

represented for the purposes of signature of this Agreement by Head of Unit, Directorate-General for Research and Innovation, Innovative Administration, Financial Management & Program Support I, Pascale CID,

and

on the other part,

1. 'the coordinator':

ILMATIETEEN LAITOS (FMI), established in Erik Palmenin aukio 1, HELSINKI 00560, Finland, VAT number: FI02446647, represented for the purposes of signing the Agreement by Hannele KORHONEN

and the following other beneficiaries, if they sign their 'Accession Form' (see Annex 3 and Article 56):

- 2. **HELSINGIN YLIOPISTO (UHEL)**, established in YLIOPISTONKATU 3, HELSINGIN YLIOPISTO 00014, Finland, VAT number: FI03134717,
- 3. **CONSIGLIO NAZIONALE DELLE RICERCHE (CNR)**, established in PIAZZALE ALDO MORO 7, ROMA 00185, Italy, VAT number: IT02118311006,
- 4. **LEIBNIZ INSTITUT FUER TROPOSPHAERENFORSCHUNG e.V. (TROPOS)**, established in Permoserstrasse 15, LEIPZIG 04318, Germany, VAT number: DE159729585,
- 5. **KARLSRUHER INSTITUT FUER TECHNOLOGIE (KIT)**, established in KAISERSTRASSE 12, KARLSRUHE 76131, Germany, VAT number: DE266749428,
- 6. **FORSCHUNGSZENTRUM JULICH GMBH (FZJ)**, established in WILHELM JOHNEN STRASSE, JULICH 52428, Germany, VAT number: DE122624631,
- 7. CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (CNRS), established in RUE MICHEL ANGE 3, PARIS 75794, France, VAT number: FR40180089013,

- 8. **INSTITUT MINES-TELECOM (IMT)**, established in 37 ET 39 RUE DAREAU, PARIS 75014, France, VAT number: FR55180092025,
- 9. **INSTITUT NATIONAL DE L ENVIRONNEMENT ET DES RISQUES INERIS (INERIS)**, established in Parc Technologique Alata, VERNEUIL EN HALATTE 60550, France, VAT number: FR73381984921,
- 10. **NORSK INSTITUTT FOR LUFTFORSKNING STIFTELSE (NILU)**, established in INSTITUTTVEIEN 18, KJELLER 2027, Norway, VAT number: NO941705561MVA,
- 11. **NATIONAL INSTITUTE OF RESEARCH AND DEVELOPMENT FOR OPTOELECTRONICS (INOE)**, established in ATOMISTILOR STREET 409, MAGURELE RO77125, Romania, VAT number: RO9113623,
- 12. **PAUL SCHERRER INSTITUT (PSI)**, established in FORSCHUNGSTRASSE 111, VILLIGEN PSI 5232, Switzerland, VAT number: CHE116133392MWST,
- 13. **EIDGENOSSISCHE MATERIALPRUFUNGS- UND FORSCHUNGSANSTALT (EMPA)**, established in UEBERLANDSTRASSE 129, DUBENDORF 8600, Switzerland, VAT number: CHE116133475MWST,
- 14. **KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT-KNMI (KNMI)**, established in UTRECHTSEWEG 297, DE BILT 3731 GA, Netherlands, VAT number: NL821693992B01,
- 15. **INSTITUT ROYAL D'AERONOMIE SPATIALEDE BELGIQUE (BIRA-IASB)**, established in AVENUE CIRCULAIRE 3, BRUXELLES 1180, Belgium, VAT number: BE0349010750,
- 16. **THE UNIVERSITY OF MANCHESTER (UNIMAN)**, established in OXFORD ROAD, MANCHESTER M13 9PL, United Kingdom, VAT number: GB849738956,
- 17. **UNITED KINGDOM RESEARCH AND INNOVATION (UKRI)**, established in POLARIS HOUSE NORTH STAR AVENUE, SWINDON SN2 1FL, United Kingdom, VAT number: GB287461957,
- 18. **THE CYPRUS INSTITUTE (CYI)**, established in CONSTANTINOU KAVAFI 20, LEFKOSIA 2121, Cyprus, VAT number: CY10167225J,
- 19. **UNIWERSYTET WARSZAWSKI (UNIWARSAW)**, established in KRAKOWSKIE PRZEDMIESCIE 26/28, WARSZAWA 00 927, Poland, VAT number: PL5250011266,
- 20. **LUNDS UNIVERSITET (ULUND)**, established in Paradisgatan 5c, LUND 22100, Sweden, VAT number: SE202100321101,
- 22. **MEDIZINISCHE UNIVERSITAT INNSBRUCK (MUI)**, established in CHRISTOPH PROBST PLATZ 1, INNSBRUCK 6020, Austria, VAT number: ATU57495455,
- 23. **ZENTRALANSTALT FUR METEOROLOGIE UNDGEODYNAMIK (ZAMG)**, established in HOHE WARTE 38, WIEN 1190, Austria,

- 24. USTAV CHEMICKYCH PROCESU AV CR, v. v. i. (ICPF), established in ROZVOJOVA 135, PRAHA 6 165 02, Czechia, VAT number: CZ67985858,
- 25. NATIONAL OBSERVATORY OF ATHENS (NOA), established in LOFOS NYMFON, ATHINA 11810, Greece, VAT number: EL090050779,
- 26. **IDRYMA TECHNOLOGIAS KAI EREVNAS (FORTH)**, established in N PLASTIRA STR 100, IRAKLEIO 70013, Greece, VAT number: EL090101655,
- 27. INSTITUTE OF NUCLEAR RESEARCH AND NUCLEAR ENERGY BULGARIAN ACADEMY OF SCIENCES (INRNE-BAS), established in Tzarigradsko Shose 72, SOFIA 1784, Bulgaria, VAT number: 2226027192,
- 28. UNIVERSITY COLLEGE CORK NATIONAL UNIVERSITY OF IRELAND, CORK (UCC), established in WESTERN ROAD, CORK T12 YN60, Ireland, VAT number: IE0006286E,
- 29. **AARHUS UNIVERSITET (AU)**, established in NORDRE RINGGADE 1, AARHUS C 8000, Denmark, VAT number: DK31119103,
- 30. UNIVERSITAT POLITECNICA DE CATALUNYA (UPC), established in CALLE JORDI GIRONA 31, BARCELONA 08034, Spain, VAT number: ESQ0818003F,
- 31. FUNDACION CENTRO DE ESTUDIOS AMBIENTALES DEL MEDITERRANEO (CEAM), established in Parque Tecnologico, C/ Charles R. Darwin 14, PATERNA, VALENCIA 46980, Spain, VAT number: ESG46957213,
- 32. **UNIVERSIDAD DE VALLADOLID (UVA)**, established in PLAZA SANTA CRUZ 8 PALACIO DE SANTA CRUZ, VALLADOLID 47002, Spain, VAT number: ESQ4718001C,
- 33. **EESTI MAAULIKOOL (EULS)**, established in KREUTZWALDI 1, TARTU 51014, Estonia, VAT number: EE100018015,
- 34. **UNIVERSIDADE DE EVORA (UEvora)**, established in LARGO DOS COLEGIAIS 2, EVORA 7000 803, Portugal, VAT number: PT501201920,
- and 21. the **Joint Research Centre (JRC)** established in Rue de la Loi 200, BRUSSELS 1049, Belgium, if it signs the 'Administrative Arrangement' (see Annex 3b).

Unless otherwise specified, references to 'beneficiary' or 'beneficiaries' include the coordinator and the Joint Research Centre (JRC).

The parties referred to above have agreed to enter into the Agreement under the terms and conditions below.

By signing the Agreement or the Accession Form or the Administrative Arrangement, the beneficiaries accept the grant and agree to implement it under their own responsibility and in accordance with the Agreement, with all the obligations and conditions it sets out.

The Agreement is composed of:

Terms and Conditions

Annex 1	Description of the action
Annex 2	Estimated budget for the action
	2a Additional information on the estimated budget
Annex 3	Accession Forms
	3b Administrative Arrangement
Annex 4	Model for the financial statements
Annex 5	Model for the certificate on the financial statements
Annex 6	Model for the certificate on the methodology

TERMS AND CONDITIONS

TABLE OF CONTENTS

CHAPTER 1 C	GENERAL	13
ARTIC	LE 1 — SUBJECT OF THE AGREEMENT	13
CHAPTER 2 A	ACTION	13
ARTIC	LE 2 — ACTION TO BE IMPLEMENTED	13
ARTIC	LE 3 — DURATION AND STARTING DATE OF THE ACTION	13
ARTIC	LE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS	13
4.1	Estimated budget	13
4.2	Budget transfers	13
CHAPTER 3 (GRANT	13
ARTIC	LE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORM COSTS	
5.1	Maximum grant amount	13
5.2	Form of grant, reimbursement rates and forms of costs	13
5.3	Final grant amount — Calculation	14
5.4	Revised final grant amount — Calculation.	16
ARTIC	LE 6 — ELIGIBLE AND INELIGIBLE COSTS	16
6.1	General conditions for costs to be eligible	16
6.2	Specific conditions for costs to be eligible	17
6.3	Conditions for costs of linked third parties to be eligible	23
6.4	Conditions for in-kind contributions provided by third parties free of charge to be eligible	24
6.5	Ineligible costs	24
6.6	Consequences of declaration of ineligible costs	24
CHAPTER 4	RIGHTS AND OBLIGATIONS OF THE PARTIES	24
SECTION 1	RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION	24
ARTIC	LE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION	25
7.1	General obligation to properly implement the action	25
7.2	Consequences of non-compliance.	25
ARTIC	LE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED I ACTION	
ARTIC	LE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING	
ARTIC	LE 10 — PURCHASE OF GOODS, WORKS OR SERVICES	25

	10.1	Rules for purchasing goods, works or services	25
	10.2	Consequences of non-compliance	26
	ARTICL	E 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT	26
	11.1	Rules for the use of in-kind contributions against payment	26
	11.2	Consequences of non-compliance.	27
	ARTICL	E 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE	27
	12.1	Rules for the use of in-kind contributions free of charge	27
	12.2	Consequences of non-compliance	27
	ARTICL	E 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS	27
	13.1	Rules for subcontracting action tasks	27
	13.2	Consequences of non-compliance	28
	ARTICL	E 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES	28
	14.1	Rules for calling upon linked third parties to implement part of the action	28
	14.2	Consequences of non-compliance.	29
	ARTICL	E 14a — IMPLEMENTATION OF ACTION TASKS BY INTERNATIONAL PARTNERS	30
	ARTICL	E 15 — FINANCIAL SUPPORT TO THIRD PARTIES	30
	15.1	Rules for providing financial support to third parties.	30
	15.2	Financial support in the form of prizes.	30
	15.3	Consequences of non-compliance.	30
	ARTICL	E 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE	30
	16.1	Rules for providing trans-national access to research infrastructure	30
	16.2	Rules for providing virtual access to research infrastructure	32
	16.3	Consequences of non-compliance.	32
SEC	ΓΙΟN 2	RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION	32
	ARTICL	E 17 — GENERAL OBLIGATION TO INFORM	32
	17.1	General obligation to provide information upon request	32
	17.2	Obligation to keep information up to date and to inform about events and circumstances likely taffect the Agreement	
	17.3	Consequences of non-compliance	33
	ARTICL	E 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION	33
	18.1	Obligation to keep records and other supporting documentation	33
	18.2	Consequences of non-compliance	34
	ARTICL	E 19 — SUBMISSION OF DELIVERABLES	34

	19.1	Obligation to submit deliverables	34
	19.2	Consequences of non-compliance	34
AR	TICLI	E 20 — REPORTING — PAYMENT REQUESTS	35
	20.1	Obligation to submit reports	35
	20.2	Reporting periods	35
	20.3	Periodic reports — Requests for interim payments	35
	20.4	Final report — Request for payment of the balance	36
	20.5	Information on cumulative expenditure incurred	37
	20.6	Currency for financial statements and conversion into euro.	37
	20.7	Language of reports.	37
	20.8	Consequences of non-compliance	37
AR	TICLI	E 21 — PAYMENTS AND PAYMENT ARRANGEMENTS	37
	21.1	Payments to be made	37
	21.2	Pre-financing payment — Amount — Amount retained for the Guarantee Fund	38
	21.3	Interim payments — Amount — Calculation	38
	21.4	Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund	39
	21.5	Notification of amounts due	40
	21.6	Currency for payments	40
	21.7	Payments to the coordinator — Distribution to the beneficiaries	40
	21.8	Bank account for payments	40
	21.9	Costs of payment transfers	40
	21.10	Date of payment	41
	21.11	Consequences of non-compliance	41
AR	TICLI	E 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS	41
	22.1	Checks, reviews and audits by the Commission	41
	22.2	Investigations by the European Anti-Fraud Office (OLAF)	43
	22.3	Checks and audits by the European Court of Auditors (ECA)	43
	22.4	Checks, reviews, audits and investigations for international organisations.	44
	22.5	Consequences of findings in checks, reviews, audits and investigations — Extension of findings	44
	22.6	Consequences of non-compliance	45
AR	TICLI	E 23 — EVALUATION OF THE IMPACT OF THE ACTION	45
	23.1	Right to evaluate the impact of the action.	46
	23.2	Consequences of non-compliance	46

SECTION 3	RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS	46
SUBSECTION	ON 1 GENERAL	46
ARTICL	E 23a — MANAGEMENT OF INTELLECTUAL PROPERTY	46
23a.1	Obligation to take measures to implement the Commission Recommendation on the manage of intellectual property in knowledge transfer activities	
23a.2	Consequences of non-compliance	46
SUBSECTION	ON 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND	46
ARTICL	E 24 — AGREEMENT ON BACKGROUND	47
24.1	Agreement on background	47
24.2	Consequences of non-compliance.	47
ARTICL	E 25 — ACCESS RIGHTS TO BACKGROUND	47
25.1	Exercise of access rights — Waiving of access rights — No sub-licensing	47
25.2	Access rights for other beneficiaries, for implementing their own tasks under the action	47
25.3	Access rights for other beneficiaries, for exploiting their own results	47
25.4	Access rights for affiliated entities	48
25.5	Access rights for third parties	48
25.6	Consequences of non-compliance.	48
SUBSECTION	ON 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS	48
ARTICL	E 26 — OWNERSHIP OF RESULTS	48
26.1	Ownership by the beneficiary that generates the results	48
26.2	Joint ownership by several beneficiaries	49
26.3	Rights of third parties (including personnel)	49
26.4	EU ownership, to protect results	49
26.5	Consequences of non-compliance.	50
ARTICL	E 27 — PROTECTION OF RESULTS — VISIBILITY OF EU FUNDING	50
27.1	Obligation to protect the results	50
27.2	EU ownership, to protect the results	51
27.3	Information on EU funding	51
27.4	Consequences of non-compliance	51
ARTICL	E 28 — EXPLOITATION OF RESULTS	51
28.1	Obligation to exploit the results	51
28.2	Results that could contribute to European or international standards — Information on EU funding	51
28.3	Consequences of non-compliance	52
ARTICL	E 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF EU	52

	29.1	Obligation to disseminate results	52
	29.2	Open access to scientific publications	52
	29.3	Open access to research data	53
	29.4	Information on EU funding — Obligation and right to use the EU emblem	53
	29.5	Disclaimer excluding Commission responsibility	54
	29.6	Consequences of non-compliance.	54
	ARTICL	E 30 — TRANSFER AND LICENSING OF RESULTS	54
	30.1	Transfer of ownership.	54
	30.2	Granting licenses.	54
	30.3	Commission right to object to transfers or licensing	55
	30.4	Consequences of non-compliance	55
	ARTICL	E 31 — ACCESS RIGHTS TO RESULTS	55
	31.1	Exercise of access rights — Waiving of access rights — No sub-licensing	55
	31.2	Access rights for other beneficiaries, for implementing their own tasks under the action	55
	31.3	Access rights for other beneficiaries, for exploiting their own results	55
	31.4	Access rights of affiliated entities.	55
	31.5	Access rights for the EU institutions, bodies, offices or agencies and EU Member States	56
	31.6	Access rights for third parties.	56
	31.7	Consequences of non-compliance	56
SEC	ΓΙΟΝ 4	OTHER RIGHTS AND OBLIGATIONS	56
	ARTICL	E 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS	56
	32.1	Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers	56
	32.2	Consequences of non-compliance	56
	ARTICL	E 33 — GENDER EQUALITY	57
	33.1	Obligation to aim for gender equality	57
	33.2	Consequences of non-compliance	57
	ARTICL	E 34 — ETHICS AND RESEARCH INTEGRITY	57
	34.1	Obligation to comply with ethical and research integrity principles	57
	34.2	Activities raising ethical issues	58
	34.3	Activities involving human embryos or human embryonic stem cells	58
	34.4	Consequences of non-compliance	58
	ARTICL	E 35 — CONFLICT OF INTERESTS	59
	35.1	Obligation to avoid a conflict of interests	59
	35.2	Consequences of non-compliance	59

ARTICI	LE 36 — CONFIDENTIALITY	59
36.1	General obligation to maintain confidentiality	59
36.2	Consequences of non-compliance	60
ARTICI	LE 37 — SECURITY-RELATED OBLIGATIONS	60
37.1	Results with a security recommendation	60
37.2	Classified information	60
37.3	Activities involving dual-use goods or dangerous materials and substances	60
37.4	Consequences of non-compliance	60
ARTICI	LE 38 — PROMOTING THE ACTION — VISIBILITY OF EU FUNDING	60
38.1	Communication activities by beneficiaries	61
38.2	Communication activities by the Commission	61
38.3	Consequences of non-compliance	62
ARTICI	LE 39 — PROCESSING OF PERSONAL DATA	63
39.1	Processing of personal data by the Commission	63
39.2	Processing of personal data by the beneficiaries	63
39.3	Consequences of non-compliance	63
ARTICI	LE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE COMMISSION	63
WIT	IVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP TH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WITH PARTNERS OF A NT ACTION	A
ARTICI	LE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WIT PARTNERS OF A JOINT ACTION	
41.1	Roles and responsibility towards the Commission.	64
41.2	Internal division of roles and responsibilities	64
41.3	Internal arrangements between beneficiaries — Consortium agreement.	65
41.4	Relationship with complementary beneficiaries — Collaboration agreement	65
41.5	Relationship with partners of a joint action — Coordination agreement	66
	EJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTION AMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE	
	REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — NCTIONS	66
ARTICI	LE 42 — REJECTION OF INELIGIBLE COSTS	66
42.1	Conditions	66
42.2	Ineligible costs to be rejected — Calculation — Procedure	66
42.3	Effects.	66
ARTICI	LE 43 — REDUCTION OF THE GRANT	67

43.1	Conditions	67
43.2	Amount to be reduced — Calculation — Procedure	67
43.3	Effects	67
ARTICL	E 44 — RECOVERY OF UNDUE AMOUNTS	68
44.1	Amount to be recovered — Calculation — Procedure	68
ARTICL	E 45 — ADMINISTRATIVE SANCTIONS	72
SECTION 2	LIABILITY FOR DAMAGES	72
ARTICL	E 46 — LIABILITY FOR DAMAGES	72
46.1	Liability of the Commission	72
46.2	Liability of the beneficiaries.	72
SECTION 3	SUSPENSION AND TERMINATION	72
ARTICL	E 47 — SUSPENSION OF PAYMENT DEADLINE	72
47.1	Conditions	72
47.2	Procedure	73
ARTICL	E 48 — SUSPENSION OF PAYMENTS	73
48.1	Conditions	73
48.2	Procedure	73
ARTICL	E 49 — SUSPENSION OF THE ACTION IMPLEMENTATION	74
49.1	Suspension of the action implementation, by the beneficiaries	74
49.2	Suspension of the action implementation, by the Commission	74
ARTICL	E 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES	
50.1	Termination of the Agreement, by the beneficiaries	76
50.2	Termination of the participation of one or more beneficiaries, by the beneficiaries	76
50.3	Termination of the Agreement or the participation of one or more beneficiaries, by the Commission	79
SECTION 4	FORCE MAJEURE	83
ARTICL	E 51 — FORCE MAJEURE	83
CHAPTER 7 FI	NAL PROVISIONS	84
ARTICL	E 52 — COMMUNICATION BETWEEN THE PARTIES	84
52.1	Form and means of communication.	84
52.2	Date of communication.	84
52.3	Addresses for communication.	85
ARTICL	E 53 — INTERPRETATION OF THE AGREEMENT	85
53.1	Precedence of the Terms and Conditions over the Annexes	85
53.2	Privileges and immunities.	85

Associated with document Ref. Ares 2019 6815 178 11 04/9 1/2019

ARTICL	E 54 — CALCULATION OF PERIODS, DATES AND DEADLINES	85
ARTICL	E 55 — AMENDMENTS TO THE AGREEMENT	85
55.1	Conditions.	85
55.2	Procedure	85
ARTICL	E 56 — ACCESSION TO THE AGREEMENT	86
56.1	Accession of the beneficiaries mentioned in the Preamble	86
56.2	Addition of new beneficiaries	86
ARTICL	E 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES	87
57.1	Applicable law	87
57.2	Dispute settlement	87
ARTICL	E 58 — ENTRY INTO FORCE OF THE AGREEMENT	87

CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and the terms and conditions applicable to the grant awarded to the beneficiaries for implementing the action set out in Chapter 2.

CHAPTER 2 ACTION

ARTICLE 2 — ACTION TO BE IMPLEMENTED

The grant is awarded for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project' — 'ACTRIS IMP' ('action'), as described in Annex 1.

ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION

The duration of the action will be **48 months** as of 1 January 2020 ('starting date of the action').

ARTICLE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS

4.1 Estimated budget

The 'estimated budget' for the action is set out in Annex 2.

It contains the estimated eligible costs and the forms of costs, broken down by beneficiary (and linked third party) and budget category (see Articles 5, 6, and 14).

4.2 Budget transfers

The estimated budget breakdown indicated in Annex 2 may be adjusted — without an amendment (see Article 55) — by transfers of amounts between beneficiaries, budget categories and/or forms of costs set out in Annex 2, if the action is implemented as described in Annex 1.

However, the beneficiaries may not add costs relating to subcontracts not provided for in Annex 1, unless such additional subcontracts are approved by an amendment or in accordance with Article 13.

CHAPTER 3 GRANT

ARTICLE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORMS OF COSTS

5.1 Maximum grant amount

The 'maximum grant amount' is EUR 4 999 997.50 (four million nine hundred and ninety nine thousand nine hundred and ninety seven EURO and fifty eurocents).

5.2 Form of grant, reimbursement rates and forms of costs

The grant reimburses 100% of the action's eligible costs (see Article 6) ('reimbursement of eligible costs grant') (see Annex 2).

The estimated eligible costs of the action are EUR **4 999 997.50** (four million nine hundred and ninety nine thousand nine hundred and ninety seven EURO and fifty eurocents).

Eligible costs (see Article 6) must be declared under the following forms ('forms of costs'):

- (a) for **direct personnel costs** (excluding direct personnel costs covered by the unit cost under Point (f)):
 - as actually incurred costs ('actual costs') or
 - on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('unit costs').

Personnel **costs for SME owners** or **beneficiaries that are natural persons** not receiving a salary (see Article 6.2, Points A.4 and A.5) must be declared on the basis of the amount per unit set out in Annex 2a (**unit costs**);

- (b) for **direct costs for subcontracting** (excluding subcontracting costs covered by the unit cost under Point (f)): as actually incurred costs (**actual costs**);
- (c) for **direct costs of providing financial support to third parties** (excluding costs of financial support covered by the unit cost under Point (f)): not applicable;
- (d) for **other direct costs** (excluding other direct costs covered by the unit cost under Point (f)):
 - for costs of internally invoiced goods and services: on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('unit costs');
 - for all other costs: as actually incurred costs (actual costs);
- (e) for **indirect costs** (excluding indirect costs covered by the unit cost under Point (f)): on the basis of a flat-rate applied as set out in Article 6.2, Point E ('flat-rate costs');
- (f) for 'Costs for providing trans-national access to research infrastructure': on the basis of the amount(s) per unit set out in Annex 2a (unit costs).

5.3 Final grant amount — Calculation

The 'final grant amount' depends on the actual extent to which the action is implemented in accordance with the Agreement's terms and conditions.

This amount is calculated by the Commission — when the payment of the balance is made (see Article 21.4) — in the following steps:

- Step 1 Application of the reimbursement rates to the eligible costs
- Step 2 Limit to the maximum grant amount
- Step 3 Reduction due to the no-profit rule

Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

5.3.1 Step 1 — Application of the reimbursement rates to the eligible costs

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries and linked third parties (see Article 20) and approved by the Commission (see Article 21).

5.3.2 Step 2 — Limit to the maximum grant amount

If the amount obtained following Step 1 is higher than the maximum grant amount set out in Article 5.1, it will be limited to the latter.

5.3.3 Step 3 — Reduction due to the no-profit rule

The grant must not produce a profit.

'**Profit**' means the surplus of the amount obtained following Steps 1 and 2 plus the action's total receipts, over the action's total eligible costs.

The 'action's total eligible costs' are the consolidated total eligible costs approved by the Commission.

The 'action's total receipts' are the consolidated total receipts generated during its duration (see Article 3).

The following are considered **receipts**:

- (a) income generated by the action; if the income is generated from selling equipment or other assets purchased under the Agreement, the receipt is up to the amount declared as eligible under the Agreement;
- (b) financial contributions given by third parties to the beneficiary or to a linked third party specifically to be used for the action, and
- (c) in-kind contributions provided by third parties free of charge and specifically to be used for the action, if they have been declared as eligible costs.

The following are however not considered receipts:

- (a) income generated by exploiting the action's results (see Article 28);
- (b) financial contributions by third parties, if they may be used to cover costs other than the eligible costs (see Article 6);
- (c) financial contributions by third parties with no obligation to repay any amount unused at the end of the period set out in Article 3.

If there is a profit, it will be deducted from the amount obtained following Steps 1 and 2.

5.3.4 Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations — Reduced grant amount — Calculation

If the grant is reduced (see Article 43), the Commission will calculate the reduced grant amount by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the maximum grant amount set out in Article 5.1.

The final grant amount will be the lower of the following two:

- the amount obtained following Steps 1 to 3 or
- the reduced grant amount following Step 4.

5.4 Revised final grant amount — Calculation

If — after the payment of the balance (in particular, after checks, reviews, audits or investigations; see Article 22) — the Commission rejects costs (see Article 42) or reduces the grant (see Article 43), it will calculate the 'revised final grant amount' for the beneficiary concerned by the findings.

This amount is calculated by the Commission on the basis of the findings, as follows:

- in case of **rejection of costs**: by applying the reimbursement rate to the revised eligible costs approved by the Commission for the beneficiary concerned;
- in case of **reduction of the grant**: by calculating the concerned beneficiary's share in the grant amount reduced in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations (see Article 43.2).

In case of **rejection of costs and reduction of the grant**, the revised final grant amount for the beneficiary concerned will be the lower of the two amounts above.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS

6.1 General conditions for costs to be eligible

'Eligible costs' are costs that meet the following criteria:

(a) for actual costs:

- (i) they must be actually incurred by the beneficiary;
- (ii) they must be incurred in the period set out in Article 3, with the exception of costs relating to the submission of the periodic report for the last reporting period and the final report (see Article 20);
- (iii) they must be indicated in the estimated budget set out in Annex 2;
- (iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation;
- (v) they must be identifiable and verifiable, in particular recorded in the beneficiary's accounts in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices;

- (vi) they must comply with the applicable national law on taxes, labour and social security, and
- (vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency;

(b) for unit costs:

(i) they must be calculated as follows:

{amounts per unit set out in Annex 2a or calculated by the beneficiary in accordance with its usual cost accounting practices (see Article 6.2, Point A and Article 6.2.D.5) multiplied by

the number of actual units};

- (ii) the number of actual units must comply with the following conditions:
 - the units must be actually used or produced in the period set out in Article 3;
 - the units must be necessary for implementing the action or produced by it, and
 - the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 18);

(c) for flat-rate costs:

- (i) they must be calculated by applying the flat-rate set out in Annex 2, and
- (ii) the costs (actual costs or unit costs) to which the flat-rate is applied must comply with the conditions for eligibility set out in this Article.

6.2 Specific conditions for costs to be eligible

Costs are eligible if they comply with the general conditions (see above) and the specific conditions set out below for each of the following budget categories:

- A. direct personnel costs;
- B. direct costs of subcontracting;
- C. not applicable;
- D. other direct costs;
- E. indirect costs;
- F. 'Costs for providing trans-national access to research infrastructure'.

'Direct costs' are costs that are directly linked to the action implementation and can therefore be attributed to it directly. They must not include any indirect costs (see Point E below).

'Indirect costs' are costs that are not directly linked to the action implementation and therefore cannot be attributed directly to it.

A. Direct personnel costs (not covered by Point F)

Types of eligible personnel costs

A.1 Personnel costs are eligible, if they are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action ('costs for employees (or equivalent)'). They must be limited to salaries (including during parental leave), social security contributions, taxes and other costs included in the remuneration, if they arise from national law or the employment contract (or equivalent appointing act).

Beneficiaries that are non-profit legal entities¹ may also declare as personnel costs **additional remuneration** for personnel assigned to the action (including payments on the basis of supplementary contracts regardless of their nature), if:

- (a) it is part of the beneficiary's usual remuneration practices and is paid in a consistent manner whenever the same kind of work or expertise is required;
- (b) the criteria used to calculate the supplementary payments are objective and generally applied by the beneficiary, regardless of the source of funding used.
- 'Additional remuneration' means any part of the remuneration which exceeds what the person would be paid for time worked in projects funded by national schemes.

Additional remuneration for personnel assigned to the action is eligible up to the following amount:

- (a) if the person works full time and exclusively on the action during the full year: up to EUR 8 000;
- (b) if the person works exclusively on the action but not full-time or not for the full year: up to the corresponding pro-rata amount of EUR 8 000, or
- (c) if the person does not work exclusively on the action: up to a pro-rata amount calculated as follows:

```
{{EUR 8 000 divided by the number of annual productive hours (see below)}, multiplied by the number of hours that the person has worked on the action during the year}.
```

- A.2 The **costs for natural persons working under a direct contract** with the beneficiary other than an employment contract are eligible personnel costs, if:
 - (a) the person works under conditions similar to those of an employee (in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed);
 - (b) the result of the work carried out belongs to the beneficiary (unless exceptionally agreed otherwise), and

¹ For the definition, see Article 2.1(14) of the Rules for Participation Regulation No 1290/2013: 'non-profit legal entity' means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.

- (c) the costs are not significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.
- A.3 The **costs of personnel seconded by a third party against payment** are eligible personnel costs, if the conditions in Article 11.1 are met.
- A.4 Costs of owners of beneficiaries that are small and medium-sized enterprises ('SME owners') who are working on the action and who do not receive a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.
- A.5 Costs of 'beneficiaries that are natural persons' not receiving a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.
- A.6 Personnel costs for providing trans-national access to research infrastructure are eligible only if also the conditions set out in Article 16.1.1 are met.

Calculation

Personnel costs must be calculated by the beneficiaries as follows:

```
{{hourly rate multiplied by the number of actual hours worked on the action}, plus for non-profit legal entities: additional remuneration to personnel assigned to the action under the conditions set out above (Point A.1)}.
```

The number of actual hours declared for a person must be identifiable and verifiable (see Article 18).

The total number of hours declared in EU or Euratom grants, for a person for a year, cannot be higher than the annual productive hours used for the calculations of the hourly rate. Therefore, the maximum number of hours that can be declared for the grant are:

```
{number of annual productive hours for the year (see below)
minus
total number of hours declared by the beneficiary, for that person in that year, for other EU or Euratom
grants}.
```

The 'hourly rate' is one of the following:

(a) for personnel costs declared as **actual costs** (i.e. budget categories A.1, A.2, A.3 and A.6): the hourly rate is calculated *per full financial year*, as follows:

```
{actual annual personnel costs (excluding additional remuneration) for the person divided by number of annual productive hours}.
```

using the personnel costs and the number of productive hours for each full financial year covered by the reporting period concerned. If a financial year is not closed at the end of the reporting period, the beneficiaries must use the hourly rate of the last closed financial year available.

For the 'number of annual productive hours', the beneficiaries may choose one of the following:

- (i) 'fixed number of hours': 1 720 hours for persons working full time (or corresponding pro-rata for persons not working full time);
- (ii) 'individual annual productive hours': the total number of hours worked by the person in the year for the beneficiary, calculated as follows:

{annual workable hours of the person (according to the employment contract, applicable collective labour agreement or national law)

plus

overtime worked

minus

absences (such as sick leave and special leave)}.

'Annual workable hours' means the period during which the personnel must be working, at the employer's disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.

If the contract (or applicable collective labour agreement or national working time legislation) does not allow to determine the annual workable hours, this option cannot be used;

(iii) 'standard annual productive hours': the 'standard number of annual hours' generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the 'standard annual workable hours'.

If there is no applicable reference for the standard annual workable hours, this option cannot be used.

For all options, the actual time spent on **parental leave** by a person assigned to the action may be deducted from the number of annual productive hours.

As an alternative, beneficiaries may calculate the hourly rate *per month*, as follows:

```
{actual monthly personnel cost (excluding additional remuneration) for the person divided by
{number of annual productive hours / 12}}
```

using the personnel costs for each month and (one twelfth of) the annual productive hours calculated according to either option (i) or (iii) above, i.e.:

- fixed number of hours or

- standard annual productive hours.

Time spent on **parental leave** may not be deducted when calculating the hourly rate per month. However, beneficiaries may declare personnel costs incurred in periods of parental leave in proportion to the time the person worked on the action in that financial year.

If parts of a basic remuneration are generated over a period longer than a month, the beneficiaries may include only the share which is generated in the month (irrespective of the amount actually paid for that month).

Each beneficiary must use only one option (per full financial year or per month) for each full financial year;

- (b) for personnel costs declared on the basis of **unit costs** (i.e. budget categories A.1, A.2, A.4, A.5 and A.6): the hourly rate is one of the following:
 - (i) for SME owners or beneficiaries that are natural persons: the hourly rate set out in Annex 2a (see Points A.4 and A.5 above), or
 - (ii) for personnel costs declared on the basis of the beneficiary's usual cost accounting practices: the hourly rate calculated by the beneficiary in accordance with its usual cost accounting practices, if:
 - the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
 - the hourly rate is calculated using the actual personnel costs recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

The actual personnel costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information;

and

- the hourly rate is calculated using the number of annual productive hours (see above).
- **B.** Direct costs of subcontracting (not covered by Point F) (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if the conditions in Article 13 1 1 are met

Subcontracting costs for providing trans-national access to research infrastructure are eligible only if also the conditions set out in Article 16.1.1 are met.

C. Direct costs of providing financial support to third parties (not covered by Point F)

Not applicable

D. Other direct costs (not covered by Point F)

D.1 **Travel costs and related subsistence allowances** (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if they are in line with the beneficiary's usual practices on travel.

Travel costs **for providing trans-national access to research infrastructure** are eligible only if also the conditions set out in Article 16.1.1 are met.

D.2 The **depreciation costs of equipment, infrastructure or other assets** (new or second-hand) as recorded in the beneficiary's accounts are eligible, if they were purchased in accordance with Article 10.1.1 and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.

The **costs of renting or leasing** equipment, infrastructure or other assets (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

The costs of equipment, infrastructure or other assets **contributed in-kind against payment** are eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets, do not include any financing fees and if the conditions in Article 11.1 are met.

The only portion of the costs that will be taken into account is that which corresponds to the duration of the action and rate of actual use for the purposes of the action.

As an exception, the beneficiaries must not declare such costs (i.e. costs of renting, leasing, purchasing depreciable equipment, infrastructure and other assets) for providing trans-national access to research infrastructure (see Article 16.1).

- D.3 Costs of other goods and services (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible, if they are:
 - (a) purchased specifically for the action and in accordance with Article 10.1.1 or
 - (b) contributed in kind against payment and in accordance with Article 11.1.

Such goods and services include, for instance, consumables and supplies, dissemination (including open access), protection of results, certificates on the financial statements (if they are required by the Agreement), certificates on the methodology, translations and publications.

Costs of other goods and services for providing trans-national access to research infrastructure are eligible only if also the conditions set out in Article 16.1.1 are met.

- D.4 Capitalised and operating costs of 'large research infrastructure'. Not applicable
- D.5 Costs of internally invoiced goods and services directly used for the action are eligible, if:
 - (a) they are declared on the basis of a unit cost calculated in accordance with the beneficiary's usual cost accounting practices;

² 'Large research infrastructure' means research infrastructure of a total value of at least EUR 20 million, for a beneficiary, calculated as the sum of historical asset values of each individual research infrastructure of that beneficiary, as they appear in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure.

- (b) the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
- (c) the unit cost is calculated using the actual costs for the good or service recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.
 - The actual costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the costs, reasonable and correspond to objective and verifiable information;
- (d) the unit cost excludes any costs of items which are not directly linked to the production of the invoiced goods or service.

'Internally invoiced goods and services' means goods or services which are provided by the beneficiary directly for the action and which the beneficiary values on the basis of its usual cost accounting practices.

E. Indirect costs (not covered by Point F)

Indirect costs are eligible if they are declared on the basis of the flat-rate of 25% of the eligible direct costs (see Article 5.2 and Points A to D above), from which are excluded:

- (a) costs of subcontracting and
- (b) costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises;
- (c) not applicable;
- (d) unit costs under Articles 5.2(f) and 6.2.F.

Beneficiaries receiving an operating grant⁴ financed by the EU or Euratom budget cannot declare indirect costs for the period covered by the operating grant, unless they can demonstrate that the operating grant does not cover any costs of the action.

F. 'Costs for providing trans-national access to research infrastructure'

'Costs for providing trans-national access to research infrastructure' are eligible if they correspond to the amount per unit set out in Annex 2a multiplied by the actual number of units and if the conditions set out in Article 16 1 are met

6.3 Conditions for costs of linked third parties to be eligible

Costs incurred by linked third parties are eligible if they fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 14.1.1.

⁴ For the definition, see Article 121(1)(b) of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 ('Financial Regulation No 966/2012')(OJ L 218, 26.10.2012, p.1): 'operating grant' means direct financial contribution, by way of donation, from the budget in order to finance the functioning of a body which pursues an aim of general EU interest or has an objective forming part of and supporting an EU policy.

6.4 Conditions for in-kind contributions provided by third parties free of charge to be eligible

In-kind contributions provided free of charge are eligible direct costs (for the beneficiary or linked third party), if the costs incurred by the third party fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 12.1.

6.5 Ineligible costs

'Ineligible costs' are:

- (a) costs that do not comply with the conditions set out above (Article 6.1 to 6.4), in particular:
 - (i) costs related to return on capital;
 - (ii) debt and debt service charges;
 - (iii) provisions for future losses or debts;
 - (iv) interest owed;
 - (v) doubtful debts;
 - (vi) currency exchange losses;
 - (vii) bank costs charged by the beneficiary's bank for transfers from the Commission;
 - (viii) excessive or reckless expenditure;
 - (ix) deductible VAT;
 - (x) costs incurred during suspension of the implementation of the action (see Article 49);
- (b) costs declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU or Euratom budget and grants awarded by bodies other than the Commission for the purpose of implementing the EU or Euratom budget); in particular, indirect costs if the beneficiary is already receiving an operating grant financed by the EU or Euratom budget in the same period, unless it can demonstrate that the operating grant does not cover any costs of the action.

6.6 Consequences of declaration of ineligible costs

Declared costs that are ineligible will be rejected (see Article 42).

This may also lead to any of the other measures described in Chapter 6.

CHAPTER 4 RIGHTS AND OBLIGATIONS OF THE PARTIES

SECTION 1 RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION

ARTICLE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION

7.1 General obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement and all legal obligations under applicable EU, international and national law

7.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED IN THE ACTION

The beneficiaries must have the appropriate resources to implement the action.

If it is necessary to implement the action, the beneficiaries may:

- purchase goods, works and services (see Article 10);
- use in-kind contributions provided by third parties against payment (see Article 11);
- use in-kind contributions provided by third parties free of charge (see Article 12);
- call upon subcontractors to implement action tasks described in Annex 1 (see Article 13);
- call upon linked third parties to implement action tasks described in Annex 1 (see Article 14);
- call upon international partners to implement action tasks described in Annex 1 (see Article 14a).

In these cases, the beneficiaries retain sole responsibility towards the Commission and the other beneficiaries for implementing the action.

ARTICLE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING EU FUNDING

Not applicable

ARTICLE 10 — PURCHASE OF GOODS, WORKS OR SERVICES

10.1 Rules for purchasing goods, works or services

10.1.1 If necessary to implement the action, the beneficiaries may purchase goods, works or services.

The beneficiaries must make such purchases ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The beneficiaries must ensure that the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their contractors.

10.1.2 Beneficiaries that are 'contracting authorities' within the meaning of Directive 2004/18/EC⁵ (or 2014/24/EU⁶) or 'contracting entities' within the meaning of Directive 2004/17/EC⁷ (or 2014/25/EU⁸) must comply with the applicable national law on public procurement.

10.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 10.1.1, the costs related to the contract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 10.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT

11.1 Rules for the use of in-kind contributions against payment

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties against payment.

The beneficiaries may declare costs related to the payment of in-kind contributions as eligible (see Article 6.1 and 6.2), up to the third parties' costs for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services.

The third parties and their contributions must be set out in Annex 1. The Commission may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

⁵ Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts (OJ L 134, 30.04.2004, p. 114).

⁶ Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC. (OJ L 94, 28.03.2014, p. 65).

⁷ Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors (OJ L 134, 30.04.2004, p. 1)

⁸ Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC (OJ L 94, 28.03.2014, p. 243).

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs related to the payment of the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE

12.1 Rules for the use of in-kind contributions free of charge

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties free of charge.

The beneficiaries may declare costs incurred by the third parties for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services as eligible in accordance with Article 6.4.

The third parties and their contributions must be set out in Annex 1. The Commission may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs incurred by the third parties related to the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS

13.1 Rules for subcontracting action tasks

13.1.1 If necessary to implement the action, the beneficiaries may award subcontracts covering the implementation of certain action tasks described in Annex 1.

Subcontracting may cover only a limited part of the action.

The beneficiaries must award the subcontracts ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The tasks to be implemented and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2. The Commission

may however approve subcontracts not set out in Annex 1 and 2 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- they do not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their subcontractors.

13.1.2 The beneficiaries must ensure that their obligations under Articles 35, 36, 38 and 46 also apply to the subcontractors.

Beneficiaries that are 'contracting authorities' within the meaning of Directive 2004/18/EC (or 2014/24/EU) or 'contracting entities' within the meaning of Directive 2004/17/EC (or 2014/25/EU) must comply with the applicable national law on public procurement.

13.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 13.1.1, the costs related to the subcontract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 13.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES

14.1 Rules for calling upon linked third parties to implement part of the action

14.1.1 The following affiliated entities¹⁰ and third parties with a legal link to a beneficiary¹¹ ('linked third parties') may implement the action tasks attributed to them in Annex 1:

- under the direct or indirect control of a participant, or
- under the same direct or indirect control as the participant, or
- directly or indirectly controlling a participant.

'Control' may take any of the following forms:

¹⁰ For the definition see Article 2.1(2) Rules for Participation Regulation No 1290/2013: '**affiliated entity**' means any legal entity that is:

⁽a) the direct or indirect holding of more than 50% of the nominal value of the issued share capital in the legal entity concerned, or of a majority of the voting rights of the shareholders or associates of that entity;

⁽b) the direct or indirect holding, in fact or in law, of decision-making powers in the legal entity concerned. However the following relationships between legal entities shall not in themselves be deemed to constitute controlling relationships:

⁽a) the same public investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50% of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;

⁽b) the legal entities concerned are owned or supervised by the same public body.

¹¹ 'Third party with a legal link to a beneficiary' is any legal entity which has a legal link to the beneficiary implying collaboration that is not limited to the action.

- UNIVERSITE DE VERSAILLES SAINT-QUENTIN-EN-YVELINES. (UVSQ), affiliated or linked to CNRS
- UNIVERSITE DE LILLE (LILLE), affiliated or linked to CNRS
- UNIVERSITE GRENOBLE ALPES (UGA), affiliated or linked to CNRS
- UNIVERSITE PARIS XII VAL DE MARNE (UPEC), affiliated or linked to CNRS
- TECHNISCHE UNIVERSITEIT DELFT (TUD), affiliated or linked to KNMI
- Instytut Geofizyki Polskiej Akademii Nauk (IGF-PAS), affiliated or linked to UNIWARSAW
- CESKY HYDROMETEOROLOGICKY USTAV (CHMI), affiliated or linked to ICPF
- NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS" (NCSR-D), affiliated or linked to NOA
- INSTITUT PRO ELEKTRONIKA NA BAN INSTITUTE OF ELECTRONICS BULGARIAN ACADEMY OF SCIENCES (IE-BAS), affiliated or linked to INRNE-BAS
- CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT (CIEMAT), affiliated or linked to UPC
- UNIVERSIDAD DE GRANADA (UGR), affiliated or linked to UPC
- BARCELONA SUPERCOMPUTING CENTER CENTRO NACIONAL DE SUPERCOMPUTACION (BSC), affiliated or linked to UPC
- INSTITUTO NACIONAL DE TECNICA AEROESPACIAL ESTEBAN TERRADAS (INTA), affiliated or linked to UPC
- AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS (CSIC), affiliated or linked to CEAM
- AGENCIA ESTATAL DE METEOROLOGIA (AEMET), affiliated or linked to UVA

The linked third parties may declare as eligible the costs they incur for implementing the action tasks in accordance with Article 6.3.

The beneficiaries must ensure that the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their linked third parties.

14.1.2 The beneficiaries must ensure that their obligations under Articles 18, 20, 35, 36 and 38 also apply to their linked third parties.

14.2 Consequences of non-compliance

If any obligation under Article 14.1.1 is breached, the costs of the linked third party will be ineligible (see Article 6) and will be rejected (see Article 42).

If any obligation under Article 14.1.2 is breached, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14a — IMPLEMENTATION OF ACTION TASKS BY INTERNATIONAL PARTNERS

Not applicable

ARTICLE 15 — FINANCIAL SUPPORT TO THIRD PARTIES

15.1 Rules for providing financial support to third parties

Not applicable

15.2 Financial support in the form of prizes

Not applicable

15.3 Consequences of non-compliance

Not applicable

ARTICLE 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE

16.1 Rules for providing trans-national access to research infrastructure

16.1.1 'Access providers' must provide access to research infrastructure or installations in accordance with the following conditions:

(a) access which must be provided:

The access must be free of charge, trans-national access to research infrastructure or installations for selected user-groups.

This access must include the logistical, technological and scientific support and the specific training that is usually provided to external researchers using the infrastructure.

(b) categories of users that may have access:

Trans-national access must be provided to selected 'user-groups', i.e. teams of one or more researchers (users) led by a 'user group leader'.

The user group leader and the majority of the users must work in a country other than the country(ies) where the installation is located.

This rule does not apply:

¹³ 'Access provider' means a beneficiary or linked third party that is in charge of providing access to one or more research infrastructures or installations, or part of them, as described in Annex 1.

¹⁴ 'Installation' means a part or a service of a research infrastructure that could be used independently from the rest. A research infrastructure consists of one or more installations.

- if access is provided by an International organisation, the Joint Research Centre (JRC), an ERIC or similar legal entities;
- in case of remote access to a set of installations located in different countries offering the same type of service.

Only user groups that are allowed to disseminate the results they have generated under the action may benefit from the access, unless the users are working for SMEs.

Access for user groups with a majority of users not working in a EU or associated country¹⁵ is limited to 20% of the total amount of units of access provided under the grant, unless a higher percentage is foreseen in Annex 1;

(c) procedure and criteria for selecting user groups:

The user groups must request access by submitting (in writing) a description of the work that they wish to carry out and the names, nationalities and home institutions of the users.

The user groups must be selected by a **selection panel** set up by the access providers.

The selection panel must be composed of international experts in the field, at least half of them independent from the beneficiaries, unless otherwise specified in Annex 1.

The selection panel must assess all proposals received and recommend a short-list of the user groups that should benefit from access.

The selection panel must base its selection on scientific merit, taking into account that priority should be given to user groups composed of users who:

- have not previously used the installation and
- are working in countries where no equivalent research infrastructure exist.

It will apply the principles of transparency, fairness and impartiality.

(d) other conditions:

The access provider must request written approval from the Commission (see Article 52) for the selection of user groups requiring visits to the installation(s) exceeding 3 months, unless such visits are foreseen in Annex 1

16.1.2 In addition, the access provider must:

- advertise widely, including on a dedicated website, the access offered under the Agreement;
- promote equal opportunities in advertising the access and take into account the gender dimension when defining the support provided to users;

¹⁵ For the definition, see Article 2.1(3) of the Rules for Participation Regulation No 1290/2013: 'associated country' means a third country which is party to an international agreement with the Union, as identified in Article 7 of Horizon 2020 Framework Programme Regulation No 1291/2013. Article 7 sets out the conditions for association of non-EU countries to Horizon 2020.

- ensure that users comply with the terms and conditions of this Agreement;
- ensure that its obligations under Articles 35, 36, 38 and 46 also apply to the users.

16.2 Rules for providing virtual access to research infrastructure

Not applicable

16.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Articles 16.1.1 and 16.2, the costs of access will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Articles 16.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SECTION 2 RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION

ARTICLE 17 — GENERAL OBLIGATION TO INFORM

17.1 General obligation to provide information upon request

The beneficiaries must provide — during implementation of the action or afterwards and in accordance with Article 41.2 — any information requested in order to verify eligibility of the costs, proper implementation of the action and compliance with any other obligation under the Agreement.

17.2 Obligation to keep information up to date and to inform about events and circumstances likely to affect the Agreement

Each beneficiary must keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system; see Article 52) up to date, in particular, its name, address, legal representatives, legal form and organisation type.

Each beneficiary must immediately inform the coordinator — which must immediately inform the Commission and the other beneficiaries — of any of the following:

- (a) **events** which are likely to affect significantly or delay the implementation of the action or the EU's financial interests, in particular:
 - (i) changes in its legal, financial, technical, organisational or ownership situation or those of its linked third parties and
 - (ii) changes in the name, address, legal form, organisation type of its linked third parties;

(b) circumstances affecting:

(i) the decision to award the grant or

(ii) compliance with requirements under the Agreement.

17.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION

18.1 Obligation to keep records and other supporting documentation

The beneficiaries must — for a period of five years after the payment of the balance — keep records and other supporting documentation in order to prove the proper implementation of the action and the costs they declare as eligible.

They must make them available upon request (see Article 17) or in the context of checks, reviews, audits or investigations (see Article 22).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 22), the beneficiaries must keep the records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The Commission may accept non-original documents if it considers that they offer a comparable level of assurance.

18.1.1 Records and other supporting documentation on the scientific and technical implementation

The beneficiaries must keep records and other supporting documentation on scientific and technical implementation of the action in line with the accepted standards in the respective field.

18.1.2 Records and other documentation to support the costs declared

The beneficiaries must keep the records and documentation supporting the costs declared, in particular the following:

- (a) for **actual costs**: adequate records and other supporting documentation to prove the costs declared, such as contracts, subcontracts, invoices and accounting records. In addition, the beneficiaries' usual cost accounting practices and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documentation;
- (b) for **unit costs**: adequate records and other supporting documentation to prove the number of units declared. This documentation must include records of the names, nationalities, and home institutions of users, as well as the nature and quantity of access provided to them. Beneficiaries do not need to identify the actual eligible costs covered or to keep or provide supporting documentation (such as accounting statements) to prove the amount per unit.

In addition, for unit costs calculated in accordance with the beneficiary's usual cost accounting practices, the beneficiaries must keep adequate records and documentation to prove that the cost accounting practices used comply with the conditions set out in Article 6.2.

The beneficiaries and linked third parties may submit to the Commission, for approval, a certificate (drawn up in accordance with Annex 6) stating that their usual cost accounting practices comply with these conditions ('certificate on the methodology'). If the certificate is approved, costs declared in line with this methodology will not be challenged subsequently, unless the beneficiaries have concealed information for the purpose of the approval.

(c) for **flat-rate costs**: adequate records and other supporting documentation to prove the eligibility of the costs to which the flat-rate is applied. The beneficiaries do not need to identify the costs covered or provide supporting documentation (such as accounting statements) to prove the amount declared at a flat-rate.

In addition, for **personnel costs** (declared as actual costs or on the basis of unit costs), the beneficiaries must keep **time records** for the number of hours declared. The time records must be in writing and approved by the persons working on the action and their supervisors, at least monthly. In the absence of reliable time records of the hours worked on the action, the Commission may accept alternative evidence supporting the number of hours declared, if it considers that it offers an adequate level of assurance.

As an exception, for **persons working exclusively on the action**, there is no need to keep time records, if the beneficiary signs a **declaration** confirming that the persons concerned have worked exclusively on the action.

For costs declared by linked third parties (see Article 14), it is the beneficiary that must keep the originals of the financial statements and the certificates on the financial statements of the linked third parties.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 42), and the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 19 — SUBMISSION OF DELIVERABLES

19.1 Obligation to submit deliverables

The coordinator must submit the 'deliverables' identified in Annex 1, in accordance with the timing and conditions set out in it.

19.2 Consequences of non-compliance

If the coordinator breaches any of its obligations under this Article, the Commission may apply any of the measures described in Chapter 6.

ARTICLE 20 — REPORTING — PAYMENT REQUESTS

20.1 Obligation to submit reports

The coordinator must submit to the Commission (see Article 52) the technical and financial reports set out in this Article. These reports include requests for payment and must be drawn up using the forms and templates provided in the electronic exchange system (see Article 52).

20.2 Reporting periods

The action is divided into the following 'reporting periods':

- RP1: from month 1 to month 18
- RP2: from month 19 to month 36
- RP3: from month 37 to month 48

20.3 Periodic reports — Requests for interim payments

The coordinator must submit a periodic report within 60 days following the end of each reporting period.

The **periodic report** must include the following:

- (a) a 'periodic technical report' containing:
 - (i) an **explanation of the work carried out** by the beneficiaries;
 - (ii) an **overview of the progress** towards the objectives of the action, including milestones and deliverables identified in Annex 1.

This report must include explanations justifying the differences between work expected to be carried out in accordance with Annex 1 and that actually carried out.

The report must detail the exploitation and dissemination of the results and — if required in Annex 1 — an updated 'plan for the exploitation and dissemination of the results'.

The report must indicate the communication activities.

The report must detail the access activity, indicating the members of the selection panel, the selection procedure, the exact amount of access provided to the user groups, the description of their work, and information on the users (including names, nationality and home institutions);

- (iii) a **summary** for publication by the Commission;
- (iv) the answers to the 'questionnaire', covering issues related to the action implementation and the economic and societal impact, notably in the context of the Horizon 2020 key performance indicators and the Horizon 2020 monitoring requirements;
- (b) a 'periodic financial report' containing:
 - (i) an 'individual financial statement' (see Annex 4) from each beneficiary and from each linked third party, for the reporting period concerned.

The individual financial statement must detail the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) for each budget category (see Annex 2).

The beneficiaries and linked third parties must declare all eligible costs, even if — for actual costs, unit costs and flat-rate costs — they exceed the amounts indicated in the estimated budget (see Annex 2). Amounts which are not declared in the individual financial statement will not be taken into account by the Commission.

If an individual financial statement is not submitted for a reporting period, it may be included in the periodic financial report for the next reporting period.

The individual financial statements of the last reporting period must also detail the **receipts of the action** (see Article 5.3.3).

Each beneficiary and each linked third party must **certify** that:

- the information provided is full, reliable and true;
- the costs declared are eligible (see Article 6);
- the costs can be substantiated by adequate records and supporting documentation (see Article 18) that will be produced upon request (see Article 17) or in the context of checks, reviews, audits and investigations (see Article 22), and
- for the last reporting period: that all the receipts have been declared (see Article 5.3.3);
- (ii) an **explanation of the use of resources** and the information on subcontracting (see Article 13) and in-kind contributions provided by third parties (see Articles 11 and 12) from each beneficiary and from each linked third party, for the reporting period concerned;
- (iii) information on the amount of each interim payment and payment of the balance to be paid by the Commission to the Joint Research Centre (JRC);
- (iv) a 'periodic summary financial statement', created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including except for the last reporting period the request for interim payment.

20.4 Final report — Request for payment of the balance

In addition to the periodic report for the last reporting period, the coordinator must submit the final report within 60 days following the end of the last reporting period.

The **final report** must include the following:

- (a) a 'final technical report' with a summary for publication containing:
 - (i) an overview of the results and their exploitation and dissemination;
 - (ii) the conclusions on the action, and

(iii) the socio-economic impact of the action;

(b) a 'final financial report' containing:

- (i) a 'final summary financial statement', created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the request for payment of the balance and
- (ii) a 'certificate on the financial statements' (drawn up in accordance with Annex 5) for each beneficiary and for each linked third party, if it requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 5.2 and Article 6.2).

20.5 Information on cumulative expenditure incurred

Not applicable

20.6 Currency for financial statements and conversion into euro

Financial statements must be drafted in euro.

Beneficiaries and linked third parties with accounting established in a currency other than the euro must convert the costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union*, calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal of the European Union* for the currency in question, they must be converted at the average of the monthly accounting rates published on the Commission's website, calculated over the corresponding reporting period.

Beneficiaries and linked third parties with accounting established in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

20.7 Language of reports

All reports (technical and financial reports, including financial statements) must be submitted in the language of the Agreement.

20.8 Consequences of non-compliance

If the reports submitted do not comply with this Article, the Commission may suspend the payment deadline (see Article 47) and apply any of the other measures described in Chapter 6.

If the coordinator breaches its obligation to submit the reports and if it fails to comply with this obligation within 30 days following a written reminder, the Commission may terminate the Agreement (see Article 50) or apply any of the other measures described in Chapter 6.

ARTICLE 21 — PAYMENTS AND PAYMENT ARRANGEMENTS

21.1 Payments to be made

The following payments will be made to the coordinator:

- one pre-financing payment;
- one or more **interim payments**, on the basis of the request(s) for interim payment (see Article 20), and
- one **payment of the balance**, on the basis of the request for payment of the balance (see Article 20).

21.2 Pre-financing payment — Amount — Amount retained for the Guarantee Fund

The aim of the pre-financing is to provide the beneficiaries with a float.

It remains the property of the EU until the payment of the balance.

The amount of the pre-financing payment will be EUR 2 666 665.33 (two million six hundred and sixty six thousand six hundred and sixty five EURO and thirty three eurocents).

The Commission will — except if Article 48 applies — make the pre-financing payment to the coordinator within 30 days, either from the entry into force of the Agreement (see Article 58) or from 10 days before the starting date of the action (see Article 3), whichever is the latest.

An amount of EUR **249 999.88** (two hundred and forty nine thousand nine hundred and ninety nine EURO and eighty eight eurocents), corresponding to 5% of the maximum grant amount (see Article 5.1), is retained by the Commission from the pre-financing payment and transferred into the 'Guarantee Fund'.

Moreover, the part of the pre-financing payment related to the Joint Research Centre (JRC) (24 188.00 (twenty four thousand one hundred and eighty eight EURO)) is not paid to the coordinator, but kept by the Commission for the JRC.

21.3 Interim payments — Amount — Calculation

Interim payments reimburse the eligible costs incurred for the implementation of the action during the corresponding reporting periods.

The Commission will pay to the coordinator the amount due as interim payment within 90 days from receiving the periodic report (see Article 20.3), except if Articles 47 or 48 apply.

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as interim payment** is calculated by the Commission in the following steps:

Step 1 — Application of the reimbursement rates

Step 2 — Limit to 90% of the maximum grant amount

21.3.1 Step 1 — Application of the reimbursement rates

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and

flat-rate costs; see Article 6) declared by the beneficiaries and the linked third parties (see Article 20) and approved by the Commission (see above) for the concerned reporting period.

21.3.2 Step 2 — Limit to 90% of the maximum grant amount

The total amount of pre-financing and interim payments must not exceed 90% of the maximum grant amount set out in Article 5.1. The maximum amount for the interim payment will be calculated as follows:

```
{90% of the maximum grant amount (see Article 5.1) minus
{pre-financing and previous interim payments}}.
```

21.4 Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund

The payment of the balance reimburses the remaining part of the eligible costs incurred by the beneficiaries for the implementation of the action.

If the total amount of earlier payments is greater than the final grant amount (see Article 5.3), the payment of the balance takes the form of a recovery (see Article 44).

If the total amount of earlier payments is lower than the final grant amount, the Commission will pay the balance within 90 days from receiving the final report (see Article 20.4), except if Articles 47 or 48 apply.

Payment is subject to the approval of the final report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as the balance** is calculated by the Commission by deducting the total amount of pre-financing and interim payments (if any) already made, from the final grant amount determined in accordance with Article 5.3:

```
{final grant amount (see Article 5.3)
minus
{pre-financing and interim payments (if any) made}}.
```

At the payment of the balance, the amount retained for the Guarantee Fund (see above) will be released and:

- if the balance is positive: the amount released will be paid in full to the coordinator together with the amount due as the balance;
- if the balance is negative (payment of the balance taking the form of recovery): it will be deducted from the amount released (see Article 44.1.2). If the resulting amount:
 - is positive, it will be paid to the coordinator
 - is negative, it will be recovered.

The amount to be paid may however be offset — without the beneficiaries' consent — against any other amount owed by a beneficiary to the Commission or an executive agency (under the EU or Euratom budget), up to the maximum EU contribution indicated, for that beneficiary, in the estimated budget (see Annex 2).

21.5 Notification of amounts due

When making payments, the Commission will formally notify to the coordinator the amount due, specifying whether it concerns an interim payment or the payment of the balance.

For the payment of the balance, the notification will also specify the final grant amount.

In the case of reduction of the grant or recovery of undue amounts, the notification will be preceded by the contradictory procedure set out in Articles 43 and 44.

21.6 Currency for payments

The Commission will make all payments in euro.

21.7 Payments to the coordinator — Distribution to the beneficiaries

Payments will be made to the coordinator.

Payments to the coordinator will discharge the Commission from its payment obligation.

The coordinator must distribute the payments between the beneficiaries without unjustified delay.

Pre-financing may however be distributed only:

- (a) if the minimum number of beneficiaries set out in the call for proposals has acceded to the Agreement (see Article 56) and
- (b) to beneficiaries that have acceded to the Agreement (see Article 56).

21.8 Bank account for payments

All payments will be made to the following bank account:

Name of bank: POHJOLA PANKKI OYJ (POHJOLA BANK PLC)

Full name of the account holder: ILMATIETEEN LAITOS FINNISH METEOROLOGICAL

INSTITUTE FMI

IBAN code: FI2850000120378566

21.9 Costs of payment transfers

The cost of the payment transfers is borne as follows:

- the Commission bears the cost of transfers charged by its bank;
- the beneficiary bears the cost of transfers charged by its bank;
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

21.10 Date of payment

Payments by the Commission are considered to have been carried out on the date when they are debited to its account.

21.11 Consequences of non-compliance

21.11.1 If the Commission does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus three and a half points. The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only upon request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

Suspension of the payment deadline or payments (see Articles 47 and 48) will not be considered as late payment.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

21.11.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or the participation of the coordinator may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

22.1 Checks, reviews and audits by the Commission

22.1.1 Right to carry out checks

The Commission will — during the implementation of the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing deliverables and reports.

For this purpose the Commission may be assisted by external persons or bodies.

The Commission may also request additional information in accordance with Article 17. The Commission may request beneficiaries to provide such information to it directly.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

22.1.2 Right to carry out reviews

The Commission may — during the implementation of the action or afterwards — carry out reviews on the proper implementation of the action (including assessment of deliverables and reports), compliance with the obligations under the Agreement and continued scientific or technological relevance of the action.

Reviews may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the review is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The Commission may carry out reviews directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The Commission may request beneficiaries to provide such information to it directly.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with external experts.

For **on-the-spot** reviews, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a 'review report' will be drawn up.

The Commission will formally notify the review report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('contradictory review procedure').

Reviews (including review reports) are in the language of the Agreement.

22.1.3 Right to carry out audits

The Commission may — during the implementation of the action or afterwards — carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Audits may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the audit is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The Commission may carry out audits directly (using its own staff) or indirectly (using external

persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. The Commission may request beneficiaries to provide such information to it directly.

For **on-the-spot** audits, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a 'draft audit report' will be drawn up.

The Commission will formally notify the draft audit report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('contradictory audit procedure'). This period may be extended by the Commission in justified cases.

The 'final audit report' will take into account observations by the coordinator or beneficiary concerned. The report will be formally notified to it.

Audits (including audit reports) are in the language of the Agreement.

The Commission may also access the beneficiaries' statutory records for the periodical assessment of unit costs or flat-rate amounts.

22.2 Investigations by the European Anti-Fraud Office (OLAF)

Under Regulations No 883/2013¹⁶ and No 2185/96¹⁷ (and in accordance with their provisions and procedures), the European Anti-Fraud Office (OLAF) may — at any moment during implementation of the action or afterwards — carry out investigations, including on-the-spot checks and inspections, to establish whether there has been fraud, corruption or any other illegal activity affecting the financial interests of the EU.

22.3 Checks and audits by the European Court of Auditors (ECA)

Under Article 287 of the Treaty on the Functioning of the European Union (TFEU) and Article 161 of the Financial Regulation No 966/2012¹⁸, the European Court of Auditors (ECA) may — at any moment during implementation of the action or afterwards — carry out audits.

¹⁶ Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18.09.2013, p. 1).

¹⁷ Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15.11.1996, p. 2).

¹⁸ Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 (OJ L 298, 26.10.2012, p. 1).

The ECA has the right of access for the purpose of checks and audits.

22.4 Checks, reviews, audits and investigations for international organisations

Not applicable

22.5 Consequences of findings in checks, reviews, audits and investigations — Extension of findings

22.5.1 Findings in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to the rejection of ineligible costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44) or to any of the other measures described in Chapter 6.

Rejection of costs or reduction of the grant after the payment of the balance will lead to a revised final grant amount (see Article 5.4).

Findings in checks, reviews, audits or investigations may lead to a request for amendment for the modification of Annex 1 (see Article 55).

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations may also lead to consequences in other EU or Euratom grants awarded under similar conditions ('extension of findings from this grant to other grants').

Moreover, findings arising from an OLAF investigation may lead to criminal prosecution under national law.

22.5.2 Findings in other grants

The Commission may extend findings from other grants to this grant ('extension of findings from other grants to this grant'), if:

- (a) the beneficiary concerned is found, in other EU or Euratom grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and
- (b) those findings are formally notified to the beneficiary concerned together with the list of grants affected by the findings no later than two years after the payment of the balance of this grant.

The extension of findings may lead to the rejection of costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44), suspension of payments (see Article 48), suspension of the action implementation (see Article 49) or termination (see Article 50).

22.5.3 Procedure

The Commission will formally notify the beneficiary concerned the systemic or recurrent errors and its intention to extend these audit findings, together with the list of grants affected.

22.5.3.1 If the findings concern **eligibility of costs**: the formal notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings;

- (b) the request to submit **revised financial statements** for all grants affected;
- (c) the **correction rate for extrapolation** established by the Commission on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected if the beneficiary concerned:
 - (i) considers that the submission of revised financial statements is not possible or practicable or
 - (ii) does not submit revised financial statements.

The beneficiary concerned has 90 days from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method**. This period may be extended by the Commission in justified cases.

The Commission may then start a rejection procedure in accordance with Article 42, on the basis of:

- the revised financial statements, if approved;
- the proposed alternative correction method, if accepted

or

- the initially notified correction rate for extrapolation, if it does not receive any observations or revised financial statements, does not accept the observations or the proposed alternative correction method or does not approve the revised financial statements.
- 22.5.3.2 If the findings concern substantial errors, irregularities or fraud or serious breach of obligations: the formal notification will include:
 - (a) an invitation to submit observations on the list of grants affected by the findings and
 - (b) the flat-rate the Commission intends to apply according to the principle of proportionality.

The beneficiary concerned has 90 days from receiving notification to submit observations or to propose a duly substantiated alternative flat-rate.

The Commission may then start a reduction procedure in accordance with Article 43, on the basis of:

- the proposed alternative flat-rate, if accepted

or

- the initially notified flat-rate, if it does not receive any observations or does not accept the observations or the proposed alternative flat-rate.

22.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, any insufficiently substantiated costs will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 23 — EVALUATION OF THE IMPACT OF THE ACTION

23.1 Right to evaluate the impact of the action

The Commission may carry out interim and final evaluations of the impact of the action measured against the objective of the EU programme.

Evaluations may be started during implementation of the action and up to five years after the payment of the balance. The evaluation is considered to start on the date of the formal notification to the coordinator or beneficiaries.

The Commission may make these evaluations directly (using its own staff) or indirectly (using external bodies or persons it has authorised to do so).

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

23.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the Commission may apply the measures described in Chapter 6.

SECTION 3 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS

SUBSECTION 1 GENERAL

ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY

23a.1 Obligation to take measures to implement the Commission Recommendation on the management of intellectual property in knowledge transfer activities

Beneficiaries that are universities or other public research organisations must take measures to implement the principles set out in Points 1 and 2 of the Code of Practice annexed to the Commission Recommendation on the management of intellectual property in knowledge transfer activities¹⁹.

This does not change the obligations set out in Subsections 2 and 3 of this Section.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

23a.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the Commission may apply any of the measures described in Chapter 6.

SUBSECTION 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND

¹⁹ Commission Recommendation C(2008) 1329 of 10.4.2008 on the management of intellectual property in knowledge transfer activities and the Code of Practice for universities and other public research institutions attached to this recommendation.

ARTICLE 24 — AGREEMENT ON BACKGROUND

24.1 Agreement on background

The beneficiaries must identify and agree (in writing) on the background for the action ('agreement on background').

'Background' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that:

- (a) is held by the beneficiaries before they acceded to the Agreement, and
- (b) is needed to implement the action or exploit the results.

24.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND

25.1 Exercise of access rights — Waiving of access rights — No sub-licensing

To exercise access rights, this must first be requested in writing ('request for access').

'Access rights' means rights to use results or background under the terms and conditions laid down in this Agreement.

Waivers of access rights are not valid unless in writing.

Unless agreed otherwise, access rights do not include the right to sub-license.

25.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- (a) informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel), or
- (b) agreed with the other beneficiaries that access would not be on a royalty-free basis.

25.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other access — under fair and reasonable conditions — to background needed for exploiting their own results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel).

'Fair and reasonable conditions' means appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3

25.4 Access rights for affiliated entities

Unless otherwise agreed in the consortium agreement, access to background must also be given — under fair and reasonable conditions (see above; Article 25.3) and unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) — to affiliated entities²⁰ established in an EU Member State or 'associated country'²¹, if this is needed to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 25.1), the affiliated entity concerned must make the request directly to the beneficiary that holds the background.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.5 Access rights for third parties

The access provider must — unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) — give users royalty-free access to background needed to implement the action.

The access provider must inform the users as soon as possible of any restriction which might substantially affect the granting of access rights.

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SUBSECTION 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS

ARTICLE 26 — OWNERSHIP OF RESULTS

26.1 Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them.

²⁰ For the definition, see 'affiliated entity' footnote (Article 14.1).

²¹ For the definition, see Article 2.1(3) of the Rules for Participation Regulation No 1290/2013: 'associated country' means a third country which is party to an international agreement with the Union, as identified in Article 7 of Horizon 2020 Framework Programme Regulation No 1291/2013. Article 7 sets out the conditions for association of non-EU countries to Horizon 2020.

'Results' means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

26.2 Joint ownership by several beneficiaries

Two or more beneficiaries own results jointly if:

- (a) they have jointly generated them and
- (b) it is not possible to:
 - (i) establish the respective contribution of each beneficiary, or
 - (ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership ('joint ownership agreement'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

- (a) at least 45 days advance notice and
- (b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

26.3 Rights of third parties (including personnel)

If third parties (including personnel) may claim rights to the results, the beneficiary concerned must ensure that it complies with its obligations under the Agreement.

If a third party generates results, the beneficiary concerned must obtain all necessary rights (transfer, licences or other) from the third party, in order to be able to respect its obligations as if those results were generated by the beneficiary itself.

If obtaining the rights is impossible, the beneficiary must refrain from using the third party to generate the results.

26.4 EU ownership, to protect results

- 26.4.1 The EU may with the consent of the beneficiary concerned assume ownership of results to protect them, if a beneficiary intends up to four years after the period set out in Article 3 to disseminate its results without protecting them, except in any of the following cases:
 - (a) the lack of protection is because protecting the results is not possible, reasonable or justified (given the circumstances);

- (b) the lack of protection is because there is a lack of potential for commercial or industrial exploitation, or
- (c) the beneficiary intends to transfer the results to another beneficiary or third party established in an EU Member State or associated country, which will protect them.

Before the results are disseminated and unless any of the cases above under Points (a), (b) or (c) applies, the beneficiary must formally notify the Commission and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the Commission decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

No dissemination relating to these results may take place before the end of this period or, if the Commission takes a positive decision, until it has taken the necessary steps to protect the results.

26.4.2 The EU may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to stop protecting them or not to seek an extension of protection, except in any of the following cases:

- (a) the protection is stopped because of a lack of potential for commercial or industrial exploitation;
- (b) an extension would not be justified given the circumstances.

A beneficiary that intends to stop protecting results or not seek an extension must — unless any of the cases above under Points (a) or (b) applies — formally notify the Commission at least 60 days before the protection lapses or its extension is no longer possible and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the Commission decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

26.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to the any of the other measures described in Chapter 6.

ARTICLE 27 — PROTECTION OF RESULTS — VISIBILITY OF EU FUNDING

27.1 Obligation to protect the results

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

- (a) the results can reasonably be expected to be commercially or industrially exploited and
- (b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

27.2 EU ownership, to protect the results

If a beneficiary intends not to protect its results, to stop protecting them or not seek an extension of protection, the EU may — under certain conditions (see Article 26.4) — assume ownership to ensure their (continued) protection.

27.3 Information on EU funding

Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must — unless the Commission requests or agrees otherwise or unless it is impossible — include the following:

"The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871115".

27.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 28 — EXPLOITATION OF RESULTS

28.1 Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure '**exploitation**' of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

- (a) using them in further research activities (outside the action);
- (b) developing, creating or marketing a product or process;
- (c) creating and providing a service, or
- (d) using them in standardisation activities.

This does not change the security obligations in Article 37, which still apply.

28.2 Results that could contribute to European or international standards — Information on EU funding

If results are incorporated in a standard, the beneficiary concerned must — unless the Commission requests or agrees otherwise or unless it is impossible — ask the standardisation body to include the following statement in (information related to) the standard:

"Results incorporated in this standard received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871115".

28.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced in accordance with Article 43.

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF EU FUNDING

29.1 Obligation to disseminate results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — 'disseminate' its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may — under certain conditions (see Article 26.4.1) — need to formally notify the Commission before dissemination takes place.

29.2 Open access to scientific publications

Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

- (a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;
 - Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.
- (b) ensure open access to the deposited publication via the repository at the latest:
 - (i) on publication, if an electronic version is available for free via the publisher, or

- (ii) within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.
- (c) ensure open access via the repository to the bibliographic metadata that identify the deposited publication.

The bibliographic metadata must be in a standard format and must include all of the following:

- the terms "European Union (EU)" and "Horizon 2020";
- the name of the action, acronym and grant number;
- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

29.3 Open access to research data

Regarding the digital research data generated in the action ('data'), the beneficiaries must:

- (a) deposit in a research data repository and take measures to make it possible for third parties to access, mine, exploit, reproduce and disseminate free of charge for any user the following:
 - (i) the data, including associated metadata, needed to validate the results presented in scientific publications, as soon as possible;
 - (ii) not applicable;
 - (iii) other data, including associated metadata, as specified and within the deadlines laid down in the 'data management plan' (see Annex 1);
- (b) provide information via the repository about tools and instruments at the disposal of the beneficiaries and necessary for validating the results (and where possible provide the tools and instruments themselves).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

As an exception, the beneficiaries do not have to ensure open access to specific parts of their research data under Point (a)(i) and (iii), if the achievement of the action's main objective (as described in Annex 1) would be jeopardised by making those specific parts of the research data openly accessible. In this case, the data management plan must contain the reasons for not giving access.

29.4 Information on EU funding — Obligation and right to use the EU emblem

Unless the Commission requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:

- (a) display the EU emblem and
- (b) include the following text:

"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871115".

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the Commission.

This does not however give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

29.5 Disclaimer excluding Commission responsibility

Any dissemination of results must indicate that it reflects only the author's view and that the Commission is not responsible for any use that may be made of the information it contains.

29.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 30 — TRANSFER AND LICENSING OF RESULTS

30.1 Transfer of ownership

Each beneficiary may transfer ownership of its results.

It must however ensure that its obligations under Articles 26.2, 26.4, 27, 28, 29, 30 and 31 also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer.

This does not change the security obligations in Article 37, which still apply.

Unless agreed otherwise (in writing) for specifically-identified third parties or unless impossible under applicable EU and national laws on mergers and acquisitions, a beneficiary that intends to transfer ownership of results must give at least 45 days advance notice (or less if agreed in writing) to the other beneficiaries that still have (or still may request) access rights to the results. This notification must include sufficient information on the new owner to enable any beneficiary concerned to assess the effects on its access rights.

Unless agreed otherwise (in writing) for specifically-identified third parties, any other beneficiary may object within 30 days of receiving notification (or less if agreed in writing), if it can show that the transfer would adversely affect its access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

30.2 Granting licenses

Each beneficiary may grant licences to its results (or otherwise give the right to exploit them), if:

- (a) this does not impede the access rights under Article 31 and
- (b) not applicable.

In addition to Points (a) and (b), exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights (see Article 31.1).

This does not change the dissemination obligations in Article 29 or security obligations in Article 37, which still apply.

30.3 Commission right to object to transfers or licensing

Not applicable

30.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 31 — ACCESS RIGHTS TO RESULTS

31.1 Exercise of access rights — Waiving of access rights — No sub-licensing

The conditions set out in Article 25.1 apply.

The obligations set out in this Article do not change the security obligations in Article 37, which still apply.

31.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

31.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other — under fair and reasonable conditions (see Article 25.3) — access to results needed for exploiting their own results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.4 Access rights of affiliated entities

Unless agreed otherwise in the consortium agreement, access to results must also be given — under fair and reasonable conditions (Article 25.3) — to affiliated entities established in an EU Member State or associated country, if this is needed for those entities to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 31.1), the affiliated entity concerned must make any such request directly to the beneficiary that owns the results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.5 Access rights for the EU institutions, bodies, offices or agencies and EU Member States

The beneficiaries must give access to their results — on a royalty-free basis — to EU institutions, bodies, offices or agencies, for developing, implementing or monitoring EU policies or programmes.

Such access rights are limited to non-commercial and non-competitive use.

This does not change the right to use any material, document or information received from the beneficiaries for communication and publicising activities (see Article 38.2).

31.6 Access rights for third parties

The access provider must give the users royalty-free access to the results needed to implement the action.

31.7 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SECTION 4 OTHER RIGHTS AND OBLIGATIONS

ARTICLE 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS

32.1 Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers²³, in particular regarding:

- working conditions;
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

32.2 Consequences of non-compliance

²³ Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

If a beneficiary breaches its obligations under this Article, the Commission may apply any of the measures described in Chapter 6.

ARTICLE 33 — GENDER EQUALITY

33.1 Obligation to aim for gender equality

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

33.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the Commission may apply any of the measures described in Chapter 6.

ARTICLE 34 — ETHICS AND RESEARCH INTEGRITY

34.1 Obligation to comply with ethical and research integrity principles

The beneficiaries must carry out the action in compliance with:

- (a) ethical principles (including the highest standards of research integrity)
- and
- (b) applicable international, EU and national law.

Funding will not be granted for activities carried out outside the EU if they are prohibited in all Member States or for activities which destroy human embryos (for example, for obtaining stem cells).

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- (a) aim at human cloning for reproductive purposes;
- (b) intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed), or
- (c) intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity²⁴.

This implies compliance with the following fundamental principles:

²⁴ European Code of Conduct for Research Integrity of ALLEA (All European Academies) http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf

- **reliability** in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources;
- **honesty** in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way;
- **respect** for colleagues, research participants, society, ecosystems, cultural heritage and the environment;
- **accountability** for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices and refrain from the research integrity violations described in this Code.

This does not change the other obligations under this Agreement or obligations under applicable international, EU or national law, all of which still apply.

34.2 Activities raising ethical issues

Activities raising ethical issues must comply with the 'ethics requirements' set out as deliverables in Annex 1.

Before the beginning of an activity raising an ethical issue, each beneficiary must have obtained:

- (a) any ethics committee opinion required under national law and
- (b) any notification or authorisation for activities raising ethical issues required under national and/or European law

needed for implementing the action tasks in question.

The documents must be kept on file and be submitted upon request by the coordinator to the Commission (see Article 52). If they are not in English, they must be submitted together with an English summary, which shows that the action tasks in question are covered and includes the conclusions of the committee or authority concerned (if available).

34.3 Activities involving human embryos or human embryonic stem cells

Activities involving research on human embryos or human embryonic stem cells may be carried out, in addition to Article 34.1, only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the Commission (see Article 52).

34.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 35 — CONFLICT OF INTERESTS

35.1 Obligation to avoid a conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the action is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest ('conflict of interests').

They must formally notify to the Commission without delay any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The Commission may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

35.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 36 — CONFIDENTIALITY

36.1 General obligation to maintain confidentiality

During implementation of the action and for four years after the period set out in Article 3, the parties must keep confidential any data, documents or other material (in any form) that is identified as confidential at the time it is disclosed ('confidential information').

If a beneficiary requests, the Commission may agree to keep such information confidential for an additional period beyond the initial four years.

If information has been identified as confidential only orally, it will be considered to be confidential only if this is confirmed in writing within 15 days of the oral disclosure.

Unless otherwise agreed between the parties, they may use confidential information only to implement the Agreement.

The beneficiaries may disclose confidential information to their personnel or third parties involved in the action only if they:

- (a) need to know to implement the Agreement and
- (b) are bound by an obligation of confidentiality.

This does not change the security obligations in Article 37, which still apply.

The Commission may disclose confidential information to its staff, other EU institutions and bodies. It may disclose confidential information to third parties, if:

(a) this is necessary to implement the Agreement or safeguard the EU's financial interests and

(b) the recipients of the information are bound by an obligation of confidentiality.

Under the conditions set out in Article 4 of the Rules for Participation Regulation No 1290/2013²⁵, the Commission must moreover make available information on the results to other EU institutions, bodies, offices or agencies as well as Member States or associated countries.

The confidentiality obligations no longer apply if:

- (a) the disclosing party agrees to release the other party;
- (b) the information was already known by the recipient or is given to him without obligation of confidentiality by a third party that was not bound by any obligation of confidentiality;
- (c) the recipient proves that the information was developed without the use of confidential information;
- (d) the information becomes generally and publicly available, without breaching any confidentiality obligation, or
- (e) the disclosure of the information is required by EU or national law.

36.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 37 — SECURITY-RELATED OBLIGATIONS

37.1 Results with a security recommendation

Not applicable

37.2 Classified information

Not applicable

37.3 Activities involving dual-use goods or dangerous materials and substances

Not applicable

37.4 Consequences of non-compliance

Not applicable

ARTICLE 38 — PROMOTING THE ACTION — VISIBILITY OF EU FUNDING

²⁵ Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" (OJ L 347, 20.12.2013 p.81).

38.1 Communication activities by beneficiaries

38.1.1 Obligation to promote the action and its results

The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.

Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the Commission (see Article 52).

38.1.2 Information on EU funding — Obligation and right to use the EU emblem

Unless the Commission requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) and any infrastructure, equipment and major results funded by the grant must:

- (a) display the EU emblem and
- (b) include the following text:

For communication activities:

"This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871115".

For infrastructure, equipment and major results:

"This [infrastructure][equipment][insert type of result] is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871115".

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the Commission.

This does not, however, give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

38.1.3 Disclaimer excluding Commission responsibility

Any communication activity related to the action must indicate that it reflects only the author's view and that the Commission is not responsible for any use that may be made of the information it contains.

38.2 Communication activities by the Commission

38.2.1 Right to use beneficiaries' materials, documents or information

The Commission may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication and public deliverables as well as any

other material, such as pictures or audio-visual material received from any beneficiary (including in electronic form).

This does not change the confidentiality obligations in Article 36 and the security obligations in Article 37, all of which still apply.

If the Commission's use of these materials, documents or information would risk compromising legitimate interests, the beneficiary concerned may request the Commission not to use it (see Article 52).

The right to use a beneficiary's materials, documents and information includes:

- (a) **use for its own purposes** (in particular, making them available to persons working for the Commission or any other EU institution, body, office or agency or body or institutions in EU Member States; and copying or reproducing them in whole or in part, in unlimited numbers);
- (b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes);
- (c) **editing or redrafting** for communication and publicising activities (including shortening, summarising, inserting other elements (such as meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation);
- (d) translation;
- (e) giving access in response to individual requests under Regulation No 1049/2001²⁷, without the right to reproduce or exploit;
- (f) **storage** in paper, electronic or other form;
- (g) archiving, in line with applicable document-management rules, and
- (h) the right to authorise **third parties** to act on its behalf or sub-license the modes of use set out in Points (b), (c), (d) and (f) to third parties if needed for the communication and publicising activities of the Commission.

If the right of use is subject to rights of a third party (including personnel of the beneficiary), the beneficiary must ensure that it complies with its obligations under this Agreement (in particular, by obtaining the necessary approval from the third parties concerned).

Where applicable (and if provided by the beneficiaries), the Commission will insert the following information:

"© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the European Union (EU) under conditions."

38.3 Consequences of non-compliance

²⁷ Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145, 31.5.2001, p. 43.

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 39 — PROCESSING OF PERSONAL DATA

39.1 Processing of personal data by the Commission

Any personal data under the Agreement will be processed by the Commission under Regulation No $45/2001^{28}$ and according to the 'notifications of the processing operations' to the Data Protection Officer (DPO) of the Commission (publicly accessible in the DPO register).

Such data will be processed by the 'data controller' of the Commission for the purposes of implementing, managing and monitoring the Agreement or protecting the financial interests of the EU or Euratom (including checks, reviews, audits and investigations; see Article 22).

The persons whose personal data are processed have the right to access and correct their own personal data. For this purpose, they must send any queries about the processing of their personal data to the data controller, via the contact point indicated in the privacy statement(s) that are published on the Commission websites.

They also have the right to have recourse at any time to the European Data Protection Supervisor (EDPS).

39.2 Processing of personal data by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with applicable EU and national law on data protection (including authorisations or notification requirements).

The beneficiaries may grant their personnel access only to data that is strictly necessary for implementing, managing and monitoring the Agreement.

The beneficiaries must inform the personnel whose personal data are collected and processed by the Commission. For this purpose, they must provide them with the privacy statement(s) (see above), before transmitting their data to the Commission.

39.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 39.2, the Commission may apply any of the measures described in Chapter 6.

ARTICLE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE COMMISSION

The beneficiaries may not assign any of their claims for payment against the Commission to any

²⁸ Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data (OJ L 8, 12.01.2001, p. 1).

third party, except if approved by the Commission on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the Commission has not accepted the assignment or the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the Commission

CHAPTER 5 DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WITH PARTNERS OF A JOINT ACTION

ARTICLE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES — RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES — RELATIONSHIP WITH PARTNERS OF A JOINT ACTION

41.1 Roles and responsibility towards the Commission

The beneficiaries have full responsibility for implementing the action and complying with the Agreement.

The beneficiaries are jointly and severally liable for the **technical implementation** of the action as described in Annex 1. If a beneficiary fails to implement its part of the action, the other beneficiaries become responsible for implementing this part (without being entitled to any additional EU funding for doing so), unless the Commission expressly relieves them of this obligation.

The **financial responsibility** of each beneficiary is governed by Article 44.

41.2 Internal division of roles and responsibilities

The internal roles and responsibilities of the beneficiaries are divided as follows:

(a) Each beneficiary must:

- (i) keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system) up to date (see Article 17):
- (ii) inform the coordinator immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 17);
- (iii) submit to the coordinator in good time:
 - individual financial statements for itself and its linked third parties and, if required, certificates on the financial statements (see Article 20);
 - the data needed to draw up the technical reports (see Article 20);
 - ethics committee opinions and notifications or authorisations for activities raising ethical issues (see Article 34);

- any other documents or information required by the Commission under the Agreement, unless the Agreement requires the beneficiary to submit this information directly to the Commission.

(b) The **coordinator** must:

- (i) monitor that the action is implemented properly (see Article 7);
- (ii) act as the intermediary for all communications between the beneficiaries and the Commission (in particular, providing the Commission with the information described in Article 17), unless the Agreement specifies otherwise;
- (iii) request and review any documents or information required by the Commission and verify their completeness and correctness before passing them on to the Commission;
- (iv) submit the deliverables and reports to the Commission (see Articles 19 and 20);
- (v) ensure that all payments are made to the other beneficiaries without unjustified delay (see Article 21);
- (vi) inform the Commission of the amounts paid to each beneficiary, when required under the Agreement (see Articles 44 and 50) or requested by the Commission.

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including linked third parties).

41.3 Internal arrangements between beneficiaries — Consortium agreement

The beneficiaries must have internal arrangements regarding their operation and co-ordination to ensure that the action is implemented properly. These internal arrangements must be set out in a written 'consortium agreement' between the beneficiaries, which may cover:

- internal organisation of the consortium;
- management of access to the electronic exchange system;
- distribution of EU funding;
- additional rules on rights and obligations related to background and results (including whether access rights remain or not, if a beneficiary is in breach of its obligations) (see Section 3 of Chapter 4);
- settlement of internal disputes;
- liability, indemnification and confidentiality arrangements between the beneficiaries.

The consortium agreement must not contain any provision contrary to the Agreement.

41.4 Relationship with complementary beneficiaries — Collaboration agreement

Not applicable

41.5 Relationship with partners of a joint action — Coordination agreement

Not applicable

<u>CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT —</u> RECOVERY — SANCTIONS — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE

SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS

ARTICLE 42 — REJECTION OF INELIGIBLE COSTS

42.1 Conditions

The Commission will — after termination of the participation of a beneficiary, at the time of an interim payment, at the payment of the balance or afterwards — reject any costs which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 22).

The rejection may also be based on the **extension of findings from other grants to this grant** (see Article 22.5.2).

42.2 Ineligible costs to be rejected — Calculation — Procedure

Ineligible costs will be rejected in full.

If the rejection of costs does not lead to a recovery (see Article 44), the Commission will formally notify the coordinator or beneficiary concerned of the rejection of costs, the amounts and the reasons why (if applicable, together with the notification of amounts due; see Article 21.5). The coordinator or beneficiary concerned may — within 30 days of receiving notification — formally notify the Commission of its disagreement and the reasons why.

If the rejection of costs leads to a recovery, the Commission will follow the contradictory procedure with pre-information letter set out in Article 44.

42.3 Effects

If the Commission rejects costs at the time of an **interim payment** or **the payment of the balance**, it will deduct them from the total eligible costs declared, for the action, in the periodic or final summary financial statement (see Articles 20.3 and 20.4). It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the Commission rejects costs **after termination of the participation of a beneficiary**, it will deduct them from the costs declared by the beneficiary in the termination report and include the rejection in the calculation after termination (see Article 50.2 and 50.3).

If the Commission — after an interim payment but before the payment of the balance — rejects costs declared in a periodic summary financial statement, it will deduct them from the total eligible

costs declared, for the action, in the next periodic summary financial statement or in the final summary financial statement. It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the Commission rejects costs **after the payment of the balance**, it will deduct the amount rejected from the total eligible costs declared, by the beneficiary, in the final summary financial statement. It will then calculate the revised final grant amount as set out in Article 5.4.

ARTICLE 43 — REDUCTION OF THE GRANT

43.1 Conditions

The Commission may — after termination of the participation of a beneficiary, at the payment of the balance or afterwards — reduce the grant amount (see Article 5.1), if:

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed in other EU or Euratom grants awarded to it under similar conditions systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 22.5.2).

43.2 Amount to be reduced — Calculation — Procedure

The amount of the reduction will be proportionate to the seriousness of the errors, irregularities or fraud or breach of obligations.

Before reduction of the grant, the Commission will formally notify a 'pre-information letter' to the coordinator or beneficiary concerned:

- informing it of its intention to reduce the grant, the amount it intends to reduce and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the Commission does not receive any observations or decides to pursue reduction despite the observations it has received, it will formally notify **confirmation** of the reduction (if applicable, together with the notification of amounts due; see Article 21).

43.3 Effects

If the Commission reduces the grant **after termination of the participation of a beneficiary**, it will calculate the reduced grant amount for that beneficiary and then determine the amount due to that beneficiary (see Article 50.2 and 50.3).

If the Commission reduces the grant at the payment of the balance, it will calculate the reduced grant amount for the action and then determine the amount due as payment of the balance (see Articles 5.3.4 and 21.4).

If the Commission reduces the grant **after the payment of the balance**, it will calculate the revised final grant amount for the beneficiary concerned (see Article 5.4). If the revised final grant amount for the beneficiary concerned is lower than its share of the final grant amount, the Commission will recover the difference (see Article 44).

ARTICLE 44 — RECOVERY OF UNDUE AMOUNTS

44.1 Amount to be recovered — Calculation — Procedure

The Commission will — after termination of the participation of a beneficiary, at the payment of the balance or afterwards — claim back any amount that was paid, but is not due under the Agreement.

Each beneficiary's financial responsibility in case of recovery is limited to its own debt (including undue amounts paid by the Commission for costs declared by its linked third parties), except for the amount retained for the Guarantee Fund (see Article 21.4).

44.1.1 Recovery after termination of a beneficiary's participation

If recovery takes place after termination of a beneficiary's participation (including the coordinator), the Commission will claim back the undue amount from the beneficiary concerned, by formally notifying it a debit note (see Article 50.2 and 50.3). This note will specify the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the Commission will **recover** the amount:

- (a) by 'offsetting' it without the beneficiary's consent against any amounts owed to the beneficiary concerned by the Commission or an executive agency (from the EU or Euratom budget).
 - In exceptional circumstances, to safeguard the EU's financial interests, the Commission may offset before the payment date specified in the debit note;
- (b) not applicable;
- (c) by taking legal action (see Article 57) or by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial regulation No 966/2012.

If payment is not made by the date specified in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC²⁹ applies.

44.1.2 Recovery at payment of the balance

If the payment of the balance takes the form of a recovery (see Article 21.4), the Commission will formally notify a '**pre-information letter**' to the coordinator:

- informing it of its intention to recover, the amount due as the balance and the reasons why;
- specifying that it intends to deduct the amount to be recovered from the amount retained for the Guarantee Fund;
- requesting the coordinator to submit a report on the distribution of payments to the beneficiaries within 30 days of receiving notification, and
- inviting the coordinator to submit observations within 30 days of receiving notification.

If no observations are submitted or the Commission decides to pursue recovery despite the observations it has received, it will **confirm recovery** (together with the notification of amounts due; see Article 21.5) and:

- pay the difference between the amount to be recovered and the amount retained for the Guarantee Fund, if the difference is positive or
- formally notify to the coordinator a **debit note** for the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is negative**. This note will also specify the terms and the date for payment.

If the coordinator does not repay the Commission by the date in the debit note and has not submitted the report on the distribution of payments: the Commission will **recover** the amount set out in the debit note from the coordinator (see below).

If the coordinator does not repay the Commission by the date in the debit note, but has submitted the report on the distribution of payments: the Commission will:

(a) identify the beneficiaries for which the amount calculated as follows is negative:

{{{beneficiary's costs declared in the final summary financial statement and approved by the Commission multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned

plus

its linked third parties' costs declared in the final summary financial statement and approved by the Commission multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned}

divided by

the EU contribution for the action calculated according to Article 5.3.1

²⁹ Directive 2007/64/EC of the European Parliament and of the Council of 13 November 2007 on payment services in the internal market amending Directives 97/7/EC, 2002/65/EC, 2005/60/EC and 2006/48/EC and repealing Directive 97/5/EC (OJ L 319, 05.12.2007, p. 1).

```
multiplied by
the final grant amount (see Article 5.3)},
minus
{pre-financing and interim payments received by the beneficiary}}.
```

(b) formally notify to each beneficiary identified according to point (a) a **debit note** specifying the terms and date for payment. The amount of the debit note is calculated as follows:

```
{{amount calculated according to point (a) for the beneficiary concerned divided by the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)} multiplied by the amount set out in the debit note formally notified to the coordinator}.
```

If payment is not made by the date specified in the debit note, the Commission will **recover** the amount:

(a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the Commission or an executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the Commission may offset before the payment date specified in the debit note;

- (b) by **drawing on the Guarantee Fund**. The Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:
 - (i) not applicable;
 - (ii) by taking legal action (see Article 57) or by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

44.1.3 Recovery of amounts after payment of the balance

If, for a beneficiary, the revised final grant amount (see Article 5.4) is lower than its share of the final grant amount, it must repay the difference to the Commission.

The beneficiary's share of the final grant amount is calculated as follows:

```
{{{beneficiary's costs declared in the final summary financial statement and approved by the Commission multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned plus its linked third parties' costs declared in the final summary financial statement and approved by the Commission multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned} divided by the EU contribution for the action calculated according to Article 5.3.1} multiplied by the final grant amount (see Article 5.3)}.
```

If the coordinator has not distributed amounts received (see Article 21.7), the Commission will also recover these amounts.

The Commission will formally notify a **pre-information letter** to the beneficiary concerned:

- informing it of its intention to recover, the due amount and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If no observations are submitted or the Commission decides to pursue recovery despite the observations it has received, it will **confirm** the amount to be recovered and formally notify to the beneficiary concerned a **debit note**. This note will also specify the terms and the date for payment.

If payment is not made by the date specified in the debit note, the Commission will **recover** the amount:

(a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the Commission or an executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the Commission may offset before the payment date specified in the debit note;

- (b) by **drawing on the Guarantee Fund**. The Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:
 - (i) not applicable;
 - (ii) by taking legal action (see Article 57) or by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the

date for payment in the debit note, up to and including the date the Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

ARTICLE 45 — ADMINISTRATIVE SANCTIONS

In addition to contractual measures, the Commission may also adopt administrative sanctions under Articles 106 and 131(4) of the Financial Regulation No 966/2012 (i.e. exclusion from future procurement contracts, grants, prizes and expert contracts and/or financial penalties).

SECTION 2 LIABILITY FOR DAMAGES

ARTICLE 46 — LIABILITY FOR DAMAGES

46.1 Liability of the Commission

The Commission cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of implementing the Agreement, including for gross negligence.

The Commission cannot be held liable for any damage caused by any of the beneficiaries or third parties involved in the action, as a consequence of implementing the Agreement.

46.2 Liability of the beneficiaries

Except in case of force majeure (see Article 51), the beneficiaries must compensate the Commission for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement.

SECTION 3 SUSPENSION AND TERMINATION

ARTICLE 47 — SUSPENSION OF PAYMENT DEADLINE

47.1 Conditions

The Commission may — at any moment — suspend the payment deadline (see Article 21.2 to 21.4) if a request for payment (see Article 20) cannot be approved because:

- (a) it does not comply with the provisions of the Agreement (see Article 20);
- (b) the technical or financial reports have not been submitted or are not complete or additional information is needed, or
- (c) there is doubt about the eligibility of the costs declared in the financial statements and additional checks, reviews, audits or investigations are necessary.

47.2 Procedure

The Commission will formally notify the coordinator of the suspension and the reasons why.

The suspension will take effect the day notification is sent by the Commission (see Article 52).

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining period will resume.

If the suspension exceeds two months, the coordinator may request the Commission if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the technical or financial reports (see Article 20) and the revised report or statement is not submitted or was submitted but is also rejected, the Commission may also terminate the Agreement or the participation of the beneficiary (see Article 50.3.1(1)).

ARTICLE 48 — SUSPENSION OF PAYMENTS

48.1 Conditions

The Commission may — at any moment — suspend payments, in whole or in part and interim payments or the payment of the balance for one or more beneficiaries, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed in other EU or Euratom grants awarded to it under similar conditions systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 22.5.2).

If payments are suspended for one or more beneficiaries, the Commission will make partial payment(s) for the part(s) not suspended. If suspension concerns the payment of the balance, — once suspension is lifted — the payment or the recovery of the amount(s) concerned will be considered the payment of the balance that closes the action.

48.2 Procedure

Before suspending payments, the Commission will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend payments and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the Commission does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the suspension procedure is not continued.

The suspension will take effect the day the confirmation notification is sent by the Commission.

If the conditions for resuming payments are met, the suspension will be **lifted**. The Commission will formally notify the coordinator or beneficiary concerned.

During the suspension, the periodic report(s) for all reporting periods except the last one (see Article 20.3), must not contain any individual financial statements from the beneficiary concerned and its linked third parties. The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

The beneficiaries may suspend implementation of the action (see Article 49.1) or terminate the Agreement or the participation of the beneficiary concerned (see Article 50.1 and 50.2).

ARTICLE 49 — SUSPENSION OF THE ACTION IMPLEMENTATION

49.1 Suspension of the action implementation, by the beneficiaries

49.1.1 Conditions

The beneficiaries may suspend implementation of the action or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 51) — make implementation impossible or excessively difficult.

49.1.2 Procedure

The coordinator must immediately formally notify to the Commission the suspension (see Article 52), stating:

- the reasons why and
- the expected date of resumption.

The suspension will **take effect** the day this notification is received by the Commission.

Once circumstances allow for implementation to resume, the coordinator must immediately formally notify the Commission and request an **amendment** of the Agreement to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement or the participation of a beneficiary has been terminated (see Article 50).

The suspension will be **lifted** with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension of the action implementation are not eligible (see Article 6).

49.2 Suspension of the action implementation, by the Commission

49.2.1 Conditions

The Commission may suspend implementation of the action or any part of it, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (b) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed in other EU or Euratom grants awarded to it under similar conditions systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 22.5.2), or
- (c) the action is suspected of having lost its scientific or technological relevance.

49.2.2 Procedure

Before suspending implementation of the action, the Commission will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend the implementation and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the Commission does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the procedure is not continued.

The suspension will **take effect** five days after confirmation notification is received (or on a later date specified in the notification).

It will be **lifted** if the conditions for resuming implementation of the action are met.

The coordinator or beneficiary concerned will be formally notified of the lifting and the Agreement will be **amended** to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement has already been terminated (see Article 50).

The suspension will be lifted with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension are not eligible (see Article 6).

The beneficiaries may not claim damages due to suspension by the Commission (see Article 46).

Suspension of the action implementation does not affect the Commission's right to terminate the

Agreement or participation of a beneficiary (see Article 50), reduce the grant or recover amounts unduly paid (see Articles 43 and 44).

ARTICLE 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES

50.1 Termination of the Agreement, by the beneficiaries

50.1.1 Conditions and procedure

The beneficiaries may terminate the Agreement.

The coordinator must formally notify termination to the Commission (see Article 52), stating:

- the reasons why and
- the date the termination will take effect. This date must be after the notification.

If no reasons are given or if the Commission considers the reasons do not justify termination, the Agreement will be considered to have been 'terminated improperly'.

The termination will **take effect** on the day specified in the notification.

50.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the open reporting period until termination; see Article 20.3) and
- (ii) the final report (see Article 20.4).

If the Commission does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The Commission will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Improper termination may lead to a reduction of the grant (see Article 43).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

50.2 Termination of the participation of one or more beneficiaries, by the beneficiaries

50.2.1 Conditions and procedure

The participation of one or more beneficiaries may be terminated by the coordinator, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must formally notify termination to the Commission (see Article 52) and inform the beneficiary concerned.

If the coordinator's participation is terminated without its agreement, the formal notification must be done by another beneficiary (acting on behalf of the other beneficiaries).

The notification must include:

- the reasons why;
- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing);
- the date the termination takes effect. This date must be after the notification, and
- a request for amendment (see Article 55), with a proposal for reallocation of the tasks and the estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination takes effect after the period set out in Article 3, no request for amendment must be included unless the beneficiary concerned is the coordinator. In this case, the request for amendment must propose a new coordinator

If this information is not given or if the Commission considers that the reasons do not justify termination, the participation will be considered to have been **terminated improperly**.

The termination will **take effect** on the day specified in the notification.

50.2.2 Effects

The coordinator must — within 30 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned and
- (ii) if termination takes effect during the period set out in Article 3, a 'termination report' from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Articles 20.3 and 20.4).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the Commission (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the Commission, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The Commission will — on the basis of the periodic reports, the termination report and the report on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the Commission.

Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

In case of a reduction (see Article 43), the Commission will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received exceed the amounts due:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The Commission will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the Commission will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the Commission will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Commission the amount due and the Commission will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
 - termination takes effect after an interim payment and
 - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the Commission will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Commission the amount due. The Commission will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the Commission does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the Commission does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

Improper termination may lead to a reduction of the grant (see Article 43) or termination of the Agreement (see Article 50).

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

50.3 Termination of the Agreement or the participation of one or more beneficiaries, by the Commission

50.3.1 Conditions

The Commission may terminate the Agreement or the participation of one or more beneficiaries, if:

- (a) one or more beneficiaries do not accede to the Agreement (see Article 56);
- (b) a change to their legal, financial, technical, organisational or ownership situation (or those of its linked third parties) is likely to substantially affect or delay the implementation of the action or calls into question the decision to award the grant;
- (c) following termination of participation for one or more beneficiaries (see above), the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants (see Article 55);
- (d) implementation of the action is prevented by force majeure (see Article 51) or suspended by the coordinator (see Article 49.1) and either:
 - (i) resumption is impossible, or
 - (ii) the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants;
- (e) a beneficiary is declared bankrupt, being wound up, having its affairs administered by the courts, has entered into an arrangement with creditors, has suspended business activities, or is subject to any other similar proceedings or procedures under national law;
- (f) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has been found guilty of professional misconduct, proven by any means;
- (g) a beneficiary does not comply with the applicable national law on taxes and social security;
- (h) the action has lost scientific or technological relevance;
- (i) not applicable;
- (j) not applicable;

- (k) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed fraud, corruption, or is involved in a criminal organisation, money laundering or any other illegal activity;
- (l) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (m) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed in other EU or Euratom grants awarded to it under similar conditions systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 22.5.2);
- (n) despite a specific request by the Commission, a beneficiary does not request through the coordinator an amendment to the Agreement to end the participation of one of its linked third parties or international partners that is in one of the situations under points (e), (f), (g), (k), (l) or (m) and to reallocate its tasks.

50.3.2 Procedure

Before terminating the Agreement or participation of one or more beneficiaries, the Commission will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to terminate and the reasons why and
- inviting it, within 30 days of receiving notification, to submit observations and in case of Point (l.ii) above to inform the Commission of the measures to ensure compliance with the obligations under the Agreement.

If the Commission does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify to the coordinator or beneficiary concerned **confirmation** of the termination and the date it will take effect. Otherwise, it will formally notify that the procedure is not continued.

The termination will **take effect**:

- for terminations under Points (b), (c), (e), (g), (h), (j), (l.ii) and (n) above: on the day specified in the notification of the confirmation (see above);
- for terminations under Points (a), (d), (f), (i), (k), (l.i) and (m) above: on the day after the notification of the confirmation is received.

50.3.3 Effects

(a) for termination of the Agreement:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the last open reporting period until termination; see Article 20.3) and
- (ii) a final report (see Article 20.4).

If the Agreement is terminated for breach of the obligation to submit reports (see Articles 20.8 and 50.3.1(1)), the coordinator may not submit any reports after termination.

If the Commission does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The Commission will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

This does not affect the Commission's right to reduce the grant (see Article 43) or to impose administrative sanctions (Article 45).

The beneficiaries may not claim damages due to termination by the Commission (see Article 46).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

(b) for termination of the participation of one or more beneficiaries:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned;
- (ii) a request for amendment (see Article 55), with a proposal for reallocation of the tasks and estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination is notified after the period set out in Article 3, no request for amendment must be submitted unless the beneficiary concerned is the coordinator. In this case the request for amendment must propose a new coordinator, and
- (iii) if termination takes effect during the period set out in Article 3, a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Article 20).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the Commission (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the Commission, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The Commission will — on the basis of the periodic reports, the termination report and the report on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the Commission.

Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

In case of a reduction (see Article 43), the Commission will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received exceed the amounts due:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The Commission will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the Commission will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the Commission will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Commission the amount due and the Commission will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
 - termination takes effect after an interim payment and

- the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the Commission will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Commission the amount due. The Commission will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the Commission does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the Commission does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

SECTION 4 FORCE MAJEURE

ARTICLE 51 — FORCE MAJEURE

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties' control,
- was not due to error or negligence on their part (or on the part of third parties involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

The following cannot be invoked as force majeure:

- any default of a service, defect in equipment or material or delays in making them available, unless they stem directly from a relevant case of force majeure,
- labour disputes or strikes, or
- financial difficulties.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

The party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

CHAPTER 7 FINAL PROVISIONS

ARTICLE 52 — COMMUNICATION BETWEEN THE PARTIES

52.1 Form and means of communication

Communication under the Agreement (information, requests, submissions, 'formal notifications', etc.) must:

- be made in writing and
- bear the number of the Agreement.

All communication must be made through the Participant Portal **electronic** exchange system and using the forms and templates provided there.

If — after the payment of the balance — the Commission finds that a formal notification was not accessed, a second formal notification will be made by registered post with proof of delivery ('formal notification on **paper**'). Deadlines will be calculated from the moment of the second notification.

Communications in the electronic exchange system must be made by persons authorised according to the Participant Portal Terms & Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'legal entity appointed representative (LEAR)'. The role and tasks of the LEAR are stipulated in his/her appointment letter (see Participant Portal Terms & Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the Commission website.

52.2 Date of communication

Communications are considered to have been made when they are sent by the sending party (i.e. on the date and time they are sent through the electronic exchange system).

Formal notifications through the **electronic** exchange system are considered to have been made when they are received by the receiving party (i.e. on the date and time of acceptance by the receiving party, as indicated by the time stamp). A formal notification that has not been accepted within 10 days after sending is considered to have been accepted.

Formal notifications **on paper** sent by **registered post** with proof of delivery (only after the payment of the balance) are considered to have been made on either:

- the delivery date registered by the postal service or
- the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

52.3 Addresses for communication

The **electronic** exchange system must be accessed via the following URL:

https://ec.europa.eu/research/participants/portal/desktop/en/projects/

The Commission will formally notify the coordinator and beneficiaries in advance any changes to this URL.

Formal notifications on paper (only after the payment of the balance) addressed **to the Commission** must be sent to the official mailing address indicated on the Commission's website.

Formal notifications on paper (only after the payment of the balance) addressed **to the beneficiaries** must be sent to their legal address as specified in the Participant Portal Beneficiary Register.

ARTICLE 53 — INTERPRETATION OF THE AGREEMENT

53.1 Precedence of the Terms and Conditions over the Annexes

The provisions in the Terms and Conditions of the Agreement take precedence over its Annexes.

Annex 2 takes precedence over Annex 1.

53.2 Privileges and immunities

Not applicable

ARTICLE 54 — CALCULATION OF PERIODS, DATES AND DEADLINES

In accordance with Regulation No 1182/71³⁰, periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

ARTICLE 55 — AMENDMENTS TO THE AGREEMENT

55.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

55.2 Procedure

³⁰ Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8.6.1971, p. 1).

The party requesting an amendment must submit a request for amendment signed in the electronic exchange system (see Article 52).

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3).

If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why;
- the appropriate supporting documents, and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The Commission may request additional information.

If the party receiving the request agrees, it must sign the amendment in the electronic exchange system within 45 days of receiving notification (or any additional information the Commission has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date agreed by the parties or, in the absence of such an agreement, on the date on which the amendment enters into force.

ARTICLE 56 — ACCESSION TO THE AGREEMENT

56.1 Accession of the beneficiaries mentioned in the Preamble

The other beneficiaries must accede to the Agreement by signing the Accession Form (see Annex 3) in the electronic exchange system (see Article 52) within 30 days after its entry into force (see Article 58).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 58).

If a beneficiary does not accede to the Agreement within the above deadline, the coordinator must — within 30 days — request an amendment to make any changes necessary to ensure proper implementation of the action. This does not affect the Commission's right to terminate the Agreement (see Article 50).

56.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 55.

Associated with document Ref. Ares 2M9 6815 46 Lti 04/9 1/2019

It must include an Accession Form (see Annex 3) signed by the new beneficiary in the electronic exchange system (see Article 52).

New beneficiaries must assume the rights and obligations under the Agreement with effect from the date of their accession specified in the Accession Form (see Annex 3).

ARTICLE 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

57.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

57.2 Dispute settlement

If a dispute concerning the interpretation, application or validity of the Agreement cannot be settled amicably, the General Court — or, on appeal, the Court of Justice of the European Union — has sole jurisdiction. Such actions must be brought under Article 272 of the Treaty on the Functioning of the EU (TFEU).

As an exception, if such a dispute is between the Commission and NORSK INSTITUTT FOR LUFTFORSKNING STIFTELSE, PAUL SCHERRER INSTITUT, EIDGENOSSISCHE MATERIALPRUFUNGS- UND FORSCHUNGSANSTALT, the competent Belgian courts have sole jurisdiction.

If a dispute concerns administrative sanctions, offsetting or an enforceable decision under Article 299 TFEU (see Articles 44, 45 and 46), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice of the European Union — under Article 263 TFEU.

ARTICLE 58 — ENTRY INTO FORCE OF THE AGREEMENT

The Agreement will enter into force on the day of signature by the Commission or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

For the Commission



EUROPEAN COMMISSION Directorate-General for Research and Innovation Research & Industrial Infrastructures



ANNEX 1 (part A)

Research and Innovation action

NUMBER — 871115 — ACTRIS IMP

Table of Contents

1.1.	The project summary	3
1.2.	The list of beneficiaries	4
1.3.	Workplan Tables - Detailed implementation	6
	1.3.1. WT1 List of work packages	6
	1.3.2. WT2 List of deliverables	7
	1.3.3. WT3 Work package descriptions	11
	Work package 1	11
	Work package 2	15
	Work package 3	19
	Work package 4	23
	Work package 5	28
	Work package 6	33
	Work package 7	38
	Work package 8	49
	Work package 9	53
	Work package 10	57
	Work package 11	61
	Work package 12	65
	1.3.4. WT4 List of milestones	67
	1.3.5. WT5 Critical Implementation risks and mitigation actions	74
	1.3.6 WT6 Summary of project effort in person-months	75
	1.3.7. WT7 Tentative schedule of project reviews	78
	1.3.8 WT8 Summary of transpational / virtual access provision per installation	79

1.1. The project summary

Project Number ¹	871115	Project Acronym ²	ACTRIS IMP

One form per project							
	General information						
Project title ³	Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project						
Starting date ⁴ 01/01/2020							
Duration in months 5	48						
Call (part) identifier ⁶	H2020-INFRADEV-2019-2						
Торіс	INFRADEV-03-2018-2019 Individual support to ESFRI and other world-class research infrastructures						
Fixed EC Keywords							
Free keywords ACTRIS, Aerosol, Clouds, Trace Gases, Research Infrastructure, ESFRI, Atmosph Research, Implementation, ERIC, Catalogue of Services, Services to Users, Science Innovation, ERA							
	Abstract 7						

The Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) is a pan-European research infrastructure producing high-quality data and information on short-lived atmospheric constituents and on the processes leading to the variability of these constituents in natural and controlled atmospheres. Different atmospheric processes are increasingly in the focus of many societal and environmental challenges, such as air quality, health, sustainability and climate change. ACTRIS brings essential information for understanding atmospheric processes and bio-geochemical interactions between the atmosphere and ecosystems. ACTRIS is composed of Observational and Exploratory Platforms, Topical Centres, Data Centre, and Head Office that is coordinating the ACTRIS activities. ACTRIS serves a vast community of users such as scientists, policy makers, private sector, funding organisations and educators. ACTRIS activity started almost 20 years ago, and currently more than 100 European partners from 22 countries are engaged in building the research infrastructure. ACTRIS was selected to the ESFRI roadmap in 2016 and was granted with EC preparatory phase project funding (ACTRIS PPP) for 2017-2019. Interim ACTRIS Council (IAC), representing the governmental representatives of 16 member countries and one observer country, have submitted the ACTRIS ERIC step 1 documents to EC in Feb 2019. IAC is aiming to establish ACTRIS ERIC in 2021. ACTRIS is entering the implementation phase in 2020. The ACTRIS implementation project, ACTRIS IMP, will take ACTRIS into a new level of maturity and will set the needed structures for the implementation actions, both at the national and European level. ACTRIS IMP builds on three main pillars: securing the long-term sustainability, implementing of ACTRIS functionalities, and positioning ACTRIS in the national, European and international science and innovation landscape. ACTRIS IMP will enable ACTRIS to respond to the users' needs and requirements.

1.2. List of Beneficiaries

Project Number ¹	871115	Project Acronym ²	ACTRIS IMP

List of Beneficiaries

No	Name	Short name	Country	Project entry month ⁸	Project exit month
1	ILMATIETEEN LAITOS	FMI	Finland	1	48
2	HELSINGIN YLIOPISTO	UHEL	Finland	1	48
3	CONSIGLIO NAZIONALE DELLE RICERCHE	CNR	Italy	1	48
4	LEIBNIZ INSTITUT FUER TROPOSPHAERENFORSCHUNG e.V.	TROPOS	Germany	1	48
5	KARLSRUHER INSTITUT FUER TECHNOLOGIE	KIT	Germany	1	48
6	FORSCHUNGSZENTRUM JULICH GMBH	FZJ	Germany	1	48
7	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	CNRS	France	1	48
8	INSTITUT MINES-TELECOM	IMT	France	1	48
9	INSTITUT NATIONAL DE L ENVIRONNEMENT ET DES RISQUES INERIS FI		France	1	48
10	NORSK INSTITUTT FOR LUFTFORSKNING STIFTELSE	NILU	Norway	1	48
11	NATIONAL INSTITUTE OF RESEARCH AND DEVELOPMENT FOR OPTOELECTRONICS	INOE	Romania	1	48
12	PAUL SCHERRER INSTITUT	PSI	Switzerland	1	48
13	EIDGENOSSISCHE MATERIALPRUFUNGS- UND FORSCHUNGSANSTALT	ЕМРА	Switzerland	1	48
14	KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT-KNMI	KNMI	Netherlands	1	48
15	INSTITUT ROYAL D'AERONOMIE SPATIALEDE BELGIQUE	BIRA-IASB	Belgium	1	48
16	THE UNIVERSITY OF MANCHESTER	UNIMAN	United Kingdom	1	48
17	UNITED KINGDOM RESEARCH AND INNOVATION	UKRI	United Kingdom	1	48
18	THE CYPRUS INSTITUTE	CYI	Cyprus	1	48
19	UNIWERSYTET WARSZAWSKI	UNIWARSAW	Poland	1	48
20	LUNDS UNIVERSITET	ULUND	Sweden	1	48
21	JRC -JOINT RESEARCH CENTRE- EUROPEAN COMMISSION	JRC	Belgium	1	48
22	MEDIZINISCHE UNIVERSITAT INNSBRUCK	MUI	Austria	1	48

1.2. List of Beneficiaries

No	Name	Short name	Country	Project entry month ⁸	Project exit month
23	ZENTRALANSTALT FUR METEOROLOGIE UNDGEODYNAMIK	ZAMG	Austria	1	48
24	USTAV CHEMICKYCH PROCESU AV CR, v. v. i.	ICPF	Czechia	1	48
25	NATIONAL OBSERVATORY OF ATHENS	NOA	Greece	1	48
26	IDRYMA TECHNOLOGIAS KAI EREVNAS	FORTH	Greece	1	48
27	INSTITUTE OF NUCLEAR RESEARCH AND NUCLEAR ENERGY - BULGARIAN ACADEMY OF SCIENCES	INRNE-BAS	Bulgaria	1	48
28	UNIVERSITY COLLEGE CORK - NATIONAL UNIVERSITY OF IRELAND, CORK	UCC	Ireland	1	48
29	AARHUS UNIVERSITET	AU	Denmark	1	48
30	UNIVERSITAT POLITECNICA DE CATALUNYA	UPC	Spain	1	48
31	FUNDACION CENTRO DE ESTUDIOS AMBIENTALES DEL MEDITERRANEO	CEAM	Spain	1	48
32	UNIVERSIDAD DE VALLADOLID	UVA	Spain	1	48
33	EESTI MAAULIKOOL	EULS	Estonia	1	48
34	UNIVERSIDADE DE EVORA	UEvora	Portugal	1	48

1.3. Workplan Tables - Detailed implementation (2019)6815176 - 04/11/2019

1.3.1. WT1 List of work packages

WP Number ⁹	WP Title	Lead beneficiary ¹⁰	Person- months ¹¹	Start month ¹²	End month ¹³
WP1	Engagement and enlargement of the ACTRIS community and ACTRIS membership	1 - FMI	61.00	1	48
WP2	Implementation of a sustainable ACTRIS organization	2 - UHEL	43.00	1	48
WP3	Strategy for enhancing ACTRIS relevance and impact	2 - UHEL	44.00	1	48
WP4	Implementation and testing operation of the Central Facilities	11 - INOE	81.00	1	48
WP5	Facilitating the harmonized operation of the National Facilities	4 - TROPOS	69.00	1	48
WP6	Implementation of the user access to ACTRIS services	3 - CNR	53.00	1	48
WP7	Piloting trans-national access for supporting the implementation of ACTRIS services	7 - CNRS	18.20	1	48
WP8	Consolidating the position of ACTRIS in the European and international research landscape	7 - CNRS	29.00	1	48
WP9	Positioning ACTRIS in the European innovation ecosystem	3 - CNR	47.00	1	48
WP10	ACTRIS communication and public relations	1 - FMI	35.00	1	48
WP11	Project management and ethics	1 - FMI	25.00	1	48
WP12	Ethics requirements	1 - FMI	N/A	1	48
		Total	505.20		I.

1.3.2. WT2 list of deliverables

Deliverable Number ¹⁴	Deliverable Title	WP number ⁹	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D1.1	Report on national ACTRIS consortia	WP1	2 - UHEL	Report	Public	40
D1.2	Report on enhancement of community building	WP1	26 - FORTH	Report	Public	46
D1.3	Report on engagement activities	WP1	1 - FMI	Report	Public	46
D1.4	Status report on regional developments and sustainability plans	WP1	24 - ICPF	Report	Public	46
D2.1	Contingency plan for implementation	WP2	7 - CNRS	Report	Public	12
D2.2	Report on financial and capacity scenarios	WP2	7 - CNRS	Report	Public	40
D2.3	List of ACTRIS policies, internal rules and legal agreement templates	WP2	2 - UHEL	Websites, patents filling, etc.	Public	46
D2.4	Updated ACTRIS Business Plan	WP2	1 - FMI	Report	Public	46
D2.5	Final report on validation of ACTRIS operation support and service provision	WP2	3 - CNR	Report	Public	48
D3.1	Draft innovation strategy	WP3	18 - CYI	Report	Public	24
D3.2	Strategic plan to enhance national and regional ACTRIS activities	WP3	14 - KNMI	Report	Public	36
D3.3	The impact of ACTRIS on society: outcome of a Contingent Valuation study	WP3	25 - NOA	Report	Public	40
D3.4	ACTRIS strategy on scientific added value, impact, attractiveness and relevance	WP3	2 - UHEL	Report	Public	42
D4.1	Descriptions of the workflows between ACTRIS components	WP4	10 - NILU	Report	Public	6
D4.2	Report on internal organization of CFs	WP4	7 - CNRS	Report	Public	24
D4.3	Revised CF implementation plans	WP4	11 - INOE	Report	Public	24

Deliverable Number ¹⁴	Deliverable Title	WP number ⁹	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D4.4	Revised ACTRIS Data Management Plan	WP4	10 - NILU	Report	Public	46
D4.5	Report on CF human capital building	WP4	11 - INOE	Report	Public	46
D4.6	Report on testing activities at CFs, outcomes and identified optimization actions	WP4	4 - TROPOS	Report	Public	48
D5.1	ACTRIS NF Labelling Plan	WP5	4 - TROPOS	Report	Public	18
D5.2	Report on tests of RI operations at NFs and recommendations for improvements	WP5	3 - CNR	Report	Public	36
D5.3	Report on support activities for NFs and RPFs	WP5	13 - EMPA	Report	Public	44
D5.4	Report on development, testing and implementation of new technologies	WP5	22 - MUI	Report	Public	46
D5.5	Report on training of NF and RPF operators	WP5	30 - UPC	Report	Public	48
D6.1	ACTRIS Science and User Forum	WP6	3 - CNR	Websites, patents filling, etc.	Public	10
D6.2	Report on the ACTRIS User support system	WP6	3 - CNR	Report	Public	18
D6.3	ACTRIS online Catalogue of Services	WP6	7 - CNRS	Websites, patents filling, etc.	Public	20
D6.4	Updated ACTRIS User strategy	WP6	7 - CNRS	Report	Public	45
D6.5	ACTRIS Access and Service Management Plan	WP6	3 - CNR	Report	Public	48
D6.6	ACTRIS Access Management Platform	WP6	3 - CNR	Websites, patents filling, etc.	Public	48
D7.1	Recommendations for optimizing the access process and user interaction	WP7	7 - CNRS	Report	Public	27

Deliverable Number ¹⁴	Deliverable Title	WP number ⁹	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹
D7.2	Recommendations for implementing access to ACTRIS services	WP7	7 - CNRS	Report	Public	46
D8.1	Report on planned joint activities and synergies with other RIs and e-RIs	WP8	3 - CNR	Report	Public	18
D8.2	Defining the needs for EOSC resources in ACTRIS	WP8	10 - NILU	Report	Public	24
D8.3	Assessment of ACTRIS contribution to, and alignment of ACTRIS policies with, international networks and initiatives, incl. GEOSS and COPERNICUS	WP8	7 - CNRS	Report	Public	24
D8.4	Summary report on international ACTRIS training courses	WP8	7 - CNRS	Report	Public	40
D8.5	Application to GEO initiative on short-lived climate species	WP8	2 - UHEL	Report	Public	48
D9.1	Progress Report on the position of ACTRIS in the European Innovation Ecosystem	WP9	22 - MUI	Report	Public	18
D9.2	Means and recommendations for the operation of the ACTRIS liaison office	WP9	3 - CNR	Report	Public	36
D9.3	Report on the results of the flagship actions	WP9	8 - IMT	Report	Public	48
D9.4	ACTRIS innovation offer portfolio	WP9	3 - CNR	Report	Public	48
D10.1	Updated plan for communication within ACTRIS	WP10	1 - FMI	Report	Public	12
D10.2	Creation of dedicated communication portfolio	WP10	7 - CNRS	Websites, patents filling, etc.	Public	16
D10.3	Communication and public relations strategic master plan	WP10	2 - UHEL	Report	Public	42
D10.4	Updated plan of exploitation and	WP10	1 - FMI	Report	Public	48

Deliverable Number ¹⁴	Deliverable Title	WP number ⁹	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
	dissemination of the results					
D11.1	Ethics compliance in work performed outside EU	WP11	1 - FMI	Report	Public	2
D11.2	Protocols for questionnaires in ACTRIS IMP	WP11	1 - FMI	Report	Public	4
D11.3	ACTRIS IMP data management plan	WP11	1 - FMI	ORDP: Open Research Data Pilot	Public	6
D11.4	Minutes of ACTRIS IMP meetings in 2020	WP11	1 - FMI	Report	Public	14
D11.5	Minutes of ACTRIS IMP meetings in 2021	WP11	1 - FMI	Report	Public	26
D11.6	Minutes of ACTRIS IMP meetings in 2022	WP11	1 - FMI	Report	Public	38
D11.7	Analysis of gender balance in ACTRIS	WP11	1 - FMI	Report	Public	42
D11.8	Minutes of ACTRIS IMP meetings in 2023	WP11	1 - FMI	Report	Public	48
D11.9	Report on associated partnership program	WP11	2 - UHEL	Report	Public	48
D12.1	H - Requirement No. 1	WP12	1 - FMI	Ethics	Confidential, only for members of the consortium (including the Commission Services)	6
D12.2	POPD - Requirement No. 2	WP12	1 - FMI	Ethics	Confidential, only for members of the consortium (including the Commission Services)	6

1.3.3. WT3 Work package descriptions

Work package number 9	WP1	Lead beneficiary 10	1 - FMI		
Work package title	Engagement and enlargement of the ACTRIS community and ACTRIS membership				
Start month	1	End month	48		

Objectives

The main objective of WP1 is to ensure the long-term sustainability of ACTRIS by engaging and widening the participation of the ACTRIS community and ACTRIS members and stakeholders in the implementation of ACTRIS and subsequent ACTRIS operations. Special attention is paid to expanding the European coverage to geographical regions not yet connected to ACTRIS. The specific objectives of WP1 are to:

- consolidate the ACTRIS community and enlarge community participation, particularly in countries not yet connected to ACTRIS;
- connect the national ACTRIS activities to pan-European activities;
- maintain the engagement and enlargement of country participation in ACTRIS as ACTRIS members and observers; and
- develop links and cooperation with Regional Partner Facilities.

Expected outcomes are the reinforcement of the partnership between Member States, Associated Countries and relevant stakeholders in establishing ACTRIS as a pan-European research infrastructure. In addition, WP1 will foster capacity-building and research infrastructure human capital development in targeted, relevant regions.

Description of work and role of partners

WP1 - Engagement and enlargement of the ACTRIS community and ACTRIS membership [Months: 1-48] **FMI**, UHEL, CNR, TROPOS, CNRS, INOE, KNMI, BIRA-IASB, UNIMAN, CYI, UNIWARSAW, ULUND, ICPF, NOA, FORTH, INRNE-BAS, UCC, AU, EULS, UEvora

Engagement and enlargement of the participation includes several steps. First, the atmospheric community within a country should be aware of ACTRIS, its activities and objectives. Then, this national research community needs to organise themselves and set up a National ACTRIS consortium to link themselves to the pan-European ACTRIS community activities. The next step is to link the country funders and stakeholders to be involved and to apply for membership or observership in ACTRIS ERIC. In addition, ACTRIS is also developing partnership at the national level with the regional activities via the Regional Partner Facility concept that can involve either ACTRIS membership or firm cooperation with ACTRIS. WP1 coordinates and supports the steps towards the engagement and enlargement of the community and shall work in cooperation and interaction with all other work packages.

Task 1.1 ACTRIS community building and widening community participation

Leader: FORTH Partners: FMI, CNR, TROPOS, INOE, UW, ULUND, INRNE-BAS, EULS

The backbone of ACTRIS is the wide participation of the European atmospheric research communities in ACTRIS activities. The connections are important as the ACTRIS research community participates in the planning, implementing and operating National Facility activities in their countries. At the same time, many members of the community are also users of ACTRIS services. Task 1.1 will organize regular meetings, e.g., ACTRIS science conferences, during the ACTRIS IMP to ensure regular and effective connection with the ACTRIS communities. Task 1.1 also aims at widening participation of research communities in regions and countries that are not yet well-connected to ACTRIS through targeted events and communication with the ACTRIS-related research communities. Even though ACTRIS has good European coverage, target actions are required to expand this further. ACTRIS has already identified several potential countries, for example Iceland, Balkan and Baltic countries, for tailored community building actions. Together with WP10 (communication), Task 1.1 will create a portfolio of community actions and a toolkit for targeted one-to-one community building events. In addition to tailored events, Task 1.1 will support the participation of these new research communities in European-level ACTRIS meetings such as an ACTRIS science conference and other ACTRIS IMP meetings. Task 1.1 will prepare the ground for WP5 to continue collaboration at a technical level and the development of new ACTRIS facilities to meet ACTRIS requirements.

Task 1.2 Connecting national ACTRIS consortia to Pan-European ACTRIS

Leader: UHEL Partners: FMI, UHEL, CNR, TROPOS, CNRS, INOE, KNMI, BIRA-IASB, UMAN, CYI, UW, ULUND, ICPF, NOA, INRNE-BAS, UCC, AU, EULS, UE

ACTRIS is a highly distributed research infrastructure and most ACTRIS services and operations are provided at the national level, either via ACTRIS NFs or CFs operated and maintained by national RPOs, owners of most of assets

in ACTRIS. At the national level, ACTRIS activities are organised via National ACTRIS consortia. It is crucial that national activities and developments are aligned and linked to pan-European ACTRIS activities and implementation of ACTRIS. Task 1.2 will coordinate and support the collaborative work at the European and national level by ensuring regular communication and connections between the national ACTRIS consortia and ACTRIS. This is work is mainly done among national ACTRIS Contact Persons and with the ACTRIS IMP office (and ACTRIS ERIC Head Office (HO) when established). For new ACTRIS communities, Task 1.2 will provide support for setting up the National consortium and the formal links of National Contact Persons and ACTRIS.

Task 1.3 Maintaining and enlarging country participation and membership in ACTRIS Leader: FMI Partners: UHEL

For long-term sustainability, the utmost importance is to maintain and enlarge the engagement of the countries in ACTRIS, particularly to govern, fund and oversee the implementation of ACTRIS and set up of ACTRIS operational services in a cost-efficient manner. Task 1.3 will work with ACTRIS members and observers to ensure the smooth transition from the preparatory phase to the implementation phase. Task 1.3 will support all necessary activities to ensure that most of the countries that have participated in ACTRIS ERIC Step 1 submission will also join the final ACTRIS ERIC establishment (Step 2 submission). In addition, it is important that ACTRIS continues to reach out for new ACTRIS members by facilitating appropriate contacts and communication with ministries and decision-makers. Task 1.3 will ensure that this activity is continuously reinforced. Task 1.3 will facilitate the work of interim ACTRIS governance bodies, such as the Interim ACTRIS Council, Interim Scientific and Implementation Advisory Board, and Ethical Advisory Board, until the ACTRIS ERIC is in place. The tasks include the communication and dialogue between the members of the various bodies, organizing regular meetings and preparing all the necessary materials for the meetings. Task 1.3 will ensure timely transmission of ACTRIS IMP outcomes to ACTRIS interim bodies for feedback and decision making.

Task 1.4 Developing the ACTRIS Regional Partner Facility concept

Leader: ICPF Partners: FMI, UHEL, CYI, UW, ULUND, NOA, INRNE-BAS, AU, EULS, UE

Successful development of ACTRIS in some countries will require the adoption of a clear regional strategy to optimize their alignment with ACTRIS and the development of joint strategies for attracting and using structural funds. The regional strategy may include the development of both national ACTRIS activities and connecting Regional Partner Facility activities. This task will establish an ACTRIS Regional Partner Facility concept to cover the many types of opportunities and needs for connecting national level activities to ACTRIS benefitting both national facilities to meet the needed ACTRIS requirements and ACTRIS to link the regional characteristics and skills to the development of the ACTRIS services. Task 1.4 will target selected countries where specific efforts to consolidate regional strategies are underway. After establishment of the concept, concrete actions such as targeted meetings, capacity-building, training, consultation and technical workshops will be organised in ACTRIS IMP WP1, WP4, or WP5, depending on the scope of the actions. Many ACTRIS IMP activities will benefit from the activities performed in Task 1.4 to raise awareness and better engage research communities, private sector, stakeholders and funders with relevant ACTRIS activities in the country.

Participation per Partner			
Partner number and short name	WP1 effort		
1 - FMI	10.00		
2 - UHEL	4.00		
3 - CNR	2.00		
4 - TROPOS	2.00		
7 - CNRS	0.00		
UGA	1.00		
11 - INOE	4.00		
14 - KNMI	1.00		
15 - BIRA-IASB	1.00		
16 - UNIMAN	1.00		

Partner number and short name	WP1 effort
18 - CYI	2.00
19 - UNIWARSAW	2.00
IGF-PAS	2.00
20 - ULUND	2.00
24 - ICPF	4.00
СНМІ	2.00
25 - NOA	3.00
26 - FORTH	6.00
27 - INRNE-BAS	3.00
IE-BAS	3.00
28 - UCC	1.00
29 - AU	1.00
33 - EULS	2.00
34 - UEvora	2.00
	Total 61.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D1.1	Report on national ACTRIS consortia	2 - UHEL	Report	Public	40
D1.2	Report on enhancement of community building	26 - FORTH	Report	Public	46
D1.3	Report on engagement activities	1 - FMI	Report	Public	46
D1.4	Status report on regional developments and sustainability plans	24 - ICPF	Report	Public	46

Description of deliverables

- D 1.1 Report on national ACTRIS consortia (M40)
- D 1.2 Report on enhancement of community building (M46)
- D 1.3 Report on engagement activities (M46)
- D 1.4 Status report on regional developments and sustainability plans (M46)
- D1.1: Report on national ACTRIS consortia [40]

A report gathering the information of national ACTRIS consortia and their linkages to Pan-European ACTRIS activities.

D1.2: Report on enhancement of community building [46]

A report collecting the information of the ACTRIS community and targeted community building events.

D1.3: Report on engagement activities [46]

A report listing information on stakeholder level engagement activities, particularly related to potential ACTRIS member countries.

D1.4: Status report on regional developments and sustainability plans [46]

A status report describing ACTRIS RPF activities and future sustainability plans.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Updated list of National ACTRIS consortia with National Contact Persons	2 - UHEL	3	List available
MS2	First IAC meeting held during ACTRIS IMP	1 - FMI	8	First IAC meeting during ACTRIS IMP. Means of verification: Meeting held.
MS3	First SIAB meeting held during ACTRIS IMP	1 - FMI	12	The first SIAB meeting during ACTRIS IMP. Means of verification: Meeting held.
MS4	First ACTRIS community meeting held	26 - FORTH	18	The first ACTRIS community meeting during ACTRIS IMP. Means of verification: Meeting held.
MS5	First regional meeting organised	24 - ICPF	18	Organisation of the first regional meeting. Means of verification: Meeting held.

Work package number 9	WP2	Lead beneficiary 10	2 - UHEL
Work package title	Implementation of a sustainable ACTRIS organization		
Start month	1	End month	48

Objectives

The main objective of WP2 is to ensure the establishment and implementation of a well-managed and well organised ACTRIS ERIC and research infrastructure operations that guarantees long-term sustainability and financial commitment from the ACTRIS ERIC members and observers. The specific objectives of WP2 are to:

- finalize the ACTRIS policies, internal rules and procedures, including the legal agreements between ACTRIS ERIC and other RI components, and to analyse the needs for third-party agreements;
- ensure good human resources management and support creating career paths within ACTRIS;
- ensure the financial long-term commitments and perform a full validation of all ACTRIS CF operations, including both services for users and operation support to NFs;
- ensure the smooth implementation of ACTRIS with proper risk management actions; and
- update the long-term ACTRIS business plan.

Expected outcomes are cementing partnerships between the Member States, Associated Countries and relevant stakeholders towards establishment of ACTRIS as a pan-European research infrastructure. In addition, WP2 will foster capacity-building and research infrastructure human capital development in targeted and relevant regions.

Description of work and role of partners

WP2 - Implementation of a sustainable ACTRIS organization [Months: 1-48]

UHEL, FMI, CNR, TROPOS, KIT, CNRS, NILU, INOE, KNMI, UNIWARSAW, ICPF, INRNE-BAS, AU

RI long-term sustainability essentially depends on financial and human resource stability, as well as on well-functioning management of the organisation and processes. It requires a clean transfer from network-based project management to well-defined managerial processes. For WP2 it is especially important to work in cooperation and interaction with those WPs developing processes and strategies which are the basis for legal agreements, plans and policies; WP3 and WP9 working on innovation strategy and cooperation with private sector, WP6 providing the Catalogue of Services and access process management, WP4 working on workflows between the different actors in ACTRIS, and WP5 developing the organisation of the NFs.

Task 2.1 Refining internal policies and rules, and implementation of legal agreement framework Leader: UHEL, Partners: FMI, CNR, TROPOS, CNRS, NILU, INOE

ACTRIS requires policies to steer its activities, and to base on the necessary agreements. ACTRIS data policy, access and service policy have already been approved by the IAC. Ethical guidelines and staff policy will be in place by the end of the ACTRIS PPP project. During ACTRIS IMP other required policies and rules, such as procurement rules, will be defined and the existing policies and rules updated as required. Task 2.1 will monitor ACTRIS implementation actions to ensure they are compliant and initiate actions and adjustments when needed. Special attention is given to the management of intellectual property rights and ethical issues; technology transfer and services provided to the private sector may reveal the need to update existing ACTRIS policies and plans, such as data policy, access and services policy, and data and access management plans. The documents will be drafted jointly by relevant CF leaders and ACTRIS national representatives under IAC guidance for their approval. The defined ACTRIS policies will guide the finalising of the legal agreements between ACTRIS ERIC and the multi-national CFs, and between ACTRIS ERIC and the RPOs in charge of national activities. The framework and needs for third-party agreements will be analysed and principles for content will be provided. Implementation of the legal framework is essential for efficient coordination and operation of ACTRIS as a highly distributed RI that brings together more than one hundred independent legal entities from different European countries.

Task 2.2 Developing human capital in ACTRIS

Leader: UHEL, Partners: CNR, CNRS

The developing landscape of European RIs, and distributed RIs in particular, creates a need for a new type of expert that is not yet fully recognised. ACTRIS is an expert organisation employing highly skilled technicians, managers, data scientists, administrative personnel and leaders. These key personnel are fundamental for sustainable ACTRIS operation. In line with the European Charter for Researchers, ACTRIS ensures an excellent working environment oriented to successful performance in generating, transferring, sharing and disseminating knowledge and technological development and to the career development of researchers. ACTRIS will establish an international

working environment, in which all forms of mobility to enhance the professional development of researchers, are recognized. Moreover, the multiple roles of researchers to conduct research and/or to perform development activities at the same time when they are also involved in supervision, mentoring, management or administrative tasks, will be considered. The ACTRIS human resources strategy provided by ACTRIS PPP will form the basis of the work in Task 2.2, in which a plan will be developed for high quality human resources management and training to support a stable environment for personnel and their professional development. NFs will be supported in advocating the importance of recognising ACTRIS, and RI managerial experience in general, in relevant positions. This task will receive input from Task 8.3 on building an international training program.

Task 2.3 Ensuring financial long-term sustainability

Leader: CNR, Partners: FMI, UHEL, KIT, CNRS, NILU, INOE, KNMI, UW, ICPF, INRNE-BAS, AU

The long-term financial sustainability of ACTRIS relies on the commitments of members and observers, whose decisions are supported by the validation of all ACTRIS CF operations covering both the services for users and the operation support to NFs. A full cost validation of ACTRIS is crucial for its implementation as a distributed RI, and it is strongly connected to the specific CF implementation plans. It will include all relevant aspects, including technical and legal, addressing the long-term sustainability of ACTRIS operations and facilitating the financial planning. The extensive validation of all ACTRIS CFs is complex, and it is linked to the ACTRIS lifecycle. Therefore, the ACTRIS cost validation will be made in several rounds commencing with the most mature activities and will be performed periodically throughout the lifespan of ACTRIS. This task aims at setting the general framework, principles and process for the periodic validation of ACTRIS activities, and for performing the validation itself. ACTRIS IMP will utilize the experience gained from the first validation assessment performed during the preparatory phase to prepare the ERIC Step 2 submission. Task 2.3 will manage the validation process, support the work of the validation task group and external experts, and communicate the outcomes to IAC.

Task 2.4 Managing risks related to implementation

Leader: CNRS, Partners: UHEL, CNR, TROPOS, NILU, INOE, INRNE-BAS

The establishment of a large distributed RI requires explicit, mature plans and efficient coordination of the member countries and participating RPOs. National and European level processes related to construction, financing, and creation of operational structures and services need to be streamlined during the implementation phase. To enforce efficient and preventive planning, continuously identify and assess potential risks, ensure flexibility and define responses for any foreseeable challenges that may arise during implementation and in the future, Task 2.4 will develop a contingency plan, a risk management strategy and risk registry, and regular updates of the implementation work plans. This task will be supported by the risk management being performed in ACTRIS PPP. Different financial and capacity scenarios responding to potential changes in ACTRIS strategy and enlargement of the RI, will also be analysed for the IAC to enable well-informed decision making on financial planning.

Task 2.5 Updating the ACTRIS Business Plan Leader: FMI, Partners: UHEL, CNR, CNRS

The first version of the ACTRIS Business Plan is being developed in ACTRIS PPP. During ACTRIS IMP, the plan will be updated and enhanced. The Business Plan describes the objectives of ACTRIS and its service provision; strategies for user engagement, communication and liaisons; governance and organisation; management and resources; and financial and funding framework. The ACTRIS Business Plan will evolve during the project lifetime, as it is foreseen that ACTRIS membership will grow and the service portfolio will mature. This requires active engagement with ACTRIS stakeholders and funders to meet the current and future needs of a broad and diverse ACTRIS user community.

Participation per Partner

Partner number and short name	WP2 effort
1 - FMI	3.00
2 - UHEL	10.00
3 - CNR	5.00
4 - TROPOS	2.00
5 - KIT	1.00
7 - CNRS	3.50

Partner number and short name	WP2 effort
UPEC	0.50
10 - NILU	4.00
11 - INOE	4.00
14 - KNMI	1.00
19 - UNIWARSAW	1.00
IGF-PAS	1.00
24 - ICPF	0.00
СНМІ	1.00
27 - INRNE-BAS	3.00
IE-BAS	2.00
29 - AU	1.00
Total	43.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D2.1	Contingency plan for implementation	7 - CNRS	Report	Public	12
D2.2	Report on financial and capacity scenarios	7 - CNRS	Report	Public	40
D2.3	List of ACTRIS policies, internal rules and legal agreement templates	2 - UHEL	Websites, patents filling, etc.	Public	46
D2.4	Updated ACTRIS Business Plan	1 - FMI	Report	Public	46
D2.5	Final report on validation of ACTRIS operation support and service provision	3 - CNR	Report	Public	48

Description of deliverables

- D 2.1 Contingency plan for implementation (M12)
- D 2.2 Report on financial and capacity scenarios (M40)
- D 2.3 List of ACTRIS policies, internal rules and legal agreement templates (M46)
- D 2.4 Updated ACTRIS Business Plan (M46)
- D 2.5 Final report on validation of ACTRIS operation support and service provision (M48)
- D2.1 : Contingency plan for implementation [12]

A contingency plan to enforce efficient and preventive planning, continuously identify and assess potential risks, ensure flexibility and define responses for any foreseeable challenges that may arise during implementation and in the future.

D2.2: Report on financial and capacity scenarios [40]

A report on different financial and capacity scenarios responding to potential changes in ACTRIS strategy and enlargement of the RI.

D2.3: List of ACTRIS policies, internal rules and legal agreement templates [46]

List of policies, internal rules and legal agreement templates, including status information and links to the actual documents.

D2.4: Updated ACTRIS Business Plan [46]

An updated and enhanced version of ACTRIS Business plan developed in ACTRIS PPP.

D2.5: Final report on validation of ACTRIS operation support and service provision [48]

A report on validation of ACTRIS operation support for NFs and service provision to users.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS6	Methodology and criteria for validation of ACTRIS operation support and service provision	3 - CNR	12	Methodology and criteria for validation of ACTRIS operation support and service provision. Means of verification: Report available.
MS7	Negotiations started with the Central Facilities	2 - UHEL	18	Start of the negotiations with the Central facilities. Means of verification: First meeting held.
MS8	Plan for ACTRIS personnel training and human capital development	2 - UHEL	18	Report on the planned ACTRIS personnel training and human capital development. Means of verification: Plan available.
MS9	Mid-term report on ACTRIS operation support and service validation	3 - CNR	24	Mid-term report on ACTRIS operation support and service validation. Means of verification: Report available.
MS10	Draft report on financial and capacity scenarios	7 - CNRS	24	Draft report on financial and capacity scenarios. Means of verification: Draft report available.
MS11	Refined risk management plan	7 - CNRS	24	Refined risk management plan. Means of verification: Plan available.

Work package number 9	WP3	Lead beneficiary 10	2 - UHEL
Work package title	Strategy for enhancing ACTRIS relevance and impact		
Start month	1	End month	48

Objectives

The main objective of WP3 is to ensure that all ACTRIS IMP actions are aligned with the strategic goals of ACTRIS and to maximize the scientific relevance and socio-economic impact of ACTRIS. The specific objectives of WP3 are to:

- enhance the relevance of ACTRIS in science;
- develop ACTRIS innovation strategies;
- undertake a comprehensive socio-economic impact analysis of ACTRIS; and
- foster the local and regional impact of ACTRIS.

Expected outcomes of WP3 are: to contribute to a comprehensive landscape of sustainable RIs for responding to challenges in science, innovation and society; ensure the long-tern sustainability of ACTRIS; strengthen ACTRIS position and leading role both in the local/regional and global research and innovation landscape; promote ACTRIS contribution towards the development of global research infrastructures; foster capacity-building in technology and innovation in ACTRIS; and enable researchers to address societal challenges of global relevance.

Description of work and role of partners

WP3 - Strategy for enhancing ACTRIS relevance and impact [Months: 1-48]

UHEL, FMI, CNR, TROPOS, CNRS, NILU, INOE, PSI, KNMI, UNIMAN, CYI, ULUND, ICPF, NOA, INRNE-BAS, UEvora

WP3 will provide strategic guidance and steering to enhance the relevance of ACTRIS to science, innovation and society, and monitor the impact and added value of ACTRIS. This WP will develop and refine the strategic goals and directions for ACTRIS and create the strategic innovation plan pertinent to sustaining durable ACTRIS science and technologies. The full value chain of ACTRIS services provided to the society at large will be evaluated and measures taken to enhance the local and regional impact of ACTRIS. WP3 will cooperate and interact with all other work packages.

Task 3.1 Elaborating the ACTRIS scientific strategy

Leader: UHEL, Partners: FMI, CNR, TROPOS, CNRS, NILU, INOE, PSI, UMAN, ULUND

ACTRIS is user-driven and must, throughout its entire lifetime, respond to the evolving needs of its users. Task 3.1 will monitor the scientific impact of ACTRIS, highlight its current performance and address the evolving needs of users across sectorial boundaries (environment, energy and health). First, a comprehensive assessment for monitoring performance will be implemented using KPIs such as the number of scientific publications registered in international scientific databases (e.g., Scopus, Web of Science), their citations, number of PhD theses, keynote lectures and presentations. Second, this task will identify a series of high impact science showcases utilizing ACTRIS at full scale in an integrated manner (in-situ measurements, ground-based remote sensing, satellite remote sensing, trace gas, aerosol, and clouds, observations and laboratory work; multi-scale modelling) to illustrate the scientific and technological relevance of ACTRIS. In parallel, ACTRIS science user conferences will be regularly organized to illustrate the full potential of ACTRIS, to engage with users across multiple disciplines and to monitor emerging requirements. The outcomes through liaison and dialogue with international initiatives and programmes performed in WP8 will be adapted to inform the scientific strategy of ACTRIS.

Task 3.2 Building the strategy for innovation in ACTRIS

Leader: CYI, Partners: UHEL, CNR, CNRS, INOE, NOA

ACTRIS must develop a strategy for innovation to ensure technologies in ACTRIS remain state of the art, adopted by international standards and closely connected to the commercial market as a supplier, technology partner and user. In collaboration with NFs and CFs, and users in the academic and private sectors, Task 3.2 will monitor innovative technologies (including low-cost technologies), evaluate their potential applications in ACTRIS and define the procedures for the evolution of the ACTRIS data value-chain. Based on an assessment of past and current partnerships in ACTRIS performed in WP9, Task 3.2 will map opportunities across Europe for engaging with industry (e.g. EIT Climate-KIC), provide recommendations for best practice and perform industry events, to strengthen links between ACTRIS and private stakeholders. Task 3.2 will identify the most effective actions that serve the future innovation strategy plan, maximizing industrial engagement in ACTRIS and enhancing the impact of ACTRIS.

Task 3.3 Integrated assessment of ACTRIS societal impacts

Leader: NOA, Partners: FMI, UHEL, CNR

This task will build upon the outcomes and experience gained in ACTRIS PPP and update the macroeconomic impact analysis of ACTRIS using the most recent EU and Member States data together with the ACTRIS cost book on the required costs for the development and operation of ACTRIS. Furthermore, this task will perform a Contingent Valuation study. It will address the integrated ACTRIS capacity for providing local, regional, national and international authorities and organizations information on atmospheric composition pertinent to air quality, emission management and risk assessment to increase public awareness and to design appropriate policies and measures to minimize the negative impacts of air pollution and climate change, and to maximize social welfare. The Contingent Valuation study values non-market environmental and social goods through the formulation of hypothetical markets, in the frame of which the potential "consumer" or "user" is asked to express his/her preferences and to evaluate the potential changes in the supply of the examined good. Through this survey, the value of retaining/expanding ACTRIS for society can be obtained by aggregating the individuals' willingness to pay for the whole population. The detailed analysis will be performed in 2-3 ACTRIS countries and the results extrapolated to the whole Europe of through benefits transfer. This process will allow the estimation of the value that society attributes to ACTRIS.

Task 3.4 Enhancing the local and regional impact of ACTRIS

Leader: KNMI Partners: FMI, UHEL, CNR, CYI, ICPF, NOA, INRNE-BAS, UE

One of the key elements for long-term sustainability is to ensure that national level ACTRIS activities are embedded in national research, development and innovation strategies, and that the national level activities have a local impact. This needs regular and well-functioning connections with local and regional user communities, ACTRIS RPFs, private sector actors, stakeholders and funders, and that the importance and the relevance of ACTRIS at the local and regional level is communicated to local policy makers. In many countries national ACTRIS consortia have established connections to various user communities and have experience on how to link RI activities to boost the local and regional science and innovation actions. Task 3.4 will collect best practices, organize knowledge transfer activities and events, and facilitate the establishment of links between National ACTRIS Consortia and local users, stakeholders and policymakers to enhance the local and regional impact of ACTRIS activities.

Partner number and short name	WP3 effort
1 - FMI	1.00
2 - UHEL	10.00
3 - CNR	2.00
4 - TROPOS	2.00
7 - CNRS	0.00
UGA	2.00
10 - NILU	1.00
11 - INOE	4.00
12 - PSI	1.00
14 - KNMI	1.00
TUD	2.00
16 - UNIMAN	1.00
18 - CYI	3.00
20 - ULUND	1.00
24 - ICPF	0.00
СНМІ	1.00
25 - NOA	7.00

Partner number and short name	WP3 effort
NCSR-D	2.00
27 - INRNE-BAS	2.00
34 - UEvora	1.00
Total	44.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D3.1	Draft innovation strategy	18 - CYI	Report	Public	24
D3.2	Strategic plan to enhance national and regional ACTRIS activities	14 - KNMI	Report	Public	36
D3.3	The impact of ACTRIS on society: outcome of a Contingent Valuation study	25 - NOA	Report	Public	40
D3.4	ACTRIS strategy on scientific added value, impact, attractiveness and relevance	2 - UHEL	Report	Public	42

Description of deliverables

- D 3.1 Draft innovation strategy (M24)
- D 3.2 Strategic plan to enhance national and regional ACTRIS activities (M36)
- D 3.3 The impact of ACTRIS on society: outcome of a Contingent Valuation study (M40)
- D 3.4 ACTRIS strategy on scientific added value, impact, attractiveness and relevance (M42)
- D3.1 : Draft innovation strategy [24]

A strategy report for innovation to ensure technologies in ACTRIS remain state-of-the-art, adopted by international standards and closely connected to the commercial market.

D3.2 : Strategic plan to enhance national and regional ACTRIS activities [36]

A strategic plan to ensure best practices, knowledge transfer activities and events, and the establishment of links between National ACTRIS Consortia and local users, stakeholders and policymakers to enhance the local and regional impact of ACTRIS activities.

D3.3: The impact of ACTRIS on society: outcome of a Contingent Valuation study [40]

An integrated assessment report on the ACTRIS societal impacts based on the outcomes of the Contingent Valuation study.

D3.4 : ACTRIS strategy on scientific added value, impact, attractiveness and relevance [42]

A strategy report on the scientific impact of ACTRIS, its current performance and the evolving needs of users across sectorial boundaries (environment, energy and health).

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS12	ACTRIS meeting on technologies and innovation with participation of the ACTRIS associate from private sector	18 - CYI	12	A meeting on ACTRIS technologies and innovation with participation of the ACTRIS associate from private sector. Means of verification: Meeting held.
MS13	Macroeconomic impact analysis updated	25 - NOA	18	Updated macroeconomic impact analysis. Means of verification: Report available.
MS14	ACTRIS Meeting with the National Stakeholders organized	14 - KNMI	20	ACTRIS Meeting with the National Stakeholders. Means of verification: Meeting held.
MS15	ACTRIS general science meeting focusing on the user dimension and the international stakeholders	2 - UHEL	24	ACTRIS general science meeting focusing on the user dimension and the international stakeholders. Means of verification: Meeting held.

Work package number 9	WP4	Lead beneficiary 10	11 - INOE
Work package title	Implementation	on and testing operation of the	Central Facilities
Start month	1	End month	48

Objectives

The main objective of WP4 is to establish the functionalities of ACTRIS CFs as European-wide distributed facilities. This includes the interconnections between CFs, refinement of the implementation plans, facilitating the connections to other ACTRIS components and testing selected operation support and services. The specific objectives of WP4 are to:

- align implementation of CFs and their Units, develop the procedures and connections between the CFs;
- establish tools and implement software for managing distributed workflows between TCs, DC, and NFs;
- revise the CF implementation plans, required capacity, and set up the operation support and services with highest priority in the implementation phase;
- define and test the main CF functionalities, and identify measures to optimize the provision of operation support and services; and
- facilitate technological development at TCs and DC.

The expected outcome of this WP is establishing the operational framework in which ACTRIS operates. At the end of the project: a) CFs will be functional; b) workflows between CFs and NFs will be established and tested; c) first set of operation support will be implemented and tested; d) activities for technology development will be started. This activity supports the provision of a comprehensive European landscape of sustainable RIs and fosters the capacity-building and RI human capital development across Europe.

Description of work and role of partners

WP4 - Implementation and testing operation of the Central Facilities [Months: 1-48]

INOE, FMI, UHEL, CNR, TROPOS, KIT, FZJ, CNRS, IMT, INERIS, NILU, EMPA, KNMI, BIRA-IASB, UNIMAN, UKRI, UNIWARSAW, JRC, MUI, ZAMG, ICPF, UPC, UVA

WP4 spans the entire duration of the project. Each CF consists of several Units led by various RPOs and ACTRIS IMP partners and WP4 will address four principal elements necessary for implementing CF functionalities and enabling their operation: a) internal organization of CFs as pan-European collaborative entities; b) establishment of workflows between TCs, DC and NFs; c) revision of the CF implementation plans in agreement with ACTRIS development at national and European level; d) testing the functionalities of TCs and DC. ACTRIS IMP beneficiaries and linked Third Parties hosting the CF Units will participate in this WP.

Task 4.1 Organising the internal structure and procedures for Central Facilities

Leader: CNRS Partners: FMI, UHEL, CNR, TROPOS, KIT, FZJ, IMT, INERIS, NILU, INOE, EMPA, KNMI, BIRA-IASB, UMAN, UKRI, MUI, ZAMG, ICPF, UPC, UVA

In this task, CFs will implement their internal management structure and document the specific activities to be performed by each Unit, including the provision of a clear description of tasks and responsibilities. This information will be used in WP2 for concluding the contractual agreements between the CF Units (CF internal), and between the ERIC and the CF Units (CF external). CFs will develop and implement their internal working procedures, optimize the information flow between the Units, set up communication tools in coordination with WP10 and propose specific KPIs to be used for evaluating the CF technical and operation performance. To facilitate the CF internal management and benefit from synergies, common management software tools shall be selected and implemented at all CF Units. Partners will also seek harmonisation of procedures and tools across ACTRIS. A dedicated team will analyse the technical plans of the TC and DC Units, identify opportunities and propose technically feasible and cost-effective solutions at all Units.

Task 4.2 Refinement and implementation of workflow tools for interactions between the Topical Centres, Data Centre and National Facilities

Leader: NILU Partners: FMI, UHEL, TROPOS, KIT, CNRS, INOE, BIRA-IASB

Production of fully quality assured ACTRIS data will follow a well-defined workflow involving NFs, TCs and DC. The workflows have been established between the ACTRIS TCs, DC and the NFs in ACTRIS PPP, to ensure cost efficient and clear roles and responsibilities and sharing of tasks. To guarantee traceability of data from the NFs, the data need to be associated with instrument and data quality documentation produced at the responsible CF. The workflows will include steps distributed across NFs, TCs and DC, and a web-based workflow management tool will be selected and implemented to ensure full traceability of all data production steps. This tool will identify non-human and human agents (by login), conduct and trigger automatic and manual tasks, collect provenance information and append these to the

metadata. After implementation and testing, the workflows will be refined at the end of ACTRIS IMP in collaboration with WP5, as a part of revision of the ACTRIS Data Management Plan.

Task 4.3 Facilitating the implementation of Central Facility activities

Leader: INOE Partners: FMI, UHEL, CNR, TROPOS, KIT, FZJ, CNRS, IMT, INERIS, NILU, EMPA, KNMI, BIRA-IASB, UMAN, UKRI, MUI, ZAMG, ICPF, UPC, UVA

The first versions of the CF implementation plans have been developed in ACTRIS PPP in accordance with the CF concept descriptions. Task 4.3 will continue to develop the implementation plans and propose contingency measures. A systematic analysis of the required CF capacity will be undertaken, which will be balanced by the technical constraints, scientific relevance and financial support from stakeholders and ACTRIS ERIC (linking with WP2). In this process, each CF will break down their activities, provide information for the development of the Catalogue of Services (output to WP6), quantify the associated costs and compile lists with operation support (output to WP5) and selected services (output to WP6) for the implementation phase. ACTRIS IMP will provide the necessary support for exchanging expertise between CFs, with the aim of helping less experienced Units meet the same standards as those with more experience and become valuable partners in the CF consortia. This task will organize activities such as topical workshops, intensive training for technologists and managers, short-term visits, and seminars on technical and managerial issues.

Task 4.4 Testing the functionalities of the Central Facilities

Leader: TROPOS Partners: FMI, UHEL, KIT, CNRS, NILU, INOE, KNMI, BIRA-IASB, UMAN, UW, JRC ICPF, UVA This task includes testing the functionalities of the CFs in general, and of the priority operation support for the labelling of NFs. Work refers to the definition of testing methodology (objectives and criteria) and planning and implementation of the testing process. The basic functionalities of the CFs will be assessed against the KPIs proposed in Task 4.1 and considering the workflows implemented in Task 4.2. The outcomes of the tests will be used to identify measures for optimizing the operation and potentially for adjusting the workflows and the ACTRIS Data Management Plan. The operation support, which is essential for facilitating the labelling of the NFs (output to WP5), will be tested in the form of operation support provisions to experienced NFs and collection of their feedback (input from WP5). Optimization measures will be identified based on this exercise and implemented at CFs. The work performed in Task 4.4 will contribute to WP3, WP7 and WP9.

Participation per Partner

Partner number and short name	WP4 effort
1 - FMI	2.00
2 - UHEL	3.00
3 - CNR	4.00
4 - TROPOS	6.00
5 - KIT	3.00
6 - FZJ	1.00
7 - CNRS	4.50
UVSQ	1.50
LILLE	1.50
UPEC	0.50
8 - IMT	2.00
9 - INERIS	2.00
10 - NILU	8.00
11 - INOE	10.00
13 - EMPA	1.00
14 - KNMI	1.00

Partner number and short name	WP4 effort
TUD	2.00
15 - BIRA-IASB	3.00
16 - UNIMAN	4.00
17 - UKRI	2.00
19 - UNIWARSAW	2.00
21 - JRC	1.00
22 - MUI	3.00
23 - ZAMG	2.00
24 - ICPF	6.00
30 - UPC	0.00
BSC	2.00
32 - UVA	2.00
AEMET	1.00
	Total 81.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D4.1	Descriptions of the workflows between ACTRIS components	10 - NILU	Report	Public	6
D4.2	Report on internal organization of CFs	7 - CNRS	Report	Public	24
D4.3	Revised CF implementation plans	11 - INOE	Report	Public	24
D4.4	Revised ACTRIS Data Management Plan	10 - NILU	Report	Public	46
D4.5	Report on CF human capital building	11 - INOE	Report	Public	46
D4.6	Report on testing activities at CFs, outcomes and identified optimization actions	4 - TROPOS	Report	Public	48

Description of deliverables

- D 4.1 Descriptions of the workflows between ACTRIS components (M6)
- D 4.2 Report on internal organization of CFs (M24)
- D 4.3 Revised CF implementation plans (M24)
- D 4.4 Revised ACTRIS Data Management Plan (M46)
- D 4.5 Report on CF human capital building (M46)
- D 4.6 Report on testing activities at CFs, outcomes and identified optimization actions (M48)

D4.1 : Descriptions of the workflows between ACTRIS components [6]

Document describing detailed workflows between the National Facilities, Topical Centres (broken down at the Unit level) and the Data Centre.

D4.2: Report on internal organization of CFs [24]

Document describing the internal rules of procedures for each Central Facility, tasks and responsibilities of the Central Facilities Units and proposed Key Performance Indicators for their technical activity.

D4.3 : Revised CF implementation plans [24]

Document describing the detailed implementation plans of the Central Facilities, revised and balanced against the technical constraints, scientific relevance and available financial support from stakeholders and ERIC.

D4.4: Revised ACTRIS Data Management Plan [46]

Online machine actionable Data Management Plan. Distribution of work between DC, TC, NF will be revised during the project. This can affect the data management plan, and a consolidated version will be provided.

D4.5: Report on CF human capital building [46]

Document summarizing all actions organized for exchanging expertise between CFs, e.g. topical workshops, intensive training for technologists and managers, short-term visits, seminars on specific technical or managerial challenges.

D4.6: Report on testing activities at CFs, outcomes and identified optimization actions [48]

Document summarizing the operation support provided to selected National Facilities, analysis of the feed-backs and identified actions for optimization of functionalities.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS16	Release of the tool for estimating the necessary capacity at the Central Facilities	11 - INOE	3	Release of the tool for estimating the necessary capacity at the Central Facilities. Means of verification: Collecting tool available.
MS17	Recommendations for harmonisation of procedures and tools across the ACTRIS domains	7 - CNRS	12	Recommendations for harmonisation of procedures and tools across the ACTRIS domains. Means of verification: Summary of recommendations will be published on ACTRIS website.
MS18	Selection of web-based NF-TC-DC workflow management tool	10 - NILU	12	Selection of web-based NF-TC-DC workflow management tool. Means of verification: Selection process and results documented.
MS19	Action plan for CF human capital building	11 - INOE	12	Action plan for CF human capital building. Means of verification: Summary published on the ACTRIS website.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS20	Release of the list for priority operation support and services	11 - INOE	12	Release of the list for priority operation support and services. Means of verification: List published on the ACTRIS website.
MS21	Access to first version of web-based NF-TC-DC workflow management tool	10 - NILU	24	Access to first version of web-based NF-TC-DC workflow management tool. Means of verification: Web-based workflow management released.
MS22	Collection of the first feed- back on the operation support provided to National Facilities	4 - TROPOS	36	Collection of the first feed- back on the operation support provided to National Facilities. Means of verification: Summary published on ACTRIS website.

Work package number 9	WP5	Lead beneficiary 10	4 - TROPOS
Work package title	Facilitating th	e harmonized operation of the	National Facilities
Start month	1	End month	48

Objectives

The main objective of WP5 is to facilitate the smooth and consistent implementation of the ACTRIS observational and exploratory platforms with the aim to reach a high-grade operational functionality of the NFs at the end of the ACTRIS implementation phase. The specific objectives of WP5 are to:

- implement the ACTRIS NF labelling process;
- support new ACTRIS NFs and RPFs to meet ACTRIS technical standards;
- connect the NFs to ACTRIS operations and enable the required workflows;
- foster upgrades and technology development at the NFs;
- facilitate exchange of expertise and adoption of best practices through training and collaboration of the NF and the RPF operators.

Expected outcome of this WP is the sustainable integration of the distributed NFs in the operational framework of ACTRIS. In addition, WP5 fosters capacity-building and RI human capital development as well as the development of RPFs and their integration in the European RI landscape.

Description of work and role of partners

WP5 - Facilitating the harmonized operation of the National Facilities [Months: 1-48]

TROPOS, FMI, UHEL, CNR, KIT, FZJ, CNRS, INOE, PSI, EMPA, KNMI, BIRA-IASB, UKRI, CYI,

UNIWARSAW, ULUND, JRC, MUI, ZAMG, ICPF, NOA, INRNE-BAS, UCC, AU, UPC, CEAM, EULS, UEvora ACTRIS NFs comprise many widely distributed observational and exploratory platforms for the study of atmospheric aerosol, clouds, trace gases and their interaction processes. In ACTRIS PPP the technical concepts and requirements for the NFs have been defined and the principles and procedures of the NF labelling have been developed. Based on these achievements, WP5 aims at building the full operational capacity of the NFs at the highest technological level. WP5 provides the framework for establishing efficient procedures to label the NFs and to connect them to the other parts of the RI, for capacity-building and human capital development at new NFs and RPFs through exchange of expertise and training, and for developing new technologies and methodologies through collaboration and teaming of NFs to sustain the highest standards and to promote the pioneering spirit of ACTRIS.

Task 5.1 Implementation of the ACTRIS National Facility labelling process

Leader: TROPOS, Partners: FMI, UHEL, CNR, KIT, FJZ, CNRS, INOE, PSI, KNMI, BIRA-IASB, UKRI, CYI, UW, ULUND, JRC, MUI, ZAMG, ICPF, NOA, INRNE-BAS, UCC, UPC, CEAM

To obtain the ACTRIS label, NFs have to demonstrate their ability to follow the ACTRIS principles and technical standards, apply the quality-assurance measures defined by the associated TCs, implement the respective standard operation procedures and deliver high-quality data to the DC. For those NFs that plan to provide user access, ability, capacity and compliance with the ACTRIS access and service standards have to be proven. The NF labelling process involves the HO, associated TCs and DC, which will interact with each candidate NF to check its compliance with the ACTRIS procedures, evaluate its performance and long-term sustainability, and provide support for implementation and (test) operation. Draft procedures and document templates to facilitate the labelling process have been developed in ACTRIS PPP. Building on this work, the present task aims at fully defining the process with all relevant partners, testing and optimizing the labelling procedures, preparing a consolidated ACTRIS NF Labelling Plan and supporting the labelling of NFs during the project. There are six different observational components and two kinds of exploratory platforms involved in ACTRIS, and the labelling procedures need to be adapted to their specific requirements. A labelling pilot action will be set up in the beginning of the project, involving experienced NFs and CFs, to test and optimize the labelling procedures and to adapt the document templates for each type of NF. After consolidation of the labelling process and documenting it in the ACTRIS NF Labelling Plan, the work will focus on supporting the labelling of all ACTRIS NFs under the lead of the HO and providing input to the related work in WP1 and WP4.

Task 5.2 Support for new National Facilities and Regional Partner Facilities

Leader: EMPA, Partners: UHEL, CNR, TROPOS, INOE, UW, ICPF, INRNE-BAS, AU, EULS, UE

ACTRIS is built on the heritage of observational and exploratory networks that have been established over the last two decades and have gained a high level of expertise in setting up and operating the various research platforms. On the other hand, building a long-term sustainable RI also requires enhancements with respect to an enlarged membership, good

geographical coverage and new observational and exploratory capabilities. National roadmap processes and regional development funds currently support the implementation of new ACTRIS NFs. In addition, ACTRIS has strong ties to national and regional observation networks (operated, e.g., by national environmental agencies) that make use of new technologies and quality standards developed in ACTRIS and contribute data to the ACTRIS database. Thus, this task is dedicated to the technical integration of new NFs and RPFs to enable them to meet the technical standards of ACTRIS. New and existing facilities will be supported in planning and decision- making for setting up or upgrading instrumentation and operation procedures. The new facilities will be invited to technical workshops and training events (see tasks 5.4 and 5.5). Their specific needs will be identified, and courses and hands-on training at experienced NFs as well as individual partnerships and site visits will be organized accordingly. These activities will also make use of TNA pilots, implemented in WP7, offering hands-on training at selected NFs and of the targeted actions on RPFs developed in WP1.

Task 5.3 Connecting the National Facilities to ACTRIS operations and workflows

Leader: CNR, Partners: FMI, UHEL, TROPOS, KIT, FJZ, CNRS, INOE, PSI, KNMI, BIRA-IASB, UKRI, CYI, UW, ULUND, JRC, MUI, ZAMG, ICPF, NOA, INRNE-BAS, UCC, UPC, CEAM

The functionality of ACTRIS as a widely distributed research infrastructure will strongly depend on an efficient governance and well-organized workflows. Structure, elements and bodies to guide the ACTRIS operations as well as workflows between NFs, TCs, the DC and the HO have been already defined in ACTRIS PPP. Building on these efforts, this task aims at a) supporting the representation of the NFs as the backbone element in the ACTRIS governance and operation system and b) the implementation and optimization of the operational workflows at the level of the NFs. In support of WP1, it shall be ensured that during the ramp-up period, when more and more NFs enter the RI and become labelled, the PIs of the NFs, who bring the scientific and technological expertise in the RI, get well connected to the RI and its bodies. Experts from the NFs shall give their input and advise to ACTRIS IMP on matters related to state-of-the-art development, consistency, coherence and sustainability of the RI operations. In this role, they will also contribute to testing and optimizing the workflows between the NFs and the CFs. The respective work will focus on the identification of gaps, bottlenecks and communication lacks at the level of the NFs with respect to the implementation of QA/QC and data submission procedures, in particular for new routines suggested by the CFs. Test exercises with selected NFs will be defined for all types of platforms, and recommendations to streamline the workflows and make them most efficient will be provided to WP4.

Task 5.4 Upgrading operating strategies and technology development at the National Facilities Leader: MUI, Partners: UHEL, TROPOS, CNRS, ZAMG, ICPF, NOA

ACTRIS observational and exploratory platforms apply cutting-edge technologies, which are only partially based on commercial solutions and often involve in-house developments. Due to the challenging tasks in the measurement of aerosol, clouds and reactive trace gases, continuous work on improvements and new technologies is required to assure that ACTRIS can serve the increasing needs of the user community. For instance, providing data in near real time and assuring high data availability is essential for data assimilation and early warning purposes. Improving detection limits and developing instrumentation for mobile applications and specific platforms will help tackle new science questions and better understand atmospheric processes. Thus, this task shall foster the upgrade of instruments and the development of new technologies at NF level. An analysis of technical deficiencies and gaps for different NF types will be performed and improvements will be initiated. In particular, the potential for automation and miniaturization will be explored. The work shall be facilitated through technical workshops and involve different user groups as well as partners from the private sector. Results will be provided to WP3. New instruments and algorithms will be tested at specific NFs, possibly using TNA in WP7, and recommendations for implementations throughout the research infrastructure will be made. Specific opportunities targeted to the private sector (competitive access) will be offered through TNA in support of upgrading technologies at NFs in the present task.

Task 5.5 Exchange of expertise and training of National Facility and Regional Partner Facility operators Leader: UPC, Partners: TROPOS, KIT, FZJ, CNRS, INOE, CEAM, BIRA-IASB, UW, INRNE-BAS, UCC

ACTRIS serves a vast user community with a large variety of data products and access opportunities. Maintaining a high level of service provision requires continuous training of NF and RPF operators, integration of next-generation RI personnel, exchange of expertise and implementation of best practices at all NFs. This task aims at providing the platform for operators to communicate ACTRIS concepts, share ideas and best practices, discuss user feedback to improve and enhance ACTRIS services, strengthen the exploration of synergies at the NFs and develop new concepts to assure long-term sustainability of service provision. Three series of thematic workshops dealing with remote sensing, in-situ measurements and simulation chamber experiments of aerosol, clouds and reactive trace gases will be organized. These workshops shall serve the specific needs of operators responsible for the observational and exploratory platforms and facilitate collaboration with international experts in order to support progress towards the development of global

research infrastructures. Dedicated training events focussing on new NFs, RPFs and next-generation operators will be organized by using input and expertise from WP4.

Participation per Partner				
Partner number and short name	WP5 effort			
1 - FMI	2.00			
2 - UHEL	3.00			
3 - CNR	4.00			
4 - TROPOS	12.00			
5 - KIT	1.00			
6 - FZJ	1.00			
7 - CNRS	2.00			
11 - INOE	3.00			
12 - PSI	1.00			
13 - EMPA	2.00			
14 - KNMI	1.00			
15 - BIRA-IASB	1.00			
17 - UKRI	1.00			
18 - CYI	2.00			
19 - UNIWARSAW	3.00			
IGF-PAS	2.00			
20 - ULUND	1.00			
21 - JRC	1.00			
22 - MUI	2.00			
23 - ZAMG	2.00			
24 - ICPF	2.00			
СНМІ	4.00			
25 - NOA	2.00			
NCSR-D	1.00			
27 - INRNE-BAS	2.00			
IE-BAS	2.00			
28 - UCC	1.00			
29 - AU	1.00			
30 - UPC	2.00			
INTA	1.00			
31 - CEAM	0.00			
CSIC	1.00			

Partner number and short name	WP5 effort
33 - EULS	1.00
34 - UEvora	2.00
Total	69.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D5.1	ACTRIS NF Labelling Plan	4 - TROPOS	Report	Public	18
D5.2	Report on tests of RI operations at NFs and recommendations for improvements	3 - CNR	Report	Public	36
D5.3	Report on support activities for NFs and RPFs	13 - EMPA	Report	Public	44
D5.4	Report on development, testing and implementation of new technologies	22 - MUI	Report	Public	46
D5.5	Report on training of NF and RPF operators	30 - UPC	Report	Public	48

Description of deliverables

- D 5.1 ACTRIS NF Labelling Plan (M18)
- D 5.2 Report on tests of RI operations at NFs and recommendations for improvements (M36)
- D 5.3 Report on support activities for NFs and RPFs (M44)
- D 5.4 Report on development, testing and implementation of new technologies (M46)
- D 5.5 Report on training of NF and RPF operators (M48)
- D5.1: ACTRIS NF Labelling Plan [18]

Document describing the labelling process and the detailed procedures for all types of observational and exploratory platforms including templates for application and evaluation.

D5.2: Report on tests of RI operations at NFs and recommendations for improvements [36]

Document describing the tests of ACTRIS operational workflows at selected National Facilities including recommendations for improvements.

D5.3: Report on support activities for NFs and RPFs [44]

Document summarizing the activities organized to support new National Facilities and Regional Partner Facilities to enable them to meet the technical standards of ACTRIS.

D5.4: Report on development, testing and implementation of new technologies [46]

Document describing new developments, instrument upgrades, tests and implementation of new technologies at National Facilities.

D5.5 : Report on training of NF and RPF operators [48]

Document summarizing the activities organized to train National Facility and Regional Partner Facility Operators.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS23	Exercises to test RI operations at experienced NFs defined	3 - CNR	12	Exercises to test RI operations at experienced NFs defined. Means of verification: List of exercises available.
MS24	First series of NF thematic workshops on remote sensing, in-situ measurements and simulation chamber experiments performed	30 - UPC	14	The first series of NF thematic workshops on remote sensing, in-situ measurements and simulation chamber experiments. Means of verification: Minutes available on the website.
MS25	First NFs labelled and operational	4 - TROPOS	24	First NFs labelled and operational. Means of verification: List of labelled NFs available.
MS26	Connections to new NFs and RPFs established	13 - EMPA	26	Connections to new NFs and RPFs established. Means of verification: Participation in workshops and ACTRIS events.
MS27	First series of NF technical workshops on new developments for the observation of aerosol, clouds and reactive trace gases performed	22 - MUI	26	First series of NF technical workshops on new developments for the observation of aerosol, clouds and reactive trace gases. Means of verification: Minutes available on the website.
MS28	Majority of NFs labelled and operational	4 - TROPOS	48	Majority of NFs labelled and operational. Means of verification: List of labelled NFs available.
MS29	New NFs and RPFs reached the level of ACTRIS standards	13 - EMPA	48	New NFs and RPFs reached the level of ACTRIS standards. Means of verification: Data from new NFs and RPFs available in the ACTRIS database.

Work package number 9	WP6	Lead beneficiary 10	3 - CNR
Work package title	Implementation of the user access to ACTRIS services		
Start month	1	End month	48

Objectives

The main objective of WP6 is to connect the SAMU access management system with DC, TCs, and NFs offering physical access, and to set up the access services following a user-centric approach coherent with the ACTRIS technical capability and mission. The specific objectives of WP6 are to:

- broaden the current understanding of ACTRIS user needs as a prelude to a proper user strategy enhancement and useroriented development of the access system;
- implement the basic procedures and tools to put the user strategy into practice, thereby earning trust and awareness of users;
- develop and make available the ACTRIS Catalogue of Services to effectively support the dissemination and delivery of the ACTRIS services; and
- optimize, test and improve the user access, tools for access and service provision system.

The main expected outcome of WP6 activities is that, with fully-functioning and widely known ACTRIS access services, ACTRIS enables better support of users in addressing global challenges in science, industry and society, resulting from enhancement of the user strategy and the use of proper tools both for interaction with users and for the organization and management of the access and services.

Description of work and role of partners

WP6 - Implementation of the user access to ACTRIS services [Months: 1-48]

CNR, UHEL, TROPOS, KIT, CNRS, NILU, INOE, BIRA-IASB, ZAMG, ICPF, INRNE-BAS, UPC, CEAM, UVA Efficient access to ACTRIS services is crucial and the comprehensive system of access to ACTRIS services will be developed. The implementation of the system requires: 1) an updated definition of user needs (Task 6.1); 2) tools to enable ACTRIS to derive input for continuous improvement and self-renewing through constant user interactions (Task 6.2); 3) an on-line Catalogue of Services (Task 6.3); and 4) a management plan and service provision platform to efficiently manage all aspects of the access processes (Task 6.4).

Task 6.1 Updating the user needs analysis

Leader: CNRS Partners: CNR, TROPOS, INOE, BIRA-IASB, ZAMG, INRNE-BAS, CEAM

An update of the user needs analysis carried out in ACTRIS PPP will ensure that the development of the access and service provision system builds on a sound and up-to-date knowledge of the ACTRIS users, their background, expectations and research requirements. The needs of the ACTRIS key user groups will be inventoried, analysed and put in relation to the current and future ACTRIS capabilities, to derive recommendations for the development of services and the access system. The analysis provides input to WP4, WP5 and WP9, feeds activities in Tasks 6.2 and 6.3 and forms the basis of the enhanced user strategy. The user strategy provides a clear roadmap for user access and ensures that the ACTRIS services continue to meet the evolving user expectations and needs over the RI lifespan, thus contributing to the long-term sustainability of ACTRIS. As an ongoing process, the user needs analysis and the user strategy will be updated twice to pave the way for ACTRIS future developments beyond the implementation project.

Task 6.2 Supporting the implementation of the user strategy

Leader: CNR Partners: UHEL, KIT, CNRS, ICPF, UPC, UVA

Task 6.2 will design and test the tools needed to make the best strategic choices regarding the user engagement and reinforce a user-centric approach for access and service development. An ACTRIS Science and User Forum will be offered as an online platform where researchers interested in ACTRIS can exchange and discuss their needs and expectations regarding the services. A user support and feedback system will be designed and implemented to guarantee that the information and assistance needs of users are fulfilled, and their feedback is properly processed to provide input for continuous improvements. Periodic exchanges and interactions with user representatives will be organized to guarantee that the user strategy is correctly implemented during the project and that the activities in the whole WP continue to meet user expectations effectively.

Task 6.3 Developing the ACTRIS Catalogue of Services

Leader: CNRS Partners: UHEL, CNR, NILU, INOE

WP6 effort

Following instruction from Tasks 6.1 and 6.2, Task 6.3 will establish an ACTRIS Catalogue of Services based on input from WP4 and WP5. This catalogue will be developed and implemented as an online tool to provide users with easy, user-friendly access to all information on ACTRIS services. Services in the catalogue will be presented in a consistent and standard way including: a description of each service, how the services can be requested, the estimated duration of the selection procedure (if any) and of the provision, the available logistic and support services, costs and fees (if any), duties and responsibilities of the users for using the facility's resources. Standard average levels of service are the preliminary input to the definition of user service level agreements before the operation phase and contribute to increase the user trust. The initial release of the catalogue, which will be a "living" tool over the RI lifespan, will be available in Month 10 to be tested with the first call for TNA access in WP7. The catalogue will be then connected with the service provision system developed in Task 6.4 to manage access for the entire infrastructure. The catalogue will be also used for communication and promotion purposes, with input to/from WP10.

Task 6.4 Organizing the ACTRIS user access and services provision system Leader: CNR Partners: CNRS, NILU, INOE, ICPF, INRNE-BAS, UPC

Partner number and short name

This task will detail all aspects regarding the access to ACTRIS facilities and the RI internal processes, steps, activities, interrelations, roles and responsibilities regarding the access to ACTRIS facilities and the provision of services to users. Effective collaboration across the RI aiming at a step-by-step implementation of the full-scale virtual, physical, and remote access to all ACTRIS services will be planned and described in the updated version of the Access Management Plan, whose first draft is released at the end of ACTRIS PPP. This plan will include workflows and details on the interactions with the key actors (users, SAMU, access providers). The update of the this plan will feed the access management platform, which will consent control of each step of the access and service provision process (application, management, review and selection, approval, support to access and monitoring/reporting) as well as optimized management of facility availability. Pilot testing of access and service provision will be undertaken to monitor and assess the system performance for the various access types (physical, remote) and modes (excellence-driven, technical need-driven, market-driven). A beta version of the platform will be released for testing the specific TNA access mode in WP7, with the TNA pilots planned for the second and the third call. Possible weaknesses and drawbacks highlighted by the in-house testing and by feedback from WP7 will be addressed and fixed to improve the system for access and service provision before its final release.

2 - UHEL	2.00
3 - CNR	19.00
4 - TROPOS	1.00
5 - KIT	1.00
7 - CNRS	8.00
LILLE	0.50

Participation per Partner

5 - KII	1.00
7 - CNRS	8.00
LILLE	0.50
UGA	0.50
UPEC	2.00
10 - NILU	4.00
11 - INOE	5.00
15 - BIRA-IASB	1.00
23 - ZAMG	1.00
24 - ICPF	1.00
СНМІ	1.00
27 - INRNE-BAS	0.00
IE-BAS	2.00

Partner number and short name	WP6 effort
30 - UPC	0.00
CIEMAT	1.00
UGR	1.00
31 - CEAM	1.00
32 - UVA	0.00
AEMET	1.00
Total	53.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D6.1	ACTRIS Science and User Forum	3 - CNR	Websites, patents filling, etc.	Public	10
D6.2	Report on the ACTRIS User support system	3 - CNR	Report	Public	18
D6.3	ACTRIS online Catalogue of Services	7 - CNRS	Websites, patents filling, etc.	Public	20
D6.4	Updated ACTRIS User strategy	7 - CNRS	Report	Public	45
D6.5	ACTRIS Access and Service Management Plan	3 - CNR	Report	Public	48
D6.6	ACTRIS Access Management Platform	3 - CNR	Websites, patents filling, etc.	Public	48

Description of deliverables

- D 6.1 ACTRIS Science and User Forum (M10)
- D 6.2 Report on the ACTRIS User support system (M18)
- D 6.3 ACTRIS online Catalogue of Services (M20)
- D 6.4 Updated ACTRIS User strategy (M45)
- D 6.5 ACTRIS Access and Service Management Plan (M48)
- D 6.6 ACTRIS Access Management Platform (M48)
- D6.1 : ACTRIS Science and User Forum [10]

Online platform for fostering interactions and collaboration between ACTRIS and different user communities.

D6.2: Report on the ACTRIS User support system [18]

Document detailing the results of the user needs analysis.

D6.3 : ACTRIS online Catalogue of Services [20]

Online tool providing centralized, fully functional and searchable list of the all ACTRIS services available for users.

D6.4: Updated ACTRIS User strategy [45]

Description of the User support services and feedback collection and processing.

D6.5 : ACTRIS Access and Service Management Plan [48]

Plan detailing all aspects of the RI's internal processes regarding the access to ACTRIS Facilities and the provision of services.

D6.6: ACTRIS Access Management Platform [48]

Online platform for the centralized management of access to ACTRIS facilities and services according to the different access types and modes.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS30	ACTRIS User experience map	3 - CNR	6	ACTRIS User experience map. Means of verification: Map available.
MS31	Detailed description of ACTRIS Service catalogue	7 - CNRS	6	Detailed description of ACTRIS Service catalogue. Means of verification: Service description document available.
MS32	Design, features and functional requirements of the ACTRIS Science and User Forum	3 - CNR	8	Design, features and functional requirements of the ACTRIS Science and User Forum. Means of verification: Design documentation available.
MS33	1st release of the ACTRIS online Catalogue of Services	7 - CNRS	10	1st release of the ACTRIS online Catalogue of Services. Means of verification: Catalogue of initial services available online.
MS34	2nd draft of the ACTRIS Management Plan	3 - CNR	12	2nd draft of the ACTRIS Management Plan. Means of verification: Draft available.
MS35	Updated analysis of user needs	7 - CNRS	15	Analysis of user needs is updated. Means of verification: Document available.
MS36	Enhanced user strategy with recommendations to ACTRIS facilities	7 - CNRS	18	Enhanced user strategy with recommendations to ACTRIS facilities. Means of verification: Inventory available.
MS37	Beta version of the Access Management Platform	3 - CNR	22	Beta version of the Access Management Platform. Means of verification: Beta version available for testing and feedback.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS38	Results of the testing of the access and services provision system	3 - CNR	42	Results of the testing of the access and services provision system. Means of verification: Summary report of the tests available.

Work package number 9	WP7	Lead beneficiary 10	7 - CNRS
Work package title	Piloting trans-national access for supporting the implementation of ACTRIS services		
Start month	1	End month	48

Objectives

ACTRIS IMP will provide limited pilots of transnational access to specific services to assess and improve the reliability of the overall ACTRIS service provision, increase the user trust and expand the user base. Transnational access (TNA) will be provided to 11 ACTRIS facilities comprising representative and unique facilities – TCs, Data Centre, NFs, or combined ACTRIS Facilities for efficiently implementing the ACTRIS service provision through physical and remote access with particular emphasis on 1) services focusing on technological development, training, forefront scientific exploration, or potential for evolving user needs, 2) services having high potential for involving users from the private sector for prototype testing, joint developments, and industrial applications, and 3) services attracting new users from new/relevant regions, other scientific domains for multi-disciplinary applications, or tailored user services. The specific objectives of the WP are:

- Providing TNA to selected ACTRIS services through high-quality of access and user support, centrally managed in a coordinated and harmonized manner by the Service and Access Management Unit (SAMU), to establish a reliable system for effective ACTRIS service provision to an expanding user base respecting current and future needs,
- Testing, evaluating and improving the service provision and access process involving the key players (users, access providers, SAMU) to optimize user interaction, access workflows and management, to identify design issues and detect shortfalls, to demonstrate the functionality, feasibility, and efficiency of the access concept.

The results will serve as input to WP6 for implementing the large-scale provision of access to relevant services in the ACTRIS operational phase and is linked to WP4 for testing of access to selected CF services, to WP5 for training and instrument development activities at experienced NFs, and WP9 for its particular focus on the collaborations with the private sector. The ACTRIS service portfolio will be evaluated to build and maintain a high level of user satisfaction.

Provision of access to the following infrastructures:

- 1 Aerosol remote sensing data centre unit (ACTRIS DC-ARES)
- 2 Centre for Aerosol Remote Sensing-Automatic Sun/sky/lunar Photometers (CARS-ASP-FR)
- 3 Central Data Processing Systems for FTIR remote sensing data (CDPS-FTIR)
- 4 Station for Measuring Ecosystem-Atmosphere Relations II (SMEAR II)
- 5 High Altitude Research Station Jungfraujoch (JFJ)
- 6 Cabauw Experimental Site for Atmospheric Research (Cabauw)
- 7 Sonnblick Observatory (SBO)
- 8 Unmanned Systems Research Laboratory (USRL)
- 9 Aerosol Chamber of the Atmospheric Chemistry Department combined with Calibration Centre for the analysis of organic tracers and particle-phase constituents (ACD-C/ OGTAC CC)
- 10 Simulation of Atmospheric Photochemistry in a large Reaction chamber in combination with Centre for Reactive Trace Gases In-Situ Measurements Forschungszentrum Jülich (SAPHIR-CiGas-FZJ)
- 11 European PhotoREactor (EUPHORE)

Description of the infrastructures (ACTRIS Central Facilities and National Facilities):

(1) Aerosol remote sensing data centre unit (ACTRIS DC-ARES)

Location: Tito, Potenza, Italy

Web site address: http://www.ciao.imaa.cnr.it/, https://scc.imaa.cnr.it

Annual operating costs (excl. investment costs) of the facility: 19 371 €

Description of the facility: ACTRIS DC-ARES, operated by CNR, is the main responsible partner for the Single calculus cHain for Aerosol Remote sEnsing (SHARE), the centralized processing suite for the processing of aerosol lidar data. The Single Calculus Chain (SCC) is currently used by some of the EARLINET/ACTRIS stations and it will become mandatory for the retrieval of ACTRIS aerosol profiling data in the operational phase. ACTRIS DC-ARES provides support in setting up SCC for the stations, configuring it, interpreting the results, but also through web forum, documentation and schools. Based on this unique expertise in the aerosol lidar processing, CNR will offer the SCC use to external users for fostering international cooperation and standardization. Services currently offered by the facility: CNR is currently handling the use of SCC for the aerosol processing for some ACTRIS stations. The harmonized and centralized processing is allowing a faster analysis, traceability and faster developments of advanced products. Opening this to external users will foster international cooperation, but also new advancements in different fields. Currently most of the EARLINET stations use the SCC as ordinary tool to analyse raw lidar data. Lidar stations from Latin American

Lidar Network (LALINET) are also starting to use SCC to calculate quality-controlled aerosol optical products, and other aerosol lidar observing stations outside ACTRIS have requested access (the last SSC school has involved 6 external users and 16 associated ACTRIS partners). The access to SCC potentially attracts various user communities and countries: new users from outside Europe for improving the aerosol lidar processing (researcher communities), non-academic users (e.g., air quality related stakeholders through use in devoted campaigns). The use of the aerosol lidar processing chain can act as baseline for new products development in the private sector for example at prototype system developments, but also as testing for automatic low power lidar and ceilometer processing delivered by SMEs.

(2) Centre for Aerosol Remote Sensing- Automatic Sun/sky/lunar Photometers (CARS-ASP-FR)

Location: Lille, France

Web site address: https://www.actris.eu/DataServices/InstrumentCalibration/AERONETEurope.aspx, http://www-loa.univ-lille1.fr/photons

Annual operating costs (excl. investment costs) of the facility: 71 735 €

Description of the facility: The infrastructure is a TC unit for Aerosol Remote Sensing and in charge of instrumental development, characterization, calibration, data preparation and processing for aerosols retrievals of automatic sun/sky/lunar photometers. The facility contributes to the ground-based standardized automatic sun/sky- photometer network AERONET and complements the US NASA calibration centre. The infrastructure consists of photometry and radiometry calibration platforms for calibration of field instruments and the infrastructure holds a mobile platform simulator that allows to test instruments dedicated to mobile observations.

Services currently offered by the facility: The facility offers calibration, quality control, data processing and training services, and expertise in Aerosol Remote Sensing. CNRS-LOA will offer two types of services: (1) calibration and maintenance for sun/sky/lunar/polar photometers; and (2) services dedicated to mobile photometry for users willing to upgrade their photometer for mobile (e.g., maritime) observation capabilities. Currently, the CE318T photometer has the capability to perform measurements on a mobile platform (e.g. on ships). However, additional components are requested. Aerosols products derived from AERONET Europe activities have shown to be very useful and relevant for supporting lidar aerosol retrievals, joint photometer-lidar retrievals (LIRIC and GARRLIC), aerosol absorption profiling, night-time AOD and satellite and model validation. The scientific applications of aerosol products and services already delivers contribute to research activities in many European and worldwide countries (e.g. China) and 50 % of users are from outside the ACTRIS community. Users come from remote sensing, in-situ, and satellite communities and comprise private companies (for testing and calibration of new, e.g. mobile instruments, or users from climate services such as the UK MetOffice network).

(3) Central Data Processing Systems for FTIR remote sensing data (CDPS-FTIR)

Location: Brussels, Belgium

Web site address:

Annual operating costs (excl. investment costs) of the facility: 196 660 €

Description of the facility: CDPS-FTIR is a processing system running on HPC infrastructure at BIRA-IASB, as part of the TC unit for Reactive Traces Gases Remote Sensing (CREGARS), for processing remote sensing FTIR level 1 data (spectra) to level 2 data (geophysical products, i.e., total column abundances and in some cases vertical concentration profiles of ACTRIS target reactive gases). It consists of a Software processing chain, at the heart of which is a spectral inversion code agreed in CREGARS, with a Web-based interface for communication with the users, including upload of level1 data, and access to the processing results (level2 data and associated processing logbook). CDPS-FTIR is under development: a beta version is expected in 2020, a fully operational system by 2022.

Services currently offered by the facility: Preliminary CDPS-FTIR services have already been set up in the frame of Copernicus Atmosphere Monitoring Service (CAMS) projects. This includes central processing of all in-house measurements and of some collaborating stations. Tests with a preliminary CDPS-FTIR version have enabled users to contribute to the CAMS-84 project and resulted in several research papers. The service is available to all external instrument operators in the worldwide FTIR community; most of them are NDACC-affiliated or candidate NDACC affiliates, but also new FTIR operators outside NDACC may appear, e.g., in developing countries (capacity building). There is a strong willingness to have worldwide consistency of the data to enable research that makes use of the global dataset, e.g., for satellite validation. For users of the ACTRIS CDPS-FTIR service, this consistency is automatically ensured and the data will be much more easily integrated in research studies pertaining to the global scale. CDPS-FTIR is also of interest for new instrumental developments, e.g., by a commercial company, which may require verification of the data that CDPS-FTIR can be provide.

(4) Station for Measuring Ecosystem-Atmosphere Relations II (SMEAR II)

Location: Hyytiälä, Juupajoki, Finland

Web site address: https://www.helsinki.fi/en/research-stations/hyytiala-forestry-field-station

Annual operating costs (excl. investment costs) of the facility: 1 220 520 €

Description of the facility: SMEAR II represents a background boreal forest site consisting of a main station in a scots pine forest and additional flux measurements in wetland fen and boreal lake environments. The site, represented in the project by UHEL, has several operation units to reach into and above the stand canopy. The site is a worldrenowned site for cutting edge aerosol science, multidisciplinary research and having one of the longest time series of atmospheric data (over 20 years). The site contributes to ACTRIS (in-situ aerosol and trace gases, and remote sensing of clouds). SMEAR is comprehensive and co-located ICOS, ACTRIS and LTER site. Services currently offered by the facility: SMEAR II is operational 24/7, year-round. On-site accommodation and support are in place and open access to comprehensive multidisciplinary SMEAR II data is available. Technical help and instrument monitoring and maintenance for observations during extended periods, research planning and training are provided. SMEAR II has high potential for involving new users due to its reliable infrastructure, multidisciplinary nature of the site and high profile in science. The services aim at specific target users of TNA: instrument developers and SMEs, significant potential for involving users from the private sector; comprehensive instrumentation for benchmarking, on-site electrical engineering staff and technical staff to help in troubleshooting and instrument development, in-depth calibration and verification laboratories available upon request, development and testing of new technologies/scientific exploration, new instruments, and co-development, hands- on training activities at the site. SMEAR II data has provided novel insights into various atmospheric processes. These results are published in over 30 Nature or Science papers. SMEAR II has hosted over 50 multi- and cross- disciplinary campaigns and has over 2300 users annually. SMEAR II is currently part of the TNA programme of ACTRIS-2.

(5) High Altitude Research Station Jungfraujoch (JFJ)

Location: CH-3801 Jungfraujoch, Switzerland

Web site address: http://www.hfsjg.ch/jungfraujoch

Annual operating costs (excl. investment costs) of the facility: 389 708 €

Description of the facility: The research programmes on trace gases (i.e. greenhouse gases, reactive air pollutants) and aerosols at the JFJ are among the most comprehensive worldwide. JFJ (3450 m asl), represented in the project by PSI, is the highest research station in Europe that is accessible all year round by rail, and it is the only easily accessible observation point in Europe with adequate infrastructure that is within the free troposphere most of the year. The research station JFJ is therefore of utmost importance for ground-based observations of the free troposphere. As the research observatory is within clouds 40% of the time throughout the year, it provides a unique opportunity for in situ studies of liquid clouds (in summer) and mixed-phase and glaciated clouds (in winter). Services currently offered by the facility: Users will have access to JFJ measurement platforms to deploy and operate instruments and to data from continuously operating instruments (access to real-time and archived data). The high scientific quality of the atmospheric research is demonstrated by the more than 100 peer-reviewed publications from PSI and EMPA with JFJ data on aerosol and gas phase composition and aerosol-cloud interaction (e.g., Bianchi et al., Science, 352, 1109, 2016; Bukowiecki et al., Aerosol and Air Quality Research, 16, 764, 2016). JFJ has been massively overbooked by access requests in the past and has high potential to attract new scientific users, as well as users from the private sector. Physical access is offered to a broad variety of atmospheric scientists. Examples of activities comprise closure of organic species in the gas and aerosol phase (links to EUROCHAMP and various CFs), characterization of black carbon, investigation of vertical transport processes, or aerosol-cloud interactions. Testing of newly developed instruments by companies will be supported by cutting-edge complementary instrumentation. The data have high potential to be used by public services such as clear air authorities, and the site has sufficient maturity to provide capacity building e.g. by attracting new facility operators.

(6) Cabauw Experimental Site for Atmospheric Research (Cabauw)

Location: Lopik, The Netherlands

Web site address: http://ruisdael-observatory.nl/?page_id=388, www.cesar-observatory.nl

Annual operating costs (excl. investment costs) of the facility: 300 145 €

Description of the facility: At Cabauw (51.971° N, 4.927° E), represented in the project by KNMI/TUD, a uniquely comprehensive set of parameters is measured using state of the art instrumentation to study the physical and chemical atmosphere and its interaction with the land surface. The 213 m high Cabauw tower was built in 1972 for meteorological research to study the state of the atmospheric boundary layer linked to land surface conditions. Cabauw offers access for research and hosts cloud remote sensing and trace gas remote sensing CF units. The measurement programme supports aerosol in situ observations, aerosol remote sensing, cloud remote sensing and trace gas remote sensing. In-situ trace gases and greenhouse gases are measured for ICOS. Cabauw is a member of BSRN, NDACC, GRUAN and Aeronet networks.

Services currently offered by the facility: Cabauw provides access to users for 1) Cloud remote sensing - hands on capacity training, developing and testing new technologies and/or scientific exploration (in particular cloud calibration), this will attract users from private sector, 2) aerosol remote sensing equipment (state of the art (Raman) lidar techniques), and 3) mobile trace gas instruments. The data is provided through ACTRIS and ICOS databases, as well as the CESAR database (http://www.cesar-database.nl), to be developed into the Ruisdael Observatory data portal. The database

currently has about 1750 unique users. The multi-themed observations continuously provide an attractive environment for external research. Regular large-scale field campaigns are organised in Cabauw, including satellite validation campaigns. The datasets are invaluable for model evaluation. Recent campaigns include CINDI-2 (trace gas remote sensing), PICAB (in situ trace gases), ACCEPT (clouds), INGOS (methane). Users developing new observational sites in foreign countries are attracted to Cabauw for training and testing their equipment. The Cabauw site attracts users from strong upcoming markets such as the solar and wind-power industries and to use data and develop modelling techniques for optimal use of renewable energy sources.

(7) Sonnblick Observatory (SBO)

Location: Mt. Hoher Sonnblick, Kolmstrasse 100, 5561 Rauris, Austria

Web site address: www.sonnblick.net

Annual operating costs (excl. investment costs) of the facility: 24 856 €

Description of the facility: SBO, operated by ZAMG, is located within the Austrian Central Alps at 3106m a.s.l. It is situated in the "Nationalpark Hohe Tauern" at the main alpine ridge, being exposed, detached and nearly emission-free. SBO was established in 1886 and is surrounded by glaciers and permafrost and provides a various research area from the valley Rauris up to the top of Mt. Hoher Sonnblick. Today, SBO is a station of interdisciplinary research covering the atmosphere, cryosphere, biosphere, lithosphere and the hydrosphere. It is outstanding with the respect to its long-term climate observations and studies on glacier changes. SBO has been involved in many international projects on atmospheric chemistry and physics and is member of GTS, GAW, GCW, GTBN-P, BSRN; NDACC, LTER networks. It is used for testing instruments before starting campaigns in the Arctic or Antarctica.

Services currently offered by the facility: SBO has a comprehensive portfolio of regular measurements and access for multi-disciplinary applications is offered. Scientists have for a long time been interested in the extreme location of the observatory (e.g. the Nobel-prize winner V.F. Hess for his measurements of cosmic rays, instrument testing and material analysis by private sector). SBO provides a platform for temporary installation of scientific instrumentation to users, testing instruments, measuring campaigns, dedicated cloud in situ training and workshops. Several measuring campaigns took place and were serviced at the SBO focusing on cloud water chemistry, wet precipitation, analysis of the black carbon content of both aerosol and cloud water or analysis of scavenging processes in mixed clouds or supercooled clouds, testing and development of a cloud water sampler for high wind speeds. Users have accessed SBO during the EUROTRAC projects, for Saharan dust reports, airborne Inoculation of Microbial Communities in Glacial Environments (Marie Curie Actions-Innovative Training Networks), data, e.g. for CAMS products. External users include governmental institutions and academia, e.g. DLR, University of Utrecht, University of Heidelberg, ETH Zürich, Masaryk University and many Austrian institutions.

(8) Unmanned Systems Research Laboratory (USRL)

Location: Nicosia, Cyprus

Web site address: http://usrl.cyi.ac.cy

Annual operating costs (excl. investment costs) of the facility: 107 000 €

Description of the facility: USRL focuses on cost-effective UAV (Unmanned Aerial Vehicle) atmospheric applications (vertical profiling, 3D mapping, plume tracking) with miniaturized and lightweight atmospheric sensors fulfilling ACTRIS QA/QC and SOPs. It comprises laboratories (150 m2) with a weather chamber for sensor qualification, specialised mechanical/electronic workshops, as well as a private airfield and permanent airspace (with max ceiling of 3 km altitude) located near the Cyprus Atmospheric Observatory (ACTRIS National Facility candidate). USRL is operated by a team of 11 staff of experienced engineers (electronic, software, system, communication, mechanic / material), professional pilots (flying commercial airliners), and experienced researchers in atmospheric sciences. USRL includes a large fleet of customized UAVs (fixed and rotary wings) with different payload capacity (up to 10 kg) and miniature air sensors.

Services currently offered by the facility: USRL provides customized UAV-based solutions for lightweight sensors, lightweight instrumentation testing in weather chamber, quality UAV training of new users. USRL has been successfully used in the past for in-situ validation of lidar retrieval algorithms (Mamali et al., 2018; Marinou et al., 2019), Ice Nuclei measurements in the cloud region (Schrod et al., 2017), or for characterisation (weather chamber) of miniaturized aerosol sensors (Bezantakos et al., 2018). USRL was candidate (as TNA provider) for the 3rd TNA call of ENVRI + (http://envri.eu/2018/03/04/3rdenvriplustnacallopen/) and has been successfully used many large international field campaigns (EU-FP7 BACCHUS; H2020-ACTRIS2; ERC A-LIFE; ERC D-TECT) and for the provision of services to public/private collaborators (e.g., ADITESS). Potential new users: ISARRA Community (International Society for Atmospheric Research using Remotely piloted Aircraft; http://www.isarra.org/); >250 members, EU Research Infrastructure (ICOS, EUFAR) partners from the Eastern Mediterranean and the Middle East region, governmental Units for Environmental monitoring, Security and civil protection. Support/training for SMEs developing UAV-sensor technology in compliance with EU directives (i.e. UAV-based stack emissions), for instrument testing and optimization, and training for UAV flight operation.

(9) Aerosol Chamber of the Atmospheric Chemistry Department combined with Calibration Centre for the analysis of organic tracers and particle-phase constituents (ACD-C/ OGTAC CC)

Location: Leipzig, Germany

Web site address:

Annual operating costs (excl. investment costs) of the facility: 318 105 €

Description of the facility: The TROPOS ACD-C/OGTAC uniquely combines chamber and state-of-the-art online and offline measurement techniques. ACD-C is a twin chamber with a broad online and offline instrumentation, including two SMPS, PTR-TOFMS, PTR-QMS, two CAPS, two sub-ppb level NO2 analysers, an AMS, a CI- APi-TOFMS to comprehensively characterize a wide variety of chamber processes. The online ensemble is complemented by extensive offline instruments available in the OGTAC covering the most important separation techniques: ion, gas and liquid chromatography connected to various detectors (MS, UV, PAD, etc.). OGTAC enables users to detect and quantify the most important biogenic and anthropogenic marker compounds from their chamber experiments to examine their formation pathways and their role in the atmospheric multiphase system. Services currently offered by the facility: TROPOS has a more than 10-year history in providing access for guest researchers from all over the world (scientific activities, measurement campaigns). High-quality research is ensured through the existing excellence for experimental and theoretical investigation of gas-phase processes, SOA formation processes and the processing of biomass burning exhausts. Good chamber practice, hands-on training in online and offline instrumentation relevant for chamber experiments and comprehensive data analysis are a fixed part of the services offered. Users have successfully detected a highly relevant atmospheric BSOA marker compound and its formation mechanism (Kahnt et al., 2010 ES&T, Wang et al., 2018, Faraday Discussions). Hands-on training courses are usually booked out within few days after each call launch. To date, ACD-C has successfully provided access to international users from Europe and the US. The chamber is attractive for toxicologists, biologists, as well as for health and biodiversity studies. ACD-C strongly cooperates with SMEs like Ionicon for PTR-TOFMS technology and Aerodyne for CI-API-TOFMS. These companies will be encouraged to use the service provided by ACD-C/OGTAC.

(10) Simulation of Atmospheric PHotochemistry In a Large Reaction Chamber in combination with Centre for Reactive Trace Gases In Situ Measurements, Forschungszentrum Jülich (SAPHIR-CiGas-FZJ) Location: Forschungszentrum Jülich, Jülich, Germany

Web site address: http://www.fz-juelich.de/iek/iek- 8/EN/Expertise/Infrastructure/SAPHIR/SAPHIR_node.html Annual operating costs (excl. investment costs) of the facility: 264 916 €

Description of the facility: SAPHIR is operated by FZJ and provides a platform for reproducible studies of the atmospheric degradation of biogenic and anthropogenic trace gases and the build-up of secondary particles and pollutants. Controlled artificial trace gas mixtures, ambient air or emissions from plants can be added to SAPHIR. It is equipped with a comprehensive, unique set of sensitive instruments for radicals (OH, HO2, RO2, NO3), traces gases (NOx, N2O5, O3, HONO, OH reactivity, VOC, OVOC), aerosols, and physical parameters. CiGas-FZJ manages the calibration activities for the in-situ measurements of NOx within ACTRIS and GAW.

Services currently offered by the facility: The chamber is used for high quality experiments investigating the transformation of gas-phase species and aerosols with 1) permanently installed and calibrated instrumentation; 2) additional instrumentation provided by users while planning of experiments is carried out in collaboration with experts from FZJ. The services provided include SAPHIR chamber studies, hands-on training activities on NOx instrumentation, side by side inter-comparisons to reference methods, overarching instrument inter-comparisons, investigation of possible interferences by tuneable atmospheric matrices, and data quality workshops. In the field of atmospheric NOx measurements, new techniques have emerged, which implies a growing demand for instrument developers for inter-comparisons in exactly defined environments. In the past dedicated instrument intercomparisons for HOx, NO3, N2O5, VOCs, SOA, HCHO and HONO provided significant improvement of the respective techniques. SOA production from biogenic and anthropogenic precursors have been extensively investigated. Photochemical degradation processes of VOC revealed non-classical regeneration of HOx from RO2. In the years 2003 to 2015 scientists from 42 national and international institutions have used the SAPHIR chamber. Currently 20 GAW stations are equipped with NOxinstrumentation supervised by WCC-NOx.

(11) European PhotoREactor (EUPHORE)

Location: Paterna (Valencia), Spain

Web site address: http://www.ceam.es/WWWEUPHORE/home.htm

Annual operating costs (excl. investment costs) of the facility: 470 057 €

Description of the facility: EUPHORE is an installation with two twin outdoor simulation chambers. Its characteristics allow the study of the atmospheric behaviour of biogenic and anthropogenic VOCs, formation of ozone and aerosols under near-real conditions thanks to its large size (200 m3) and the use of natural light. For gas-phase measurements there are optical, spectroscopic and gas chromatography techniques: LP-FTIR, LP- UV/VIS-DOAS, PTRMS, GC-MS, CIMS and CEAS and. There are also O3, NOx, SO2, CO, HONO-LOPAP and HCHO monitors, and systems

to measure radiation. OH and OH2 radicals are followed using LIF-FAGE. Aerosol formation is also measured by SMPS, TEOM, CIMS and other off-line techniques (LC-MS or GC-MS/MS). Services currently offered by the facility: Scientific services comprise the study of atmospheric behaviour of biogenic and anthropogenic VOCs and semi-VOCs, formation of O3, aerosols and secondary products (determination of life times in air, and degradation products) and validation of photochemical models. Technical services include intercomparison of instrumentation with possibility of accommodating a large number of external instruments, and the use of the chamber to test, develop or improve new instruments to measure compounds in the air. EUPHORE has a high flexibility to adapt to new industry demands. EUPHORE has participated in more than 20 research projects (7 as coordinator). The facility has been used by more than 60 research groups and more than 300 international researchers (see list of projects at the EUPHORE webpage). EUPHORE has high experience in international campaigns, high versatility and potential of adaptation to specific user's demands, huge number of external instrumentations that can be accommodated for joint experiments among different communities (researchers, health, city air-quality managers, etc.), and sectors such as automotive, low-cost sensors, photo- catalytic, potential harmful market products.

Description of work and role of partners

WP7 - Piloting trans-national access for supporting the implementation of ACTRIS services [Months: 1-48] CNRS, UHEL, CNR, TROPOS, FZJ, PSI, KNMI, BIRA-IASB, CYI, ZAMG, CEAM Modalities of access under this proposal:

ACTRIS IMP will invite proposals for access to ACTRIS services based on a number of dedicated calls for access. Physical and remote access to the ACTRIS Facilities will be centrally managed by SAMU, the single point of entry for any users to obtain information about the services available, access opportunities and request access to services. SAMU coordinates the harmonized access process that is implemented for all ACTRIS services via TNA in a harmonious manner: SAMU receives the written access requests, guides the review and selection process, and informs the applicants on the acceptance or rejection of their requests, or on any revision that is needed to the application. SAMU provides assistance to users throughout the process and where needed, interacts with the access providers to ensure efficient access according to the terms of use and requirements, users support, and in line with the ACTRIS data and access policies. Once the user access is completed, SAMU contacts the users, collects the access reports and centralizes user feedback, and any other information on results and publications. ACTRIS documents and archives the data resulting from the access in the ACTRIS Data Centre (in compliance with the ethical guidelines). The duration of access depends on the facility and service, indicated below. The costs to seven facilities (out of 11) are based on unit costs where the costs for providing access over the past two years are representative and reliable. Two facilities use combined unitactual costs: 1) CARS-ASP-FR provides two services, one is based on well-known and auditable unit costs, one is a new service based on actual costs for which the costs are not yet sufficiently representative; 2) at SBO additional costs incur due to the use of cable car access to the facility. Two facilities use actual costs: 1) CDPS-FTIR due to missing historical data for the new service offered, and 2) USBL: the use of the facility is charged on the basis of actual costs according current CYI policy. The specific access modalities for each facility are summarized in table 7.1. The units of access include SWD (one staff person-working-day), UWD (one user-working-day), DAY (one day, independent of the number of users), CAL (one instrument calibration), and DPS (one data-processing-service).

Support offered under this proposal:

The provision of access to ACTRIS services is available to all users. The support to users commonly includes assistance by SAMU, on-site support for administrative and logistic issues including customs, shipping and transport of instrumentation, specific permissions, instrument and/or storage space, arrangements of travel and accommodation, scientific and technical support for project planning, preparation, set-up and disassembly, instrument handling and operation, training on the use of the facility, scientific expertise, and other necessary information related to on-site needs, data handling and archiving. Provision of TNA for using ACTRIS facility services is free-of-charge to users. Limited financial support for user travel and subsistence will be available to some facility services and upon request. Further support is detailed below for the specific facility concerned.

(1) ACTRIS DC-ARES.

Modalities of access and support offered*: Remote; uc; Ex; SWD; 45 SWD; 3 projects / 5 users; n/a; n/a.

Description of integration, duration of work, and facility-specific modalities: A remote user access typically requires 10 SWD, the time scheduling is decided in agreement with the facility. At least level 2 (fully quality assured) aerosol optical properties data will be requested as requirement, data storing capabilities are considered. SCC is based on open source project and an open data policy is mandatory for the data obtained by the SCC (modalities for data access and provision will be according to ARES modalities).

Support offered: On-site support includes necessary S&T, administrative and logistic aspects as described above. Remote access to SCC will be important for testing set up of data agreement with external users, data legacy and related

issues. SHARE offers the use of the SCC, storing and archiving of the SSC analysed data, support to the SCC users (forum, remote meeting, school), potential evaluation of climatological products based on SCC outputs.

(2) CARS-ASP-FR

Modalities of access and support offered*: Remote+physical; uc, ac; T, M; 1) CAL, 2) UWD; 10 CAL, 9 UWD; 10+3 projects, 10+3 users; 1) 1 month, 2) 3 days; y.

Description of integration, duration of work, and facility-specific modalities: The remote access for one standard calibration typically requires one month (remote access). Upgrading of mobile photometers require 2 or 3 UWD (physical access). The services typically include reception of instrument, testing in laboratory, calibration of instrument, data pre-processing, quality control, data processing and quality assurance, and training if needed.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above.

(3) CDPS-FTIR

Modalities of access and support offered*: ac; T; DPS; 4 DPS; 3 projects / 3 users; n/a; y.

Description of integration, duration of work, and facility-specific modalities: The user will interact with the CDPS remotely. The interaction will be an iterative process; the duration depends on the quality of the L1 data submitted. This may take some time for a new user, but this time will be minimal each time the user calls again for the service. CDPS will work with a queuing/scheduling system that will be elaborated by the BIRA IT managers. The service (1 data processing service, DPS) comprises data processing of one year of L1 data using a standardized protocol, including quality assurance of the resulting products. The CDPS will require formal compliance of L1 data and metadata as defined by the facility.

Support offered: On-site supports includes necessary S&T, administrative and logistic aspects as described above.

(4) SMEAR II

Modalities of access and support offered*: ac; T; DPS; 4 DPS; 3 projects / 3 users; n/a; y.

Description of integration, duration of work, and facility-specific modalities: Training services, and development and testing of new technologies/instruments and/or scientific exploration, benchmarking and co-development, the estimated duration of work is 2 weeks (10 days). Almost full independence for users with some restrictions (incl. long-term measurements and instrument operations cannot be disturbed). On-site field manager participates in the planning of the access activity.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above. Furthermore, included is, e.g., troubleshooting and maintenance, and data related support during the TNA) for the user. Compliance with local law and safety regulations, national regulations, host procedures, other measures related to access of facilities or parts of the facility, use of equipment, adequate training, and health insurances are requested from the users. Accommodation is provided on site and is free of charge for users.

(5) JFJ

Modalities of access and support offered*: Physical; us; EX, T, M; DAY; 30 DAYs; 4 projects, 8 users; 20 days; y. Description of integration, duration of work, and facility-specific modalities: All projects planned at JFJ have to be approved by the Research Foundation HFSJG (www.hfsjg.ch). Physical access to high altitude station JFJ has a duration of 2-4 weeks (typically 20 days). Access information and scheduling of project activities are given through the HFSJG and will be further detailed by PSI/EMPA. Users need to be able to work at high altitude and follow the HFSJG rules. Support offered: On-site support includes all S&T, administrative and logistic aspects as described above. PSI and EMPA will provide scientific support to users. In addition, the Research Foundation supports logistics and accommodation. Additionally, access to complementary data for data interpretation is available.

(6) Cabauw

Modalities of access and support offered*: Physical; us; EX, T, M; UWD; 36 UWD; 6 projects, 12 users; 3 days; y. Description of integration, duration of work, and facility-specific modalities: An average visit of 3 days is expected (typical duration is weeks to months). A mentor will be assigned to each user, preferably working as closely in the same research domain. Users are granted a large degree of autonomy at the site, reporting to the mentor and site manager. If needed regular meetings are held with the involved permanent site scientists.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above. Access to site and on-site office space is ensured. The team of permanent staff connected to the Cabauw site is diverse and broad. This provides a unique working environment with access to scientific support in a multitude of themes and state of the art measurement techniques. Users need to comply with the local safety regulations and protocol, insurance requirements, and local law.

(7) SBO

Modalities of access and support offered*: Physical; cb; Ex, T; UWD; 45 UWD; 3 projects, 9 users; 5 days; y.

Description of integration, duration of work, and facility-specific modalities: SBO offers access to the services all year round via cable car (SBO head must be informed beforehand). A typical duration of access is 5 days for implementation, testing and measuring. Users can work independently but have to agree with the SBO house rules and ropeway directives of the SBO cable car. The SBO cable car is owned by the "Sonnblick Verein", thus, each use has to be charged (actual costs). The access of SBO otherwise is based on unit costs.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above. SBO offers a guided tour of the facility. It provides data, data visualization and support by taking samples, observations and if needed access to software, such as KNIME Analytic Platforms. If required, support is given to get flight permits for drone flights around the SBO from the national park "Hohe Tauern"). All users are invited to the annual SBO user workshops (not included in the physical access, at charge of participants).

(8) USRL

Modalities of access and support offered*: Physical; ac; Ex, T, M; SWD; 40 SWD; 3 projects, 6 users; 10 days; y. Description of integration, duration of work, and facility-specific modalities: UAV-sensor projects = 2 weeks (1 week without user for integration; 1 week with user for field test and short measurement campaign). UAV training and Miniaturized sensors tests = 1 week with user. One SWD = activity undertaken by the whole USRL technical team in implementing the project (covering instrumentation test/integration, training, and operational flights). Access will be granted with maximum time flexibility while safeguarding health and safety standards.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above, including the general research facilities of the Cyprus Institute with dedicated offices and lab space, transportation (instrument, staff), flight permissions in Cyprus, and access to the Cyprus Atmospheric Observatory (infrastructure, data).

(9) ACD-C/OGTACC CC

Modalities of access and support offered*: Physical; uc; Ex, T; DAY; 20 DAYs; 2 projects, 8 users; 10 days; y. Description of integration, duration of work, and facility-specific modalities: A typical duration is 1.5-2 weeks of experiments (10 DAYs), of which 5 days are dedicated to the chemical analysis of the filter and/or to set-up a dedicated method for certain target compounds via OGTAC-CC. Users will be actively integrated to discuss results, gain insights into new research fields, and participate in presentations and scientific discussions.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above. For accessing the infrastructure, users will get instructions on i) planning, ii) realization, iii) minimum requirements for instrumentation, iv) good chamber practice, v) sample treatment and vi) quantification of target compounds.

(10) SAPHIR-CiGas-FZJ

Modalities of access and support offered*: Physical; uc; Ex, T; DAY; 5 DAYs; 1 project, 10 users; 5 days; y. Description of integration, duration of work, and facility-specific modalities: The location of the work will be at FZJ with its unique infrastructure. A project will last about 1 week. Experiments, instrument inter-comparisons and hands-on training will be organized on a daily basis. Daily meetings will coordinate the different activities and provide possibilities for quick look data presentation. The activities will be accompanied by experienced experts from FZJ.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above. Furthermore, training on some instrumentation (especially NOx measurement) is provided, logistic support also concerns any specific permissions concerning the user of radioactive sources. Users are requested to comply with the local health and safety regulations, to which every user will be introduced in prior to the use of the service.

(11) EUPHORE

Modalities of access and support offered*: Physical; uc; Ex, T, M; DAY; 8 DAYs; 2 projects, 4 users; 4 days; y.

Description of integration, duration of work, and facility-specific modalities: A typical duration of access is from a few to 12 access days. Timing of access is made via calendar available on-line in agreement between user and EUPHORE. Daily meetings are carried out during the campaign. EUPHORE staff continuously looks after the experiments during the campaign. The access includes carrying out the experiments and operation of EUPHORE instrumentation, and data analysis of samples acquired with EUPHORE instrumentation.

Support offered: On-site support includes all S&T, administrative and logistic aspects as described above. A previous technical adaptation of the chambers is possible if required. Support to install external user instrumentation, required documentation, and training on some instrumentation is provided. Users have to accept the safety regulations and precautions at EUPHORE Laboratories. Personal protection equipment is provided if necessary. The users must have insurance.

*) The facility-specific modalities of access indicate (in order of appearance): type of access (physical, remote), access cost base (uc-unit cost, ac-access cost, cb-combined unit/access cost), expected access mode (Ex-Excellence-driven, T-Technical need- driven, M-Market driven), unit of access, quantity of access provided, n° of projects and users, duration of access, financial support of users.

Outreach to new users:

Wide measures will be taken to advertise the opportunities of TNA within ACTRIS in collaboration with WP10. The calls for access will be largely publicized via the ACTRIS communication channels (website, social media, mailing lists, newsletters, brochures), the facility websites, and announced at scientific conferences, workshops and meetings. Additional financial support for users aims at facilitating user mobility and help attracting users. Great effort is made to reach out to new users and new user communities. ACTRIS particularly aims at attracting access projects involving new users and users from the private sector or at providing tailored services to users, which will be promoted jointly with WP4, WP5, and WP9. SAMU will encourage the users to publish the results from the access and will promote the access to these publications via the ACTRIS web portal.

Review procedure under this proposal:

A common review procedure will be implemented for evaluating and selecting the access requests. SAMU will receive the user application and guide the multi-stage review procedure including (1) verification of the application for formal compliance with the EC regulations and ACTRIS eligibility criteria, (2) interaction with the access provider to check availability of the services requested, the existing capacity, the feasibility and the timing of the access request and validation by the access provider, (3) transmission of the application to a peer-review panel for scientific and technical evaluation. The review panel will be set up at project start and will be composed of international experts in fields of research related to short-lived atmospheric components, with the majority being independent from ACTRIS. The review panel will base their evaluation on principles of transparency, fairness and impartiality and review the applications according to defined criteria and access modes, which comprise:

- Scientific excellence criteria including scientific originality, quality, state of the art, technical aspects for instrument performance and high quality, relevance and impact of the project, dissemination plan, etc.;
- Technical aspects for increasing instrument performance (maintenance, calibration, QA) and operator training;
- Market-driven aspects in relation to business and innovation, private sector participation, technological development, innovative solutions, socio-economic impact;

Additional aspects will be considered such as the user profile and/or origin of the users. Participation of new users from communities beyond the ACTRIS perimeter will be strongly encouraged including those from e.g., non- academic domains such as public services (e.g., environmental agencies, climate and space services), private sector, or users from environmental or other domains to promote cross-disciplinary research. Moreover, access of early-career researchers or researchers from less-favoured regions will be encouraged for training and educational services and for best practice, and gender equality will be promoted. The review panel will give recommendations on the users that should benefit from the provision of the services and inform the SAMU of the evaluation results. The SAMU will communicate the outcome of the review process to the users.

	Partici	pation r	per Partner
--	---------	----------	-------------

Partner number and short name	WP7 effort
2 - UHEL	0.01
3 - CNR	4.00
4 - TROPOS	0.01
6 - FZJ	0.01
7 - CNRS	5.00
12 - PSI	0.01
14 - KNMI	0.01
TUD	0.01
15 - BIRA-IASB	2.12
18 - CYI	7.00
23 - ZAMG	0.01
31 - CEAM	0.01
Total	18.20

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D7.1	Recommendations for optimizing the access process and user interaction	7 - CNRS	Report	Public	27
D7.2	Recommendations for implementing access to ACTRIS services	7 - CNRS	Report	Public	46

Description of deliverables

- D 7.1 Recommendations for optimizing the access process and user interaction (M27)
- D 7.2 Recommendations for implementing access to ACTRIS services (M46)
- D7.1: Recommendations for optimizing the access process and user interaction [27]

Document providing recommendations for improving the user interaction, access workflows, process, concept, and reporting.

D7.2: Recommendations for implementing access to ACTRIS services [46]

Document providing recommendations for full-scale implementation of access provision to ACTRIS services and user strategy.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS39	Definition of the pilot access process to ACTRIS facilities	7 - CNRS	8	Definition of the pilot access process to ACTRIS facilities. Means of verification: Document available.
MS40	Advertisement and launch of first call for access	7 - CNRS	9	Advertisement and launch of first call for access. Means of verification: 1st Call launched
MS41	Advertisement and launch of second call for access	3 - CNR	21	Advertisement and launch of second call for access. Means of verification: 2nd Call launched.
MS42	Intermediate assessment of the pilot access concept and process	7 - CNRS	25	Intermediate assessment of the pilot access concept and process. Means of verification: Mid-term summary of TNA available.
MS43	Advertisement and launch of third call for access	3 - CNR	33	Advertisement and launch of third call for access. Means of verification: 3rd Call launched.
MS44	Final assessment of the pilot access concept and process	3 - CNR	44	Final assessment of the pilot access concept and process.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
				Means of verification: Final summary of TNA available.

Work package number 9	WP8	Lead beneficiary 10	7 - CNRS	
Work package title	Consolidating the position of ACTRIS in the European and international research landscape			
Start month	1	End month	48	

Objectives

Objectives

The main objective of WP8 is to ensure that ACTRIS is strongly embedded, highly connected, and heavily collaborating in the European and international research and research infrastructure arenas, particularly related to climate and airquality topics. WP8 addresses this ambition with three overarching specific objectives, to:

- enhance cooperation with European RIs and e-Infrastructures in the EOSC framework;
- identify and align the activities and policies with relevant international initiatives, data networks, and repositories (e.g. GEOSS and Copernicus);
- establish ACTRIS as a global Research Infrastructure including definition of procedures for third parties to access ACTRIS services, worldwide; and
- establish better connection to GEO by developing the GEO initiative on Short-Lived Climate Species.

The expected outcomes of WP8 are: creation of a strong ERA position and role in the global research environment; enhanced role of the Union in international organisations and multilateral fora; progress towards the development of global research infrastructures; and coordinated actions with national and international initiatives supporting the deployment of global and sustainable approaches in atmospheric research, particularly developing synergies with GEOSS, Copernicus and other relevant European initiatives.

Description of work and role of partners

WP8 - Consolidating the position of ACTRIS in the European and international research landscape [Months: 1-48]

CNRS, FMI, UHEL, CNR, TROPOS, NILU, EMPA, BIRA-IASB, CYI, NOA, FORTH

Grand research and societal challenges addressed by ACTRIS are of international dimension by nature and require not only a pan-European approach but also a global effort to consolidate partnerships in science and technology, to enhance exchange of information and interoperability and to ensure that advanced training goals are proposed to a worldwide community of users. With the WP8 activities, ACTRIS will consolidate partnership in Europe and worldwide, ensure alignment of policies with the relevant international initiatives and contribute to strategies for enhancing uptake of ACTRIS data, data products and services by user communities. WP8 will directly contribute to defining the long-term strategies of ACTRIS in WP3. WP8 shall work in cooperation and interaction with all other work packages.

Task 8.1 Reinforce cooperation with European Research Infrastructures and e-Infrastructures Leader: NILU, Partners: FMI, CNR, CNRS

ACTRIS is constantly seeking synergies and collaboration opportunities in the form of joint activities with other RIs. Particularly, ACTRIS is working together with other environmental RIs (ENVRI) in the framework of ENVRI-FAIR, other RI cluster activities and in the ESFRI framework. ACTRIS is also reaching out to other science domains where the relation and connection to climate, air quality, health, and technology development are relevant. WP9 will propose recommendations to promote value-added ACTRIS activities in conjunction with other RIs. As a data-intensive RI, ACTRIS needs to define its links and role with the external e-infrastructure services, especially in the framework of EOSC. In Task 8.1, ACTRIS will evaluate the level of engagement in service portfolios offered by several EOSC providers to expand its base to new communities of users, but also to rationalize its own services and make use of emerging smart solutions for data storage, access, and management. Liaison with EOSC hub providers through Task 8.1 will also include strategic advice for the ACTRIS business model and procurement framework for its long-term sustainability.

Task 8.2 Compliance with international networks and initiatives, including GEOSS and Copernicus Leader: CNRS, Partners: UHEL, CNR, TROPOS, NILU, EMPA, BIRA-IASB, NOA

Task 8.2 will provide an assessment of proper alignment of activities and policies (governance, access, policies, standards, and protocols) with the relevant international initiatives and data hubs, by identifying common frameworks, seeking harmonisation opportunities, and supporting complementary roles and actions. ACTRIS is the European contribution to several networks and frameworks for the observation of atmospheric composition and properties related to aerosol, cloud and trace gases, such as AERONET, NDACC, GAW, EMEP. These frameworks and networks are also

operated under the umbrella of other research performing organisations such as NASA or under global or European initiatives such as GEO, GCOS, or Copernicus, which in turn define their standards and requirements such as in GEOSS, WMO-WIGOS or other international data repositories. ACTRIS contributes to these networks by either 1) providing observation data, 2) operating network calibration centre(s), 3) operating the network data centre or any combination of the three. Upon establishing ACTRIS ERIC, there is a need to clearly define its role and responsibilities in international partnerships to ensure that all elements of ACTRIS, from governance to access, are compliant with the participation and role in international networks and ensure the representation of ACTRIS in the long-term.

Task 8.3 Participation of third countries in ACTRIS

Leader: CNRS Partners: FMI, CNR, TROPOS, CYI

While Task 8.2 addresses ACTRIS as the European nodes of international networks, Task 8.3 is aimed at promoting ACTRIS in an international framework and facilitating the use of services by partners beyond Europe, particularly in third countries. There is still a need to define which services can be proposed to observational and exploratory facilities located in third countries and to establish the procedures for access to services, including the financial aspects. In Task 8.3, ACTRIS will implement a specific action plan to define a manageable strategy to promote the participation of third countries in ACTRIS and favour use of services and access. An international training and capacity building program will be organized not only focussing on the technical implementation at CFs and NFs and services proposed, but also on its governance, organisation, and financial concepts. It will be designed and delivered with the relevant levels of expertise required for station operators to managers.

Task 8.4 Establishing the global GEO initiative on short-lived climate species

Leader: UHEL, Partners: CNR, CNRS, NILU, FORTH

GEO is an intergovernmental partnership that improves the availability, access and use of Earth observations promoting open, coordinated and sustained data sharing in support of global priority engagement areas, including the UN 2030 Agenda for Sustainable Development, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction. GEO develops the effective policy responses for climate change adaptation and mitigation, and leads national, regional and global efforts to enhance global observation systems. Better integration of ACTRIS in the GEO framework will benefit from establishment of a GEO initiative on short-lived climate species. The initiative will be part of the ACTRIS strategy towards provision of data products to the climate impact, adaptation and vulnerability research community for the Intergovernmental Panel on Climate Change (IPCC) assessment reports. To strengthen the GEO application process, ACTRIS will first strengthen its connection with the Global Climate Observing System (GCOS) through the key partners worldwide. In a second step, ACTRIS will liaise with stakeholders in different regions to propose a joint GEO initiative on short-lived climate species, of which ACTRIS will be the European node.

Participation per Partner			
Partner number and short name	WP8 effort		
1 - FMI	2.00		
2 - UHEL	4.00		
3 - CNR	6.00		
4 - TROPOS	1.00		
7 - CNRS	0.00		
UGA	5.00		
10 - NILU	5.00		
13 - EMPA	1.00		
15 - BIRA-IASB	1.00		
18 - CYI	2.00		
25 - NOA	1.00		
26 - FORTH	1.00		
	Total 29.00		

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D8.1	Report on planned joint activities and synergies with other RIs and e-RIs	3 - CNR	Report	Public	18
D8.2	Defining the needs for EOSC resources in ACTRIS	10 - NILU	Report	Public	24
D8.3	Assessment of ACTRIS contribution to, and alignment of ACTRIS policies with, international networks and initiatives, incl. GEOSS and COPERNICUS	7 - CNRS	Report	Public	24
D8.4	Summary report on international ACTRIS training courses	7 - CNRS	Report	Public	40
D8.5	Application to GEO initiative on short-lived climate species	2 - UHEL	Report	Public	48

Description of deliverables

- D 8.1 Report on planned joint activities and synergies with other RIs and e-RIs (M18)
- D 8.2 Defining the needs for EOSC resources in ACTRIS (M24)
- D 8.3 Assessment of ACTRIS contribution to, and alignment of ACTRIS policies with, international networks and initiatives, incl. GEOSS and COPERNICUS (M24)
- D 8.4 Summary report on international ACTRIS training courses (M40)
- D 8.5 Application to GEO initiative on short-lived climate species (M48)
- D8.1: Report on planned joint activities and synergies with other RIs and e-RIs [18]

An analysis of required adjustment of policies between ACTRIS and other international data hubs.

D8.2 : Defining the needs for EOSC resources in ACTRIS [24]

A report defining the need for use of EOSC resources in ACTRIS and addressing possible options for secondment strategies.

D8.3 : Assessment of ACTRIS contribution to, and alignment of ACTRIS policies with, international networks and initiatives, incl. GEOSS and COPERNICUS [24]

An assessment of proper alignment of activities and policies (governance, access, policies, standards, and protocols) with the relevant international initiatives and data hubs, incl. GEOSS and COPERNICUS.

D8.4 : Summary report on international ACTRIS training courses [40]

A report summarizing outcomes of the international ACTRIS training courses.

D8.5 : Application to GEO initiative on short-lived climate species [48]

An application document to propose the establishment of an initiative on short-lived climate species made to GEO.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS45	Identification of potential synergistic activities with other ENVRIs	3 - CNR	6	Identification of potential synergistic activities with other ENVRIs. Means of verification: Analysis report available.
MS46	A first evaluation of alignment of ACTRIS with international networks	7 - CNRS	6	A first evaluation of alignment of ACTRIS with international networks. Means of verification: Analysis report available.
MS47	Meetings with international stakeholders addressing joint global initiatives and focusing on connection with GCOS	2 - UHEL	9	Meetings with international stakeholders addressing joint global initiatives and focusing on connection with GCOS. Means of verification: Meeting held
MS48	Internal evaluation of the potential use of e- infrastructure portfolio by ACTRIS	10 - NILU	12	Internal evaluation of the potential use of e- infrastructure portfolio by ACTRIS. Means of verification: Analysis report available.
MS49	First International ACTRIS training course held	7 - CNRS	12	First International ACTRIS training course. Means of verification: Course offered to international students.
MS50	Series of meetings with international stakeholders achieved that serve the purpose of an application to GEO initiative	2 - UHEL	24	Series of meetings with international stakeholders achieved that serve the purpose of an application to GEO initiative. Means of verification: Meeting minutes available.

Work package number 9	WP9	Lead beneficiary 10	3 - CNR
Work package title	Positioning A	CTRIS in the European innova	ntion ecosystem
Start month	1	End month	48

Objectives

The main objective of WP9 is to foster the role of ACTRIS in innovation landscape, by increasing the interest of the private sector towards ACTRIS as an innovation platform and by promoting actions for an effective technology and knowledge transfer. The specific objectives are to:

- assess past and current cooperation with the private sector within ACTRIS, highlighting best practices and success stories;
- define and formalize different partnership possibilities between ACTRIS CFs or NFs and the private sector;
- stimulate technology development actions across ACTRIS; and
- identify tools and actions to make the ACTRIS innovation brand known and attractive for the private sector, especially for SMEs.

The main expected outcome of WP9 is that ACTRIS and users will be supported in developing innovative responses to global challenges in science, industry and society. WP9 results will increase the ACTRIS potential for innovation and strengthen the position of ACTRIS in the European innovation ecosystem with the provision of diagnostics and recommendations to be utilized in WP 3. WP9 activities will enable a stronger ERA position and role in the global research environment and support the progress towards the development of ACTRIS as a global research infrastructure.

Description of work and role of partners

WP9 - Positioning ACTRIS in the European innovation ecosystem [Months: 1-48]

CNR, UHEL, TROPOS, KIT, IMT, INOE, UKRI, CYI, UNIWARSAW, MUI, ICPF, NOA, INRNE-BAS, UCC, UPC, CEAM, EULS

Since the overall performance of an innovation ecosystem depends on the quality of its governance, the work in ACTRIS IMP is directed to build an overall coordination of all ACTRIS innovation actions. The project will support the transition from an innovation model mostly based on an individual or project basis to a new appropriate governance model which will enable a successful implementation of the innovation policy within ACTRIS by including key factors such as: 1) long-term strategic planning and stakeholder involvement in strategic development and innovation keeping ACTRIS at the forefront of science with high societal impacts (WP3), and 2) delivering tools and support in monitoring and evaluating innovation actions for fostering the collaboration with the private sector (WP9). The provision of support and tools will enable ACTRIS to better exploit the networking with industries (including SMEs) and to facilitate their involvement as ACTRIS partners for technological developments. Moreover, customized services for industry and SMEs and dissemination tools for an effective technology transfer will be an outcome for this WP. WP9 shall work in cooperation and interaction with all other work packages.

Task 9.1 Analysis of the current position of ACTRIS in the European innovation ecosystem

Leader: MUI Partners: CNR, TROPOS, INOE, UW, ICPF, NOA

The ACTRIS community has already made great efforts towards innovation and transfer of knowledge to the private sector and counts on a long history of joint technological developments, continuous cooperation and exchange in hardware improvements and software updates and developments in the framework of previous supporting projects (ACTRIS, ACTRIS-2, EUROCHAMP) and through its physical and remote access programme to RI facilities. The aim of this task is to assess the past and current collaboration between ACTRIS and the private sector, to understand how the industrial R&D currently exploits the rich knowledge environment of ACTRIS, how the scientific results percolate into innovation value, how the industry benefits from access to ACTRIS facilities and to scientific data, with a view to plan actions to further strengthening interactions with the private sector. In addition, other RIs will be benchmarked for comparison and best practise analysis. Success stories of already existing collaboration between ACTRIS and private sector will be highlighted, to give the right evidence through the ACTRIS communication actions (WP10) and encourage creativity and innovation within ACTRIS community to foster new business ideas.

Task 9.2 ACTRIS modalities for technology transfer

Leader: CNR Partners: UHEL, UW, MUI, INRNE-BAS

The main purpose of Task 9.2 is to provide the framework for sound interactions and networking with the private sector in all possible models of technology/knowledge transfer: 1) upstream business model (industry as a supplier) to test novel instrumentation and algorithms for compatibility in ACTRIS (outside in); 2) downstream business model (industry as a

user) to test instruments, calibration procedures and action for fostering data driven innovation by private sector (inside out); and 3) co-creation model for exchange of expertise between ACTRIS and private sector (coupled). Essential tools and resources for establishing collaborations with the private sector will be created, including guidelines for setting up the provision of tailored services, knowledge transfer and training, access to facilities to test innovative developments and products, exchange programmes, etc. Although agreements for setting up collaborations are almost inevitably a tailor-made process, recommendations for harmonized documents and legal templates will also be delivered to WP2 to serve as a guidance for frequently occurring technology transfer situations (collaboration agreements, confidentiality agreements, etc).

Task 9.3 Addressing current and future innovation demand from the private sector

Leader: IMT Partners: CNR, TROPOS, CYI, MUI, INRNE-BAS, CEAM

Needs and requirements of the private sector will be assessed through the analysis of the inventory of user needs (input from Task 6.1 Updating the user needs analysis). The inventory of user needs will be analysed to evaluate and address the specific demand for innovation (technological and methodological needs and specific needs related to uptake of ACTRIS data) which ACTRIS can potentially answer to, thereby delineating the perimeter of innovation covered by ACTRIS. Following the input from WP3, the main topics will be reviewed through consultative interactions with stakeholders and the ACTRIS community to list the challenges which NFs and CFs operators need to work on to move ACTRIS innovation forward. A coherent set of actions will be identified and recommended to ACTRIS Facilities for future engagement of the interested parties and for fostering innovation by following an open innovation approach. An appropriate tool for internal monitoring and evaluation of the innovation actions will be set. Some flagship actions will be demonstrated, possibly using TNA pilots in WP7, to useful demonstrate the potential of joint collaborations with the private sector and to perform the actions at CFs and NFs.

Task 9.4 Fostering partnership with the private sector in ACTRIS

Leader: CNR Partners: UHEL, KIT, UKRI, UW, ICPF, INRNE-BAS, UCC, UPC, EULS

Following activities in previous tasks, the purpose of Task 9.4 is to set the frame of actions to generate an enabling environment for new opportunities of cooperation in innovation with the ACTRIS community and the private sector. This will be achieved by streamlining the innovation offer of ACTRIS and by providing guidance and principles of action for the private sector liaison for innovation function within the Development and Relations Unit of the HO (DEVU). An ACTRIS Innovation portfolio will organize the distinctive ACTRIS offer of services and opportunities for innovation provided to the private sector. The portfolio will be developed based on the necessary input from NF and CF operators (in WP4 Task 4.4 and WP5 Task 5.4) and from the catalogue of services (input from WP6). Recommendations for the operation of the DEVU liaison function will be provided (input to Task 4.1), in particular to make the ACTRIS innovation brand known, consolidated and attractive for the private sector (input to WP10), and to promote relations and partnerships with local innovation intermediaries (technology and service providers or incubators). This will bring ACTRIS closer to enterprises and foster the development of regional innovation ecosystems with benefits arising from strengthened proximity relationships for all actors.

Participation per Partner			
Partner number and short name	WP9 effort		
2 - UHEL	2.00		
3 - CNR	16.00		
4 - TROPOS	2.00		
5 - KIT	1.00		
8 - IMT	2.00		
11 - INOE	1.00		
17 - UKRI	1.00		
18 - CYI	2.00		
19 - UNIWARSAW	2.00		
IGF-PAS	1.00		

Partner number and short name		WP9 effort
22 - MUI		3.00
24 - ICPF		4.00
25 - NOA		1.00
27 - INRNE-BAS		2.00
IE-BAS		2.00
28 - UCC		2.00
30 - UPC		0.00
CIEMAT		1.00
31 - CEAM		1.00
33 - EULS		1.00
	Total	47.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D9.1	Progress Report on the position of ACTRIS in the European Innovation Ecosystem	22 - MUI	Report	Public	18
D9.2	Means and recommendations for the operation of the ACTRIS liaison office	3 - CNR	Report	Public	36
D9.3	Report on the results of the flagship actions	8 - IMT	Report	Public	48
D9.4	ACTRIS innovation offer portfolio	3 - CNR	Report	Public	48

Description of deliverables

- D 9.1 Progress Report on the position of ACTRIS in the European Innovation Ecosystem (M18)
- D 9.2 Means and recommendations for the operation of the ACTRIS liaison office (M36)
- D 9.3 Report on the results of the flagship actions (M48)
- D 9.4 ACTRIS innovation offer portfolio (M48)
- D9.1 : Progress Report on the position of ACTRIS in the European Innovation Ecosystem [18]

Analisys of the current positioning and role of ACTRIS in European Innovation Ecosystem with the evidence of Success Stories of collaboration with private sector.

D9.2: Means and recommendations for the operation of the ACTRIS liaison office [36]

Useful documents and procedures for setting formal collaboration between ACTRIS and private sector. Recommendations to foster the co-operation in innovation and facilitate a continuous exchange of knowledge and information between the whole ACTRIS community and the private sector.

D9.3: Report on the results of the flagship actions [48]

Final assessment highlighting results, practices and issues arising from the experience of joint collaborations with the private sector.

D9.4: ACTRIS innovation offer portfolio [48]

ACTRIS innovation offer portfolio is intended to collect in a consistent, integrated and accessible document the distinctive ACTRIS offer of services and opportunities for innovation provided to the private sector.

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS51	Launch of survey to identify past and current collaboration between ACTRIS and private sector and success stories	22 - MUI	6	Launch of survey to identify past and current collaboration between ACTRIS and private sector and success stories. Means of verification: Survey launched.
MS52	Identification of collaboration models between ACTRIS and private sector	3 - CNR	12	Identification of collaboration models between ACTRIS and private sector. Means of verification: Document available.
MS53	Recommendations to ACTRIS facilities	8 - IMT	18	Recommendations to ACTRIS facilities. Means of verification: Document available.
MS54	Draft ACTRIS Innovation offer portfolio	3 - CNR	24	Draft ACTRIS Innovation offer portfolio. Means of verification: Draft available.
MS55	Design of the ACTRIS Innovation section in the ACTRIS web-site	3 - CNR	26	Design of the ACTRIS Innovation section in the ACTRIS web-site. Means of verification: Document available.

Work package number 9	WP10	Lead beneficiary 10	1 - FMI
Work package title	ACTRIS com	munication and public relation	S
Start month	1	End month	48

Objectives

The main objective of WP10 is to identify and develop strategic and efficient communication practices that are essential for ensuring regular communication flows within ACTRIS and promoting ACTRIS as a global research infrastructure in the research and innovation landscape. The specific objectives of WP10 are to:

- strengthen the communication flow in ACTRIS and the wider ACTRIS community;
- implement and manage ACTRIS communication tools for both internal and external communication;
- attract potential ACTRIS user communities with tailored outreach activities and means; and
- foster strategic development of ACTRIS communication.

The expected outcome of WP10 is the implementation of effective communication tools and actions in support of all WPs to consolidate ACTRIS visibility and branding, promote its functionalities and services and, ultimately, achieve long-term sustainability. In addition, WP10 outcomes leverage the expected impact of ACTRIS IMP by strengthening the position and role of ACTRIS in ERA and the global research environment, reinforce ACTRIS community building and engagement of countries in setting up ACTRIS, enhance visibility of ACTRIS in international fora, and support the use of ACTRIS services in solving environmental and societal challenges.

Description of work and role of partners

WP10 - ACTRIS communication and public relations [Months: 1-48]

FMI, UHEL, CNR, CNRS, NILU, INOE, NOA

While ACTRIS PPP concentrates on the set up of communication means to connect the ACTRIS components and the community, ACTRIS IMP additionally focuses on advancing the internal and external communication to ensure efficient information flow among ACTRIS components, increase the stakeholder and user engagement and foster active partnerships at regional, national and international level. The objectives of WP10 will be reached by acquiring the best communication practices and by learning how to successfully exploit the communications tools for promoting ACTRIS awareness. The WP will facilitate the mutual interaction between the stakeholders and user groups and the consortium. WP10 shall work in cooperation and interaction with all other work packages.

Task 10.1 Consolidating the communication flow within ACTRIS

Leader: FMI Partners: CNR, CNRS

Task 10.1 will ensure that information is adequately communicated and disseminated within ACTRIS (among NFs, CF units, ERIC). Building on the previous experiences of the H2020 projects ACTRIS-2, ACTRIS PPP and EUROCHAMP-2020, the communication actions and tools will be further consolidated and harmonized taking into account the advancements and ongoing exchange of knowledge on best practices within the ENVRI community. Task 10.1 activities will include: 1) managing and advancing the approaches and means for more efficient information flow among ACTRIS components, for example by advertising the subscription and contributions to ACTRIS newsletter and bulletin, and adopting document management tools and collaboration hub tools; and 2) organizing and participating in suitable events providing ACTRIS partners with enhanced communication skills (e.g., capitalizing the use of social media and novel chat tools for fast communication).

Task 10.2 Implementing and managing ACTRIS communication tools and means

Leader: FMI Partners: CNR, CNRS, NILU

This task is ensuring that ACTRIS makes use of the most suitable and efficient assets of communication practices in its communication activities to maximize the efficiency and the impact of ACTRIS communication. The following activities are envisaged: 1) create an inventory of the activities developed during ACTRIS PPP, ACTRIS-2, and EUROCHAMP-2020, and by other RIs in relation to their observed impact to identify the best communication practices and use of novel communication tools; 2) refine the existing communication approaches, means and tools to meet the objectives of the ACTRIS implementation, including further development of ACTRIS webpages; 3) create professional printed and e-based communication portfolios (e.g. brochures, leaflets, poster, slide templates, document templates, social media content, videos, interviews, blogs entries etc.): and 4) ensure ACTRIS proactive attendance and participation in relevant events (scientific conferences, exhibitions, fairs, etc.).

Task 10.3 Attracting specific user groups with tailored ACTRIS outreach actions

Leader: CNRS Partners: FMI, CNR, INOE, NOA

Task 10.3 will identify the activities and tools to obtain an effective user outreach. This task is based on ACTRIS user strategy and is designed to address the specificity of ACTRIS user groups, including the private sector, to ensure that ACTRIS proficiently engages and communicates with a long-term perspective. Strategic communication, dissemination and exploitation activities, and tools will be defined to ensure the sustainability of ACTRIS. Specific dissemination and exploitation activities are presented in the draft Plan for Exploitation and Dissemination of the project results (PEDR) which maps project outcomes to target audiences, expected impacts and indicators to measure success of the dissemination and exploitation actions. The second objective of the task is to assess, validate and endorse the communication, dissemination and exploitations endeavours as a competitive asset which ensure that information is competently and efficiently communicated and disseminated to the targeted audiences, and further exploited. The periodic assessment will be used to update the living PEDR document which will be improved during the ACTRIS IMP project.

Task 10.4 Developing strategic ACTRIS communication and public relations

Leader: UHEL, Partners: FMI, CNR, CNRS, INOE

This task will develop strategic approaches towards the empowerment of the Development and Relations Unit of the HO and the ACTRIS leadership in the use of communications, media and public relations to achieve the ACTRIS mission. Task 10.4 will promote the relevance and impact of ACTRIS science, contribute to defining strategic communication of ACTRIS spokespersons and to manage public relations, including crisis communication if needed. To achieve these objectives, the following activities are envisaged: 1) collection of outcomes of the ACTRIS impact on science, technology development and societal topics (WP3) to be communicated to a wide audience; 2) definition and associated media releases of the positioning of ACTRIS with regards to specific societal issues and events; and 3) supporting communication of the ACTRIS leaders (e.g., with training).

Particip	ation r	per Parti	ner
----------	---------	-----------	-----

Partner number and short name	WP10 effort
1 - FMI	16.00
2 - UHEL	2.00
3 - CNR	6.00
7 - CNRS	6.00
10 - NILU	1.00
11 - INOE	3.00
25 - NOA	1.00
Total	35.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D10.1	Updated plan for communication within ACTRIS	1 - FMI	Report	Public	12
D10.2	Creation of dedicated communication portfolio	7 - CNRS	Websites, patents filling, etc.	Public	16

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D10.3	Communication and public relations strategic master plan	2 - UHEL	Report	Public	42
D10.4	Updated plan of exploitation and dissemination of the results	1 - FMI	Report	Public	48

Description of deliverables

- D 10.1 Updated plan for communication within ACTRIS (M12)
- D 10.2 Creation of dedicated communication portfolio (M16)
- D 10.3 Communication and public relations strategic master plan (M42)
- D 10.4 Updated plan of exploitation and dissemination of the results (M48)
- D10.1: Updated plan for communication within ACTRIS [12]

Report documenting the tools and means in use for internal communication and their performance with the goal of defining the best practices to strengthen the communication flow within ACTRIS.

D10.2 : Creation of dedicated communication portfolio [16]

Portfolio of communication tools (Stakeholder handbook, brochures, video, etc.) created targeting each specific ACTRIS user group.

D10.3 : Communication and public relations strategic master plan [42]

Plan of the strategic communication of ACTRIS Director General providing strategy and a common frame for all communication actions. It is fed by and streamline the outcomes of the previous tasks, with possible contents being, for instance, the goals of the DEVU, key messages, contents, channels and tools, public relations plan and crisis communication plan.

D10.4: Updated plan of exploitation and dissemination of the results [48]

The plan consists of a user group mapping and the selection of the most suitable communication strategy for an efficient engagement with ACTRIS user groups. The communication strategy defines the metrics to measure the effectiveness of the outreach goals of the DEVU, key messages, contents, channels and tools, public relations plan and crisis communication plan.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS56	Analysis report on the performance and fitness of the internal communication	1 - FMI	6	Analysis report on the performance and fitness of the internal communication. Means of verification: Report available.
MS57	Report of the communication means used and success, incl. metrics	7 - CNRS	10	Report of the communication means used and success, incl. metrics. Means of verification: Report available.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS58	Guidelines for communication and public relations	2 - UHEL	24	Guidelines for communication and public relations. Means of verification: Guidelines published.
MS59	Analysis of the best practices to engage ACTRIS user groups	1 - FMI	32	Analysis of the best practices to engage ACTRIS user groups. Means of verification: Report available.
MS60	Updated report of the communication means used and success, incl. metrics	7 - CNRS	38	Updated report of the communication means used and success, incl. metrics. Means of verification: Report available.

Work package number 9	WP11	Lead beneficiary 10	1 - FMI
Work package title	Project management and ethics		
Start month	1	End month	48

Objectives

The main objective of WP11 is to ensure the smooth, successful and ethical implementation of the ACTRIS IMP project. This will be reached via the following specific objectives:

- set-up and follow clear procedures for monitoring project progress and for provision and submission of project deliverables, milestones and other steps and outcomes;
- ensure the efficient flow of information within the project, and facilitate the participation of all parties in the project;
- create the legal and management framework for National Consortia members not directly connected to ACTRIS IMP; and
- investigate actions where potential departures from Horizon-2020 ethical standards may occur and generate and implement procedures to prevent such departures.

The expected outcome of this WP is the smooth and successful implementation of ACTRIS IMP following the ethical requirements of the Horizon-2020 program.

Description of work and role of partners

WP11 - Project management and ethics [Months: 1-48]

FMI, UHEL

WP11 will ensure adequate coordination and management of all ACTRIS IMP Work Packages in line with Horizon-2020 ethical standards. It will also ensure the day-to-day management tasks and communication between the scientific consortium partners, and between the scientific community and stakeholders. To perform this work, a Project Management Office (PMO) will be established.

Task 11.1 Project work flow and management

Leader: FMI Partners: UHEL

Task 11.1 contains the day-to-day management of ACTRIS IMP, including both technical and financial management. In this task the progress of the project will be followed, and potential issues with delays and contradictions identified as early as possible. Professional management techniques will be used to clearly define procedures, roles, responsibilities and work flows, including an internal quality assurance procedure for project deliverables before submission to EC.

Task 11.2 Links to Commission and project beneficiaries

Leader: FMI Partners: UHEL

Task 11.2 will handle the project-related internal communication between ACTRIS IMP coordinator, beneficiaries, linked third parties and associated partners, and between ACTRIS IMP and the European Commission, including periodic reporting. It will also facilitate ACTRIS IMP project meetings, especially larger ACTRIS community meetings and General Assembly meetings, as well as meetings of the ACTRIS IMP Executive Board. Internal meetings of other ACTRIS IMP work packages do not fall within the scope of this task, although support in terms of funding and manpower may be provided. The facilitation of meetings includes the entire action chain from meeting scheduling and venue selection through meeting announcement, agenda preparation and meeting management to provision of meeting notes. ACTRIS IMP is foreseen to have at least one project general assembly meeting per year.

Task 11.3 Associated partnership program

Leader: UHEL Partners: FMI

ACTRIS IMP will include an associated partnership program, similar to those in the earlier ACTRIS projects. These associated partners are organizations not included in ACTRIS IMP as beneficiaries or linked third parties but connected to ACTRIS through other means such as national ACTRIS consortia. These organizations can sign an associated partnership contract with the ACTRIS IMP coordinator, including a confidentiality agreement, after which the organizations will have access to ACTRIS IMP data and materials and are entitled to limited travel support to ACTRIS IMP meetings, solved case by case by the ACTRIS IMP coordinator or the national lead beneficiary in ACTRIS IMP. The associated partners do not receive any other funding via ACTRIS IMP.

Task 11.4 Ethics in ACTRIS IMP Leader: FMI Partners: UHEL

In the early phases of ACTRIS IMP, Task 11.4 will assess the Horizon-2020 ethical standards, identify in detail the actions that ACTRIS IMP will be required to take to follow these standards, and report the actions to the Commission in the form of three deliverables (D11.1, D11.2 and D11.3). After the deliverables have been submitted, Task 11.4 will continue to monitor compliance with Horizon/2020 ethical standards throughout the project. Towards the end of the project, Task 11.4 will also analyse the gender balance in ACTRIS IMP. Task 11.4 will focus only on ethical aspects within ACTRIS IMP, so activities linked to setting up and facilitating the Ethical Board of ACTRIS ERIC are not within the scope of this task, although the board may be consulted. Ethical issues related to other related projects or to the use of ACTRIS facilities are also outside the scope of this task.

Participation per Partner				
Partner number and short name	WP11 effort			
1 - FMI	19.00			
2 - UHEL	6.00			
Total	25.00			

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D11.1	Ethics compliance in work performed outside EU	1 - FMI	Report	Public	2
D11.2	Protocols for questionnaires in ACTRIS IMP	1 - FMI	Report	Public	4
D11.3	ACTRIS IMP data management plan	1 - FMI	ORDP: Open Research Data Pilot	Public	6
D11.4	Minutes of ACTRIS IMP meetings in 2020	1 - FMI	Report	Public	14
D11.5	Minutes of ACTRIS IMP meetings in 2021	1 - FMI	Report	Public	26
D11.6	Minutes of ACTRIS IMP meetings in 2022	1 - FMI	Report	Public	38
D11.7	Analysis of gender balance in ACTRIS	1 - FMI	Report	Public	42
D11.8	Minutes of ACTRIS IMP meetings in 2023	1 - FMI	Report	Public	48
D11.9	Report on associated partnership program	2 - UHEL	Report	Public	48

Description of deliverables

- D 11.1 Ethics compliance in work performed outside EU (M2)
- D 11.2 Protocols for questionnaires in ACTRIS IMP (M4)
- D 11.3 ACTRIS IMP data management plan (M6)
- D 11.4 Minutes of ACTRIS IMP meetings in 2020 (M14)

- D 11.5 Minutes of ACTRIS IMP meetings in 2021 (M26)
- D 11.6 Minutes of ACTRIS IMP meetings in 2022 (M38)
- D 11.7 Analysis of gender balance in ACTRIS (M42)
- D 11.8 Minutes of ACTRIS IMP meetings in 2023 (M48)
- D 11.9 Report on associated partnership program (M48)
- D11.1 : Ethics compliance in work performed outside EU [2]

Confirmation that the work performed outside EU will be done following the Horizon 2020 ethical standards.

D11.2 : Protocols for questionnaires in ACTRIS IMP [4]

Protocols for identifying survey and questionnaire participants in ACTRIS PPP and for obtaining their informed consent.

D11.3 : ACTRIS IMP data management plan [6]

Management procedures of data in ACTRIS IMP, including protection of personal data.

D11.4: Minutes of ACTRIS IMP meetings in 2020 [14]

Decision minutes of ACTRIS IMP meetings in 2020.

D11.5: Minutes of ACTRIS IMP meetings in 2021 [26]

Decision minutes of ACTRIS IMP meetings in 2021.

D11.6: Minutes of ACTRIS IMP meetings in 2022 [38]

Decision minutes of ACTRIS IMP meetings in 2022.

D11.7 : Analysis of gender balance in ACTRIS [42]

Analysis of gender balance in ACTRIS IMP and in the wider ACTRIS framework.

D11.8: Minutes of ACTRIS IMP meetings in 2023 [48]

Decision minutes of ACTRIS IMP meetings in 2023.

D11.9: Report on associated partnership program [48]

Report on the associated partnership program in ACTRIS IMP and use of resources for the related travel support.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS61	Deliverable work flow description available	1 - FMI	3	Deliverable work flow description available. Means of verification: Work flow description announced to beneficiaries.
MS62	ACTRIS IMP kick-off meeting	1 - FMI	3	ACTRIS IMP kick- off meeting. Means of verification: Meeting held.
MS63	Procedures for associated partnership program available	1 - FMI	3	Procedures for associated partnership program available. Means of verification: Procedures and instructions available at ACTRIS web pages.
MS64	Internal communication channels set up	1 - FMI	4	Internal communication channels set up. Means of verification: Communication channels available for use.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS65	ACTRIS IMP meeting 2021	1 - FMI	24	ACTRIS IMP meeting 2021. Means of verification: Meeting held.
MS66	ACTRIS IMP meeting 2022	1 - FMI	36	ACTRIS IMP meeting 2022. Means of verification: Meeting held.
MS67	ACTRIS IMP final meeting	1 - FMI	47	ACTRIS IMP final meeting. Means of verification: Meeting held.

Work package number 9	WP12	Lead beneficiary 10	1 - FMI
Work package title	Ethics require	ments	
Start month	1	End month	48

Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description of work and role of partners

WP12 - Ethics requirements [Months: 1-48]

FMI

This work package sets out the 'ethics requirements' that the project must comply with.

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D12.1	H - Requirement No. 1	1 - FMI	Ethics	Confidential, only for members of the consortium (including the Commission Services)	6
D12.2	POPD - Requirement No. 2	1 - FMI	Ethics	Confidential, only for members of the consortium (including the Commission Services)	6

Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D12.1: H - Requirement No. 1 [6]

The informed consent procedures that will be implemented for the participation of humans must be submitted as a deliverable. Templates of the informed consent/assent forms and information sheets (in language and terms intelligible to the participants) must be kept on file.

D12.2: POPD - Requirement No. 2 [6]

The host institution must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For host institutions not required to appoint a DPO under the GDPR a detailed data protection policy for the project must be [kept on file submitted as a deliverable. In case personal data are transferred from the EU to a non-EU country or international organisation, confirmation that such transfers are in accordance with Chapter V of the General Data Protection Regulation 2016/679, must be [submitted as a deliverable. In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be submitted as a deliverable. Detailed information on the informed consent procedures in regard to data processing must be submitted as a deliverable included in the Data Management Plan (deliverable 11.3). Templates of the informed consent forms and information sheets (in language and terms intelligible to the participants) must be kept on file.

Schedule of relevant Milestones										
		Due								
Milestone title	Lead beneficiary	Date (in	Means of verification							

months)

Milestone

number¹⁸

1.3.4. WT4 List of milestones

Milestone number ¹⁸	Milestone title	WP number ⁹	Lead beneficiary	Due Date (in months) ¹⁷	Means of verification
MS1	Updated list of National ACTRIS consortia with National Contact Persons	WP1	2 - UHEL	3	List available
MS2	First IAC meeting held during ACTRIS IMP	WP1	1 - FMI	8	First IAC meeting during ACTRIS IMP. Means of verification: Meeting held.
MS3	First SIAB meeting held during ACTRIS IMP	WP1	1 - FMI	12	The first SIAB meeting during ACTRIS IMP. Means of verification: Meeting held.
MS4	First ACTRIS community meeting held	WP1	26 - FORTH	18	The first ACTRIS community meeting during ACTRIS IMP. Means of verification: Meeting held.
MS5	First regional meeting organised	WP1	24 - ICPF	18	Organisation of the first regional meeting. Means of verification: Meeting held.
MS6	Methodology and criteria for validation of ACTRIS operation support and service provision	WP2	3 - CNR	12	Methodology and criteria for validation of ACTRIS operation support and service provision. Means of verification: Report available.
MS7	Negotiations started with the Central Facilities	WP2	2 - UHEL	18	Start of the negotiations with the Central facilities. Means of verification: First meeting held.
MS8	Plan for ACTRIS personnel training and human capital development	WP2	2 - UHEL	18	Report on the planned ACTRIS personnel training and human capital development. Means of verification: Plan available.
MS9	Mid-term report on ACTRIS operation support and service validation	WP2	3 - CNR	24	Mid-term report on ACTRIS operation support and service validation. Means of verification: Report available.
MS10	Draft report on financial and capacity scenarios	WP2	7 - CNRS	24	Draft report on financial and capacity scenarios. Means of verification: Draft report available.
MS11	Refined risk management plan	WP2	7 - CNRS	24	Refined risk management plan. Means of verification: Plan available.
MS12	ACTRIS meeting on technologies and innovation with participation of the	WP3	18 - CYI	12	A meeting on ACTRIS technologies and innovation with participation of the ACTRIS associate from

Milestone number ¹⁸	Milestone title	number months)			Means of verification
	ACTRIS associate from private sector				private sector. Means of verification: Meeting held.
MS13	Macroeconomic impact analysis updated	WP3	25 - NOA	18	Updated macroeconomic impact analysis. Means of verification: Report available.
MS14	ACTRIS Meeting with the National Stakeholders organized	WP3	14 - KNMI	20	ACTRIS Meeting with the National Stakeholders. Means of verification: Meeting held.
MS15	ACTRIS general science meeting focusing on the user dimension and the international stakeholders	WP3	2 - UHEL	24	ACTRIS general science meeting focusing on the user dimension and the international stakeholders. Means of verification: Meeting held.
MS16	Release of the tool for estimating the necessary capacity at the Central Facilities	WP4	11 - INOE	3	Release of the tool for estimating the necessary capacity at the Central Facilities. Means of verification: Collecting tool available.
MS17	Recommendations for harmonisation of procedures and tools across the ACTRIS domains	WP4	7 - CNRS	12	Recommendations for harmonisation of procedures and tools across the ACTRIS domains. Means of verification: Summary of recommendations will be published on ACTRIS website.
MS18	Selection of web-based NF-TC-DC workflow management tool	WP4	10 - NILU	12	Selection of web-based NF-TC-DC workflow management tool. Means of verification: Selection process and results documented.
MS19	Action plan for CF human capital building	WP4	11 - INOE	12	Action plan for CF human capital building. Means of verification: Summary published on the ACTRIS website.
MS20	Release of the list for priority operation support and services	WP4	11 - INOE	12	Release of the list for priority operation support and services. Means of verification: List published on the ACTRIS website.
MS21	Access to first version of web-based NF-TC-DC workflow management tool	WP4	10 - NILU	24	Access to first version of web-based NF-TC-DC workflow management tool. Means of verification: Web-based workflow management released.

Milestone number ¹⁸	Milestone title	WP number ⁹	Lead beneficiary	Due Date (in months) ¹⁷	Means of verification
MS22	Collection of the first feed-back on the operation support provided to National Facilities	WP4	4 - TROPOS	36	Collection of the first feed- back on the operation support provided to National Facilities. Means of verification: Summary published on ACTRIS website.
MS23	Exercises to test RI operations at experienced NFs defined	WP5	3 - CNR	12	Exercises to test RI operations at experienced NFs defined. Means of verification: List of exercises available.
MS24	First series of NF thematic workshops on remote sensing, in- situ measurements and simulation chamber experiments performed	WP5	30 - UPC	14	The first series of NF thematic workshops on remote sensing, in-situ measurements and simulation chamber experiments. Means of verification: Minutes available on the website.
MS25	First NFs labelled and operational	WP5	4 - TROPOS	24	First NFs labelled and operational. Means of verification: List of labelled NFs available.
MS26	Connections to new NFs and RPFs established	WP5	13 - EMPA	26	Connections to new NFs and RPFs established. Means of verification: Participation in workshops and ACTRIS events.
MS27	First series of NF technical workshops on new developments for the observation of aerosol, clouds and reactive trace gases performed	WP5	22 - MUI	26	First series of NF technical workshops on new developments for the observation of aerosol, clouds and reactive trace gases. Means of verification: Minutes available on the website.
MS28	Majority of NFs labelled and operational	WP5	4 - TROPOS	48	Majority of NFs labelled and operational. Means of verification: List of labelled NFs available.
MS29	New NFs and RPFs reached the level of ACTRIS standards	WP5	13 - EMPA	48	New NFs and RPFs reached the level of ACTRIS standards. Means of verification: Data from new NFs and RPFs available in the ACTRIS database.
MS30	ACTRIS User experience map	WP6	3 - CNR	6	ACTRIS User experience map. Means of verification: Map available.

Milestone number ¹⁸	Milestone title	WP number ⁹	Lead beneficiary	Due Date (in months) ¹⁷	Means of verification
MS31	Detailed description of ACTRIS Service catalogue	WP6	7 - CNRS	6	Detailed description of ACTRIS Service catalogue. Means of verification: Service description document available.
MS32	Design, features and functional requirements of the ACTRIS Science and User Forum	WP6	3 - CNR	8	Design, features and functional requirements of the ACTRIS Science and User Forum. Means of verification: Design documentation available.
MS33	1st release of the ACTRIS online Catalogue of Services	WP6	7 - CNRS	10	1st release of the ACTRIS online Catalogue of Services. Means of verification: Catalogue of initial services available online.
MS34	2nd draft of the ACTRIS Management Plan	WP6	3 - CNR	12	2nd draft of the ACTRIS Management Plan. Means of verification: Draft available.
MS35	Updated analysis of user needs	WP6	7 - CNRS	15	Analysis of user needs is updated. Means of verification: Document available.
MS36	Enhanced user strategy with recommendations to ACTRIS facilities	WP6	7 - CNRS	18	Enhanced user strategy with recommendations to ACTRIS facilities. Means of verification: Inventory available.
MS37	Beta version of the Access Management Platform	WP6	3 - CNR	22	Beta version of the Access Management Platform. Means of verification: Beta version available for testing and feedback.
MS38	Results of the testing of the access and services provision system	WP6	3 - CNR	42	Results of the testing of the access and services provision system. Means of verification: Summary report of the tests available.
MS39	Definition of the pilot access process to ACTRIS facilities	WP7	7 - CNRS	8	Definition of the pilot access process to ACTRIS facilities. Means of verification: Document available.
MS40	Advertisement and launch of first call for access	WP7	7 - CNRS	9	Advertisement and launch of first call for access. Means of verification: 1st Call launched
MS41	Advertisement and launch of second call for access	WP7	3 - CNR	21	Advertisement and launch of second call for access.

Milestone number ¹⁸	Milestone title	WP number ⁹	Lead beneficiary	Due Date (in months) ¹⁷	Means of verification
					Means of verification: 2nd Call launched.
MS42	Intermediate assessment of the pilot access concept and process	WP7	7 - CNRS	25	Intermediate assessment of the pilot access concept and process. Means of verification: Mid-term summary of TNA available.
MS43	Advertisement and launch of third call for access	WP7	3 - CNR	33	Advertisement and launch of third call for access. Means of verification: 3rd Call launched.
MS44	Final assessment of the pilot access concept and process	WP7	3 - CNR	44	Final assessment of the pilot access concept and process. Means of verification: Final summary of TNA available.
MS45	Identification of potential synergistic activities with other ENVRIs	WP8	3 - CNR	6	Identification of potential synergistic activities with other ENVRIs. Means of verification: Analysis report available.
MS46	A first evaluation of alignment of ACTRIS with international networks	WP8	7 - CNRS	6	A first evaluation of alignment of ACTRIS with international networks. Means of verification: Analysis report available.
MS47	Meetings with international stakeholders addressing joint global initiatives and focusing on connection with GCOS	WP8	2 - UHEL	9	Meetings with international stakeholders addressing joint global initiatives and focusing on connection with GCOS. Means of verification: Meeting held
MS48	Internal evaluation of the potential use of e- infrastructure portfolio by ACTRIS	WP8	10 - NILU	12	Internal evaluation of the potential use of e- infrastructure portfolio by ACTRIS. Means of verification: Analysis report available.
MS49	First International ACTRIS training course held	WP8	7 - CNRS	12	First International ACTRIS training course. Means of verification: Course offered to international students.
MS50	Series of meetings with international stakeholders achieved that serve the purpose of an application to GEO initiative	WP8	2 - UHEL	24	Series of meetings with international stakeholders achieved that serve the purpose of an application to GEO initiative. Means of verification: Meeting minutes available.

Milestone number ¹⁸	Milestone title	WP number ⁹	Lead beneficiary	Due Date (in months) ¹⁷	Means of verification
MS51	Launch of survey to identify past and current collaboration between ACTRIS and private sector and success stories	WP9	22 - MUI	6	Launch of survey to identify past and current collaboration between ACTRIS and private sector and success stories. Means of verification: Survey launched.
MS52	Identification of collaboration models between ACTRIS and private sector	WP9	3 - CNR	12	Identification of collaboration models between ACTRIS and private sector. Means of verification: Document available.
MS53	Recommendations to ACTRIS facilities	WP9	8 - IMT	18	Recommendations to ACTRIS facilities. Means of verification: Document available.
MS54	Draft ACTRIS Innovation offer portfolio	WP9	3 - CNR	24	Draft ACTRIS Innovation offer portfolio. Means of verification: Draft available.
MS55	Design of the ACTRIS Innovation section in the ACTRIS web-site	WP9	3 - CNR	26	Design of the ACTRIS Innovation section in the ACTRIS web-site. Means of verification: Document available.
MS56	Analysis report on the performance and fitness of the internal communication	WP10	1 - FMI	6	Analysis report on the performance and fitness of the internal communication. Means of verification: Report available.
MS57	Report of the communication means used and success, incl. metrics	WP10	7 - CNRS	10	Report of the communication means used and success, incl. metrics. Means of verification: Report available.
MS58	Guidelines for communication and public relations	WP10	2 - UHEL	24	Guidelines for communication and public relations. Means of verification: Guidelines published.
MS59	Analysis of the best practices to engage ACTRIS user groups	WP10	1 - FMI	32	Analysis of the best practices to engage ACTRIS user groups. Means of verification: Report available.
MS60	Updated report of the communication means used and success, incl. metrics	WP10	7 - CNRS	38	Updated report of the communication means used and success, incl. metrics. Means of verification: Report available.
MS61	Deliverable work flow description available	WP11	1 - FMI	3	Deliverable work flow description available. Means

Milestone number ¹⁸	Milestone title			2 44	Means of verification		
					of verification: Work flow description announced to beneficiaries.		
MS62	ACTRIS IMP kick-off meeting	WP11	1 - FMI	3	ACTRIS IMP kick- off meeting. Means of verification: Meeting held.		
MS63	Procedures for associated partnership program available	WP11	1 - FMI	3	Procedures for associated partnership program available. Means of verification: Procedures and instructions available at ACTRIS web pages.		
MS64	Internal communication channels set up	WP11	1 - FMI	4	Internal communication channels set up. Means of verification: Communication channels available for use.		
MS65	ACTRIS IMP meeting 2021	WP11	1 - FMI	24	ACTRIS IMP meeting 2021. Means of verification: Meeting held.		
MS66	ACTRIS IMP meeting 2022	WP11	1 - FMI	36	ACTRIS IMP meeting 2022. Means of verification: Meeting held.		
MS67	ACTRIS IMP final meeting	WP11	1 - FMI	47	ACTRIS IMP final meeting. Means of verification: Meeting held.		

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	Unavailability of key staff	WP1, WP10, WP11, WP12, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	A contingency plan established, incl. early measures to anticipate shift of responsibilities when necessary.
2	Lack of coordination among the WPs	WP11	Qualified WP leaders, frequent interactions and measures to ensure consistency of approaches and strategies.
3	Lack of commitment from partners	WP1, WP10, WP11, WP12, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Regular project and EB meetings, progress monitoring will anticipate suitable corrective actions.
4	Inability to harmonize the project data flows	WP11	ACTRIS IMP workflow tool with constant monitoring of workflows (WP11).
5	Delays in project results due to time interlinkages between tasks.	WP1, WP10, WP11, WP12, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Regular EB meetings, efficient follow up by WP leaders, overall efficient project management and monitoring (all WPs).
6	Allocated funding is insufficient to carry out an action.	WP11	Experience in cost planning, budgeting, and monitoring. Budget shifts to optimize the work. Matching resources of the partners (WP11).
7	Insufficient or time discrepancy in national funding to implement ACTRIS.	WP1, WP2, WP4, WP5, WP6	Strong country support and existing national funding enable CF and NF implementation at the national level. WP1 and coordination support the partners in engaging the funders and stakeholders.
8	IAC poses additional tasks to ACTRIS IMP partners.	WP1, WP11	Efficient communication between ACTRIS IMP and IAC. Common understanding on the implementation work plans.
9	Low number of NFs connected to ACTRIS IMP work	WP1, WP10, WP11, WP2	Continuous interactions with the national ACTRIS consortia to support the establishment of NFs and their connection to ACTRIS IMP (WP1, WP2, WP10, WP11).
10	Delays in implementing CFs, affecting project outcomes	WP4, WP6	Support for implementation of CFs and prioritization of actions on issues enabling implementation of CFs.
11	Low visibility and awareness of ACTRIS	WP1, WP10	Revision of diverse communication actions and tools, PEDR, re-allocation of resources to enhance the communication.
12	Lack of interest from private sector to ACTRIS services	WP10, WP3, WP9	Revision of ACTRIS IMP innovation actions and tools for communication. Adoption of ACTRIS services to meet the needs of the private sector.
13	Low socio-economic impact of ACTRIS	WP10, WP3, WP8, WP9	Existing quantitative data on the socio-economic impacts of ACTRIS. Revision of impact analyses and enhancement of WP3, WP8, WP9 and WP10 work.

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	Total Person/Months per Participant
1 - FMI	10	3	1	2	2	0	0	2	0	16	19	✓	55
2 - UHEL	4	10	10	3	3	2	0.01	4	2	2	6	✓	46.01
3 - CNR	2	5	2	4	4	19	4	6	16	6	0		68
4 - TROPOS	2	2	2	6	12	1	0.01	1	2	0	0		28.01
5 - KIT	0	1	0	3	1	1	0	0	1	0	0		7
6 - FZJ	0	0	0	1	1	0	0.01	0	0	0	0		2.01
7 - CNRS	0	3.50	0	4.50	2	8	5	0	0	6	0		29
· UVSQ	0	0	0	1.50	0	0	0	0	0	0	0		1.50
· LILLE	0	0	0	1.50	0	0.50	0	0	0	0	0		2
· UGA	1	0	2	0	0	0.50	0	5	0	0	0		8.50
· UPEC	0	0.50	0	0.50	0	2	0	0	0	0	0		3
8 - IMT	0	0	0	2	0	0	0	0	2	0	0		4
9 - INERIS	0	0	0	2	0	0	0	0	0	0	0		2
10 - NILU	0	4	1	8	0	4	0	5	0	1	0		23
11 - INOE	4	4	4	10	3	5	0	0	1	3	0		34
12 - PSI	0	0	1	0	1	0	0.01	0	0	0	0		2.01
13 - EMPA	0	0	0	1	2	0	0	1	0	0	0		4
14 - KNMI	1	1	1	1	1	0	0.01	0	0	0	0		5.01
· TUD	0	0	2	2	0	0	0.01	0	0	0	0		4.01
15 - BIRA-IASB	1	0	0	3	1	1	2.12	1	0	0	0		9.12
16 - UNIMAN	1	0	1	4	0	0	0	0	0	0	0		6
17 - UKRI	0	0	0	2	1	0	0	0	1	0	0		4
18 - CYI	2	0	3	0	2	0	7	2	2	0	0		18

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	Total Person/Months per Participant
19 - UNIWARSAW	2	1	0	2	3	0	0	0	2	0	0		10
· IGF-PAS	2	1	0	0	2	0	0	0	1	0	0		6
20 - ULUND	2	0	1	0	1	0	0	0	0	0	0		4
21 - JRC	0	0	0	1	1	0	0	0	0	0	0		2
22 - MUI	0	0	0	3	2	0	0	0	3	0	0		8
23 - ZAMG	0	0	0	2	2	1	0.01	0	0	0	0		5.01
24 - ICPF	4	0	0	6	2	1	0	0	4	0	0		17
· CHMI	2	1	1	0	4	1	0	0	0	0	0		9
25 - NOA	3	0	7	0	2	0	0	1	1	1	0		15
· NCSR-D	0	0	2	0	1	0	0	0	0	0	0		3
26 - FORTH	6	0	0	0	0	0	0	1	0	0	0		7
27 - INRNE-BAS	3	3	2	0	2	0	0	0	2	0	0		12
· IE-BAS	3	2	0	0	2	2	0	0	2	0	0		11
28 - UCC	1	0	0	0	1	0	0	0	2	0	0		4
29 - AU	1	1	0	0	1	0	0	0	0	0	0		3
30 - UPC	0	0	0	0	2	0	0	0	0	0	0		2
· CIEMAT	0	0	0	0	0	1	0	0	1	0	0		2
· UGR	0	0	0	0	0	1	0	0	0	0	0		1
· BSC	0	0	0	2	0	0	0	0	0	0	0		2
· INTA	0	0	0	0	1	0	0	0	0	0	0		1
31 - CEAM	0	0	0	0	0	1	0.01	0	1	0	0		2.01
· CSIC	0	0	0	0	1	0	0	0	0	0	0		1
32 - UVA	0	0	0	2	0	0	0	0	0	0	0		2
· AEMET	0	0	0	1	0	1	0	0	0	0	0		2
33 - EULS	2	0	0	0	1	0	0	0	1	0	0		4
34 - UEvora	2	0	1	0	2	0	0	0	0	0	0		5

Associated with document Ref. Ares(2019)6815176 - 04/11/2019

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	Total Person/Months per Participant
Total Person/Months	61	43	44	81	69	53	18.20	29	47	35	25		505.20

1.3.7. WT7 Tentative schedule of project reviews

Review number ¹⁹	Tentative timing	Planned venue of review	Comments, if any
RV1	24	Brussels	
RV2	48	Brussels	

1.3.8. WT8 Summary of transnational / virtual access provision per installation

		Inst	tallation						Access costs ²³			
Access provider short name	Short name of infrastructure	number ²⁰	Short name	Installation country code ²¹	Type of access ²²	Unit of access	Unit cost (€)	Min. quantity of access to be provided	On the basis of UC	As actual costs	Estimated number of users	Estimated number of projects
2 - UHEL	SMEAR II	1	Hyytiälä	FI	TA-uc	UWD	700	30.0	21000		12	6
3 - CNR	ACTRIS DC-ARES	1	SHARE	IT	TA-uc	SWD	450	45.0	20250		5	3
4 - TROPOS	ACD-C/ OGTAC CC	1	ACD-C/ OGTAC CC	DE	TA-uc	DAY	1100	20.0	22000		8	2
6 - FZJ	SAPHIR- CiGas-FZJ	1	SAPHIR- CiGas-FZJ	DE	TA-uc	DAY	5000	5.0	25000		10	1
7 - CNRS	CARS-ASP-FR	2	Mobile AE	FR	TA-ac	UWD		9.0		8531.25	3	3
7 - CNRS	CARS-ASP-FR	1	Calibration AE	FR	TA-uc	CAL	1350	10.0	13500		10	10
12 - PSI	JFJ	1	JFJ	СН	TA-uc	DAY	800	30.0	24000		8	4
14 - KNMI	Cabauw	1	Cabauw- KNMI	NL	TA-uc	UWD	370	36.0	13320		12	6
TUD	Cabauw	2	Cabauw- TUD		TA-uc	UWD	130	36.0	4680		12	6
15 - BIRA-IASB	CDPS-FTIR	1	CDPS-FTIR	BE	TA-ac	DPS		4.0		20050	3	3
18 - CYI	USRL	1	USRL	CY	TA-ac	SWD		40.0		20000	6	3
23 - ZAMG	SBO	1	SBO	AT	TA-cb	UWD	400	45.0	18000	2700	9	3
31 - CEAM	EUPHORE	1	EUPHORE	ES	TA-uc	DAY	4000	8.0	32000		4	2

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should** appear on each page of the grant agreement preparation documents (part A and part B) to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB: entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

R Document, report

DEM Demonstrator, pilot, prototype
DEC Websites, patent fillings, videos, etc.

OTHER

ETHICS Ethics requirement
ORDP Open Research Data Pilot
DATA data sets, microdata, etc.

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

PU Public

CO Confidential, only for members of the consortium (including the Commission Services)

EU-RES Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)

EU-CON Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)

EU-SEC Classified Information: SECRET UE (Commission Decision 2005/444/EC)

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number: MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

VA if virtual access,

TA-uc if trans-national access with access costs declared on the basis of unit cost,

TA-ac if trans-national access with access costs declared as actual costs, and

TA-cb if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

History of changes with respect to the original proposal Associated with document Ref. Ares(2019)6815176 - 04/11/2019

Change #	Change description
1	The person/month effort has been split between main beneficiaries and linked third parties
2	The "Annex 2a – Additional information on the estimated budget of the action" table has
	been uploaded
3	Revisions were made to include WP12. Revisions can be found in section 1.3 sub-section
	Methodology of ACTRIS for ACTRIS IMP, page 11; section 3.1 ACTRIS IMP Work
	plan, pages 24, 25, 26; section 4: role in the project, pages 36 and 40.
4	Section 4.1.1 updated to include Mikhail Paramonov. Also noted is paternity leave of Dr.
	Niku Kivekäs. Pages 36-37.
5	Section 3.2, part about Project Coordination was modified to clarify the role of the co-
	coordinator UHEL. Page 27.
6	Section 2.1, target indicators for impact have been quantified
7	D1.2 – name and description changed in the portal
8	D1.3 – name and description changed in the portal
9	Section 4.1.3 – Massimo Chiari was removed as he is not an employee of the CNR.
10	D9.2 and D 9.3 merged into one deliverable D9.2 Means and recommendations for the
	operation of the ACTRIS liaison office. Therefore, name and description of D9.2 changed.
	Also, what used to be D9.4 and D9.5 are now D9.3 and D9.4, respectively.
11	D9.4 (former D9.5) – description and type of deliverable changed in the portal
12	WP12 added to the Critical Risks section in the Portal.

Table of Contents

1. EXCELLENCE	
1.1 Objectives	4
1.2 RELATION TO THE WORK PROGRAM	5
1.3 CONCEPT AND METHODOLOGY	
1.4 Ambition	
2. IMPACT	13
2.1 Expected impacts of ACTRIS	13
2.2 MEASURES TO MAXIMISE ACTRIS IMP IMPACT	18
Dissemination and exploitation of results	
Communication activities	21
3. IMPLEMENTATION	23
3.1 ACTRIS IMP WORK PLAN	23
3.2 ACTRIS IMP MANAGEMENT STRUCTURE, RELATED MILESTONES AND PROCEDURES	26
3.3 CONSORTIUM AS A WHOLE	31
2.4 DESCRIBERS TO BE COMMITTED TO A CTRIS IMP PROJECT	

1. Excellence

ACTRIS is a large, highly distributed pan-European Research Infrastructure commencing the implementation phase in 2020. The community is strong, motivated and sharing a common vision. The majority of the implementation will happen at the national level, in the countries hosting ACTRIS facilities, mostly with national funding. ACTRIS IMP is an essential instrument to bring the national contributions together and form a pan-European coordination structure to establish a long-term ACTRIS with demonstrated well-functioning operations and services. ACTRIS has progressed well and ACTRIS IMP will secure a smooth transition from preparatory phase to implementation.

The Aerosol, Clouds and Trace Gases Research Infrastructure (ACTRIS) is a pan-European research infrastructure (RI) producing high-quality data and information on short-lived atmospheric constituents and on the processes leading to the variability of these constituents in natural and controlled atmospheres.

Short-lived atmospheric constituents have residence times in the atmosphere ranging from seconds or minutes to a few weeks, which make their concentrations highly variable in time and space. Their properties as concentration, and physical and chemical properties affect:

- the Earth's radiation balance through absorption, scattering and indirect cloud-related processes, a major source of uncertainty in future climate predictions;
- extreme weather, by contributing to a changing energy balance at the ground and in the atmospheric column;
- public health through aerosol particles and gases which, at concentrations typically found across Europe, give rise to severe and unacceptable health effects in the population;

ACTRIS is key to supporting scientific advances in the field of atmospheric research: Fundamental understanding of atmospheric physical and chemical processes together with advances in theory, modelling, and observations is vital in narrowing gaps in the predictive capability of simulation models from the local to the global scale. ACTRIS activities contribute to reducing uncertainties in emission sources, to understanding deposition processes that remove short-lived constituents from the atmosphere, and to quantifying their potential impacts on ecosystems. More generally, ACTRIS brings essential information for understanding global biogeochemical interactions between the atmosphere and ecosystems, and how climate-ecosystem feedback loops may change atmospheric composition in the future. ACTRIS is key to providing better constraints on climate and weather models by quantifying how atmospheric particles affect the Earth's energy budget, weather patterns, and precipitation. Air pollution is still a major problem for public health in Europe and in many other countries worldwide. ACTRIS supports the development of the required level of understanding of sources and fates of the air pollutants that negatively affect human health. Finally, ACTRIS observations are an important component complementing Earth Observations from space, providing unique ground-truthing of remote sensing information collected by current and future satellite missions.

ACTRIS is a long-term activity with more than 100 European partners engaged in building a single, pan-European, sustainable and distributed research infrastructure, to cover both the 4-dimensional (4-D) observations (latitude, longitude, height, time) and process understanding for short-lived atmospheric constituents. ACTRIS is unique in its architecture and disciplinary coverage within atmospheric and climate science. The **ACTRIS mission** is to integrate, harmonize and distribute the high-quality observations provided by first-class facilities for atmospheric research currently located in 22 European countries and other locations globally, and to operate the pan-European distributed research infrastructure providing open and effective access to unique resources and services to a wide user community of Earth system research.

Structure of ACTRIS

The National Facilities (NFs) comprise observational and exploratory platforms, both within Europe and at selected global sites, and are responsible for the acquisition of reliable and high-quality data to document the 4-D variability of aerosol, clouds and trace gases and their complex interactions. ACTRIS consists of 77 existing candidate NFs (expected to rise to more than 100 at the end of the implementation phase). Observational Platforms are fixed ground-based stations that deliver long-term data based on a regular measurement schedule and common operation standards, including quality assurance and quality control (QA/QC). Observational platforms are strategically located in diverse climate regimes both within and outside Europe. Exploratory Platforms are atmospheric simulation chambers, laboratory facilities and mobile platforms that enable dedicated experiments and contribute with data on specific atmospheric components, processes, events or regions by following recommended ACTRIS operation standards. Exploratory Platforms and selected Observational Platforms provide users physical access to state-of-theart, well-characterized and versatile facilities. The principles for the selection and labelling of the NFs in ACTRIS have been agreed by the Interim ACTRIS Council (IAC) and the NF labelling process will commence immediately after the establishment of ACTRIS ERIC (European Research Infrastructure Consortium) as a legal entity (foreseen in 2021). ACTRIS aims at reinforcing European and global developments in atmospheric monitoring and research networks by connecting regional observational sites and technology development activities to ACTRIS via a dedicated Regional Partner Facility (RPF) framework.

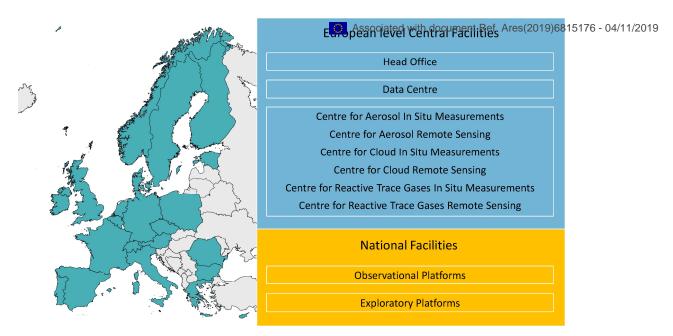


Figure 1. Countries involved in ACTRIS IMP (left) and the different components of the ACTRIS structure (right).

ACTRIS includes **8 Central Facilities (CFs):** Topical Centres (TCs), the Data Centre and the Head Office (HO), the latter comprising the Service and Access Management Unit (SAMU). Each Central Facility consists of several Units hosted by ACTRIS member countries by a responsible ACTRIS Research Performing Organisation (RPO). ACTRIS CFs are vital to ensure compliance with standard policies and procedures, to coordinate user access to state-of-the-art facilities, and to provide services required by the scientific community and other stakeholders. ACTRIS data are harmonized through standard quality control measures and are properly archived and accessible to all users for the long term. The **8 Central Facilities, operated by their respective hosting multinational consortia, were approved by the IAC** in December 2018 after an independent selection process taking into consideration their capacity, expertise and commitment for implementing the required operation support and services.

Virtual access to data and data products, together with physical and remote access to Central and National Facilities is at the core of the ACTRIS concept. The approved **documents on ACTRIS data policy and service and access policy** will drive the implementation phase. All <u>ACTRIS-related documents</u> are available at ACTRIS website.

Status of ACTRIS

After many years of community building, design and a three-year preparatory phase, ACTRIS will enter a five-year implementation phase (2020-2024) dedicated to constructing and upgrading ACTRIS NFs and CFs, setting up the user access and service provision, working on the governance and management tasks, increasing the connection with new users and member countries, further developing strategies both within ACTRIS and for international collaboration and partnerships, and integrating ACTRIS activities at multiple strategic levels (national, European and international). Following the implementation phase, ACTRIS aims to be operational from 2025 onwards and become a reference service provider for short-lived atmospheric constituents, offering a unique Catalogue of Services including open access to data and physical and remote access to high-quality services provided by CFs and NFs. ACTRIS ERIC will be the legal entity coordinating the establishment and the operation of ACTRIS.

ACTRIS has set clear objectives for its preparatory phase (ACTRIS PPP); to finalise all preparatory work for setting-up the operational framework and ensure that all constitutional documents and policies required for ACTRIS ERIC are ready by the end of the project. As a result of its maturity, ACTRIS has been progressing well during the PPP project. This maturity results from a sustained design and community building process that started almost 20 years ago, well before the official inclusion of ACTRIS in the ESFRI roadmap in 2016. In addition, ACTRIS partners host personnel with the skills and expertise necessary for setting-up a research infrastructure. The maturity of the ACTRIS community and suitable human capital enabled successful developments in a very short time, as proven by the excellent results from the EC's mid-term review of ACTRIS PPP. ACTRIS is established in accordance with all decisions made by the Interim ACTRIS Council (IAC), representing the governmental representatives of 17 member and observer countries. During the preparatory phase, the following achievements were approved by the IAC:

• the structure of ACTRIS (see Figure 1);

- a governance model and a funding model for ACTRIS;
 Associated with document Ref. Ares(2019)6815176 04/11/2019
- the ACTRIS ERIC statutes, which have been submitted to the EU commission (ERIC step 1);
- the principles underlying the ACTRIS data and services and access policies;
- the identification of Finland as the ACTRIS ERIC statutory seat;
- the selection of host candidates for all ACTRIS Central Facilities;
- the NF requirements and principles for the NF labelling process; and
- the support from 17 countries to ACTRIS ERIC step 1.

ACTRIS PPP will end in December 2019, yet the project has already fulfilled the main objectives of the preparatory work and is mature enough to move to the implementation phase. It is also foreseen that ACTRIS will fully achieve all the objectives, milestones and deliverables as planned in the Description of Actions (DoA) of ACTRIS PPP. The positive momentum and the high level of trust developed between the IAC members, hosting RPOs, and science community participating in the preparation phase will be directly transferred into the ACTRIS implementation phase and to ensure successful execution and progress during the implementation phase.

In December 2018 the IAC approved the framework and the main implementation actions planned for the ACTRIS implementation phase (2020-2024). ACTRIS set an ambitious target to become a long-term sustainable research infrastructure with demonstrated well-functioning operation and services by 2025 and to be granted the ESFRI landmark status during the next ESFRI assessment process. The following actions are to be achieved for ACTRIS to become operational:

- Establish a well-managed ACTRIS ERIC governance and legal entity operations to guarantee the long-term sustainability of the RI;
- Construct and upgrade the ACTRIS Central Facilities and National Facilities;
- Perform the NF labelling process to grant ACTRIS status for NFs to be included in ACTRIS;
- Validate the ACTRIS internal support activites for the NFs;
- Validate the ACTRIS services for the operational phase;
- Design a Catalogue of Services targeted at the broad market of ACTRIS users;
- Enable smooth and easy access to ACTRIS data by setting up work flows for data production and provision;
- Establish the formal connections between national ACTRIS consortia and ACTRIS ERIC;
- Guarantee long-term financial commitment from ACTRIS ERIC members;
- Engage potential new members, observers and RPFs;
- Generate new interactions with ESFRI research infrastructures and international programmes and initiatives;
- Ensure that ACTRIS is a well-known and recognised RI among users and collaborators;
- Increase the collaboration with, and the number of services offered to the private sector;
- Analyse the relevance and socio-economic impacts of ACTRIS to strengthen the value of ACTRIS and communicate the impact to stakeholders to ensure long-term sustainability; and
- Ensure the high-quality performance of ACTRIS operations and service provision by monitoring the Key Performing Indicators (KPIs) and risks.

1.1 Objectives

This INFRADEV-3 proposal - **ACTRIS Implementation project (ACTRIS IMP)** - builds on the achievements of the successful ACTRIS PPP and on the scientific and technical deliveries of the ACTRIS-2 and EUROCHAMP-2020 projects. The ACTRIS IMP project objectives are based on the overall ACTRIS implementation phase objectives. Moreover, the **ACTRIS IMP project will elevate ACTRIS to a new level of maturity and will set the required coordinated structures for coherent implementation actions,** to be performed at both the national and European level.

The overarching objective of ACTRIS IMP is to coordinate and accomplish the actions required for implementing a globally-recognised long-term sustainable research infrastructure with operational services by 2025.

ACTRIS IMP will build on three strategic pillars: 1) securing the **long-term sustainability** of ACTRIS; 2) ensuring the coordinated **implementation of ACTRIS functionalities**; and 3) **positioning** ACTRIS in the regional, European and international science and innovation landscape. ACTRIS IMP will enable ACTRIS to respond to user-community needs and requirements for fully operational services supporting Earth system science, for atmospheric and climate research in particular. Moreover, ACTRIS IMP will enhance ACTRIS relevance, innovation potential, and societal impacts.

- Engaging and widening participation of the science communities, countries and stakeholders in ACTRIS, with particular focus on expanding European coverage;
- Developing regional partnerships and reinforcing a balanced development in Europe;
- Optimizing the coordination and management with suitable human resources, necessary financial commitments, and proper legal framework to guarantee long-term sustainability;
- Ensuring that ACTRIS activities are aligned with the strategic targets of ACTRIS to maximize the relevance and impact of ACTRIS;
- Implementing the functionalities of the ACTRIS CFs and NFs and optimizing the workflows among all ACTRIS elements for cost-effective and efficient functioning service provision;
- Setting-up and testing ACTRIS user services;
- Establishing the ACTRIS Catalogue of Services;
- Establishing ACTRIS as a global research infrastructure, providing services to the global user communities and consolidating its international cooperation, with specific focus on Copernicus and GEOSS (Global Earth Observation System of Systems);
- Fostering the impact of ACTRIS on innovation, technology development and technology transfer by collaboration and providing services to the private sector;
- Developing strategic and efficient communication practices reaching out to various user groups, collaborators and countries and facilitating the positioning of ACTRIS in the research and innovation landscape.

ACTRIS IMP will form the coordinated European framework having the necessary with the needed tools towards for achieving these objectives duringin the four-year duration of the project, also implementing effective risk management and contingency plans to fully embrace all requirements for its the successful implementation of ACTRIS.

1.2 Relation to the Work Program

The ACTRIS IMP proposal addresses the topic *INFRADEV-3-2019 Individual support to ESFRI and other world-class research infrastructures* within the H2020 Work Programme 2018-2019 on European Research Infrastructures (including e-infrastructures). The pathways for addressing the specific challenges and the scope of the call for the ACTRIS implementation phase within ACTRIS IMP are described below.

- 1 Tackling the most delicate and difficult phase as financial sustainability must be proven and the trust and awareness of users must be addressed. The ACTRIS community is well aware of the risks related to the transition from the preparatory phase to the implementation phase (known as the valley of death), which is particularly influenced by the unavoidable changes in the governance and management structures when the ACTRIS legal entity is established, is dependent on national construction and national commitments (challenge of aligning national funding processes and timelines to European-level implementation actions) and requires maintaining and attracting new user communities with a newly established service system and access rules. ACTRIS IMP is an essential tool for ensuring the smooth transition for ACTRIS, as it is about creating the necessary European-level coordination structure and framework for successful progress towards a long-term sustainable RI in the field of atmospheric research and for avoiding financial risks related to the transition phase. ACTRIS IMP will facilitate the managed transition from project-based use of ACTRIS facilities and services to the coordinated legal-entity-based RI service provision ensuring user trust and increasing user awareness. Moreover, ACTRIS IMP will act as a mobiliser and a focus for actions consolidating human and funding resources, including past investment from 22 countries (at an estimated value of 450 M€).
- **2 Long-term sustainability of ACTRIS.** ACTRIS IMP addresses long-term sustainability by supporting project activities consolidating and enlarging the participation of the ACTRIS community and ensuring country-level commitments to ACTRIS, particularly in the form of ACTRIS membership. In addition, ACTRIS IMP will have targeted actions for expanding European coverage and participation in countries not yet connected to ACTRIS. ACTRIS IMP will support and facilitate the work of the member countries (first via IAC and later via ACTRIS ERIC General Assembly) to align and commit the necessary funding resources for ensuring financial sustainability. At the heart of ACTRIS IMP are activities required for implementing ACTRIS functionalities, service development and improvement; such as setting up the technical functionalities of NFs and CFs, establishing the legal framework, piloting access provision and testing user services. The long-term sustainability of ACTRIS also requires the positioning of ACTRIS at the heart of the international research and innovation landscape. This will be achieved through the international liaison and cooperation activities of ACTRIS IMP with both public and private sector actors, including novel outreach and technology-transfer activities. All outcomes of the ACTRIS IMP project will support

the update of the ACTRIS Business Plan including the ACTR vision and seion or colerance. And (2007) ct. 15crtice 4/11/2019 portfolio, user communities, structure, governance as well as work and funding plans.

- **3 Interaction with industry and SMEs and the fostering of the innovation potential of ACTRIS.** Partnership with the private sector and technology transfer activities will be addressed at various levels in ACTRIS IMP. ACTRIS has already put in place an established partnership with 25 private companies in Europe and worldwide representing suppliers, technology partners and users of ACTRIS (<u>list of associated partners</u>). These existing partnerships will be utilized in defining the strategic plan for partnership with the private sector and fostering of the innovation potential in ACTRIS. ACTRIS IMP aims at identifying needs and opportunities for cooperation, best practices and strategies to consolidate industry engagement with ACTRIS, developing tools, branding and marketing materials, offering training and support for industry, and organizing industry events. Capacity for offering services will be tested also for the private sector, promoting the visibility of opportunities for interactions between industry and ACTRIS, best practices in procurement, knowledge transfer and management of the intellectual property rights.
- 4 Supporting national ACTRIS activities and the development of Regional Partner Facilities (RPFs) together with their integration in the European research infrastructure landscape. The success of ACTRIS is tightly connected to effectively functioning National ACTRIS consortia that will provide support to the implementation and operation of NFs and CFs. ACTRIS IMP will monitor and contribute to the proper alignment of ACTRIS with national strategies. ACTRIS IMP will stimulate NFs and CFs to provide state of the art services encouraging access for the best scientific users in Europe and worldwide. The strong connection in ACTRIS between the national and European levels is key to favouring mobility of staff and cross-fertilization between the different ACTRIS components, and to motivate development of RPFs, strongly connected to the RI. ACTRIS envisages four different types of Regional Partner Facility actions in ACTRIS IMP: 1) support of national-level development of RPFs such as legislation-driven monitoring networks to meet the technology and service standards of ACTRIS (target community building and training activities planned); 2) collaboration with RPFs that have complementary capacities and experience in different science disciplines, which will help ACTRIS in developing new services (e.g. cross-RI service development); 3) collaboration with RPFs in countries that have not yet joined the ACTRIS but could be potential new members (ACTRIS IMP actions on training, consultation and technical workshops to meet ACTRIS NF standards); and 4) support of regional and local activities that benefit from ACTRIS but do not need to be directly linked to the pan-European RI.

1.3 Concept and methodology

ACTRIS IMP concept

The prime target of ACTRIS is to become a long-term sustainable research infrastructure by 2025. To this end, the ACTRIS IMP project is organized in three strategic pillars underpinned by efficient project management. The strategic pillars, described in Figure 2, in ACTRIS IMP are:

- 1. **Securing the long-term sustainability of ACTRIS**, by defining and reinforcing the engagement of the ACTRIS community and stakeholders, securing the financial resources, consolidating the Business Plan and the Catalogue of Services, fortifying its user relationships, and addressing the ACTRIS relevance and societal impacts.
- 2. **Implementing the ACTRIS components, functionalities, and services,** guaranteeing the effective operability of ACTRIS services at the end of the implementation phase through extensive testing of CFs and the workflows between all ACTRIS components and further developing the user dimension of ACTRIS.
- 3. Consolidating the position of ACTRIS in the national, European and international framework, including the establishment of ACTRIS as a global research infrastructure contributing to the research and innovation landscape. Extensive outreach and communication activities will ensure the ACTRIS positioning and publishing the ACTRIS relevance and impact.

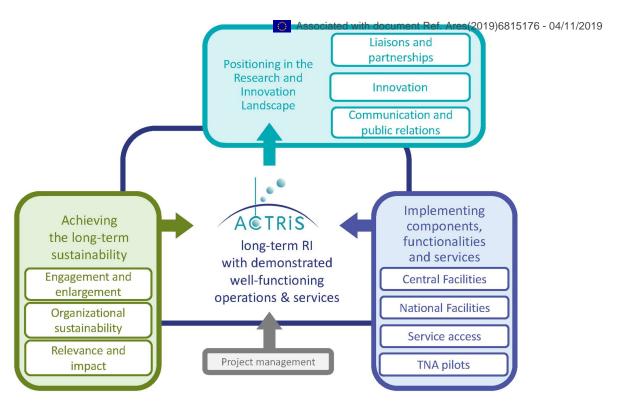


Figure 2. Three strategic pillars to achieve the main objective of ACTRIS IMP - ACTRIS established as a long-term RI with demonstrated well-functioning operations and services.

In addition to these three strategic pillars, ACTRIS IMP has several transversal actions important for all three pillars. These are activities on:

- Enhancing the innovation and technology development potential of ACTRIS to maximize private-user uptake of ACTRIS services and renewal of ACTRIS technologies;
- Balancing European participation and contribution in ACTRIS by ensuring broad pan-European participation and promoting regional initiatives connected to ACTRIS;
- Testing of operation support and services under realistic conditions both internally and by external users;
- Providing continuous availability of training both internally and to potential users; and
- Ensuring balanced human capital development in ACTRIS following the European Charter for Researchers and giving special attention for engaging early or mid-career scientists.

The ACTRIS IMP consortium comprises all key partners representing ACTRIS activities in all member and observer countries involved and beyond, and representatives of all Central Facilities. In addition, more than 70 additional associated partners are envisaged to be connected to ACTRIS IMP to ensure a fair representation of the National Facility network in ACTRIS.

Interdisciplinary considerations and utilisation of user' knowledge

ACTRIS is science-driven, user-oriented, and produces data, data products, access services and scientific knowledge essential to a wide range of user communities that will expand further as a result of the sustainable long-term ACTRIS strategy. These interdisciplinary user communities, referred to as ACTRIS users, are: global climate and air-quality research communities; space agencies for validation and the development of new satellite data products and missions; legislation-based monitoring networks of atmospheric compositional change; sensor and measurement instrument industries for testing, prototyping, benchmarking and demonstrations; numerical-weather-prediction centres for model validation, biodiversity, ecosystem and toxicology research communities. Other important user groups are the policy makers, ministries and funding organizations, educators and civil society in general. It is anticipated that ACTRIS IMP will foster the development of new ACTRIS services facilitating and expanding their use by the interdisciplinary research communities and other stakeholder communities such as government, private sector, and citizens. ACTRIS is a federation of different atmospheric observation networks and the operating infrastructures of associated scientific communities, which were previously handled separately and operated with short-term project-based funding. Accordingly, ACTRIS IMP will enable an unprecedented level of scientific and technological integration and coordination of European activities. During the ACTRIS preparatory phase, the available ACTRIS data has attracted a substantial and increasing number of users worldwide, even though ACTRIS

services are not yet fully operational. Indicatively, between 201 and 2018 to the requirement from reachest conferences of ACTRIS measurement data have been downloaded from 72 countries. ACTRIS IMP will organise user events (conferences, meetings, test groups) and will place users central to its service strategy, in order to be able to respond timely to changing user needs and requirements.

The ACTRIS IMP project will **support policy-driven monitoring networks** such as those established to respond to EU-directives (local and European air-quality networks), to the Convention on Long Range Trans-Boundary Air Pollution (CLRTAP) of the United Nations Economic Commission for Europe (UNECE) and to the recent recommendation of Civil Aviation Authorities to improve the monitoring system for atmospheric hazards management, thus responding to several societal needs and challenges. Furthermore, ACTRIS provides coordinated and committed European contributions to NDACC, AERONET and WMO-GAW networks, enabling better recognized and evaluated globally representative data products. ACTRIS has close connections to ESA, EUMETSAT, ECMWF, AeroCom, WMO-GCOS (see the list of acronyms, p. 36). Moreover, ACTRIS provides access to expert services for the development and testing of novel technologies and products. Test beds for new technologies and instruments, development of quality assurance procedures for metrology standards, and expert training courses, have created a very strong and robust relationship with associated partners in the private sector, supporting ACTRIS knowledge and technology transfer. ACTRIS IMP will enhance collaboration with the private sector and develop ACTRIS as a technology and innovation platform.

Public engagement and co-design of activities

Public engagement activities are usually most effective when addressing topics that are locally relevant within the ACTRIS framework, thus the NFs are key in activities related to public engagement. Many NFs and RPOs involved in ACTRIS are very active in education and public relations. As an example, the Finnish National Facility (SMEAR II) is hosting an Art Residence Program, fostering a dialogue between art, science and education by offering access to artists for co-creation and co-design purposes. The artworks created within the program can gain surprisingly large public audiences and visibility for scientific work and generate public discussion on environmental and societal challenges and the role of atmospheric research in tackling the challenges. The artworks can be presented in the form of exhibitions, layman-friendly art software applications and installations. ACTRIS IMP will continue to support NFs in disseminating ACTRIS results locally and participating in societal discourse and co-creation activities.

National and international activities supporting ACTRIS IMP

At the national level, ACTRIS is listed in 10 national research infrastructure roadmaps and is under evaluation in 7 more countries. ACTRIS IMP will coordinate and align national-level strategies with implementation and investment plans. In addition to the financial resources gained, ACTRIS will participate in many national-level research and technology development projects and initiatives which will directly feed into ACTRIS IMP in the form of expertise (competent human resources), development and implementation of ACTRIS functionalities, services and will connect and widen the user pool. ACTRIS IMP will be instrumental in pulling together the national level ACTRIS resources, mobilizing national and regional funds (specifically targeting European structural and investment funds (ESIF) and the European regional development funds (ERDF)), and ensure synergies between funds mobilized at different levels.

Furthermore, ACTRIS participates in many European level EC-funded projects that are complementary to ACTRIS IMP. The most relevant EC projects are listed in Table 1 in which the complementarity and reciprocal benefits of ACTRIS IMP and each specific project are highlighted.

Table 1. Relevant EC-projects that are synergic to ACTRIS implementation.

Acronym and duration	Contributing activity benefitting ACTRIS IMP
ENVRIplus (2015-2019)	ACTRIS IMP directly benefits from guidelines developed in the ENVRIplus project related to technologies, data management, access provision, ethical and training issues and to management of distributed RIs.
ENVRI-FAIR (2019-2023)	ACTRIS leads the development of the e-environment towards FAIR for RIs in the atmospheric domain. The strategy for defining the correct level of liaison with European Open Science Cloud (EOSC) (and EOSC-hub – 2018-2022 – in particular) will be based on the outcome of ENVRI-FAIR.
EOSC-hub (2018-2020)	EOSC-hub brings together multiple service providers to create a single contact point for access, use and reuse of a broad spectrum of resources for advanced data-driven research. ACTRIS IMP will evaluate the need for connecting some services to EOSC-hub.

	-
ENRIITC (under evaluation),	ACTRIS IMP is associated with the pending project. NRIPTC—European Network of Research Infrastructures & Industry for Collaboration – that will help defining the ACTRIS innovation strategy and Network of Research Infrastructure Industrial Liaison and Contact Officers.(INFRAINNOV-2-2019)
ERA-PLANET (2016-2020)	ACTRIS partners are involved in several H2020 GEO-related projects such as ERA-PLANET (2016-2020). Connection with GEO projects will facilitate integration of ACTRIS activities into a GEO initiative.
NEXT-GEOSS (2016-2020)	ACTRIS DC is a partner in the NEXT-GEOSS project that will be used for evaluating strategies addressing the downstream segment of ACTRIS.
E-SHAPE (2020-2024)	ACTRIS IMP benefits from the experience developed in E-SHAPE (formerly EUROGEOSS) to evaluate and develop its downstream applications.
FORCeS (2019-2023)	ACTRIS IMP contributes via comprehensive observations to provide constrained aerosol forcing pertinent for improved climate projections.
RISCAPE (2017-2019)	ACTRIS IMP contributes to the landscape analysis that will directly benefit the European Union strategic RI development and policy.
COST COLOSSAL (2017-2021)	ACTRIS IMP will benefit from the establishment of a well-defined user-community connected to the Topical Center for Aerosol in-Situ measurements organized in COLOSSAL.
EMPIR - EURAMET	ACTRIS IMP partners, together with National Metrological Institutes in Europe, are involved in a series of projects – Black-Carbon (2017-2020), KEY-NOx-2 (2017-2020), MetClimVOC (submitted) – funded under the EURAMET program to develop the necessary standard procedures that will be used in ACTRIS.
E-PROFILE - EUMETNET	ACTRIS IMP facilitates provision of services from the relevant TCs to the E-PROFILE EUMETNET network.
COOP + (2017-2019)	ACTRIS IMP uses COOP+ outcome to strengthen the links and coordination of ACTRIS with international counterparts.

EC-funded ACTRIS projects

ACTRIS IMP benefits from synergies and complementarities with four previous or current ACTRIS EU grants:

- ACTRIS PPP ACTRIS IMP clearly builds upon the outcome of ACTRIS PPP (2017-2019). The mid-term
 evaluation of the ACTRIS PPP project in May 2018 highlighted that the project has delivered exceptional results
 with some activities advancing faster than planned in the DoA. Since then, many actions were completed and it
 is expected that ACTRIS PPP will fully achieve all the objectives, milestones and deliverables as planned in the
 DoA.
- ACTRIS-2 Following the ACTRIS PPP strategy, ACTRIS IMP will also involve the science communities of ACTRIS-2 (2015-2019) that are developing the required procedures to be implemented by the ACTRIS Central and National Facilities. Representatives from the project are involved in key activities within ACTRIS IMP.
- **EUROCHAMP-2020** Following the ACTRIS PPP strategy, ACTRIS IMP will also involve the science communities of EUROCHAMP-2020 (2017-2020) that are developing the required procedures to be implemented by the ACTRIS Central and National Facilities involving atmospheric simulation chambers. Representatives from the project are involved in key activities within ACTRIS IMP.
- ACTRIS aerosol profiles for Copernicus CAMS program (ACTRIS-A pro CAMS) and ACTRIS in-situ pilot for CAMS (ACTRIS-CAMS IS Pilot) are two pilot contracts with Copernicus (2019-2021) to develop the procedures for the provision of specific quality-controlled data products in Near-Real-Time (NRT).

Methodology of ACTRIS for ACTRIS IMP

ACTRIS IMP will be fundamental for ACTRIS to establish and secure a long-term sustainable system for RI operations. National funding to support the implementation is crucial and ACTRIS IMP will offer the tools for coordinated and managed utilisation of national resources. To achieve its objectives, ACTRIS IMP is organised into 11 Work Packages belonging to three strategic pillars (SP) and one management action and supporting five cross-WP transversal activities (TS) and one specific gender dimension action. The planned tasks in all strategic pillars

will run in parallel and are all strongly interlinked. The transvariations are the strongly interlinked and the strongly interlinked are the strongly interlinked are the strongly interlinked. The transvariation are the strongly interlinked are the strongly int

Work packages linked to the strategic pillars of ACTRIS IMP are:

SP1: Securing the long-term sustainability of ACTRIS (research and innovation action)

- WP1 Engagement and enlargement of the ACTRIS community and ACTRIS membership
- WP2 Implementation of a sustainable ACTRIS organization
- WP3 Strategy for enhancing ACTRIS relevance and impact

ACTRIS IMP will address the key issues of long-term sustainability through: 1) consolidation of the governance structure approved by IAC; 2) ensuring that adequate human resources for an effective and efficiently managed RI are in place; 3) elaboration of the Data Management Plan and Service and Access Plan following the policies approved by IAC, 4) finalising the ACTRIS policies, internal rules and procedures including the service-level legal agreements between the ACTRIS ERIC and ACTRIS components (CFs, NFs), 5) updating the long-term ACTRIS Business Plan with ACTRIS members; and 6) coordinating the national implementation strategies according to NF requirements and CF-specific implementation plans. ACTRIS IMP will support and facilitate the work of the member countries (via IAC and later ACTRIS ERIC General Assembly) to align and commit the necessary funding resources for ACTRIS construction. Financial sustainability and engaging new countries are core focus areas for IAC and later, General Assembly, in the forthcoming years. Full validation of ACTRIS operations and services will be performed. Sustainability of ACTRIS is also closely related to the active engagement and widening participation of the user communities. In addition to financial sustainability, ACTRIS IMP will consolidate the existing ACTRIS partnership and engage substantial efforts to expand country participation in ACTRIS. Key to extending the European coverage of ACTRIS is to reach out and mobilize atmospheric research communities in countries not yet connected to ACTRIS, contributing to the development of the national ACTRIS activities, and acting as a leverage for national and structural funds. Particular efforts are made to facilitate the development of RPFs and their integration in the European RI landscape.

SP2: Implementing the ACTRIS components, functionalities and services (research and innovation action)

- WP4 Implementation and testing operation of the Central Facilities
- WP5 Facilitating the harmonized operation of the National Facilities
- WP6 Implementation of the user access to ACTRIS services
- WP7 Piloting trans-national access for supporting the implementation of ACTRIS services

The transition from the preparatory to the operational phase will require a full implementation and testing of the ACTRIS operation support and service provision, considering all relevant aspects from technical to the financial and legal, proper dimensioning and addressing the issue of sustainability. CF implementation plans are being established, and the operations and services, approved after validation, will be implemented and tested during the project. The provision of operational support for the labelling of ACTRIS National Facilities is a crucial activity during this time frame, and it will be implemented and tested in ACTRIS IMP. Several pilots of access provision for testing and improving user services to increase reliability, consolidate the users' trust and widen the user base will be offered in ACTRIS IMP, using the trans-national access tool. At the same time, the user Access and Services provision system (including the internal procedures related to access and services provision and centralized management via SAMU - Service and Access Management Unit) will be optimized, tested and improved. ACTRIS IMP will facilitate the implementation of SAMU with a well-elaborated access management system and the establishment of a Catalogue of Services for user access.

SP3: Consolidating the position of ACTRIS in the national, European and international framework (research and innovation action)

- WP8 Consolidating the position of ACTRIS in the European and international research landscape
- WP9 Positioning ACTRIS in the European innovation ecosystem
- WP10 ACTRIS communication and public relations

ACTRIS IMP will consolidate the European contribution to several international atmospheric networks and position ACTRIS as a leading actor globally. ACTRIS IMP will support the evolution of ACTRIS towards a global research infrastructure, which, in addition to the provision of data for global use, operates international calibration centres, organises training sessions, acts as an international data hub closely connected to the ACTRIS Data Centre and leads the establishment of standard operating procedures for measurement, calibration and data curation. ACTRIS IMP will reinforce links with other RIs, not only in the atmospheric domain (IAGOS, ICOS, SIOS, EISCAT-3D) but also in the larger environmental domain (ENVRI) and with the e-infrastructures operating the European Open Science

Cloud (EOSC). ACTRIS IMP will position ACTRIS within the Entropy personal contents and end-users. ACTRIS imp will develop strategic and efficient communication practices to strengthen the communication flow in ACTRIS and the wider ACTRIS community, reaching out and attracting new ACTRIS user communities with tailored outreach activities.

Work packages linked to the management of ACTRIS IMP (management action):

- WP11 ACTRIS IMP project management and ethics
- WP12 Ethics requirements

ACTRIS IMP will maintain smooth and successful high-quality management procedures developed in ACTRIS PPP for the implementation of ACTRIS following the ethical requirements of the Horizon-2020 program.

Cross-WP transversal activities of ACTRIS IMP are:

TA1- Enhancing the innovation and technology development potential of ACTRIS

ACTRIS NFs have long history of technology development and collaboration with the private sector. ACTRIS IMP, together with CFs, will expand and harmonize this to a European-wide action. Targeted private sector TNA actions will support this work. Furthermore, ACTRIS IMP will formalize the pathways for new innovation to penetrate through ACTRIS providing renewal of the observational capacity of ACTRIS and enabling further development of data products and services.

TA2- Balancing European participation and contribution in ACTRIS:

ACTRIS IMP will facilitate dialogue between national activities, European collaboration and the global community in atmospheric composition. ACTRIS IMP will provide a platform to enhance the development of national ACTRIS components and facilitate the development of Regional Partner Facilities and their integration into the European research infrastructure landscape. ACTRIS IMP will solidify ACTRIS as a pan-European research infrastructure with strong national and regional commitment and support.

TA3- Testing of operational support and services under realistic conditions:

ACTRIS IMP will implement the NF and CF concepts developed in ACTRIS PP and test their operations. The proposed TNA activities will both pilot and test the support and services provided by CFs and NFs. ACTRIS IMP will utilize the feedback from these pilots to improve the services that will then be supplied in ACTRIS ERIC.

TA4- Providing a continuous availability of training both internally and to potential users:

Training and capacity building in human resources will be supported by both ACTRIS CF activities and TNA actions. The ACTRIS IMP beneficiaries include universities and research units accustomed to multi-disciplinary education and training. ACTRIS IMP will disseminate the knowledge and expertise through joint workshops to the potential users in a harmonized manner throughout Europe.

TA5- Ensuring a balanced human capital development in ACTRIS:

ACTRIS IMP will support human capital and career development across the Work Packages and will define a plan for ACTRIS personnel training and human capital development, that will give guidelines for the whole ACTRIS community.

Gender dimension analysis and support measures during ACTRIS IMP

In ACTRIS, the gender balance is less male-biased than in most other RIs: ACTRIS IMP is coordinated by a female (coordinator) and a male (co-coordinator), and 8 out of the 11 work packages (73 %) are led by females, including the WP activities related to finances, technical implementation, innovation and private sector collaboration. Yet, about 65% of the principal personnel participating in the project are male and 35% female and ACTRIS recognise the need and importance of promoting gender balance in a holistic manner throughout the project to stand out as an excellent example of a well-balanced working community with female-dominant leadership. ACTRIS IMP has the opportunity and capacity to bring in a female-gender-related dimension on many inherited aspects, approaches and methods defined by century-long dominance of males in natural sciences. One of the concrete examples is that ACTRIS will actively work to build up physical access schemes to its Observational and Exploratory Platforms that allow equal participation of genders, as the platforms are often located in remote locations and operating or visiting the platform as a user or manager may require a long stay at the site. Therefore, it is important that the services built around the platforms enable users and managers in all life situations to be able to work at these prestige platforms. In addition, much of the RI work is technically (and sometimes also physically) demanding, e.g., data acquisition

gender-balanced technical training of ACTRIS NF operators, managers and users. In general, gender-related interests and priorities are included in this proposal. All discussions and communication among partners have been supportive, permissive and open for gender-oriented interests. During the project, specific attention will be given to the gender-dimension aspect when defining the user requirements, identifying and working with user groups, communicating and disseminating ACTRIS IMP results and deliverables, and coordinating internal and external collaborative actions. ACTRIS IMP is aiming to act as a role model in atmospheric research and in the research infrastructure area, and will facilitate mentoring and networking opportunities for both genders.

1.4 Ambition

The ambition of ACTRIS IMP is to **upgrade and integrate the current quality and efficiency of services** into a consolidated, correctly dimensioned high-quality ACTRIS framework where:

- The **long-term funding model** including the financial perspectives of the RI are shared by ACTRIS countries, in particular by those where services are provided;
- **Partnership is extended**, and the involved communities are strongly engaged through shared national ACTRIS strategies and regional partnerships;
- ACTRIS is established as a **Global Research Infrastructure** with services used by researchers worldwide and with its contribution to international networks being clearly recognized;
- Services are **upgraded and adjusted** to meet the evolving high-quality standards and user requirements, and the effectiveness of the services is independently evaluated;
- Multi-disciplinary and multi-dimensional data and services are accessible through a unique simplified
 environment (for data discovery, mining, visualization, processing and modelling), aligned with FAIR
 principles;
- Procedures for **accessing facilities** (Observational and Exploratory Platforms, Topical Centres) are efficiently organized within a facilitated framework, also suitable for public-private partnership;
- ACTRIS acts as a leading entity for developing global high-quality standards and standard operation procedures, and other requirements in atmospheric measurements, in close cooperation with National Metrology Institutes and the private sector;
- The ACTRIS **innovation platform** facilitates work and collaboration with actors in the private sector, working towards lowering the limitations and barriers (social, organizational, legal, etc.) that could inhibit interactions between ACTRIS and the private sector;
- All steps in the ACTRIS data management plan are robust and suitable for routine use in the provision
 of services for climate, air quality applications and atmospheric hazards management by Copernicus, GEOSS
 or other service providers;
- The ACTRIS Catalogue of Services is well-defined, well-connected and harmonized with e-environment in EOSC-related service catalogue for the benefit of users, in the Earth system science communities and beyond.

Progressing towards this ambition:

ACTRIS IMP will advance science, technology development and RI services beyond the current state of the art.

ACTRIS IMP is a key step for ACTRIS, a unique RI in the European Research Infrastructure landscape. ACTRIS is filling the scientific and service gap in the atmospheric RI domain in Europe. It provides unique services that complement IAGOS (In-service Aircraft for a Global Observing System), by adding the required continuity for time series, and providing the spatial dimension by offering 4-D information across Europe pertinent for e.g. satellite data verification, in conjunction with offering parallel services through the exploratory (experimental) dimension related to atmospheric processes. ACTRIS provides data and facilities for studying short-lived climate forcers that are not connected to any other RI and thus ACTRIS complements the atmospheric component of ICOS (Integrated Carbon Observation System). ACTRIS IMP has a fundamental role in strengthening the EU position and leadership in the atmospheric research arena and creating the proper conditions for addressing the complex interconnections between aerosol, clouds, and trace gases that are key to predicting future evolution of the Earth's climate. The ambition of ACTRIS is to become the reference research infrastructure for atmospheric and climate research, responding to the user demand for accessing high quality data on atmospheric composition and processes, and offering services, tools and reference methodologies that are used and applied by a very wide community worldwide.

ACTRIS IMP will elevate ACTRIS beyond the current achievements in long-term sustainability

ACTRIS is now in a transition from project-based governance and sustainability as a decisive step towards the adequate framework conditions for effective governance and sustainability as a decisive step towards the establishment of ACTRIS ERIC and the associated country commitments to engage resources in ACTRIS that are not yet in place. ACTRIS IMP addresses all key aspects of sustainability: 1) preparing and training ACTRIS managers, operators and users of tomorrow; 2) ensuring that scientific excellence is maintained and increased by attracting scientists to first-class atmospheric research platforms and setting the conditions for full exploitation of data generated in ACTRIS; 3) providing clear and unambiguous measurements of the socio-economic impacts, from global to European to national and local scales, and; 4) structuring the international outreach of ACTRIS.

ACTRIS IMP fosters the innovation potential of ACTRIS

ACTRIS IMP will consolidate and offer all elements needed to foster innovation and industrial partnership in ACTRIS. The ground-breaking nature of ACTRIS relies on a unique and effective delivery of high-quality standardized and multi-dimension services for the users: (1) virtual access to harmonized, reliable and documented observational data and digital tools on the chemical and physical state and the processes of the atmosphere, linking surface observations with vertical profiles, total-column observations and cloud processes; (2) physical and remote access to National and Central Facilities; (3) training opportunities for capacity building at both data-production (including new technologies) and data-product-usage levels, and; (4) support for basic and applied research conducted at the ACTRIS research facilities, including technological innovation via instrument and service development and benchmarking, new measurement standards and operating procedures, and support to operational activities. Specific measures are organized in ACTRIS IMP to ensure that industrial companies can play the roles of potential supplier, user and co-developer of the construction. ACTRIS IMP addresses the **framework for interaction** with industry, engaging associated partnership to fully perceive the reciprocal potential benefits in collaboration. ACTRIS IMP will develop the appropriate information flow beyond academic circles, targeting industry partners with specific services and opportunities with the ambition to establish a culture of innovation at every level in ACTRIS. The ambition is to ensure flexibility and agility of interactions, maintain and enhance the level of trust, integrity and confidence already existing between ACTRIS and its industrial partners.

2. Impact

ACTRIS IMP is a key contribution for establishing ACTRIS as a long-term operational research infrastructure. ACTRIS IMP will have a positive impact on the service provision for generating and disseminating knowledge, on boosting science and technological development, creating human capital, jobs and welfare for the benefit of society, and addressing environmental and societal challenges following the European Research Area (ERA) principles of optimal transnational cooperation and competition.

2.1 Expected impacts of ACTRIS

During ACTRIS PPP, ACTRIS has made first evaluation of the benefits its delivers through knowledge building, contribution to society, impact on regional and national economies, and capacity building and human capital development. ACTRIS IMP will continue to analyse and monitor the impact of ACTRIS in Work Package 3 and will contribute in adjusting its strategies to the user demand.

According to the socio-economic evaluation, ACTRIS creates positive socio-economic effects through a number of impact pathways: direct impact on the ACTRIS community (RPOs, companies) involved in the development, maintenance and operation of ACTRIS; wider research communities (research groups, organizations and programs) utilizing the outcomes of ACTRIS; industry and societal actors (including local authorities, environmental protection agencies, companies, ministries, international organizations, weather services) utilizing ACTRIS outcomes to optimize their environmental strategies and improve their decision-making processes.

Using the <u>socio-economic evaluation of ACTRIS</u> and the impact indicators typically used in assessments for European RIs, the long-term demonstrable impact of ACTRIS can be summarized as follows:

Impact on science

ACTRIS creates excellent science in the field of atmospheric and Earth climate research. In the last 10 years, ACTRIS has resulted in more than 8,000 scientific papers and 100 book chapters. Between 2015 and 2018, the equivalent of 55,000 full years of measurement data have been downloaded from by more than 2300 clients in 72 different countries, covering all instruments and/methodologies. The equivalent of Approximately 18,000 years of measurements have been are delivered as a tailored service for Copernicus model validation. A significant fraction of

ACTRIS scientific publications is directly connected to work processed and Mrs. dag Translated to 4/11/2019 evaluate global and regional emission inventories for key natural and anthropogenic species, to measure atmospheric concentration trends, to simulate different atmospheric condition to better quantify processes from nanoscale to macro-scale, to provide regional air- quality, numerical weather prediction and climate models with the necessary information for assimilation or validation and testing, to complete observation from space for many different applications and to evaluate effectiveness of public policies. ACTRIS will increase its impact in enabling cutting-edge science in the atmospheric research disciplines, with an increasing number of scientific users, once services are fully implemented.

Impact on human capital development

The development, construction, operation and maintenance of ACTRIS offers important opportunities for strengthening human capital creation, through supporting educational activities, facilitating scientific cooperation, and creating employment opportunities in specialized and high-level positions. During the period 2008-2016, around 950 Master and Ph.D. students performed part of their research in ACTRIS and more than 2,200 graduates received training at ACTRIS facilities. In addition, hundreds of students and researchers have been able to develop their skills, ranging from technical and scientific abilities, to personal competencies such as learning new transferable skills on communication, managerial, negotiating and organizational capabilities, by participating in meetings, seminars, workshops, conferences and other events offered by ACTRIS partners. As an outcome, ACTRIS has built a robust community of scientists, managers and engineers involved in using Earth Observation both for research and policy-making applications. Currently, more than 800 specialized research and technical staff are working in association with ACTRIS, either under full-time or part-time employment status. ACTRIS enhances exchange of expertise, mobility and networking of researchers. For example, one in four trainees, researchers or technicians working in ACTRIS comes from outside the country of residence, strengthening the ERA in terms of integration. ACTRIS contributes to building a community of knowledge that will respond to a rising societal demand for expertise in environmental and climate science.

Impact on economy

ACTRIS contributes directly to the economy through direct payments, taxes and creation of employment. In addition, the realization of the activities associated with the implementation of ACTRIS and its operation requires the purchase of goods and services such as construction materials and equipment, maintenance tools, and supplies, together with manpower, essentials such as food, clothing, spares and safety equipment, all enhancing further the economic development at both local, national and regional level (indirect economic effects). Moreover, ACTRIS is creating business opportunities. During 2008-2016, organizations involved in ACTRIS signed contracts with approximately 100 private companies to develop, upgrade or use the research infrastructure. Partnerships with industry and more generally, the private sector, have generated funding to partners exceeding 16 M€ in the period 2008-2016. The innovative character of ACTRIS is manifested by the 19 patent applications filed in the period 2008-2016, 12 of which have already been granted. National ACTRIS activities have already led to the creation of 12 start-ups and spin-offs. Furthermore, during the period 2008-2016, approximately 140 new methodologies, prototypes or designs were developed within the ACTRIS community, some in conjunction with National Metrology Institutes and adopted as CEN standards. ACTRIS has proven very efficient leverage for attracting national and international research funding. It is estimated that approximately 300M€ has been raised for performing research using ACTRIS during 2008-2016 (approximately 27 M€ per year). During 2008-2016, for each 1 M€ already invested in the development, maintenance and upgrading of the research infrastructure, another 0.92 M€ was acquired through research and development programs. The long-term sustainability of ACTRIS, together with the increased visibility of its Catalogue of Services will clearly augment the attractiveness of ACTRIS for partnership with both academics and the private sector.

Impact on society

ACTRIS is at the heart of grand challenges facing society: climate change and human health. Data and data products provided by ACTRIS partners have already led to improved predictions for weather, climate and air-quality as well as enhancing awareness of the environmental challenges. The information provided by ACTRIS will contribute to defining mitigation and adaptation strategies, and supporting international conventions and protocols. The ACTRIS community has been instrumental in delivering key information to civil aviation authorities during the Iceland volcanic eruption in 2010 and is regularly used to identify causes for high-level of particulate matter in European cities, and for early-warning of atmospheric hazards such as dust or forest fire episodes. Furthermore, the unique atmospheric probing capabilities in ACTRIS have provided support for decision making and risk management during many atmospheric hazards related to fires, volcanic eruptions, severe pollution events, thus increasing societal resilience to hazards. Establishing ACTRIS as a sustainable RI will expand the capacity to provide the science-based information necessary to face grand societal challenges.

Impact 1: Contribute to providing Europe with a comprehensive landscape of sustainable Research Infrastructures helping to respond to challenges in science, industry and society

ACTRIS is unique in its scope and service provision, filling a scientific and service gap in the RI landscape. ACTRIS IMP will support the establishment of ACTRIS as a comprehensive European RI in disciplines currently not covered by any other RI. ACTRIS will develop an extensive Catalogue of Services and high-quality operations openly available to a wide range of user groups, such as scientists, policy makers, funding agencies, educators and the private sector. (all ACTRIS IMP Work Packages, WPs).

ACTRIS IMP will consolidate 22 national strategies into one coherent European strategy, thus reducing fragmentation in Europe, aligning national investments, and promoting European harmonisation of RI activities in the field of atmospheric research (all WPs).

ACTRIS IMP will secure the smooth, effective, timely and cost-efficient implementation of ACTRIS (including the establishment of the legal entity, CFs and NFs, and their operation support and services), and thus enabling Europe to increase competitiveness in science and industry, and to tackle societal challenges (WP2, WP4-6, WP8, WP9).

ACTRIS IMP will revise the ACTRIS Data Management Plan following the FAIR principles (WP4) and develop a Service & Access Management Plan with an access management system to facilitate easy access for the users (WP6). It will offer access to users in science and industry for testing ACTRIS services and facilities through TNA pilots (WP7), including targeted market-oriented access to CFs and selected NFs supporting the innovation strategies and actions (WP3, WP7, WP9).

ACTRIS IMP will reinforce the cooperation with other European RIs and e-Infrastructures and contribute to the construction of EOSC. ACTRIS is active in the ENVRI community and is leading the strategic cluster tasks and the implementation of FAIR in the atmospheric domain in the ENVRI-FAIR project (ACTRIS IMP WP4, WP8). The cluster collaboration will facilitate the development of interoperability between RIs and promote interand multidisciplinary research to tackle challenges in science and society.

<u>Target indicators</u>: No. of countries and RPOs involved in ACTRIS IMP (ACTRIS IMP involved 22 countries and 34 RPOs in the project); ACTRIS ERIC established in 2021; ACTRIS Data Management Plan established with FAIR compatibility in 2022; ACTRIS Catalogue of Services available online in 2021; No. of access provided to different user groups (value shall increase annually, in 2025 400 access will have been granted); ACTRIS access management platform and innovation platform established in 2022; No. participation of ACTRIS in actions with other RIs (Permanent participation).

Impact 2: Strengthen the ERA position and role in the global research environment

ACTRIS IMP will facilitate the ambition of ACTRIS to strengthen the position and leadership of ERA in the discipline of atmospheric research by providing unique information, services, tools and reference methodologies that will be used and applied by a wide community both within and outside of Europe (all WPs).

ACTRIS IMP will support ACTRIS in gathering European experience and expertise together to generate world-leading competence and capacity. ACTRIS already hosts NFs in different continents and ACTRIS IMP will help in building liaisons, partnerships, and training activities in other continents to achieve a global research infrastructure coverage (WP1, WP3, WP5 WP8, WP10).

Moreover, the research opportunities and training programmes offered by ACTRIS IMP for researchers and technicians will increase the mobility both within Europe and attract talented researchers to Europe, increasing global connections for young researchers (WP3-8).

ACTRIS IMP will continue the development of the ACTRIS innovation portfolio and platform to boost European technological capacity and effectiveness by establishing joint research and development activities with industry, enhancing procurement opportunities, and providing test-beds and tailored services for companies to develop their own products and extend their offer portfolios (WP3-7, WP9, WP10).

<u>Target indicators</u>: No. of pre-operational NFs (at least 50% of the foreseen NFs) and 70% of CFs fulfilling the requirements by 2024; Data downloads from ACTRIS DC globally (up to 100 000 downloads by 2024); No. of ACTRIS affiliated measurement stations globally (at least 10 in 2024); No. of training events organised (permanent activity); No. of contacts and actions made with private sector (permanent contact, at least 10% of the contacts shall be successful).

Impact 3: Reinforce the partnership between the Commiss Alember States, 124 Associateds Commission and 4/11/2019 relevant stakeholders in establishing pan-European research infrastructures

ACTRIS IMP will consolidate and create the conditions favourable for enlargement of the ACTRIS membership in EU Member States and Associated Countries, aiming for to expand the geographical coverage of ACTRIS (WP1). ACTRIS IMP will develop tailored communication tools strengthening the connection between ACTRIS and the national ACTRIS consortia and consolidate effective engagement with stakeholders (WP1, WP10).

ACTRIS IMP will bring the national ACTRIS actors together and ensure the alignment of national ACTRIS activities with the overall ACTRIS strategy. In addition, ACTRIS has many demonstrated local, national, regional and national impacts and ACTRIS IMP will further enhance the impact of ACTRIS on the research and innovation landscape at local, national, regional, European and international level (WP1, WP3-5, WP9).

Furthermore, ACTRIS IMP will contribute to the optimal use of public investments in research infrastructures adopting synergistic strategies with countries (WP1) and, thus will address the challenge of aligning of national funding processes and timelines to European level implementation actions (all WPs).

ACTRIS IMP will actively reach out to the science communities and countries not yet connected to ACTRIS through science conferences and meetings (WP1), technical and thematic workshops and training events (WP4, WP5), and liaison activities (WP8), with the aim of expanding participation and leveraging the competence in operating observational and exploratory platforms to European standards (e.g. RPF activities in WP1, WP3, WP5).

During ACTRIS IMP, ACTRIS will work together with the ENVRI community and e-Infrastructures for developing common guidelines and protocols, sharing knowledge, and optimizing the use of public investments in RIs by adopting synergistic strategies with other RIs (WP1, WP4, WP8).

ACTRIS IMP can contribute to the creation of an open labour market for researchers, particularly by encouraging systematic mobility of researchers and staff (WP1-2, WP4, WP5).

<u>Target indicators</u>: No. of countries as members and observers in ACTRIS ERIC (50% of the Interim countries members and observers); Amount of funding committed to ACTRIS; No. of events organized involving stakeholders in ACTRIS and potential ACTRIS countries (Permanent activity); No. of participants in ACTRIS targeted sessions (Permanent activity); No. of participation of ACTRIS in actions with other RIs (Permanent participation).

Impact 4: Enhance the role of the Union in international organisations and multilateral fora

ACTRIS is the European contribution to global networks through data and service provision. ACTRIS IMP will foster the development and harmonisation of QA/QC and data quality requirements in global programs and legislation-based monitoring networks (WP5, WP8).

In GEO, ACTRIS is participating in the creation of a GEOSS data portal linking Earth observation resources globally across multiple Societal Benefit Areas making ACTRIS resources available for informed decision-making. ACTRIS IMP will strengthen its connection to the Global Climate Observing System (GCOS) on essential climate variables (atmospheric) and with GEO, proposing a joint GEO initiative on short-lived climate species, of which ACTRIS will be the European node (WP8).

ACTRIS contributes to Copernicus services by providing data products to CAMS for near-real time model validation. CAMS monitors air-quality in Europe and provides forecast of air-quality for European cities. ACTRIS IMP will formalise the partnership with Copernicus and ensure the data flow from DC to CAMS (WP8).

ACTRIS has close connections to satellite and modelling communities, ACTRIS IMP will facilitate the cooperation and communication with organisations such as ESA, EUMETSAT, ECMWF and AeroCom (WP2, WP8).

ACTRIS is a key RI contributing to IPCC assessment reports on short-lived atmospheric constituents. This work will continue during ACTRIS IMP. ACTRIS IMP activities will support international conventions, such as UNFCCC, and UNECE/CLRTAP, and Civil Aviation Authorities internationally (WP3, WP8).

<u>Target indicators</u>: Participation of ACTRIS in GEO activities (Permanent participation); No. of ACTRIS variables of relevance to GCOS (at least 20% of the variables provided by ACTRIS); Quantity of data transferred to Copernicus; No. of ACTRIS publication referenced in international assessments (at least 10% of high-impact ACTRIS publications); No. of participations of ACTRIS in satellite and modelling -related activities (Permanent participation).

Impact 5: Support progress towards the development of global research infrastructures

ACTRIS is international by essence and ACTRIS IMP will strengthen the development of ACTRIS as a global RI.

ACTRIS partners host international WMO-GAW calibration centres for volatile organic compounds and for aerosol. 871115 ACTRIS IMP – Part B

In addition, ACTRIS DC contains the global data centre for Wath Data Centre in ACTRIS partners operate the EMEP data centre and the AERONET-Europe calibration centre for the AERONET network, and are key contributors to operations of the international Network for the Detection of Atmospheric Composition Changes (NDACC). ACTRIS operates some of the measurements for the Global Climate Observing Network. ACTRIS IMP will continue the development of ACTRIS contributions at a global level (WP4, WP8). By supporting the implementation of Topical Centres and the Data Centre, ACTRIS IMP will enable ACTRIS to further progress towards a global research infrastructure and the development of standards, procedures and methodologies in the field of atmospheric research and measurements including QA for metrology (WP3-5, WP8, WP9).

ACTRIS IMP will continue to establish an effective international partnership with third countries and international organisations discussing appropriate joint management structures and its financial implications (WP2, WP8).

All training activities of ACTRIS IMP will also be open to international partners (WP4-5, WP8). Moreover, specific capacity building and training activities will be organised in third countries.

ACTRIS IMP will develop strategies for the promotion of innovation and technology transfer and the management of intellectual property (WP2, WP10), and promote exploitation and utilisation of data and technologies to be used in the international context (WP4).

<u>Target indicators</u>: No. of participants in international events (Permanent participation); No. of third countries participating in ACTRIS; No. of agreements concluded with international partners (30% of the agreements started each year); No. of cooperation agreements and partnerships across Europe (50% of the agreements started each year).

Impact 6: Enable researchers to address societal challenges with a global dimension

ACTRIS responds to the need for producing reliable predictions of climate, weather, air-quality and human health, and the understanding of interconnected atmosphere-biosphere processes. ACTRIS IMP will deliver integrated atmospheric data products and services to tackle societal challenges globally (WP3, WP8).

By establishing the ACTRIS Catalogue of Services, ACTRIS IMP will facilitate the uptake of high-quality, reliable data by a broad scientific community (WP4-5) and will respond to the needs in other regions of the world (WP3).

ACTRIS IMP will provide an updated socio-economic impact analysis of ACTRIS using OECD Global Science Forum standards (WP3) to quantify the impact of ACTRIS on global research in environmental and societal challenges (WP3).

ACTRIS IMP will reinforce links with other environmental RIs (IAGOS, ICOS, SIOS, EISCAT-3D, eLTER, SIOS, ANAEE). Some ACTRIS NFs are jointly operated with other RIs, enabling cross-RI access and multidisciplinary studies. Furthermore, ACTRIS IMP will develop cross-domain RI collaboration particularly in the disciplines of food and health, cultural heritage, and technology development within the physics domain. Collaboration with other environmental RIs will support a combined effort in addressing global societal challenges (WP8).

<u>Target indicators</u>: No. of international users of ACTRIS services (at least 60% of the applications shall be accomplished); No. of joint publications with international partners addressing grand challenges (10% of ACTRIS publications annually); Socio-economic assessment of ACTRIS provided; No. of cross- RI domain activities (Permanent participation).

Impact 7: Foster capacity-building and Research Infrastructure human capital development in targeted/relevant regions

ACTRIS employ highly skilled technicians, managers, data scientists, administrative personnel and leaders. To maintain their expertise and support further development, ACTRIS IMP will develop a plan for ACTRIS personnel training and human capital, considering users beyond the current partnership (WP2-3).

ACTRIS IMP will provide many technical capacity-building opportunities for ACTRIS staff, for example training for NF managers and operators on instrument, sensor, and software installations (WP4-5) and internal ACTRIS training for CF unit managers on technical and managerial tasks (WP4).

Selected NFs and TCs provide physical access for users, including user training for all user groups. ACTRIS IMP will organise also user training as a part of the TNA pilot activity (WP6-7).

ACTRIS IMP will develop and organise targeted training and activities activities for AAS TRIS (WP1, Partner Facilities, international partners, and national science communities not yet connected to ACTRIS (WP1, WP5, WP8).

<u>Target indicators</u>: Plan for human capital development in ACTRIS established (2024); Quantity of user access training organized (permanent evaluation); No. of participants from ACTRIS NFs and CFs in training sessions (90% of the applications shall be granted); No. of external training sessions organised (permanent activity).

2.2 Measures to maximise ACTRIS IMP impact

Dissemination and exploitation of results

Target groups for ACTRIS comprise a wide range of communities including 1) research communities worldwide in atmospheric science and related areas; 2) national and international public organisations with responsibility for the environment; 3) policy actors at the national and international level; 4) private companies, including but not limited to SMEs; 5) ministries and funding agencies; 6) educators, and 7) civil society. How the project outcomes are linked in relation to the impact and target group is shown in Figure 3.

Plan for exploitation and dissemination of ACTRIS results (ACTRIS PEDR)

The draft plan for exploitation and dissemination of results, and project outcomes of ACTRIS IMP is designed to benefit the ACTRIS implementation and operation as well as all the target groups mentioned above. The success of the full exploitation and dissemination of results will rely on effective management and execution of engagement and communication activities with ACTRIS users and other target groups. The exploitation and dissemination plan will include: 1) identification of the main ACTRIS IMP results, 2) areas of expected impact, 3) description of the main dissemination and exploitation actions, and 4) definition of the indicators for the dissemination and exploitation assessment. The methodologies for the protection of ACTRIS IMP results are described in the dedicated sections of Data Management Plan & Open Access Strategy and Knowledge Management and protection strategy in ACTRIS IMP. Draft plan for the exploitation and dissemination of results in ACTRIS IMP is shown in Table 2.

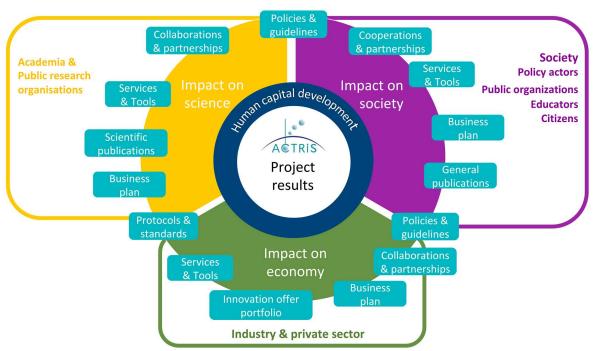


Figure 3. Illustration of the ACTRIS IMP main project outputs, and their relations to the expected field of impact (science, economy, society) and the main target groups (academia, society, and industry & private sector).

Table 2. Draft plan for the exploitation and dissemination of results (PEDR) in ACTRIS IMP. The results are linked to the impacts listed in call text, targeted groups, planned dissemination (D) and exploitation (E) actions and indicators. The protection strategy is described in dedicated sections.

lui gere	Project outputs (WP#)	Link to impact (*)	Target group	D & E actions	D & E indicators
	Catalogue of Services (WP6)	I1-2, I5-6. By enabling uptake of data and services	End-users, scientific community, society private sector	D: section on project website E: by service users, further research	D: no. of visits & IP locations, no. user group access E: no. of data downloads, no. of publications
& Tools	Innovation offer portfolio (WP9)	I1. By favouring access and partnerships	Private sector, industry	D: section on project website E: by industrial users for understanding ACTRIS offers	D: no. of visits & IP locations E: no. of contacts and actions with industry, no. of signed agreements
Service &	TNA (pilots) (WP7)	I1,I6. By showcasing the access to services and facilities	Scientific community, private sector, public services	D: reports, events, website newsletters E: trademarks for collaborations (**)	D: no. of events and participants, no. of publications E: no. of requests and accesses for each user groups
	Access Management Platform (WP6)	I1-7. By providing unique access to services	All groups	D: section on project website E: open access to all user groups, further research (**)	D: no. of visits and IP locations, no. of user feedbacks E: no. of data downloads, no. of publications
& sh	Data management plan (WP4,6)	I4-6. By assuring high- standard, QC/QA, FAIR principles	End-users, Consortium, data providers	D: website, workshops and project meetings E: usage by service providers	D: no. of users, no. of events and participants E: quantity of data passed to Copernicus and service providers
Protocols & standards	Documents and legal templates (WP2,9)	I3. By enabling fast and clear partnerships	National Consortia, beneficiaries, private sector	D: workshops, project meetings E: standardization of procedures	D: no. of events held E: no. of concluded partnerships
Pre st	Labelling of the NF (WP5)	I1, I4-5. By providing high-quality facilities attracting new actors	Consortium, operators, end- users	D: workshops, relevant events E: global benchmark of quality (**)	D: no. of events and participants E: no. of request and protocols
uman pment	Technical training for ACTRIS managers (WP4-5)	I7. By assuring high- level technical competences	Consortium, operators (CF, NF & RPFs), service providers	D: project workshops, webinars E: utilization of state-of-the-art standards (**)	D: no. events and participants E: no. of thesis and publications, no. of new methodologies
Training & Human capital development	User training (WP4,5,8)	I5-7. By assuring high- level technical competences	Research community, private sector, society, education	D: workshops, meetings, website, newsletter E: education (**)	D. no. of data downloads and visits, no. of training and participants E: no. of publications and citations
Train	Human capital development (WP2)	I1, I5, I7. By offering staff exchange and personnel training	Consortium, operators, National Consortia	D: workshops, webinars, relevant events E: fostering new career paths (**)	D: no. events and participants
	Agreed actions with networks, initiatives & organizations	I4-6. By aligning policies and contributing to international	International policy makers, public services and networks representatives	D: policy meetings or targeted events E: publications, joint projects &	D: no. of events and participants E: no. of data transferred to Copernicus, no. of relevant variables to GCOS, no. of publications
	(WP8)	initiatives		actions for applications to global initiative (**)	and citations in international assessments, no. of network participations
Cooper ation &	Agreed cross-RIs & cross-domain actions (WP8,10)	I2, I4-6. By sharing experiences and resources	RIs, ENVRI, EOSC and e-RIs	D: project website, conference and other relevant events E: interdisciplinary education	D: no. of RI collaborations and joint events E: no. of publications outside the atmospheric domain

	Agreed technology development and Innovation actions (WP9-10)	I1-2. By combining capacities	Private sector	D: fairs, expo, meetings E: advancement in R&D (**)	D: no. of participants, events and publications E: no. of signed contracts, no. of patents & licenses
	Development of regional, national and EU coverage (WP1,3,4-5)	I3, I7. By advocacy and by offering attractive opportunities	Scientists, RPOs, National Consortia and stakeholders	D: targeted regional and national meetings E: opportunities for provision of new activities and users	D: no. of events and participants E: no. of new partnerships
	Development of ACTRIS as global RI (WP3,4,5,10)	I1-2, I5-6.	End-users, scientific community, policy makers private sector	D: international conferences and targeted meeting, website, publications E: provision of data and service on global scale (**)	D: no. of events and participants, no. of IPs outside Europe, no. of international publications E: no. of non-EU users and partnerships
	Innovation strategy (WP3,9)	I3, I5. By setting goals & procedure for collaborations	Private sector, Consortium, stakeholders	D: project meetings and targeted meetings E: advancement in R&D	D: no. of events and participants E: no. of new partnerships
guidelines	Science strategy (WP3)	I1-2, I4-6. By enhancing ACTRIS relevance	Consortium, stakeholders, end-users, policy makers	D: project meetings and targeted meetings E: publications, advancement in R&D	D: no. of events and participants E. no. of users, no. of data downloads, no. of publications
	Communication strategy (W10)	I1-7. By providing communication tools	Consortium	D: project meetings E: creating a communication network within ACTRIS	D: no. of meetings and participants
Policies &	Assessment of societal relevance and impacts (WP3)	I1, I2, I5. By creating business and job opportunities	Consortium, stakeholders, policy makers, society	D: project meetings, relevant event E: new economic commitment from stakeholders (**)	D: no. of meetings and participants E: no. of contract agreements
	Assessment on local & regional impact (WP3)	I7. By creating local and regional business and job opportunities	National Consortia, Consortium, stakeholder, society	D: project meetings, relevant event E: new economic commitment from stakeholders (**)	D: no. of meetings and participants E: no. of contract agreements
s Plan	Updated Business Plan (WP2)	I1-7. By communicating activities & progresses	All groups	D: printed copies and e-format E: by increased visibility and interest among users (**)	D. no. of prints, no. of downloads E: no. of users and partnerships
Business Plan & publications	ACTRIS branding elements (WP10)	I1-7. By promoting ACTRIS visibility	Consortium, all stakeholders	D: marketing and project materials, handbooks, social media	D: no. of portfolios (targeting specific stakeholders), no. of Stakeholder Handbooks, social media engagement

^(*) The links follow the numbering of the impacts (I) listed in the section "ACTRIS IMP contribution to the impacts listed in the Work Programme"

^(**) including the activities after the project

In ACTRIS PPP, ACTRIS published two ACTRIS Stakeholder Handbooks containing information on ACTRIS in general (vision, mission, structure and implementation) together with the profiles of National ACTRIS Consortia. ACTRIS IMP will further develop the well-received ACTRIS Stakeholder Handbook and will elaborate special editions for specific target groups. Based on the ACTRIS Stakeholder Handbooks, ACTRIS PPP will prepare the first version of the full ACTRIS Business Plan (outline of the Business Plan approved by IAC in October 2018). In ACTRIS IMP, the ACTRIS Business Plan will be updated to meet the state-of-the-art in ACTRIS development and the progress gained during the implementation phase. The ACTRIS Business Plan will be available in both printed and electronic versions and will be distributed widely to all groups (users, stakeholders, funders, ministries). The objective is to communicate ACTRIS activities in a condensed manner to give ACTRIS stakeholders compact and relevant information on the ACTRIS concept and implementation, and to increase the visibility of ACTRIS among potential users.

Data Management Plan & Open Access Strategy

The ACTRIS IMP project participates in the Pilot on Open Research Data in Horizon 2020, in line with the Commission's Open Access to research data policy for facilitating access, re-use and preservation of its research data. For this purpose, a Data Management Plan (DMP) will be developed by Month 6 and documented in a deliverable according to the EC guidelines on FAIR data management. This plan will outline how research data will be handled during and after the project, describing what data will be collected, processed or generated following which methodology and standards, whether and how this data will be shared and/or made open, and how it will be curated and preserved. The DMP will also provide the dataset metadata specification that will be used in the data registry, following an appropriate relevant standard. It will specify the recommended licensing schemes, preferably using the Creative Commons Public Domain (CC0) and Attribution (CC BY) licenses as suggested by H2020. In the cases where the datasets cannot be publicly shared, the reasons will be mentioned in its metadata description (e.g. ethical, personal data rules, intellectual property, commercial, privacy-related, or security-related).

Knowledge management and protection strategy in ACTRIS IMP

The knowledge that will be created within ACTRIS IMP is aimed at directly benefitting ACTRIS members and users. Generally, ACTRIS IMP will follow the knowledge management and protection strategy of open access to the project outcomes to enhance knowledge creation in the establishment of ACTRIS. However, ACTRIS IMP will undertake measures to ensure that beneficiaries' IPR are respected in the project and, when needed, IPR shall be protected. The main IPR conditions and procedures will be established in the Consortium Agreement (CA). In addition, WP2 will deal with all legal issues related to the ownership and IPR of ACTRIS data, outcomes and knowledge. WP9 in ACTRIS IMP will facilitate technology transfer and pursue market opportunities provided by ACTRIS IMP. ACTRIS is fostering open access to data and data products as well as acknowledgment of data providers. Open access as such is not an obstacle for innovation, on the contrary, but protection of IPR may be necessary when working with industry and within technology transfer. Open access and attribution to the data may also impact efficient industry cooperation on innovation. WP2, together with WP9, will work further on this topic. The open access to project outcomes will only be restricted on a case-to-case basis. In the case of scientific publications, open access publishing (i.e. articles made publicly available for free immediately after publication, "gold" open access), will be favoured and all ACTRIS publications are expected to follow this approach. In some special cases, for strong reasons, open access to articles can be provided following an embargo period ("green" open access).

Communication activities

The project consortium recognizes that efficient communication and outreach activities are essential for achieving the ambitions of ACTRIS IMP and ACTRIS in general. ACTRIS IMP has reserved the needed resources (both ECrequested funding and participating organizations' matching funding) to perform the planned communication actions. ACTRIS IMP will enable dissemination of information, engagement with the ACTRIS community and countries, and promotion of ACTRIS services to users, stakeholders and target audiences. ACTRIS IMP will work to identify efficient methods and tools to enhance the existing communication practices that are essential for ensuring seamless information exchange within the ACTRIS community. Furthermore, ACTRIS IMP will develop strategic communication and outreach approaches to enhance the positioning of ACTRIS as a global research infrastructure in the research and innovation landscape.

ACTRIS is currently focusing on the development and construction of ACTRIS, thus maintaining a limited, yet sufficient, communication and outreach portfolio to meet the needs of both internal and external communication. However, during the implementation phase, ACTRIS will move to the next level of activity requiring a coherent and unified approach and therefore there is a need to strengthen the communication flow between ACTRIS CFs and NFs, as well as within the ACTRIS community to ensure the efficient implementation of actions and information transfer. In addition, ACTRIS IMP will have several community building activities to engage and expand the ACTRIS

community to increase participation of new countries in ACTRIS, including targeted outreach and communication activities at the national and regional level.

One of the main communication and outreach activities of ACTRIS IMP is related to attracting new user communities and positioning ACTRIS in the international research and innovation landscape. WP10 will approach and attract potential ACTRIS user communities using tailored outreach activities and provid tools and means for communicating ACTRIS IMP outcomes widely in global research arenas and connect to the private sector.

ACTRIS IMP will implement ACTRIS communication tools both for internal and external communication. A major communication tool is the ACTRIS website that has been developed in ACTRIS PPP, ACTRIS-2 and EUROCHAMP-2020. ACTRIS IMP will continue to elaborate the ACTRIS website particularly connecting the ACTRIS access service system, Science and User Platform, and platform for innovation actions to it to ensure easy access to ACTRIS. As new elements, the website will include the innovation portfolio, Catalogue of Services, single access point for users, and designated sections that contain material prepared for specific target groups. The ACTRIS website is the main tool for promoting the numerous workshops, training and access opportunities in ACTRIS. However, effective communication to users in scientific research and industry will also be achieved through targeted use of professional networks (Research Gate®, Mendeley®, LinkedIn®). In a similar way, communication with the public will be performed using more general social media platforms, including Twitter® and Facebook®. The effectiveness of these various communication and dissemination strategies will be monitored by analysing statistics on website visits, document/file downloads and social media interactions.

During the ACTRIS implementation phase and ACTRIS IMP, the emphasis in the development of communications will move from internal communication to developing a strategic approach for communicating the relevance and impacts of ACTRIS. ACTRIS IMP will empower HO and the ACTRIS leadership in using communications, media and public relations for supporting the ACTRIS strategy and goals. ACTRIS IMP will define strategic communication targets and approaches, including crisis communication.

Internal project communication will be organized in the management Work Package (WP11) to ensure that the project will run smoothly and achieves its overall objectives. Optimal communication between the ACTRIS IMP beneficiaries will be achieved via regular e-mails and web-conferences, the project website, and dedicated workshops for the networking and joint research activities. Regular web-conferences will also be organized to reinforce the communication flow within and between the work packages to improve efficiency, while also minimizing time, costs and environmental impacts related to travel policy. Annual project meetings will be held to provide an overview of progress in ACTRIS IMP and ACTRIS and to discuss future work plans. The project website will have both open and password protected areas (intranet). The password protected area will contain working documents such as progress reports related to deliverables and draft annual project reports. It will serve for the exchange of documents and data, while the public area will host the project description, major outcomes and publications, and information related to outreach activities.

3. Implementation

3.1 ACTRIS IMP work plan

Overall structure of the ACTRIS IMP work plan

The ACTRIS IMP project is organized according to three main strategic pillars: 1) Securing the long-term sustainability of ACTRIS; 2) Implementing ACTRIS components, functionalities and services; and 3) Consolidating the position of ACTRIS in the national, European and international landscape. The project is organised in 11 work packages (WP): three (WP1-3) are dedicated to the sustainability of ACTRIS, four (WP4-7) to implement ACTRIS components, and three (WP8-10) to strategic pillars. The management of ACTRIS IMP (WP11) is under the responsibility of the partner organisations holding the ACTRIS ERIC statutory seat. ACTRIS IMP comprises the following WPs:

- WP1 Engagement and enlargement of the ACTRIS community and ACTRIS membership will target the consolidation of the participation of the ACTRIS community and ACTRIS membership to secure the long-term sustainability of ACTRIS. WP1 will embrace new communities and countries and develop regional strategies to align national level activities and resources and connect them to ACTRIS.
- WP2 Implementation of a sustainable ACTRIS organization is key to addressing all operations that will guarantee long-term sustainability and financial commitment of the ACTRIS ERIC members and observers. It will address the implementation of an efficient working organization and management system by finalizing policies, internal rules and legal and financial procedures, human resource management, and sustainable risk management that will serve to update the long-term ACTRIS business plan.
- WP3 Strategy for enhancing ACTRIS relevance and impact will provide strategic guidance and steering
 to enhance the relevance of ACTRIS for science and society and monitor the added value of ACTRIS as a
 whole. It includes development of a strategic innovation plan pertinent to facilitating the enhancement of
 ACTRIS science and technologies.
- WP4 Implementation and testing operation of the Central Facilities is dedicated to establishing the functional workflows between CFs and NFs, refining the CF detailed implementation plans, and testing the provision of priority CF operation support needed for the labelling of NFs.
- WP5 Facilitating the harmonized operation of the National Facilities will ensure a smooth and consistent
 implementation of the ACTRIS observational and exploratory platforms with the aim of reaching a highgrade operational functionality of the National Facilities at the end of the ACTRIS implementation phase.
 WP5 will address the NF labelling process and support new ACTRIS NFs and PF to meet the ACTRIS
 technical standards.
- WP6 Implementation of the user access to ACTRIS services will deliver a coherent plan to coordinate
 and structure the user access to ACTRIS, starting from the development of a comprehensive ACTRIS
 Catalogue of Services and will lead to the implementation of the full-scale virtual, physical, and remote
 access to all ACTRIS services based on the development of an efficient and effective user strategy and the
 delivery of tools for the organization and management of the access and service provision and for the
 continuous interaction with the users.
- WP7 Piloting trans-national access for supporting the implementation of ACTRIS services will give ACTRIS IMP the capacity to support full-scale testing of specific services to assess and improve the reliability of the overall ACTRIS service provision, increase the user trust and widen the user base.
- WP8 Consolidating the position of ACTRIS in the European and international research landscape is to solidify ACTRIS leadership as a global distributed research infrastructure and liaise with both the relevant international institutions and the other European Research infrastructures and e-infrastructures.
- WP9 Positioning ACTRIS in the European innovation ecosystem will develop the specific tools and tailored actions for better connecting ACTRIS with the private sector. It will analyse and address the needs of the private sector (including its specific requirements and modalities), foster the collaboration with SMEs and industries, develop the necessary innovation policies, and drive the innovation and technology development actions at the Central and National Facilities
- WP10 ACTRIS communication and public relations is set up for the elaboration of the communication tools to effectively promote ACTRIS as a global research infrastructure. WP10 develops the communication practices and support tools that are required for promoting the stakeholder engagement at regional, national, and international level, and connecting and engaging with key users, including the private sector.
- WP11 Project management and ethics is centralised at the two partner organisations coordinating the project, to maintain an excellent level of functioning through efficient management structures. This WP is configured to ensure effective coordination of activities and the overall smooth running of the project.

•	WP12 Ethics requirements is set to ensure compliance with the 'ethics requirements' set out in this work package. WP12 sets out the 'ethics requirements' that the project must comply with. The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

Timing of the different work packages

ACTRIS IMP is planned as a four-year (48 months) project. The Gantt chart for the project implementation is shown in Figure 4.

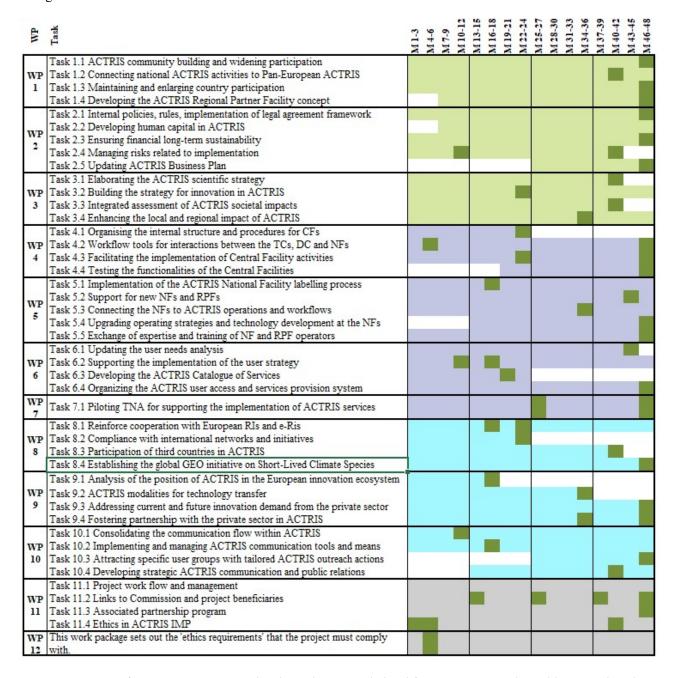


Figure 4. Timing of ACTRIS IMP WPs and tasks at the quarterly level for 2020-2024. Deliverables in each task are marked with darker green boxes.

The work packages of ACTRIS IMP are highly interlinked and have several connections in term of input and output of WP results and outcomes. The main interlinkages are presented in the Figure 5.

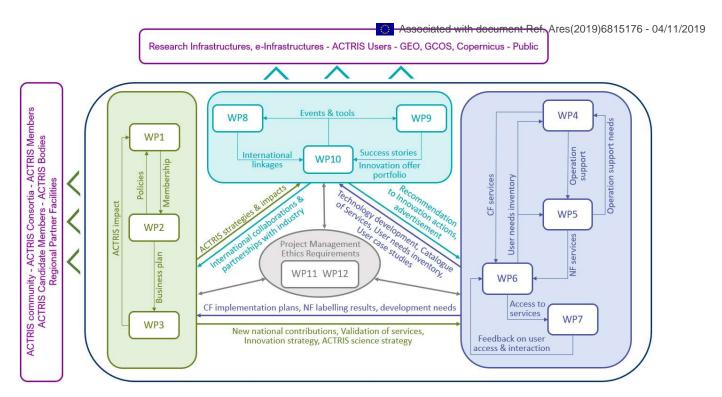


Figure 5. The main interlinkages of the ACTRIS IMP work packages are illustrated with the arrows between the WP boxes. On the right are mentioned the main internal ACTRIS actors and on the top the main external liaison actors benefitting the ACTRIS IMP results.

3.2 ACTRIS IMP management structure, related milestones and procedures

The ACTRIS lifecycle can be broken down into three specific phases: the 3-year Preparatory Phase, supported by the ACTRIS PPP that will end in December 2019; the 5-year Implementation Phase from 2020 – 2024 when most of the construction, upgrades and implementation of the entire RI system will occur, including the set-up of the governance and management structures for ACTRIS ERIC and the Operational Phase. ACTRIS IMP project is targeted to support and coordinate the implementation actions during the ACTRIS Implementation Phase. The Operational Phase of ACTRIS planned to start 2025. As the ERIC is not yet in place, ACTRIS has an interim governance and management structure, that ACTRIS IMP will support. The highest decision-making body in this transition phase is Interim ACTRIS Council (IAC). ACTRIS IMP will also facilitate the work of other internal ACTRIS advisory bodies such as the Research Infrastructure Committee, the National Facility Assembly, interim Scientific and Implementation Advisory Board (SIAB), and Ethical Advisory Board.

All countries participating in the implementation of ACTRIS have substantial national communities involved in ACTRIS represented by numerous RPOs together with the different organisations hosting networks or facilities that can join ACTRIS as RPF. It is important that ACTRIS communities are well organized at the national level and have established a national ACTRIS consortium. National consortia are the communication channels between national ACTRIS activities and ACTRIS; ACTRIS.

Organizational structure of the ACTRIS IMP

As ACTRIS IMP is an EC-funded research and innovation action, the project will have a standard European Commission project management structure including ACTRIS IMP General Assembly, Executive Board, Project Coordinator, Co-Coordinator and Project Management Office. The ACTRIS IMP organizational structure complies with the DESCA Horizon 2020 Model Consortium Agreement "Governance structure for Medium and Large Projects" (http://www.desca-2020.eu/).

ACTRIS IMP General Assembly (GA) shall be the decision-making body of the implementation project consortium and will deal with the issues related to the project; it will not decide on issues that are the responsibility of IAC and ACTRIS ERIC GA. ACTRIS IMP GA consists of one authorized representative of each ACTRIS IMP beneficiary. GA meetings will occur at least once per calendar year, co-incident with the project annual meetings.

GA will be responsible for the content, finances and intellectual property rights of the project; appointment of the members of additional project bodies; and for preparing and amending the Consortium Agreement.

ACTRIS IMP Executive Board (EB) shall the supervisory body for the execution of the project, which shall report to, and be accountable to, the ACTRIS IMP GA. The EB consists of the Coordinator, Co-Coordinator, WP Leaders and Project Manager of ACTRIS IMP. The EB is responsible for the proper execution and implementation of GA decisions. EB will monitor the effective and efficient implementation of the project. In the case of tasks abolished because of a GA decision, EB shall advise GA on ways to rearrange tasks and budgets of the Parties concerned, taking into consideration the legitimate commitments taken prior to the decisions. Executive Board meetings shall be chaired by the Coordinator. EB will have meetings at least quarterly with one meeting in coordination with annual GA meetings, but will meet either in person or virtually when requested by at least two EB members. Detailed meeting procedures will be defined in the Consortium Agreement. The Executive Board shall:

- prepare the meetings, propose decisions and prepare the agenda of the General Assembly;
- seek a consensus among the Parties;
- collect information at least every 6 months on the progress of the project, examine that information to assess the compliance of the project with the consortium plan and, if necessary, propose modifications of the consortium plan to the General Assembly;
- support the Coordinator in preparing meetings with the funding authority and in preparing related data and deliverables:
- prepare the content and timing of press releases and joint publications by the consortium or proposed by the funding authority; and
- perform any other tasks specified in the Consortium Agreement or required by the General Assembly.

Project coordination of ACTRIS IMP shall be provided by partner 1 (FMI) together with partner 2 (UHEL). The ACTRIS IMP **Coordinator** will be Dr. Sanna Sorvari Sundet, Finnish Meteorological Institute and the **Co-Coordinator** be Prof. Tuukka Petäjä, University of Helsinki. The ACTRIS IMP Coordinator represents the project consortium to the European Commission and ACTRIS member countries, and oversees the administrative, legal, and financial management of the ACTRIS IMP project and the overall ACTRIS Implementation until ACTRIS ERIC is established. In addition, the ACTRIS IMP Coordinator acts as the leader of ACTRIS until ACTRIS ERIC is in place. Co-coordinator (UHEL) is in charge of scientific coordination of ACTRIS IMP. The Coordinator and Co-Coordinator shall be supported by the **Project Management Office (PMO)** and by the **Project Manager** Dr. Niku Kivekäs, FMI. The Coordinator, Co-Coordinator and Project Management Office shall be responsible for:

- monitoring that the actions, such as effective project management and execution of the decisions of GA, are implemented properly;
- representing the intermediary for communication between EC and the consortium, including transmitting documents and information connected to ACTRIS IMP to relevant parties;
- ensuring the outreach beyond the consortium, for example with ACTRIS members, larger scientific community and other stakeholders:
- ensuring the ease of communication across the consortium for example by keeping the contact list of Members and other contact persons updated and available;
- collecting, reviewing and submitting documents, information and deliverables required and verifying their completeness and correctness before submitting them on to EC or other parties;
- administering the financial contribution of EC and financial tasks, for example ensuring that all payments are made to the other beneficiaries without unjustified delay and informing EC of the payments;
- chairing and organizing the GA and EB meetings and drafting the minutes; and
- implementing an efficient project management and providing management in all administrative, legal, financial and scientific matters and day-to-day management.

The Work Package Leaders shall be responsible for WP progress and their objectives. They will also maintain communication within each WP, present WP results in project meetings and report on WP progress to ACTRIS IMP coordination and, if needed, to GA. They shall also be responsible for providing WP deliverables on time and performing the initial quality control of WP deliverables.

ACTRIS IMP WP1 and WP2 will facilitate the work of the interim ACTRIS governance bodies. WP1 will focus on engaging and widening the participation of the ACTRIS community and ACTRIS members and supporting the organisation of the meetings of the ACTRIS interim bodies and preparing the materials for the work. WP2 will ensure

the establishment of a well-managed ACTRIS ERIC, and WP2 will Associated with document Ref. Ares (2019) 6815176 - 04/11/2019 ACTRIS ERIS and other ACTRIS components together with finalising the internal rules, policies and procedures for ACTRIS ERIC. Both WPs aim to assure the long-term sustainability of ACTRIS and thus their role in the governance and management structure is important. Figure 6 shows the ACTRIS IMP management structure and its relation to ACTRIS governance structure (both interim and ACTRIS ERIC governance).

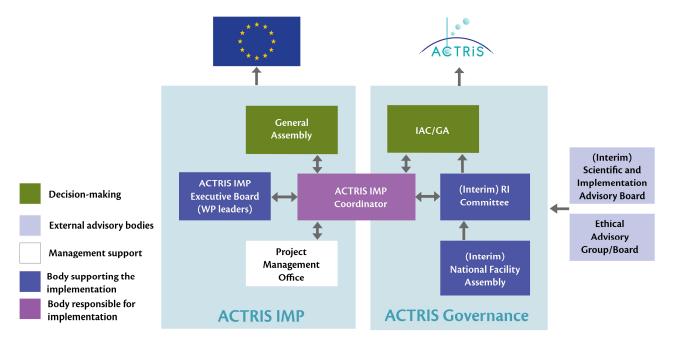


Figure 6. ACTRIS IMP governance and its relation and role as facilitator of the Interim ACTRIS bodies before the ACTRIS ERIC is established (ca. 2021). After establishment of ACTRIS ERIC, ACTRIS IMP will continue to work in a supporting role for ACTRIS ERIC governance.

Milestones of the ACTRIS IMP project

ACTRIS IMP innovation management

The innovation management of ACTRIS IMP will be overseen by the ACTRIS IMP Executive Board together with the ACTRIS RI committee, National Facility Assembly and will be supported by the work performed in WP3, WP4, WP5 and WP9. In ACTRIS IMP, the innovation strategy will be developed in WP3, whereas the technical work for innovation and industry involvement will be tackled in WP9. Most innovation-related actions are foreseen to take place in ACTRIS CFs and NFs, being the focus of WP4 and WP5, respectively. ACTRIS IMP will enable the full innovation potential of ACTRIS and provide the necessary support to the whole consortium to become more innovation-friendly to respond to new openings societal and industrial challenges.

ACTRIS IMP risk management

The risk management of ACTRIS IMP is seen as a process of identifying, addressing, prioritizing, and eliminating potential sources of failure to achieve the project objectives. ACTRIS IMP risk management will aim to be proactive, preventive and predictive for any given risk. This is necessary for a successful and timely project implementation. The identified ACTRIS IMP related risks (see Table 3.2b) are related to the planning and delivery of the project outcomes and special attention will be made to meet ACTRIS IMP objectives within the planned schedule and cost. ACTRIS IMP has a very skilled and experienced project management office and devoted project partners. The success of this cooperation and common experience has been demonstrated in ACTRIS PPP, ACTRIS-2, and EUROCHAMP-2020 projects, all of which have received excellent review results for their mid-tern reports.

The coordinator and PMO will perform regular risk monitoring by following the advancement of the project in terms of milestones and deliverables and by observing the early-warning signals of potential departures from the schedule and conflicts. The WP leaders shall be responsible for reporting any imminent risks to Coordination and EB immediately. EB will review the key risks and agree on the most appropriate mitigation actions. The Consortium Agreement will also provide for additional tools to minimize and mitigate risks in the consortium. Moreover, EC will monitor the progress via submitted deliverables and its project reviews, e.g., in their mid-term review, and the IAC

will monitor the overall progress of the implementation of ACTRIS in its meetings. In WPI1, the workflows, as well as the progress of work and budget expenditure, will be followed to recognize the potential risks and to start any mitigation measures. PMO will also develop a quality control system within ACTRIS PPP through which all deliverables are vetted before they are delivered to the Commission.

Table 3.2c: Summary of trans-national access provision

Access	summary of trans		Installation	Installati	T. C	Unit of	TET *.	Min.	Access	s costs	Estimated	Estimated
provider short name	Short name of infrastructure	Nr	Short name	on Country code	Type of access	access	Unit cost (UC) (€)	quantity of access to be provided	On the basis of UC	As actual costs	number of users	number of user projects
2-UHEL	SMEAR II	1	Hyytiälä	FI	TA-uc	UWD	700,00	30	21 000,00	-	12	6
3-CNR	ACTRIS DC- ARES	1	SHARE	IT	TA-uc	SWD	450,00	45	20 250,00		5	3
4-TROPOS	ACD-C/ OGTAC CC	1	ACD-C/ OGTAC CC	DE	TA-uc	DAY	1 100,00	20	22 000,00		8	2
6-FZJ	SAPHIR- CiGas-FZJ	1	SAPHIR- CiGas-FZJ	DE	TA-uc	DAY	5 000,00	5	25 000,00		10	1
7-CNRS	CARS-ASP- FR	1	Calibration AE	FR	TA-cb	CAL	1 350,00	10	13 500,00		10	10
7-CNRS	CARS-ASP- FR	2	Mobile AE	FR	TA-cb	UWD		9		8 531,25	3	3
12-PSI	JFJ	1	JFJ	СН	TA-uc	DAY	800,00	30	24 000,00		8	4
14-KNMI	Cabauw	1	Cabauw- KNMI	NL	TA-uc	UWD	500,00	36	18 000,00		12	6
15-BIRA- IASB	CDPS-FTIR	1	CDPS-FTIR	BE	TA-ac	DPS		4		20 050,00	3	3
18-CYI	USRL	1	USRL	CY	TA-ac	SWD		40		20 000,00	6	3
23-ZAMG	SBO	1	SBO	AT	TA-cb	UWD	400,00	45	18 000,00	2 700,00	9	3
31-CEAM	EUPHORE	1	EUPHORE	ES	TA-uc	DAY	4 000,00	8	32 000,00		4	2

3.3 Consortium as a whole

ACTRIS IMP consists of 34 beneficiaries, representing 22 participating countries and the European Commission's Joint Research Centre. An additional 15 research organizations participate as Linked Third Parties (LTPs) in the project. The ACTRIS IMP project consortium consists of beneficiaries that are directly contributing to project work and represent their national ACTRIS consortia in the project. LTPs contribute their specific expertise to ACTRIS IMP work specified in section 4.2. Beyond the beneficiaries and LTPs, there are many research organizations committing their resources to national ACTRIS activities, even though not directly linked to ACTRIS IMP. These organizations will be linked to ACTRIS IMP via an associated partner programme as ACTRIS IMP associate partners. New associate partners can join via the Associate Partner Programme managed by WP11. The regularly updated list of ACTRIS IMP associated partners will be found at the ACTRIS web-site (www.actris.eu).

The ACTRIS IMP consortium has a record of strong collaboration in EC-funded projects (eg. ACTRIS-2, EUROCHAMP-2020 and ACTRIS PPP) and includes a high level of scientific expertise in the research of aerosol, clouds and trace gases measured with in-situ and remote sensing techniques and simulated with controlled experiments in simulation chambers and laboratory facilities. The ACTRIS IMP consortium has the required expertise to meet the project objectives laid out in the proposal's excellence section. Moreover, the ACTRIS IMP consortium has the needed level of expertise in legal and financial matters, project coordination, management and implementation of a RI, impact assessments, liaisons, technology development and transfer, and many communication and outreach activities. Beneficiaries and LTPs also provide the required expertise for creating and operating ACTRIS CFs. Constant communication with relevant user groups, ACTRIS members and stakeholders will be undertaken and ACTRIS IMP envisages collaborations with industrial partners who may also be linked to the project as associate partners. In summary, the ACTRIS IMP consortium has demonstrated the strong expertise and experience necessary for delivering the final project outcome – ACTRIS research infrastructure.

ACTRIS has a wide geographical representation with 22 participating European countries including all 17 countries that have participated in the process of preparing the ACTRIS ERIC step 1 application. Furthermore, the ACTRIS implementation plan and the objectives of the ACTRIS IMP project have been approved by these 17 countries (IAC decisions). This is a demonstration of the strong commitment of the countries to ACTRIS and to ACTRIS IMP. During ACTRIS IMP, constant communication with participating countries, and reaching out to engage potential new countries will be organised and supported. Maintaining and upgrading the current ACTRIS operations in ACTRIS countries and developing the technical capacity of the ACTRIS CF components are not *per se* included in the activities of ACTRIS IMP but are coordinated and aligned with the project through ACTRIS IMP and IAC.

The ACTRIS capabilities, capacities and resources support ACTRIS IMP in its project activities. The ACTRIS IMP consortium includes:

ACTRIS Finland represented by FMI and UHEL. They will coordinate the project and lead the work on developing the long-term sustainability of ACTRIS (WPs 1-3), ACTRIS communication (WP10) and ACTRIS IMP management (WP11), In addition, Finland will contribute to all other WPs. Finland has been chosen to host the statutory seat of ACTRIS ERIC with the ACTRIS HO. In total 4 Finnish RPOs are involved in the implementation of ACTRIS.

ACTRIS Italy represented by CNR, will lead the work on ACTRIS service access (WP6) and innovation platform (WP9). Italy will also be involved in most of the other WPs. Italy is included in the ACTRIS ERIC step 1 application and 7 Italian RPOs are involved in the implementation of ACTRIS.

ACTRIS Germany represented by TROPOS, KIT and FZJ, will lead the work on ACTRIS National Facilities (WP5). In addition, Germany contributes significantly to most of the other WPs. Germany supports the ACTRIS ERIC step 1 application and 13 German RPOs are involved in the implementation of ACTRIS.

ACTRIS France represented by CNRS (and its Linked Third Parties, UGA, ULille, UPEC and UVSQ), IMT and INERIS, will lead the work on TNA provision (WP7) and positioning ACTRIS in the RI landscape (WP8). France will also make a significant contribution to most of the other WPs. France is included in the ACTRIS ERIC step 1 application and 20 French RPOs are involved in the implementation of ACTRIS.

ACTRIS Norway represented by NILU, will be involved in most of the WPs. Norway is included in the ACTRIS ERIC step 1 application and 3 Norwegian RPOs are involved in the implementation of ACTRIS.

ACTRIS Romania represented by INOE, will lead the work on developing the implementation of ACTRIS Central Facilities (WP 4). Romania is included in the ACTRIS ERIC step 1 application and 5 Romanian RPOs are involved in the implementation of ACTRIS.

ACTRIS Switzerland is represented by PSI and EMPA. Switzerland is included in the ACTRIS ERIC step 1 application as a future observer of the RI and 7 Swiss RPOs are involved in the implementation of ACTRIS.

ACTRIS Netherlands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party WUD! Wether Rands is represented by KNMI and its Linked himself party with the party

ACTRIS Belgium is represented by BIRA-IASB. Belgium is included in the ACTRIS ERIC step 1 application and 4 Belgian RPOs are involved in the implementation of ACTRIS.

ACTRIS United Kingdom is represented by UMAN and UKRI and includes 6 UK RPOs participating in the implementation of ACTRIS. UK has participated in preparation of the ACTRIS ERIC step 1 application.

ACTRIS Cyprus is represented by CYI. Cyprus is included in the ACTRIS ERIC step 1 application, and 4 Cypriot RPOs are involved in the implementation of ACTRIS.

ACTRIS Poland is represented by UW and its Linked Third party IGF PAS. Poland is included in the ACTRIS ERIC step 1 application, and 7 Polish RPOs are involved in the implementation of ACTRIS.

ACTRIS Sweden is represented by ULUND. 6 Swedish RPOs are participating in the implementation of ACTRIS. **JRC - Joint Research Centre - European Commission** will participate in common activities in WPs 1 and 5.

ACTRIS Austria is represented by MUI and ZAMG. Austria is included in the ACTRIS ERIC step 1 application, and 6 Austrian institutions are involved in the implementation of ACTRIS.

ACTRIS Czech Republic is represented by ICPF and its Linked Third Party CHMI. Czech Republic is included in the ACTRIS ERIC step 1 application and 4 Czech RPOs are involved in the implementation of ACTRIS.

ACTRIS Greece is represented by NOA (with Linked Third Party NCSR-D) and FORTH. Greece is included in the ACTRIS ERIC step 1 application and 11 Greek RPOs are involved in the implementation of ACTRIS.

ACTRIS Bulgaria is represented by INRNE-BAS (with Linked Third Party IE-BAS). Bulgaria is included in the ACTRIS ERIC step 1 application and 2 Bulgarian RPOs are involved in the implementation of ACTRIS.

ACTRIS Ireland is represented by UCC. 4 Irish RPOs are participating in the implementation of ACTRIS.

ACTRIS Denmark is represented by AU. 2 Danish RPOs are participating in the implementation of ACTRIS.

ACTRIS Spain, represented by UPC (with Linked Third Parties UGR, CIEMAT, INTA and BSC), UVA (with Linked Third Party AEMET) and CEAM (with Linked Third Party CSIC). Spain is included in the ACTRIS ERIC step 1 application and 11 Spanish RPOs are involved in the implementation of ACTRIS.

ACTRIS Estonia is represented by EULS. 5 Estonian RPOs are participating in the implementation of ACTRIS. **ACTRIS Portugal** is represented by UEvora. 6 Portuguese RPOs are participating in the implementation of ACTRIS.

3.4. Resources to be committed to ACTRIS IMP project

The overall requested ACTRIS IMP budget is 5 M € for 48 months. During this timeframe ACTRIS IMP will mobilise 505 Person Months (PMs) in addition to all national level resources that are already committed to ACTRIS implementation. The allocation of ACTRIS IMP PMs is shared among the main strategic pillars as follows: long-term sustainability 29 %, implementing ACTRIS functionalities 44 %, positioning ACTRIS 22 %, and project management 5 %. Besides PMs, the budget of ACTRIS IMP has allocations to travel (864 000 €, including travel to project meetings, liaison- and outreach related travel and travel support to associated partners) and other indirect costs (361 000 €, including meeting facilitation, outreach materials, financial audits of beneficiaries etc.). The resources allocated for TNA pilot activity are 389 000 €. In the allocation of work load and budget, emphasis is given to the countries and beneficiaries leading and operating the core functions of ACTRIS, for example, to Finland and Italy leading the ACTRIS implementation and hosting Head Office, including SAMU. In addition, countries that are bringing extensive national resources to ACTRIS and setting up several ACTRIS components (NFs and CFs units) have budget share according to this activity.

ACTRIS IMP is aligning and pulling together national resources and these will be used as matching funding for ACTRIS IMP activities. It has been estimated that, for the CF implementation, more than 115 M \in has already been invested by 2019, and another 85 M \in will be used for CF implementation in the next five years. Moreover, ACTRIS countries are constructing and upgrading their NFs with more than 100 M \in (estimate) over the next five years. The total ACTRIS value is estimated to be 450 M \in . Therefore, the requested 5 M \in of ACTRIS IMP resources will be used for coordinating and streamlining national ACTRIS investments and implementation actions. Any contributions to the CF implementation beyond ACTRIS IMP work are subject to the availability and timing of national funding.

There eller eller eller eller	1101118 (11.00	ver, equipment, other goods and services) of Hellas IIII.
1/FMI	Cost (€)	Justification
Other Travel	82 000	Participation in project meetings, the support to associated partners,
		stakeholders and external experts.
Other goods and services	121 180	Annual project and other meeting arrangements, project related materials,
_		Financial Audit.
Total	203 100	

2 / UHEL	Cost (€)	Justification
Travel & subsistence for	6 000	Travel & subsistence costs for users of SMEAR II.
trans-national access		
Other Travel	44 000	Participation in project meetings, support to national associated partners.
Other goods and services	30 000	Project meeting arrangements, Financial Audit
Total	80 000	

3 / CNR	Cost (€)	Justification
Other Travel	56 000	Participation in project meetings, support to national associated partners.
Other goods and services	40 000	Project meeting arrangements, Financial Audit
Total	96 000	

4/TROPOS	Cost (€)	Justification
Travel & subsistence for	10 400	Travel & subsistence costs for users of ACD-C/OGTAC.
trans-national access		
Other Travel	44 000	Participation in project meetings, support to national associated partners.
Other goods and services	40 000	Project meeting arrangements.
Total	94 400	

5/KIT	Cost (€)	Justification
Other Travel	15 000	Participation in project meetings.
Total	15 000	

6 / FZJ	Cost (€)	Justification
Travel & subsistence for	9 250	Travel & subsistence costs for users of SAPHIR-CiGas-FZJ.
trans-national access		
Other Travel	3 550	Participation in project meetings.
Total	12 800	

7 / CNRS	Cost (€)	Justification
Travel & subsistence for	2 400	Travel & subsistence costs for users of CARS-ASP-FR/Mobility AE.
trans-national access		
Other Travel	58 500	Participation in project meetings, including the LTPs travel budget, support
		to national associated partners.
Other goods and services	1 900	Consumables and utilities for provision of TNA to CARS-ASP-
_		FR/Mobility AE.
Total	62 800	

8 / IMT	Cost (€)	Justification
Other Travel	8 000	Participation in project meetings.
Total	8 000	

9 / INERIS	Cost (€)	Justification
Other Travel	18 000	Participation in project meetings.
Total	18 000	

10 / NILU	Cost (€)	Justification
Other Travel	30 000	Participation in project meetings, support to national associated partners.

15 000 45 000 Cost (€) 25 800 30 000 55 800 Cost (€) 6 400 10 000 16 400 Cost (€) 9 500 9 500 Cost (€)	Project meeting arrang Justification Participation in project meetings, support to national associated partners. Project meeting arrangements. Justification Travel & subsistence costs for users of JFJ. Participation in project meetings. Justification Participation in project meetings.
Cost (€) 25 800 30 000 55 800 Cost (€) 6 400 10 000 16 400 Cost (€) 9 500 9 500	Participation in project meetings, support to national associated partners. Project meeting arrangements. Justification Travel & subsistence costs for users of JFJ. Participation in project meetings.
25 800 30 000 55 800 Cost (€) 6 400 10 000 16 400 Cost (€) 9 500 9 500	Participation in project meetings, support to national associated partners. Project meeting arrangements. Justification Travel & subsistence costs for users of JFJ. Participation in project meetings.
30 000 55 800 Cost (€) 6 400 10 000 16 400 Cost (€) 9 500 9 500	Project meeting arrangements. Justification Travel & subsistence costs for users of JFJ. Participation in project meetings. Justification
55 800 Cost (€) 6 400 10 000 16 400 Cost (€) 9 500 9 500	Justification Travel & subsistence costs for users of JFJ. Participation in project meetings. Justification
Cost (€) 6 400 10 000 16 400 Cost (€) 9 500 9 500	Travel & subsistence costs for users of JFJ. Participation in project meetings. Justification
6 400 10 000 16 400 Cost (€) 9 500 9 500	Travel & subsistence costs for users of JFJ. Participation in project meetings. Justification
10 000 16 400 Cost (€) 9 500 9 500	Participation in project meetings. Justification
16 400 Cost (€) 9 500 9 500	Justification
16 400 Cost (€) 9 500 9 500	Justification
Cost (€) 9 500 9 500	
9 500 9 500	
9 500 9 500	
Cost (€)	
- (191 (#)	Justification
9 600	Travel & subsistence costs for users of Cabauw.
<i>7</i> 000	11avel & subsistence costs for users of Cabauw.
19 000	Participation in project meetings, including the LTP travel budget.
28 600	
	T come of
	Justification Destriction in a series of the
	Participation in project meetings.
/ /00	
Cost (€)	Justification
6 400	Participation in project meetings.
6 400	
Cost (€)	Justification
	Travel & subsistence costs for users of USRL.
10 700	Participation in project meetings.
19 700	
Cost (£)	Justification
	Participation in project meetings, including the LTP travel budget.
	1 and openion in project meetings, including the D11 thavel outget.
	Justification
	Participation in project meetings.
12 000	
Cost (€)	Justification
11 000	Participation in project meetings.
11 000	
Cost (f)	Justification
	Travel & subsistence costs for users of SBO.
1015	114.01 & bacolistelles costs for assets of SDO.
4 000	Participation in project meetings.
2 160	Costs for use of cable car for transport and access to SBO relating to TNA
	activities.
14 035	
Cost (f)	Justification
Cost (€)	JUSUNICAUON
18 000	Participation in project meetings, including the LTP travel budget.
	6 400 6 400 Cost (€) 9 000 10 700 19 700 Cost (€) 15 500 12 000 12 000 Cost (€) 11 000 11 000 Cost (€) 7 875 4 000

26 / FORTH	Cost (€)	Justification Associated with document Ref. Ares(2019)6815176 - 04/11/2019
Other Travel	8 000	Participation in project meetings.
Other goods and services	10 000	Project meeting arrangements.
Total	18 000	
AR / INDNIE DAG	G (0)	T (10)
27 / INRNE-BAS	Cost (€)	Justification LTD
Other Travel	16 000	Participation in project meetings, including the LTP travel budget.
Total	16 000	
28 / UCC	Cost (€)	Justification
Other Travel	17 000	Participation in project meetings.
Total	17 000	
20 / AU	C-4 (C)	T(*°°(*)
29 / AU	Cost (€)	Justification
Other Travel	5 000	Participation in project meetings.
Total	5 000	
30 / UPC	Cost (€)	Justification
Other Travel	13 400	Participation in project meetings, including the LTPs travel budget.
Total	13 400	
31 / CEAM	Cost (€)	Justification
Travel & subsistence for	3 600	Travel & subsistence costs for users of EUPHORE.
trans-national access		
Other Travel	5 200	Participation in project meetings, including the LTP travel budget.
Total	8 800	
		Y 100 1
32 / UVA	Cost (€)	Justification
Other Travel	5 300	Participation in project meetings, including the LTP travel budget.
Total	5 300	
33 / EULS	Cost (€)	Justification
Other Travel	10 000	Participation in project meetings.
Total	10 000	
34 UE	Cost (€)	Justification
Other Travel	10 500	Participation in project meetings.
Total	10 500	

List of acronyms

ACTRIS – Aerosol, Clouds and Trace Gases Research Infrastructure

ACTRIS IMP – ACTRIS Implementation Project

ACTRIS PPP – ACTRIS Preparatory Phase Project (H2020 grant 739530)

ACTRIS-2 – ACTRIS Integrated Activity project (H2020 grant 654109).

AeroCom – Aerosol Comparisons between Observations and Models

AERONET – Aerosol Robotic Network

ANAEE - European research infrastructure on Analysis and Experimentation on Ecosystems

AOD - Aerosol optical depth

CAMS – Copernicus Atmosphere Monitoring Service

CF – Central Facility

CLRTAP – Convention on Long-range Transboundary Air Pollution

DC - Data Centre

ECMWF – European Centre for Medium-Range Weather Forecasts

EISCAT-3D – European Incoherent Scatter Scientific Association ESFRI project

EIT Climate-KIC – European Institute of Innovation and Technology, Climate Knowledge and Innovation Community

eLTER – European Long-Term Ecosystem Research infrasturcture

EMEP – European Monitoring and Evaluation Programme **ENVRI-FAIR** – Environmental Research Infrastructures building Fair services Accessible for Society, Innovation and

EOSC – European Open Science Cloud

ERA – European Research Area

ERDF – European regional development funds

ERIC – European Research Infrastructure Consortium

ESA – European Space Agency

ESIF – European structural and investment funds

Associated with document Ref. Ares(2019)6815176 - 04/11/2019

EUMETSAT – European Organisation for the Exploitation of Meteorological Satellites

EUROCHAMP-2020 – Integration of European Simulation

Chambers for Investigating Atmospheric Processes -

Towards 2020 and beyond (H2020 grant 730997)

GAW – Global Atmosphere Watch

GCOS - Global Climate Observing System

GEO – Group on Earth Observations

GEOSS – Global Earth Observation System of Systems

HO - Head Office

IAC – Interim ACTRIS Council

IAGOS – In-service Aircraft for a Global Observing System

ICOS – Integrated Carbon Observation System

IPCC - Intergovernmental Panel on Climate Change

KPI – Key Performance Indicator

NASA – National Aeronautics and Space Administration

NDACC - Network for the Detection of Atmospheric

Composition Change **NF** – National Facility

QA – Quality Assurance

QC - Quality Control

RI – Research Infrastructure

RPF - Regional Partner Facility

RPO – Research performing organisation

SAMU - Service and Access Management Unit

SIAB – Scientific and Implementation Advisory Board

SIOS – Svalbard Integrated Earth Observing System

SME - Small or medium-sized enterprise

TC – Topical Centre

UNFCCC – United Nations Framework Convention on Climate Change

UNECE – United Nations Economic Commission for Europe

VOC – Volatile organic compounds

WIGOS – Integrated Global Observing System

WMO – World Meteorological Organization

WMO-WIS – WMO World Information System

4.1. Participants (applicants)

4.1.1 Ilmatieteen laitos (FMI)

Ilmatieteen Laitos, the Finnish Meteorological Institute (FMI), is a research and service agency reporting to the Finnish Ministry of Transport and Communications. The main objective of the Finnish Meteorological Institute is to provide the Finnish nation with the best possible information about the atmosphere above and around Finland, for ensuring public safety relating to atmospheric, marine and airborne hazards and for satisfying requirements for specialized meteorological products. FMI produces high-quality observational data and research knowledge about the atmosphere and marine, combining its know-how into weather, climate, air-quality and security related services to the benefit of the society and environment. FMI, together with University of Helsinki, is the hosting organization for ICOS ERIC, leads the setting-up of the ESFRI ACTRIS research infrastructure in Europe and is active partner in many research infrastructure and e-infrastructure projects and initiatives. In addition, part of the ICOS Atmospheric Thematic Centre ATC is operated in FMI and ACTRIS CloudDataNet Data Centre component will be located in FMI. FMI runs its own super-computing environment and collaborates closely with national, Nordic, and European super-computing centers and operational services such as ECWMF and international organizations such as WMO.

Role in the project

FMI is coordinating the ACTRIS Preparatory Phase Project. FMI is leading the WP1 (Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP10 (ACTRIS communication and public relations), WP11 (Project management and ethics) and WP12 (Ethics requirements). FMI has also major contributions to WP2 (Implementation of a sustainable ACTRIS organization), and WP8 (Consolidating ACTRIS's position in the European and international research landscapes). Furthermore, FMI has additional contributions to other WPs: WP3 (Strategy for enhancing ACTRIS relevance and impact) WP4 (Implementation and test operation of the Central Facilities), WP5 (Facilitating the harmonized operation of the National Facilities).

Principal personnel involved

Dr. Sanna Sorvari Sundet (female), ACTRIS IMP Project Coordinator, is a Research Manager at FMI. She has over 25 years of experience in climate and environmental change research and she has broad experience in coordination, initiation and implementation of international, European and national research and research infrastructure activities. In recent years she has worked on establishing ESFRI Environmental Research Infrastructures at the European and national level, especially Sorvari Sundet has coordinated ACTRIS PPP, lead the ESFRI roadmap process for ACTRIS, and participated in developing long-term sustainability strategy for ACTRIS (ACTRIS-13 and ACTRIS-2). Sorvari Sundet has also worked in setting-up ICOS RI and ICOS ERIC as a member of interim ICOS Head office, Finnish ICOS ERIC General Assembly delegate and chair of ICOS Sweden Board. Sorvari Sundet is a chair of the European Environmental Research Infrastructure Board (BEERi) that organizes the collaborative strategic cluster work of Environmental RIs at the European level. She has been a WP leader or key contributor in many EC-funded research infrastructure projects, e.g. in ENVRI, ENVRIplus, ENVRIFAIR, COOPEUS, and COOP+ -projects. Sorvari Sundet has also contributed the research data activities by participating in EC-funded EOSCpilot, acting as a co-chair of the OECD Expert Group on International Data Infrastructures, Scientific Steering Committee member of ICSU World Data Systems. Currently she is coordinating ACTRIS in its implementation work.

Dr. Niku Kivekäs (male), proposed ACTRIS IMP Project Manager, has been working since 2014 as project manager in ACTRIS ESFRI process and in the H-2020 project ACTRIS PPP for the coordination of ACTRIS activities at the European level. He has obtained professional project manager training. He has 14 years of expertise in aerosol- and cloud research. He has obtained his PhD in Physics in 2010 at University of Helsinki, Finland, and he has been working at FMI, Finland and at Lund University, Sweden. His research has been focused on analysing long data sets of aerosol measurements from around globe. He has published 30 peer- reviewed scientific papers. Currently on paternity leave until September 2020.

Dr. Mikhail Paramonov (male), interim ACTRIS IMP Project Manager, has been working in ACTRIS since June 2019. He has obtained his PhD from the University of Helsinki in 2015, and his field of expertise is aerosol-cloud-

climate interactions. He has worked as a Post-Doctoral Researc at SETH Chrith Corners of West Activities, as well as a Marie Skłodowska-Curie Individual Fellow. He has extensive background in pedagogical activities, as well as leadership and project management training. At the University of Helsinki he has been the main organiser of international intensive field courses for several years and for 12 months acted as a substitute coordinator of the Atmospheric Master's Degree Programme. He has published 6 and co-authored 6 peer-reviewed scientific publications.

MSc. Giulia Saponaro (female) is an electronic engineer currently working on her PhD thesis regarding the application of satellite data for the detection of aerosols, clouds, and their interaction. She co-authored 7 peer-reviewed papers, and she has been involved in the international projects such as BACCHUS and TROPOMI. Giulia is interested in scientific public outreach, information design and the visualization of scientific topics. Since 2018 she has been part of ACTRIS Head Office and responsible for ACTRIS communications.

Dr Edith Rodriguez (Female) is a senior researcher at FMI with experience within remote sensing both passive and active instrumentation. She has been involved in different European projects funded by EU and ESA, working on the development of aerosol retrievals using satellite instruments and the synergy with ground-based measurements. She has published 28 per review publications and participated in more than 100 scientific conferences. She has also experience in strategic management project for both research and international cooperation. Since 2018 she is a project manager in ACTRIS Head office, working with the implementation of the ACTRIS ERIC.

Dr. Ewan O'Connor (male) is a Tenure-track Professor and develops and uses new radar and lidar techniques to retrieve cloud, aerosol and turbulent parameters to understand cloud processes, and for the evaluation and improvement of numerical forecast and climate models. He is responsible for the design and implementation of the Finnish Doppler lidar network, and the ACTRIS/Cloudnet site at Pallas-Sodankyla. He coordinates Cloudnet, which is now responsible for the cloud remote-sensing segment of the ACTRIS Data Centre. He has been involved in several international research projects as WP leader, and was chair of the working group on Doppler lidar within the EU COST Action TOPROF. He has published 60+ papers, and is currently supervisor of two postdoctoral researchers, and supervisor or co-supervisor of five postgraduate students.

Dr. Simo Tukiainen (male), He has 10+ years of experience in scientific computing, radiative transfer modeling and atmospheric retrievals. He has developed retrieval methods for the satellite-based UV-visible limb measurements, especially for GOMOS on Envisat and OSIRIS on Odin, and for ground-based FTIR measurements. Since May 2017, Dr. Tukiainen has worked in the ACTRIS RI project, developing one of the Data Centre Units involved in cloud remote sensing. His duties include, e.g., revision of the cloud remote sensing data processing, maintenance of the meta-database and web-development.

MA. Anna Salonen (female) Project Service Manager leads a Project Specialist group providing financial and administrative services for Co-funded projects at FMI. She has been working in several coordination and research infrastructure projects in FP7 and H2020 as well as in other EU funding instruments.

Research Prof. Hannele Hakola (female) is a research professor and the head of the Atmospheric Composition Research unit. Her fields of expertise are VOCs, their emissions, atmospheric concentrations, and reactions, and she has been responsible for background air quality measurements in Finland for years and she is a Finnish participant and Head of Delegation to EMEP Steering Body. She has published 102 peer-reviewed articles and her h-index is 35 (WoS, 6.3 2019). She is a team leader in the *Centre of Excellence in Atmospheric Science - From Molecular and Biological processes to The Global Climate* (2014-2019) nominated by the Academy of Finland and led by Academician Markku Kulmala (UH). She is also a supervisor in the guidance group of researchers at the University of Helsinki (VOCs in the atmosphere) and she has supervised several PhD students.

Dr. Antti Hyvärinen (male) is the head of Atmospheric Aerosols Group at the FMI. The group of more than 25 postdoctoral and PhD students studies the interaction of aerosol particles with the climate in various national and international locations around the world, including the Finnish Lapland, India and Russia. Dr. Hyvärinen has been responsible for setting up aerosol- and cloud in-situ measurements for long term observations in these settings and is currently also responsible for FMI's aerosol measurements in Pallastunturi and Utö, planned as ACTRIS National Facility stations. He has published 67 peer reviewed publications with more than 1700 citations (h-index 24) of

this work. Dr. Hyvärinen also has a strong background American and Central Asia.

Relevant publications

- 1. Asmi, A., M. Brus, and S. Sorvari (2017). Community-Driven Efforts for Joint Development of Environmental Research Infrastructures. Chabbi A. & Loescher HW (Eds.). Terrestrial Ecosystem Research Infrastructures: Challenges and Opportunities, 534 pages. ISBN 9781498751315 CAT# K27248
- 2. A. Arneth, S.P. Harrison, K. Tsigaridis, S. Menon, P.J. Bartlein, H. Feichter, A. Korhola, M. Kulmala, D. O'Donell, G. Schurgers, S. Sorvari, T. Vesala and S. Zaehle. Terrestrial biogeochemical feedbacks in the climate system: from past to future. Nature Geoscience 3, 525-532, doi: 10.1038/ngeo905, 2010.
- Hoeger C. C., A. Werner, C. Plass-Duelmer, S. Reimann, E. Eckart, R. Steinbrecher, J. Aalto, J. Arduini, N. Bonnaire, J. N. Cape, A. Colomb, R. Connolly, J. Diskova, P. Dumitrean, C. Ehlers, V. Gros, H. Hakola, M. Hill, J. R. Hopkins, J. Jäger, R. Junek, M. K. Kajos, D. Klemp, M. Leuchner, A. C. Lewis, N. Locoge, M. Maione, D. Martin, K. Michl, E. Nemitz, S. O'Doherty, P. Pérez Ballesta, T. M. Ruuskanen, S. Sauvage, N. Schmidbauer, T. G. Spain, E. Straube, M. Vana, M. K. Vollmer, R. Wegener, and A. Wenger, 2015. ACTRIS non-methane hydrocarbon intercomparison experiment in Europe to support WMO-GAW and EMEP observation networks. Atmos. Meas. Tech., 8, 2715-2736, 2015
- 4. M. Collaud Coen, E. Andrews, A. Asmi, U. Baltensperger, N. Bukowiecki, D. Day, M. Fiebig, A. M. Fjaeraa, H. Flentje, A. Hyvärinen, A. Jefferson, S. G. Jennings, G. Kouvarakis, H. Lihavainen, C. Lund Myhre, W. C. Malm, N. Mihapopoulos, J. V. Molenar, C. O'Dowd, J. A. Ogren, B. A. Schichtel, P. Sheridan, A. Virkkula, E. Weingartner, R. Weller, and P. Laj, Aerosol decadal trends Part 1: In-situ optical measurements at GAW and IMPROVE stations Atmos. Chem. Phys., Atmos. Chem. Phys., 13, 869-894, 2013.
- 5. Raatikainen, T., D. Brus, A.-P. Hyvarinen, J. Svensson, E. Asmi, and H. Lihavainen (2015), Black carbon concentrations and mixing state in the Finnish Arctic, Atmospheric Chemistry and Physics, 15(17), 10057-10070, doi:10.5194/acp-15-10057-2015.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530, coordinator.
- 2. ACTRIS-2 (Aerosols, Clouds and Trace gases Research Infrastructure 2), 2015-2019, Grant agreement no 654109
- 3. ENVRI-FAIR, 2019-2022, Grant agreement no 824868 as continuation of ENVRIPLUS (Environmental Research Infrastructures Providing Shared Solutions for Science and Society), 2015-2019, Grant agreement n. 654182, and ENVRI (Common Operations for Environmental Research Infrastructures), 2011 2015, Grant agreement no 283465.
- 4. COOP+, 2015- 2019, Grant agreement no 654131, is continuation of COOPEUS (Building a Framework for a Sustainable, Transatlantic Cooperation in the Field of Environmental Research Infrastructure), 2012 -2014, Grant agreement no 312118.
- 5. EOSC-NORDIC (European Open Science Cloud-NORDIC), 2019-2021, Grant agreement no 857652 and EOSC-PILOT (European Open Science Cloud—PILOT), 2017-2019, Grant agreement no 739563.

Significant infrastructures

FMI hosts Pallas Atmosphere-Ecosystem Supersite in Finnish Lapland above the Arctic Circle, which is part of WMOs Global Atmosphere Watch (GAW) programme. The station is also a member of other networks (e.g. AMAP, EMEP, ICOS, ACTRIS, IASOA). Atmospheric composition and aerosol parameters have been measured at Pallas since 1994.

The second significant infrastructure is the Utö Atmospheric and Marine Research Station, which is located on Utö Island at the outer edge of the Finnish Archipelago Sea. The Finnish Meteorological Institute started meteorological observations on the island in 1881, and atmospheric trace gas and aerosol measurements as member of the EMEP-network in 1980. Utö is also a member of the HELCOM marine monitoring network. Recently, the measurement station became a founding member of the European ICOS network. Currently, the marine component is developed in co-operation with Finnish Environment institute.

As part of its research remit, FMI performs world-leading experimental research on aerosols, clouds and aerosol precursors as well as greenhouse gases in Finland and in key places around the globe (e.g. in Arctic and Antarctic, Himalayas in India, in northern Siberia in Russia). FMI is a member of EARLINET and operates national

ceilometer and Doppler Lidar networks and a research Closs Randaria to Mithrenautre sensing edisor Nation 1/2019 complemented with airplane and UAV—observation systems.

FMI will be the main contributor to ACTRIS Head Office in Helsinki. Furthermore, FMI will contribute to the ACTRIS Data Centre by hosting the CloudNet component of the Data Centre, focusing on observations of cloud parameters. FMI is planning to include the following observational stations to ACTRIS: Pallas, Sodankylä, Utö, Puijo, Marambio (Antarctica), and possibly station(s) from Russian Arctic.

4.1.2 Helsingin yliopisto (UHEL)

Helsingin yliopisto (University of Helsinki) is a European research university with over 34,000 students and 8,000 employees. UHEL is the largest and most versatile university in Finland and ranks among the top 100 universities worldwide. It is a research university with many Academy of Finland designated National Centres of Excellence (10 for 2012-2017, 11 for 2014-2019). The Institute for Atmospheric and Earth System Research (INAR) is a multiand interdisciplinary research unit based in physics, chemistry, meteorology, forest sciences, environmental sciences and social sciences at UHEL. INAR (formerly for the most part the Division of Atmospheric Sciences, Department of Physics) has over 30-year tradition in atmospheric research and research coordination, including coordination of several Framework Programme projects. In addition to ACTRIS, INAR is strongly connected to many other major European and international research and research infrastructure initiatives such as ICOS, ANAEE, RDA, EUDAT and LTER.

Role in the project

UHEL is the co-coordinator of ACTRIS-IMP. UHEL will have a significant role in the project regarding the ACTRIS legal framework, risk management, and strategic development of ACTRIS and ACTRIS societal impacts. UHEL will lead the work packages WP2 (Towards sustainable ACTRIS organization) and WP3 (Strategy for enhancing ACTRIS relevance and impact). UHEL will significantly contribute to WP1 (Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP4 (Implementation and test operation of the Central Facilities), WP5 (Facilitating the harmonized operation of the National Facilities), WP8 (Consolidating ACTRIS's position in the European and international research landscape), WP9 (Positioning ACTRIS in the European innovation ecosystem), WP11 (Project management and ethics) and WP12 (Ethics requirements). In addition, UHEL will actively contribute to, WP6 (Implementation of the user access to ACTRIS services) and WP10 (ACTRIS communication and public relations).

Principal personnel involved

Prof. Tuukka Petäjä (male):

Prof. Tuukka Petäjä has almost 20 years of research experience related to atmospheric sciences. He leads the experimental aerosol group; educated 23 PhDs and currently supervising 10 students; has published over 330 peer reviewed articles (9 in Science, 8 in Nature), total citations 14750, h-factor of 59. He is highly cited scientist (2014, Thompson Reuters). He received FAAR Award in excellent aerosol science and Vaisala Award 2013 for his work on combining state-of-the-art science and instrument development; Receiver of Science and Technology in Society Future Leader Award, New York Academy of Sciences, PI of Biogenic Aerosols – Effects on Clouds and Climate (BAECC), multiplatform research campaign to elucidate the role of secondary aerosols to clouds, supported by US Department of Energy. Science director of Pan Eurasian Experiment (PEEX), national delegate to SAON board, board member of PACES initiative, academician in International Eurasian Academy of Sciences (IEAS). Managerial expertise: head of technical staff of Kumpula science campus, head of Värriö sub-arctic research station in Lapland, Head of SMEAR atmospheric observations. He has participated practical organization of 12 EU projects, Coordinator of iCUPE. UHEL PI in ACTRIS2 H2020 infrastructure project, which is constructing European-wide harmonized observations on atmospheric trace gases, aerosol particles and clouds. Petäjä is a team leader in Finnish Center of Excellence of Academy of Finland on atmospheric sciences responsible for long-term, comprehensive observations in Finland and developing observational capacity in Russia and China.

Prof. Markku Kulmala (male): Director of the Division of Atmospheric Sciences at the Department of Physics, and professor at the University of Helsinki since 1996. Kulmala also acts as coordinator for the Centre of Excellence, appointed by the Academy of Finland first time in 2002 and for Nordic Center of Excellence, appointed by Nordforsk ("Cryosphere-atmosphere interactions in a changing Arctic climate" (CRAICC)), which is the largest joint Nordic research and innovation initiative to date, aiming to strengthen research and innovation regarding climate change issues in the Nordic and high-latitude Regions. Prof. Kulmala together with Prof. Pertti Hari is the primary inventor of the SMEAR (Stations Measuring Ecosystem Atmospheric Relations) concept. According to the ISI Web of Knowledge, M. Kulmala is in the first place in the Citation Rankings in Geosciences (since 1.5.2011). His H-factor is 105 (> 47 000 citations). Prof. Kulmala has received several international awards such as the Smoluchovski Award (1997), the International Aerosol Fellow Award (2004), the Wilhelm Bjerkenes medals (2007), Fuchs Memorial Award (2010) and Litke Medal (2015). In 2015 he was acknowledged by a membership of the CASAD, Chinese Academy of Sciences, (CAS). Kulmala together with the Prof. Sergej Zilitinkevich is the

Dr. Eija Juurola (female): Research Coordinator in ACTRIS Interim Head Office, in University of Helsinki from March 2019. She has more than 7 years' experience on research infrastructure construction, governance, development and management of operations. She was working in ICOS RI 2010-2018 both at national and European level. She has led the financial negotiations during the preparatory and interim phase of ICOS RI and contributed for building the financial, governance and operational structure of ICOS RI. As the Head of Operations, she was responsible e.g. for annual planning and reporting and budgeting, operational management of the ICOS station network, liaisons with new members, and coordination of Central Facilities and development of the RI. Juurola completed her PhD (Forestry) in 2005 on forest ecophysiology. After her PhD, she worked as a researcher at the Department of Forest Science and Department of Physics, University of Helsinki, specialized on photosynthesis and seasonality of trees. During her scientific career she has co-authored more than 20 articles in peer-reviewed scientific journals; more than 40 congress proceedings, abstracts or scientific reports. She has been a supervisor or a co-supervisor for 5 MSc thesis and 6 PhD thesis. In addition to her other duties, in 2006-2009 she worked also as a secretary of the Finnish Society of Forest Science.

Dr. Pirjo Kontkanen (female): Doctor of Laws, is a Legal Counsel at the University of Helsinki and works at the university central administration. She is expert on intellectual property rights, especially copyrights, and has over ten years of experience about legal matters and negotiations concerning university research projects and EU research funding. She has been involved in several ESFRI projects, like EATRIS, CLARIN, EPOS, AnaEE and especially ICOS helping to draft and negotiate all the relevant documents and agreements for the ICOS ERIC and ICOS RI. She is the legal counsel of ICOS ERIC.

Dr. Silja Häme (female) has over ten years of experience in aerosol and climate change research. With a renowned Fulbright scholarship, she performed essential part of her doctorate research at Columbia University in the city of New York during 2012-2014. She obtained her PhD at the Department of Physics, University of Helsinki in 2015. In addition to her background as an aerosol physicist, she is experienced in administrative and research politics related reporting and planning, and development tasks. She currently acts as the Coordinator of ACTRIS-Finland national activities and participates in ACTRIS preparations as a project manager in the ACTRIS PPP Coordination Office (2016-). Previously to ACTRIS, she has worked for the European research infrastructure AnaEE (Analysis and Experimentation on Ecosystems); project manager for AnaEE-Finland and member of EU-FP7-AnaEE Preparatory Phase Project working group developing long-term legal, governance and funding framework for the research infrastructure.

Dr. Paolo Laj (male) holds a PhD in Physical Sciences, in Atmospheric Physics and Chemistry. His research thematic deals with the composition of the free troposphere and with the metrology of aerosol particles. He published more than 120 publications since 1990 in the field of atmospheric aerosols processes and variability, clouds physics and chemistry, precipitation chemistry, glaciochemistry with h factor of 43. He is the winner of the 2002 CNRS Bronze medal award and obtained the Hägen-Smit Prize in 2014. He is currently Professor at UHEL, division of Atmospheric Science, working part-time. As a scientific manager, at European level, he is actually the scientific co-coordinator of the Cluster Project ENVRIPlus, and of ACTRIS-2, and has been co-coordinator of ACTRIS I3 (FP7) and coordinator of EUSAAR (FP6). Paolo Laj also has different responsibilities in international instances: member of the Scientific Committee of the initiative called "Sixth Global Environment Outlook", chairman of the SAG commission Global Atmosphere Watch OMM from 2015, member of the AOPC (Atmosphere Ocean Panel for Climate) of GCOS (Global Climate Observing System). He is also a scientific expert for Italy (National evaluation commission of scientific research) and Switzerland (for international cooperation). Dr. Paolo Laj works 25 % at UHEL and 75 % at UGA, France. At UHEL Dr. Paolo Laj will be involved in WP3, WP8 and WP10 of ACTRIS IMP.

Dr. Tuija Jokinen (female): Head of ACTRIS Central Facility UHEL Unit (Centre for Reactive Trace Gases In Situ Measurement). She obtained her M.Sc. in chemistry and did her Ph.D. in physics (2015) receiving a dissertation award for her multidisciplinary thesis conducted with a high level of international collaboration. Before graduating she worked as a visiting scientist, teaching mass spectrometric methods for gas phase aerosol precursor studies, at the TROPOS institute in Germany. She was a postdoctoral fellow at the University of California, Irvine (UCI) chemistry department working with novel mass spectrometric methods and developing new analysis methods for ambient low volatility molecules. She has years of experience in experimental gas phase aerosol precursor

molecules and cluster studies and related method development Arms where the comparison with large collaborations such as the CLOUD experiment at CERN, CRAICC campaign at Station Nord in Greenland and FINNARP2014-expedition to Antarctica. She has first author publications in high impact journals PNAS and Angwandte Chemie and on top of that 4 articles in Nature, 1 in Science and 1 in Nature Communication.

Assoc. Prof. Katrianne Lehtipalo (female): ACTRIS tenure-track professor at UHEL and Finnish Meteorological Institute and leader of Atmospheric Aerosols sub-group at INAR. She received her PhD in aerosol physics in 2011. After that she has worked as post-doctoral researcher and MSCA fellow at Paul Scherrer Institute, Switzerland and University of Helsinki. She earned the title of Docent in 2017. Her research concentrates on atmospheric aerosol measurements and new particle formation, using both laboratory experiments and field studies. She has participated in several large international research projects and numerous measurement campaigns. Number of peer-reviewed publications: 72 out of which 7 in Nature/Science, H-index 26.

Relevant publications

- 1. Kulmala, M., Asmi, A., Lappalainen, H. K., et al.: General overview: European Integrated project on Aerosol Cloud Climate and Air Quality interactions (EUCAARI) integrating aerosol research from nano to global scales, Atmos. Chem. Phys. 11, 13061–13143, 2011.
- Kulmala, M., Lappalainen, H. K., Petäjä, T., Kurten, T., Kerminen, V.-M., Viisanen, Y., Hari, P., Sorvari, S., Bäck, J., Bondur, V., Kasimov, N., Kotlyakov, V., Matvienko, G., Baklanov, A., Guo, H. D., Ding, A., Hansson, H.-C., and Zilitinkevich, S.: Introduction: The Pan-Eurasian Experiment (PEEX) multidisciplinary, multiscale and multicomponent research and capacity-building initiative, Atmos. Chem. Phys. 15, 13085–13096, 2015.
- 3. Hari, P., Petäjä, T., Bäck, J., Kerminen, V.-M., Lappalainen, H. K., Vihma, T., Laurila, T., Viisanen, Y., Vesala, T., and Kulmala, M.: Conceptual design of a measurement network of the global change, Atmos. Chem. Phys. 16, 1017–1028, 2016.
- 4. Petäjä, T., O'Connor, E.J., Moisseev, D., Sinclair, V.A., Manninen, A.J., Väänänen, R., von Lerber, A., Thornton, J.A., Nicoll, K., Petersen, W., Chandrasekar, V., Smith, J.N., Winkler, P.M., Krüger, O., Hakola, H., Timonen, H., Brus, D., Laurila, T., Asmi, E., Riekkola, M.-L., Mona, L., Massoli, P., Engelmann, R., Komppula, M., Wang, J., Kuang, C., Bäck, J., Virtanen, A., Levula, J., Ritsche, M. and Hickmon, N.: BAECC, A field campaign to elucidate the impact of Biogenic Aerosols on Clouds and Climate, Bull. Am. Met. Soc. 97, 1909–1928, 2016.
- 5. Pandolfi, M., Alados-Arboledas, L., Alastuey, A., Andrade, M., Angelov, C., Artiñano, B., Backman, J., Baltensperger, U., Bonasoni, P., Bukowiecki, N., Collaud Coen, M., Conil, S., Crenn, V., Dudoitis, V., Ealo, M., Eleftheriadis, K., Favez, O., Fetfatzis, P., Fiebig, M., Flentje, H., Ginot, P., Gysel, M., Henzing, B., Hoffer, A., Holubova Smejkalova, A., Kalapov, I., Kalivitis, N., Kouvarakis, G., Kristensson, A., Kulmala, M., Lihavainen, H., Lunder, C., Luoma, K., Lyamani, H., Marinoni, A., Mihalopoulos, N., Moerman, M., Nicolas, J., O'Dowd, C., Petäjä, T., Petit, J.-E., Pichon, J.M., Prokopciuk, N., Putaud, J.-P., Rodriguez, S., Sciare, J., Sellegri, K., Swietlicki, E., Titos, G., Tuch, T., Tunved, P., Ulevicius, V., Vaishya, A., Vana, M., Virkkula, A., Vratolis, S., Weingartner, E., Wiedensohler, A. and Laj, P.: A European aerosol phenology-6: scattering characteristics of atmospheric aerosol particles from 28 ACTRIS stations, Atmos. Chem. Phys. 18, 7877–7911, 2018.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530, co-coordinator.
- 2. ACTRIS-2 (Aerosols, Clouds and Trace gases Research Infrastructure 2), 2015-2019, Grant agreement n. 654109.
- 3. ENVRIPLUS (Environmental Research Infrastructures Providing Shared Solutions for Science and Society), 2015-2019, Grant agreement n. 654182.
- 4. ACTRIS (Aerosol, Clouds, and Trace gases Research Infrastructure network), 2011-2015, Grant agreement n. 262254.
- 5. Academy of Finland project Centre of Excellence in Atmospheric Science From Molecular and Biological processes to The Global Climate (2014-2019), Grant agreement n. 272041.

Significant infrastructures

UHEL operates three extensive multidisciplinary SMEAR (Stations for Measuring Earth surface and Atmosphere

Relations) observation sites in Finland. They cover regions from the application of the Bartion Seast Gor 4/11/2019 in Southern Finland. These observation sites are part of ACTRIS-Finland, and connected to ICOS, ANAEE, LTER, GAW and other international infrastructures and initiatives. In addition to the SMEAR I-III stations, ACTRIS-Finland facilities hosted by UHEL include a state-of-the-art aerosol, cluster and trace gas laboratory. UHEL will contribute to setting up the ACTRIS Head Office in Helsinki. In addition to this, UHEL will significantly contribute to two ACTRIS Topical Centres by hosting a Unit in both them; ACTRIS Centre for Aerosol In Situ Measurements (CAIS) and ACTRIS Centre for Reactive Trace Gases In Situ Measurements (CiGas). UHEL CAIS Unit will provide instrument-specific calibration services for sub 10 nm aerosol, clusters and ions, and training. UHEL CiGas Unit will provide instrument and methodology development, cluster measurements, and training.

Consiglio Nazionale delle Ricerche, the National Research Council of Italy, is the largest public research performing organization in Italy, reporting directly to the Ministry of the Education, University and Research. Its duty is to carry out, promote, spread, transfer and improve research activities in the main sectors of knowledge growth and of its applications for the scientific, technological, economic and social development. It is organized in seven Departments coordinating the activities of more than 100 Institutes in the main fields of knowledge, from life sciences to engineering, from earth system science to humanities, and managing the research infrastructures.

The CNR Department of Earth System Science and Environmental Technologies (CNR-DTA, www.dta.cnr.it) is one of them. Its mission is to support and coordinate the research activities carried out by its 13 associated Institutes dealing with environmental sciences, including climate change, and the development of innovative monitoring technologies. The activities of the Department of Earth System Science and Environmental Technologies (DTA) are carried out by a staff of approximately 1100 people supported by approximately other 800 collaborators in the research area.

In the consortium two institutes of CNR - DTA are involved: IMAA and ISAC.

The Institute of Methodologies for Environmental Analysis (IMAA) research activities involve more than 150 researchers and make use of laboratories and facilities of international relevance in the field of the Earth Observation. The IMAA scientific mission is the study of the atmosphere and of the Earth's surface by using remote sensing techniques, environmental and geophysical monitoring, the evaluation of the impacts of the anthropogenic activities system and the implementation of optimising models to assess the best allocation of resources. At IMAA is operative a large atmospheric observatory CIAO that will cover, as National Facilities, all the ACTRIS constituents (aerosol, clouds and trace gases). IMAA will host 3 Central Facilities units, in particular, SAMU in Head Office, AHL in CARS and ARES in DC.

The Institute of Atmospheric Sciences and Climate (ISAC) employs 127 staff members to conducts pure and applied research on atmospheric and climate sciences and to produce results directly transferable to the society also beyond the national borders. The headquarter is located in Bologna, and other six territorial units are located around the country. ISAC is organized into three research areas: Observations and Modelling for Meteorology and Climate, Atmospheric Composition, Climate Forcers and Air quality, Impacts on Environment, Health, Cultural Heritage. Different sites distributed from north to south Italy will contribute as National Facilities.

CNR represents the interest of the Italian Research Performing Organisations (RPO) participating in the national ACTRIS-IT consortium. These RPOs will be associated partners to the project and are the following: Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), Università degli Studi di Napoli "Federico II" (UNINA), Università degli Studi dell'Aquila (UNIVAQ), Università del Salento (UNISALENTO), Università degli Studi di Urbino "Carlo Bo" (UNIURB), Istituto Nazionale di Fisica Nucleare (INFN).

Role in the project

CNR will coordinate the Work packages WP6 (Implementation of the user access to ACTRIS services) and WP9 (Positioning ACTRIS in the European Innovation Ecosystem) and it will actively contribute to the TNA pilot implementation within the WP7 (Pilots of trans-national access to support the implementation of ACTRIS services). CNR will strongly contribute to WP2 (Implementation of a sustainable ACTRIS organization) and WP5(Facilitating the harmonized operation of the National Facilities) with a leading role for the task 2.3 and task 5.3. CNR will also contribute to the WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP3 (Strategy for enhancing ACTRIS relevance and impact), WP4(Implementation and test operation of the Central Facilities), WP8(Consolidating ACTRIS's position in the European and international research landscape), and WP10(ACTRIS communication and public relations). A TNA pilot action is foreseen to offer the Single Calculus Chain use to external users for fostering international cooperation and standardization on the processing of aerosol lidar data.

Principal personnel involved

Dr. Gelsomina Pappalardo (**female**) is the chief scientist of the Head of Lidar Group and of the CNR-IMAA Atmospheric Observatory (CIAO). She has over 25 years of research experience in the field of atmospheric studies with lidar techniques. She has authored or co-authored more than 70 papers in the peer-reviewed literature. Dr. Gelsomina Pappalardo participated as PI in several national and international projects. She is the coordinator of the H2020 ACTRIS-2 Project. Dr. Gelsomina Pappalardo is co-chair of GALION and member of the Scientific Advisory Group for Aerosols of the Global Atmosphere Watch (GAW) aerosol program of WMO. Dr. Pappalardo is member of the Executive Board of ESFRI and member of the ESFRI Strategy Working Group for Environmental Science.

Dr. Carmela Cornacchia (female) is researcher at CNR-IMAA. She has experience in Earth Observation methodologies and technologies for atmospheric study. She is involved in technology transfer activities at IMAA, working at the implementation of the triple helix model for spreading innovation in regional context and enhancing collaboration between researchers, industrial partners and public authorities. She is promoting the activities of the regional technological cluster on Earth Observation, as well as fostering the participation of CNR to the regional clusters on the 5 priority areas of the regional Smart Specialization Strategy. Since 2008, she has been the head of R&D office at CNR-IMAA and she is charge of coordinating and managing several RTD projects at regional, national and EU level in Earth Observation, Environmental and Smart Cities related issues. She has a leading role to define the long term financial sustainability activities of ACTRIS in ACTRIS PPP.

Dr. Giuseppe Gargano (male) is a qualified engineer with proven history of working in the delivery of IT platforms and business intelligence solutions for the management of various business processes. He has a strong experience as business consultant for the definition and reporting of key performance metrics and business insights on customer usage, spend management, cost saving initiatives, finance and operations. As technologist at CNR-IMAA, he supports the preparation of the ACTRIS contributing to the activities for the identification of the suitable funding model and financial rules for the sustainability of the research infrastructure.

Dr. Lucia Mona (female): is a researcher at CNR-IMAA. Dr Mona has a researcher profile that combines expertise on developments of lidar systems, instruments integration/combination, analysis methodologies, exploitation of state-of-the-art measurements for different application fields and integrated studies with models. She is working on exploitation of EARLINET (European Aerosol Research Lidar NETwork) database for comparison/integration with other ground-based and satellite measurements and models and model evaluation/integration studies for peculiar long-range transport cases and for multi-year observation. She is leading the AEROSAT (International Satellite Aerosol Science Network) Working Group on Aerosol Typing. She is member of the Regional Steering Group of the SDS-WAS (Sand and Dust Storm Warning Advisory and Assessment System) of the WMO.

Dr. Angela Marinoni (female) has degree and PhD in Environmental Science, with experience on chemistry and photochemistry of aerosol, cloud and precipitations in different environments. She is working since 2005 at CNR-ISAC, where she gained experience on integration of observations concerning chemical, physical and optical aerosol properties, especially in mountain and remote areas. She is responsible for the measures of atmospheric aerosol at the GAW global stations of Monte Cimone (Northern Apennines, 2165 m), Nepal Climate Observatory-Pyramid (Himalayas, 5079 m asl), WMO/GAW regional station of Capo Granitola and in the framework of EUSAAR and ACTRIS (1 and 2) projects. She is author or co-author of about 60 papers in ISI journals (h-index 27).

Dr. Rosa Maria Petracca Altieri (female) Project manager with more than 15 years' experience in managing international activities, internationalization programs and technology transfer plans for universities, research centers and industries in Italy and abroad. As technologist at the National Research Council of Italy (CNR) - Institute of Methodologies for Environmental Analysis, she supports the preparation of the ACTRIS, contributing to the definition of the user policy, the access policy and the access management of the research infrastructure.

Relevant publications

1. Pappalardo, G., Amodeo, A., Apituley, A., Comeron, A., Freudenthaler, V., Linné, H., Ansmann, A., Bösenberg, J., D'Amico, G., Mattis, I., Mona, L., Wandinger, U., Amiridis, V., Alados-Arboledas, L., Nicolae, D., and Wiegner, M.: EARLINET: towards an advanced sustainable European aerosol lidar network, Atmos. Meas.

- Tech., 7, 2389-2409, doi:10.5194/amt-7-2389-2014, 2014. Associated with document Ref. Ares(2019)6815176 04/11/2019
- 2. D'Amico, G., Amodeo, A., Baars, H., Binietoglou, I., Freudenthaler, V., Mattis, I., Wandinger, U., and Pappalardo, G.: EARLINET Single Calculus Chain general presentation methodology and strategy, Atmos. Meas. Tech., 8, 4891-4916, doi:10.5194/amt-8-4891-2015, 2015.
- 3. Papagiannopoulos, N., Mona, L., Amodeo, A., D'Amico, G., Gumà Claramunt, P., Pappalardo, G., Alados-Arboledas, L., Guerrero-Rascado, J. L., Amiridis, V., Apituley, A., Baars, H., Schwarz, A., Wandinger, U., Binietoglou, I., Nicolae, D., Bortoli, D., Comerón, A., Rodríguez-Gómez, A., Sicard, M., Kokkalis, P., Papayannis, A., and Wiegner, M.: An automatic observation-based typing method for EARLINET, Atmos. Chem. Phys., 18, 15879-15901, https://doi.org/10.5194/acp-18-15879-2018, 2018.
- 4. Benedetti, A., Reid, J. S., Knippertz, P., Marsham, J. H., Di Giuseppe, F., Rémy, S., Basart, S., Boucher, O., Brooks, I. M., Menut, L., Mona, L., Laj, P., Pappalardo, G., Wiedensohler, A., Baklanov, A., Brooks, M., Colarco, P. R., Cuevas, E., da Silva, A., Escribano, J., Flemming, J., Huneeus, N., Jorba, O., Kazadzis, S., Kinne, S., Popp, T., Quinn, P. K., Sekiyama, T. T., Tanaka, T., and Terradellas, E.: Status and future of numerical atmospheric aerosol prediction with a focus on data requirements, Atmos. Chem. Phys., 18, 10615-10643, https://doi.org/10.5194/acp-18-10615-2018, 2018.
- Bucci, S., P. Cristofanelli, S. Decesari, A. Marinoni, S. Sandrini, J. Größ, A. Wiedensohler, C. Di Marco, E. Nemitz, F. Cairo, L. Di Liberto, F. Fierli. Vertical distribution of aerosol optical properties in the Po Valley during the 2012 summer campaigns. Atmos. Chem. Phys., 18(8), 5371-5389, 2018. doi.org/10.5194/acp-18-5371-2018.

Relevant projects

- 1. EU H2020 project ACTRIS-PPP (ACTRIS Preparatory Phase Project), 2017 2019. Grant agreement n. 739530.
- 2. EU H2020 project ACTRIS 2 (Aerosol, Clouds, and Trace gases Research Infrastructure-2), 2015-2019, Grant agreement n. 654109.
- 3. EU H2020 project ENVRIFAIR (ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research), 2019-2022, Grant agreement n. 654182.
- 4. EU H2020 project ENVRIPLUS (Environmental Research Infrastructures Providing Shared Solutions for Science and Society), 2015-2019, Grant agreement n. 654182.
- 5. EU FP7 project ACTRIS (Aerosol, Clouds, and Trace gases Research Infrastructure network), 2011-2015. Grant agreement n. 262254.

Significant infrastructures

CNR-IMAA with CIAO (CNR-IMAA Atmospheric Observatory, www.ciao.imaa.cnr.it) located in Tito, Southern Italy, on the Apennine mountains (40.60N, 15.72E, 760 m a.s.l.) less than 150 km from the West, South and East coasts, and with EARLINET data base for the lidar profiling data, plans to contribute to the following ACTRIS Central Facility units:

Head Office - Service and Access Management Unit (SAMU) devoted to the provision of information on ACTRIS and ACTRIS services (service catalogue), being a single entry-point for users to access to ACTRIS services, managing the user access;

Data Centre - ACTRIS Aerosol remote sensing data centre unit (ARES) to provide of Aerosol remote sensing data processing and curation. This includes centralized processing, traceability, armonization and data versioning, quality control, data provision and archiving, and documentation. The activity enables RRT and NRT delivery. Tutorial activities. Production of level 3 data for climatological analysis and new products.

Centre for Aerosol Remote Sensing - CARS-AHL-CNR unit to provide the comparison with fixed / mobile reference AHLs, Development of software tools for automatic submission of AHL measurements to the SCC, Codification of the results of the QA program for AHLs for uptake at the ACTRIS DC, Training on specific subjects related to AHLs (face-to-face), Training on specific subjects related to AHLs, Laboratory tests for characterization of optical components and blocks for AHLs, Consultancy for specific AHL observation protocols, Testing of new AHLs and blocks.

As well as the INFN plans to contribute to Centre for Aerosol In Situ Measurements hosting at the LABEC accelerator laboratory the Elemental Mass Composition Centre (EMC2) unit with the provision of access and elementary analysis for the ACTRIS variables: Mass concentration of particulate elements, Measurement of particulate heavy metals and

inorganic element composition, Proficiency tests of individual lates to specifically sixty three tests of individual lates to specifically sixty. In the test of the latest several partition of the latest several partition

Several observational and exploratory platforms, as ACTRIS National Facilities, are distributed over the country.

The Leibniz Institute for Tropospheric Research (TROPOS, www.tropos.de) is an independent research institution with about 150 employees and is member of the Leibniz Association, one of the German non-university research organizations. The institute has a well-defined research profile with focus on aerosol and clouds. The TROPOS expertise ranges from physical and chemical laboratory studies to large field experiments and numerical modelling of atmospheric processes. TROPOS has been an active and leading partner in many international projects in the fields of air pollution and climate. The institute has initiated the German proposal for the National Roadmap for Research Infrastructures, involving 13 German research institutions.

TROPOS is a world-leading centre for aerosol and cloud in-situ and remote observations. Over the past two decades, TROPOS has contributed to the field with new and innovative technologies and methodologies, e.g., for in-situ measurements of the particle size distribution, humidity-dependent and absorption particle properties, and mixing state of aerosol particles as well as for remote sensing of particle optical and microphysical properties with multi-wavelength Raman and polarization lidars and of cloud-aerosol interactions with combined lidar and radar profiling techniques. The institute has been involved in a large number of field studies and performs continuous observations at stations worldwide. TROPOS has been an active member in ACTRIS and its predecessor projects since 2000 and contributes with a vast amount of data to the ACTRIS databases on the four-dimensional distribution of aerosol, clouds and reactive trace gases.

TROPOS operates two atmospheric simulation chambers, the aerosol twin chamber (Atmospheric Chemistry Department chamber, ACD-C) and the Turbulent Leipzig Aerosol and Cloud Interaction Simulator (LACIS-T), to study chemical and physical aerosol and cloud processes under well controlled conditions. Both chambers have been active members in the EU infrastructure projects EUROCHAMP, EUROCHAMP-2, and EUROCHAMP-2020 and provide access for users.

The TROPOS Research Station Melpitz is dedicated to ACTRIS and jointly operated by the Departments of Atmospheric Chemistry, Experimental Aerosol and Cloud Microphysics, and Remote Sensing of Atmospheric Processes. At the Melpitz station, a more than 20-year-long record of near-surface aerosol and trace-gas data has been established. Moreover, the institute conducts aerosol in-situ measurements at GAW stations, such as Cape Verde Observatory or Chacaltaya, Bolivia, and within the German Ultrafine Aerosol Network (GUAN), which all deliver data to the World Data Centre for Aerosols at NILU, Norway. Furthermore, the institute performs aerosol remote-sensing observations at various global sites based on its PollyNET network of autonomous lidar instruments. Two mobile aerosol and cloud remote-sensing platforms for land-based and shipborne deployment are part of the ACTRIS facilities as well. All instruments at the various sites are integrated in the ACTRIS quality-assurance activities, participate in the regular round-robin tests, site inter-comparisons, and internal quality checks, and deliver data to the ACTRIS databases.

TROPOS hosts the World Calibration Centre for Aerosol Physics (WCCAP) of the World Meteorological Organization – Global Atmosphere Watch program (WMO-GAW), which is responsible for the quality assurance of microphysical aerosol parameters in GAW, ACTRIS, and GUAN. The Atmospheric Chemistry Department of TROPOS hosts the Calibration Centre for Organic Tracers and Aerosol Constituents (OGTAC CC), which is responsible for the QA/QC of the analytics of particulate organic matter. It has been established within EUROCHAMP-2020 and provides access to national and international users. Both calibration centres will become units of the Centre for Aerosol In Situ Measurements (CAIS) in ACTRIS. It is foreeen to also host the Centre for Cloud Water Chemistry as a unit of the Centre for Cloud In Situ Measurements (CIS). This activity is closely connected with a foreseen upgrade of the existing cloud site Schmücke to a permanent cloud observabory that will allow for Langrange-type cloud studies using natural clouds as flow-through reactors.

Within ACTRIS PPP, TROPOS coordinates the activities within WP5 related to the definition of standards and requirements for ACTRIS National Facilities and contributes to the definition of concepts for the Central Facilities. Within ACTRIS-2, TROPOS is actively involved in all networking and joint research activities related to aerosol and trace-gas in-situ measurements and vertical profiling of aerosol and clouds. In ACTRIS-2, TROPOS leads NA2 on Aerosol and Cloud Profiling and coordinates the European Centre for Aerosol Calibration and characterization. In addition, TNA to the research station Melpitz is provided. Within EUROCHAMP-2020, TROPOS is actively involved in all networking and joint research activities as it participates into joint measurement campaigns and it

provides access to both simulation chambers, ACD-C and LACI. AND CONTINUE PROPERTY OF THE CONTINUE PAY 11/2019 are an integrative part of EUROCHAMP.

Role in the project

TROPOS coordinates the German ACTRIS activities. In this role, it will actively contribute to WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP2(Implementation of a sustainable ACTRIS organization), and WP3 (Strategy for enhancing ACTRIS relevance and impact) of ACTRIS IMP. TROPOS will lead WP5(Facilitating the harmonized operation of the National Facilities) and thus guide the work on facilitating the harmonized operation of the National Facilities. In WP4 (Implementation and test operation of the Central Facilities), TROPOS will lead the task on testing the functionalities of the Topical Centres and the Data Centre. TROPOS will contribute to the tests of ACTRIS service provision by providing TNA to its ACD-C chamber. TROPOS will also contribute to the WP6 (Implementation of the user access to ACTRIS services), WP8 (Consolidating ACTRIS's position in the European and international research landscape) and WP9 (Positioning ACTRIS in the European innovation ecosystem).

Principal personnel involved

Dr. Ulla Wandinger (female) is deputy head of the Department of Remote Sensing of Atmospheric Processes of TROPOS and coordinator of the German ACTRIS activities. She has gained >25 years of experience in aerosol and cloud remote observations. Since 2000, she has actively contributed to the establishment of EARLINET and, later on, ACTRIS. She has also been working on the development of space-borne active remote sensing missions for ESA. In ACTRIS PPP, she is responsible for the definition of the concepts and technical requirements for the ACTRIS National Facilities. In ACTRIS-2 she leads NA2 on "Aerosol and Cloud Profiling". Ulla Wandinger has published >90 articles (h-index 47). She is member of the ACTRIS PPP Executive Board, the ACTRIS-2 Scientific Steering Committee, the EARLINET Council, and the ESA-JAXA EarthCARE Joint Mission Advisory Group.

Prof. Dr. Alfred Wiedensohler (male) is head of the Department of Experimental Aerosol and Cloud Microphysics and the Aerosol Working Group of TROPOS. He also leads the World Calibration Centre for Aerosol Physics of WMO-GAW. He has gained >30 years of experience in aerosol in-situ technology, atmospheric process studies, and long-term observations. In ACTRIS he was responsible for the NA on "In-situ chemical, physical and optical properties of aerosols" and in ACTRIS-2 he leads the European Centre for Aerosol Calibration and characterization. He has published >360 articles (h-index 67) and is among the "highly cited researchers" by Thomson Reuters in the field of atmospheric research for four years now. Prof. Wiedensohler is member of the WMO-GAW Scientific Advisory Group and served in the Scientific Steering Committees of ACCENT, EUSAAR, EUCAARI and ACTRIS.

Dr. Markus Hermann (male) is deputy group leader of the Aerosol Working Group in the Department of Experimental Aerosol and Cloud Microphysics. He is an expert for airborne aerosol instrumentation and has developed small and light particle instruments for that purpose. His scientific focus is on in-situ particle measurements in the free troposphere, where he has >20 years of experience. Since more than a decade, he is the PI for the particle number and size distribution measurements in the CARIBIC column of the European Research Infrastructure (Landmark) IAGOS and has gained experience with the implementation of an ERI. Markus Hermann is member of the Scientific Steering Committees of the German research aircraft HALO. He has published >55 articles.

Dr. Frank Stratmann (male) is head of the Cloud Working Group of TROPOS. He is an internationally well-recognized expert in the field of aerosol-cloud interactions in general, and atmospheric ice nucleation and cloud condensation nucleus activation in particular. His working group investigates aerosol-cloud interactions in both laboratory and field. His group hosts two internationally well-recognized aerosol-cloud-interaction-related infrastructures (the turbulent moist air wind-tunnel LACIS-T, and ACTOS, a helicopter-based in-situ measurement system) and is currently focusing on atmospheric INP measurements. His publication record features 169 articles (hindex 43).

Prof. Dr. Hartmut Herrmann (male) is head of the Atmospheric Chemistry Department (ACD). His research intends to understand the tropospheric multiphase system. Model development is based on experimental work in the laboratory and in the field. The practical work utilizes state-of-the-art physical and analytical chemistry methods to study gas phase, aqueous phase, organic phase, surface, and, all together, multiphase phenomena. Field work aims to

understand chemical processing and composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees with the composition of tropospher paragrees which can be considered with the composition of tropospher paragrees with the composition of the composition of tropospher paragrees with the composition of the composition of tropospher paragrees with

Dr. Dominik van Pinxteren (male) is senior scientist in the Atmospheric Chemistry Department of TROPOS. His research fields include the chemical composition of atmospheric particles and cloud water, with a focus on organic constituents, analytical developments and advanced statistical data analysis. He has published >50 articles in peer-reviewed journals.

Dr. Gerald Spindler (male) is senior research scientist in the Department of Atmospheric Chemistry and responsible for the research station Melpitz. Since 1986, he has been strongly engaged in atmospheric chemistry. He has initiated the buildup of the research station Melpitz in 1992 in the framework of a national project and started with the measurement of dry deposition fluxes in a strongly polluted troposphere. As a result of his engagement in different national and international projects, a long-time record for PM and trace gases has been established. Gerald Spindler is responsible for the Melpitz site and the chemical detection of carbonaceous species (OC/EC) with thermo-graphic and thermo-optical methods at TROPOS. He published >50 articles in peer- reviewed journals.

Dr. Anke Mutzel (female) is junior research scientist in the Atmospheric Chemistry Department of TROPOS. She has gained 9 years of experience in laboratory studies on atmospheric particle formation and atmospheric gas-phase reactions. She is actively involved in the simulation chamber studies at ACD-C and responsible for OGTAC CC. She published 20 articles in peer-reviewed journals.

Relevant publications

- 1. Hartmann, S., Niedermeier, D., Voigtlaender, J., Clauss, T., Shaw, R.A., Wex, H., Kiselev, A., and Stratmann, F.: Homogeneous and heterogeneous ice nucleation at LACIS: operating principle and theoretical studies. Atmos. Chem. Phys., 11, 1753-1767, doi:10.5194/acp-11-1753-2011, 2011.
- 2. Mutzel, A., Poulain, L., Berndt, T., Iinuma, Y., Rodigast., M., Böge, O., Richters, S., Spindler, G., Sipila, M., Jokinen, T., Kulmala, M., and Herrmann, H.: Highly oxidized multifunctional organic compounds observed in tropospheric particles: A Field and Laboratory Study, Environ. Sci. Technol., 49, 7754-7761, doi:10.1021/acs.est.5b00885, 2015.
- 3. Spindler, G., Grüner, A., Müller, K., Schlimper, S., and Herrmann, H.: Long-time size-segregated particle (PM10, PM2.5, PM1) characterization study at Melpitz Influence of air mass inflow, weather conditions and season. J. Atmos. Chem., 70, 165-195, doi:10.1007/s10874-013-9263-8, 2013.
- 4. Wandinger, U., Freudenthaler, V., Baars, H., Amodeo, A., Engelmann, R., Mattis, I., Groß, S., Pappalardo, G., Giunta, A., D'Amico, G., Chaikovsky, A., Osipenko, F., Slesar, A., Nicolae, D., Belegante, L., Talianu, C., Serikov, I., Linné, H., Jansen, F., Apituley, A., Wilson, K. M., de Graaf, M., Trickl, T., Giehl, H., Adam, M., Comerón, A., Muñoz-Porcar, C., Rocadenbosch, F., Sicard, M., Tomás, S., Lange, D., Kumar, D., Pujadas, M., Molero, F., Fernández, A. J., Alados-Arboledas, L., Bravo-Aranda, J. A., Navas-Guzmán, F., Guerrero-Rascado, J. L., Granados-Muñoz, M. J., Preißler, J., Wagner, F., Gausa, M., Grigorov, I., Stoyanov, D., Iarlori, M., Rizi, V., Spinelli, N., Boselli, A., Wang, X., Lo Feudo, T., Perrone, M. R., De Tomasi, F., and Burlizzi, P.: EARLINET instrument intercomparison campaigns: overview on strategy and results, Atmos. Meas. Tech., 9, 1001-1023, doi:10.5194/amt-9-1001-2016, 2016.
- 5. Wiedensohler, A., Birmili, W., Nowak, A., Sonntag, A., Weinhold, K., Merkel, M., Wehner, B., Tuch, T., Pfeifer, S., Fiebig, M., Fjäraa, A. M., Asmi, E., Sellegri, K., Depuy, R., Venzac, H., Villani, P., Laj, P., Aalto, P., Ogren, J. A., Swietlicki, E., Williams, P., Roldin, P., Quincey, P., Hüglin, C., Fierz- Schmidhauser, R., Gysel, M., Weingartner, E., Riccobono, F., Santos, S., Grüning, C., Faloon, K., Beddows, D., Harrison, R., Monahan, C., Jennings, S. G., O'Dowd, C. D., Marinoni, A., Horn, H.-G., Keck, L., Jiang, J., Scheckman, J., McMurry, P. H., Deng, Z., Zhao, C. S., Moerman, M., Henzing, B., de Leeuw, G., Löschau, G., and Bastian, S.: Mobility particle size spectrometers: harmonization of technical standards and data structure to facilitate high quality long-term observations of atmospheric particle number size distributions, Atmos. Meas. Tech., 5, 657-685, doi:10.5194/amt-5-657-2012, 2012.

Relevant projects

- 1. ACTRIS PPP (Aerosols, Clouds and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Aerosols, Grant agreement No 739530, WP leader.
- 2. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes

- Towards 2020 and beyond), 2016-2020, Grant agreement 730997ted with document Ref. Ares(2019)6815176 04/11/2019
- 3. ACTRIS-2 (Aerosols, Clouds and Trace gases Research Infrastructure 2), 2015-2019, Grant agreement No 654109.
- 4. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, Grant Agreement No 262254.
- 5. EUROCHAMP-2, (European Simulation Chambers for Investigating Atmospheric Processes), 2009-2013, Grant Agreement No 228335.

Significant infrastructures

The European Centre for Aerosol Calibration and characterization (ECAC) shall be implemented as the Topical Centre for in-situ aerosol measurements in ACTRIS and consists of six TC units. Two of them, the World Calibration Centre for Aerosol Physics (WCCAP) and the OrGanic Traces and Aerosol Constituents Calibration Centre (OGTAC CC) are located at TROPOS in the Experimental Aerosol and Cloud Microphysics Department and the Atmospheric Chemistry Department (ACD), respectively.

The WCCAP was established in 2002 as part of Germany's contribution to the Global Atmosphere Watch (GAW) program of the World Meteorological Organization (WMO). The main task of the WCCAP is to perform the quality assurance of in-situ measurements of physical aerosol parameters worldwide. This work includes the calibration of aerosol instrumentation, audits of observatories, recommendations for aerosol measurements, capacity building for young scientists and station personnel as well as the development of measurement procedures and methodologies for data analysis. In ACTRIS, the WCCAP has been responsible for the development and implementation of standards and the harmonization of measurements in the European research infrastructure projects EUSAAR, ACTRIS and ACTRIS-2. The WCCAP leads the current ECAC consortium. Instrument calibrations have been performed on a regular basis within the ECAC and numerous articles have been published to improve and harmonize physical insitu measurements of the atmospheric aerosol. Therefore, the WCCAP also cooperates with many companies for aerosol in-situ instrumentation to further improve and characterize their instruments. Moreover, there are frequent projects with the State Agencies for Environment.

The **OGTAG CC** is the first calibration centre for organic marker compounds worldwide, providing a strong benefit to the aerosol and simulation chamber communities, as it harmonizes approaches for the chemical analysis of organic particulate constituents. The activities of OGTAC CC are focused on two pillars: hands-on training sessions on state-of-the-art instruments to gain highly trained personnel and ensure highest level of QA/QC due to inter-laboratory comparisons. Currently, OGTAC CC is part of EUROCHAMP-2020. Moreover, the OGTAC CC fosters a strong network of research groups across Europe working in the area of organic aerosol analysis. The OGTAC CC provides support and service for basic separation and detection techniques such as LC/MS, GC/MS, IC/PAD, which offer convenient methods for the analysis of organic particulate compounds. The support by OGTAC CC in ACTRIS will include the development and provision of standard operating procedures (SOPs), the organization of training sessions and the realization of inter-laboratory comparison studies. In addition, OGTAC CC will actively follow and engage in ongoing developments in scientific research and technical evolution, resulting also in a strong connection to industry and instrument manufacturers. Moreover, the technical evolution will lead to instruments with higher resolution, accuracy and sensitivity, combined with an enhanced time resolution, which will inevitably require highly trained personnel for the demanding tasks of laboratory work and data analysis.

The Turbulent Leipzig Aerosol and Cloud Interaction Simulator (LACIS-T) is a world-wide unique closed-loop turbulent moist-air wind tunnel. The actual measuring section of the tunnel is 2 m long, 0.8 m wide and 0.2 m deep. Cloud formation occurs via turbulent mixing of three conditioned flows (i.e., two particle-free air streams and one aerosol stream) and is initiated at the inlet of the measuring section. With LACIS-T, TROPOS aims at gaining fundamental and quantitative understanding concerning a) the relative roles of turbulence vs. aerosol particle physical and chemical properties in cloud microphysical processes such as cloud droplet activation and droplet freezing and b) the influences of entrainment and detrainment processes on the microphysical properties of clouds. In contrast to field measurements, LACIS-T is able to produce well-defined and reproducible laboratory conditions. For example, turbulent temperature and water-vapor fields can be precisely adjusted, and the operators have full control on aerosol particle properties, i.e., particle chemical composition, size and number. Consequently, LACIS-T is an ideal facility for pursuing mechanistic understanding concerning the above-mentioned processes and interactions.

The Atmospheric Chemistry Department chamber (ACD-C) the orien of the orient of th ACD. Only few twin-chambers exist worldwide. The two identical cylindrical reaction chambers are made of teflon FEP, have a volume of 19 m³ and a surface/volume ratio of 2/m. The ACD chamber is equipped with state-of-the-art online and offline instruments and allows the investigation of atmospheric relevant processes under controlled and well-defined conditions. Studies at the ACD-C focus on VOC degradation, SOA formation, particulate products, multiphase chemistry, and, as experiments can be performed at relative humidity of up to 75%, the study of deliquescent particles. Recently, the ACD chamber has been extended so that it can also be operated as a flow-through reactor, which has proven useful for the studies under atmospheric relevant conditions. The combination of the ACD chamber with OGTAC CC offers the possibility to comprehensively characterize formed gas and particle phase products to provide the highest level of understanding of atmospheric processes at a molecular level. The Leipzig Biomass Burning Facility (LBBF) is part of the ACD chamber. This facility allows studies on primary emissions from biomass burning as well as the processing (aging) of the emitted smoke. The combination of biomass burning and aging in the ACD-C offers a nearly unique tool for studying the atmospheric chemistry associated with biomass burning. In addition, it is possible to study multiphase processes with emphasis on aqueous particles makes the ACD chamber unique, complementing the knowledge and the dedicated laboratory and modelling work of TROPOS ACD in this sector.

The **Research Station Melpitz** is situated in the rural background of the eastern German lowlands in Central Europe (12°56'E, 51°32'N, 86 m a.s.l.). Especially during winter, continental air masses arriving from easterly directions are influenced by long-range-transported anthropogenic emissions. The site is an ACTRIS and EMEP station. The existing size-segregated, long-term characterization of chemical and physical aerosol properties by offline methods in combination with chemical analysis for ions OC/EC and for specific organic tracers (e.g., PAK, alkanes, hopanes with CPP-GCMS, sugars and sugar alcohols with HPAEC-PAD) and state-of-the-art online methods (e.g., particle number and size distribution, aerosol absorption and scattering coefficients, aerosol mass spectra from HR-ToF-AMS, ACSM, CI-Api-ToF-MS and MARGA) provide a comprehensive dataset. With the possibility for profiling of aerosol, clouds, and atmospheric dynamics (multiwavelegth Raman lidar, Sun photometer, Doppler lidar, and cloud radar are currently applied on campaign basis; permanent deployment is planned for the future), Melpitz is a unique research infrastructure in Europe and a perfect site to study changes in atmospheric composition.

The Leipzig Aerosol and Clouds Remote Observations System (LACROS) is a combined aerosol and cloud remote-sensing mobile facility. It consists of a 35-GHz cloud radar, a multiwavelength polarization Raman lidar, a Doppler lidar, a ceilometer, a microwave radiometer, a sun photometer, and auxiliary instrumentation for measurements of radiation and atmospheric state parameters. The mobile facility is used for observations at the TROPOS sites in Leipzig and Melpitz as well as in field experimentsat global hotspots. LACROS has been contributing to the German HD(CP)² project (High Definition Clouds and Precipitation for Climate Prediction), was deployed for an 18-month campaign at Cyprus in 2016-2018 to investigate the interaction of aerosol, clouds, precipitation and dynamics in the heavily polluted Eastern Mediterranean and is currently stationed at Punta Arenas, Chile to explore contrasting conditions in the pristine environment of the Southern Ocean.

The purpose of the **mobile shipborne remote observation facility OCEANET** is to provide continuous profiling of aerosol and clouds on board research vessels such as RV Polarstern or RV Meteor. Therefore, it contributes to ACTRIS with a unique observation capability for polar and marine environments. Core instruments of the setup are a multiwavelength lidar, a microwave radiometer and radiation sensors. The facility has been developed with the goal to support studies of atmosphere-ocean exchange processes, in conjunction with other instrumentation. The OCEANET platform is regularly operated aboard RV Polarstern during its meridional cruises to the southern hemisphere and back. Additional observations over several months have been performed at cruise destinations in South Africa and South America. The facility has also been deployed aboard RV Meteor on a west-to-east Atlantic transect. In 2019/20, it will take part in the international Arctic drift expedition MOSAiC.

The **network of automated aerosol remote-sensing platforms** based on the multi-wavelength Raman polarization lidar PollyXT developed at TROPOS sets the ACTRIS standard for automated aerosol remote-sensing observations and near-real-time data provision. PollyXT measurements are utilized in the framework of PollyNet, following common procedures in compliance with ACTRIS requirements. PollyXT lidars are operated for ACTRIS at the TROPOS site in Leipzig, the Meteorological Observatory Hohenpeißenberg of DWD and by ACTRIS partners in Finland (Finnish Meteorological Institute, Kuopio), Poland (University of Warsaw), Portugal (University of Evora) and Greece (National Observatory of Athens). Currently, TROPOS is establishing new permanent observation sites

in Dushanbe (Tajikistan) and Limassol (Cyprus). PollyXT system characteristic for the first for the

The **Schmücke cloud observatory** is planned as a worldwide unique setup with three permanent measurement sites: The in-cloud site close to the summit of the Schmücke mountain in central Germany (10°46'E, 50°39'N, 937 m a.s.l.) and two valley sites upwind and downwind of the summit, close to the villages Goldlauter and Gehlberg, are all operated under the lead of TROPOS ACD. In contrast to other cloud observatories existing at mountain sites, this will allow for continuous Lagrange-type experiments, where hill cap clouds serve as a natural flow-through reactor and air masses can be studied before, during, and after their passage through the cloud. The unique setup enables the observation of in-situ cloud processing of aerosol particles and aerosol-cloud interaction processes. It has already been successfully applied during several field campaigns at the Schmücke (FEBUKO I & II, HCCT-2010) and the results of these campaigns documented this approach not only to be well feasible but also to address a wider range of important scientific questions related to physical and chemical aerosol-cloud interactions as compared to isolated in-cloud observatories. A comprehensive suite of measurements at the three sites around the Schmücke will provide an unprecedented dataset of long-term in-situ aerosol and cloud data that is expected to provide very valuable insight into aerosol-cloud interactions and the impact of cloud processing on important physical and chemical aerosol properties.

The Institute for Meteorology and Climate Research (IMK) at the Karlsruhe Institute of Technology (KIT) with its four departments (about 250 FTE, 13 professorships) is strongly involved in atmospheric and climate research on the national and international level. IMK contributes to this research with its expertise covering tropospheric and stratospheric processes, biosphere-atmosphere interactions, atmospheric dynamics, cloud physics and trace gas transport processes. This diverse knowledge is complemented by long-term experience in QA/QC measures of selected climate relevant compounds and in remote sensing using satellites, surface-based as well as airborne remote sensing techniques (FTIR, RADAR, LIDAR). Long-term observation site, e.g. at Schneefernerhaus High- Altitude Research Station, the KIT Zugspitze lab, in Kiruna (Sweden), Izana (Spain) or in the TERENO Observatory Network as well as sophisticated mobile infrastructure (e.g. KIT-Cube) are used to assess and understand climate trends and changes on the different scales. KIT is a member of the Helmholtz Association, which provides support, advice, and services to its members.

Role in the project

KIT has applied for hosting the Centre for Reactive Trace Gases in situ Measurements (CiGAS) and the Centre for Cloud in situ Measurements (CIS), and will contribute a unit to the Centre for Reactive Trace Gases Remote Sensing (CREGARS). Therefore, KIT will mainly support the project work packages on RI implementation, service development, international cooperation and innovation and technological development activities, WP4 (Implementation and test operation of the Central Facilities), WP5(Facilitating the harmonized operation of the National Facilities), WP6 (Implementation of the user access to ACTRIS services) and WP9 (Positioning ACTRIS in the European innovation ecosystem). These activities are supported by KIT's leading roles in operating the WMO-GAW World Calibration Centre for volatile organic compounds (WCC-VOC) as well as long-term records in operating and further developing the AIDA cloud simulation chamber and the diverse FTIR and Lidar observational sites around the world. KIT will also collaborate in WP2 (Implementation of a sustainable ACTRIS organization).

Principal personnel involved

Dr. Ottmar Möhler (male) will and be the scientist in charge for KIT in ACTRIS and will guide the implementation process for the ACTRIS Centre for Cloud in situ Measurements (CIS). He is also scientific director of the AIDA cloud chamber, and will contribute to the implementation of the EUROCHAMP-2020 partners into ACTRIS.

Dr. Kristina Höhler (female) will lead the implementation process for the ACTRIS Centre for Cloud in situ Measurements (CIS) and will become director in of this TC. She has many years of experience in industrial and scientific project management.

Dr. Rainer Steinbrecher (male) will lead and coordinate the activities of the future ACTRIS CF Centre for Reactive Trace Gases in situ Measurements (CiGas). As Head of the WMO-GAW WCC for VOC at IMK he has a more than 12 years of experience in implementing and maintaining QA/QC procedures in a global air observation network.

PD Dr. Ralf Sussmann (male) is head of the group "Atmospheric Variability and Trends" at IMK-IFU (Atmospheric Environmental Research) in Garmisch-Partenkirchen and member of the NDACC steering committee. He is responsible for all NDACC and EARLINET related field measurements at the site Zugspitze/Garmisch and their integration into ACTRIS.

Dr. Thomas Blumenstock (male) is head of the group "Ground-based remote sensing" at IMK-ASF (Atmospheric Trace Gases and Remote Sensing) in Karlsruhe and has more than 20 years of experience in ground-based infrared remote sensing. He is co-chair of the infrared working group of NDACC (Network for the Detection of Atmospheric Composition Change) and in charge of the integration of the field measurements in Karlsruhe, Kiruna and Tenerife in ACTRIS.

Relevant publications

Fahey, D. W., Gao, R.-S., Möhler, O., Saathoff, H., Schiller, C., Ebert, V., Krämer, M., Peter, T., Amarouche, N., Avallone, L. M., Bauer, R., Bozóki, Z., Christensen, L. E., Davis, S. M., Durry, G., Dyroff, C., Herman, R. L., Hunsmann, S., Khaykin, S. M., Mackrodt, P., Meyer, J., Smith, J. B., Spelten, N., Troy, R. F., Vömel, H., Wagner, S., and Wienhold, F. G.: The AquaVIT-1 intercomparison of atmospheric water vapor

- measurement techniques, Atmos. Meas. Tech., 7, 31 ነው ይዩያሩ የሚተው የሚተው 19 ነው የሚተው የሚተው 19 ነው የሚተው 19 ነው የሚተው የሚተው 19 ነው የሚተ
- Hiranuma, N., Augustin-Bauditz, S., Bingemer, H., Budke, C., Curtius, J., Danielczok, A., Diehl, K., Dreischmeier, K., Ebert, M., Frank, F., Hoffmann, N., Kandler, K., Kiselev, A., Koop, T., Leisner, T., Möhler, O., Nillius, B., Peckhaus, A., Rose, D., Weinbruch, S., Wex, H., Boose, Y., DeMott, P. J., Hader, J. D., Hill, T. C. J., Kanji, Z. A., Kulkarni, G., Levin, E. J. T., McCluskey, C. S., Murakami, M., Murray, B. J., Niedermeier, D., Petters, M. D., O'Sullivan, D., Saito, A., Schill, G. P., Tajiri, T., Tolbert, M. A., Welti, A., Whale, T. F., Wright, T. P., and Yamashita, K.: A comprehensive laboratory study on the immersion freezing behavior of illite NX particles: a comparison of 17 ice nucleation measurement techniques, Atmos. Chem. Phys., 15, 2489-2518, https://doi.org/10.5194/acp-15-2489-2015, 2015.
- 3. Hoerger C.C., Claude A., Plass-Duelmer C., Reimann S., Eckart E., Steinbrecher R., Aalto J., Arduini J., Bonnaire N., Cape J.N., Colomb A., Connolly R., Diskova J., Dumitrean P., Ehlers C., Gros V., Hakola H., Hill M., Hopkins J.R., Jäger J., Junek R., Kajos M.K., Klemp D., Leuchner M., Lewis A.C., Locoge N., Maione M., Martin D., Michl K., Nemitz E., O'Doherty S., PÉrez Ballesta P., Ruuskanen T.M., Sauvage S., Schmidbauer N., Spain T.G., Straube E., Vana, M., Vollmer M.K., Wegener R., Wenger, A.: ACTRISnonmethane hydrocarbon intercomparison experiment in Europe to support WMO GAW and EMEP observation networks. Atmospheric Measurement Techniques, 8(7), 2715-2736, 2015.
- Vigouroux, C., T. Blumenstock, M. Coffey, Q. Errera, O. García, N. B. Jones, J. W. Hannigan, F. Hase, B. Liley, E. Mahieu, J. Mellqvist, J. Notholt, M. Palm, G. Persson, M. Schneider, C. Servais, D. Smale, L. Thölix, and M. De Mazière: Trends of ozone total columns and vertical distribution from FTIR observations at eight NDACC stations around the globe, Atmos. Chem. Phys., 15, 2915-2933, doi:10.5194/acp-15-2915-2015, 2015
- 5. Wandinger, U., Freudenthaler, V., Baars, H., Amodeo, A., Engelmann, R., Mattis, I., Groß, S., Pappalardo, G., Giunta, A., D'Amico, G., Chaikovsky, A., Osipenko, F., Slesar, A., Nicolae, D., Belegante, L., Talianu, C., Serikov, I., Linné, H., Jansen, F., Apituley, A., Wilson, K. M., de Graaf, M., Trickl, T., Giehl, H., Adam, M., Comerón, A., Muñoz-Porcar, C., Rocadenbosch, F., Sicard, M., Tomás, S., Lange, D., Kumar, D., Pujadas, M., Molero, F., Fernández, A. J., Alados-Arboledas, L., Bravo-Aranda, J. A., Navas-Guzmán, F., Guerrero-Rascado, J. L., Granados-Muñoz, M. J., Preißler, J., Wagner, F., Gausa, M., Grigorov, I., Stoyanov, D., Iarlori, M., Rizi, V., Spinelli, N., Boselli, A., Wang, X., Lo Feudo, T., Perrone, M. R., De Tomasi, F., and Burlizzi, P.: EARLINET instrument intercomparison campaigns: overview on strategy and results, Atmos. Meas. Tech., 9, 1001-1023, doi:10.5194/amt-9-1001-2016, 2016.

Relevant projects

- 1. ACTRIS PPP (Aerosols, Clouds and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant Agreement no. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds and Trace gases Research Infrastructure 2), 2015-2019, Grant agreement No 654109, associated partner (contract no. 654109), continued from ACTRIS Aerosols, Clouds and Trace gases Research Infrastructure), 2011-2015, Grant Agreement No 262254, associated partner (contract no. 262254).
- 3. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes Towards 2020 and beyond), 2016-2020, Grant agreement No 730997, continued from EUROCHAMP-2 (European Simulation Chambers for Investigating Atmospheric Processes), 2009-2013 (FP7, contract no. 228335) and EUROCHAMP (European Simulation Chambers for Investigating Atmospheric Processes), 2005-2010 (FP6, contract no. 505968)
- 4. WMO-GAW/WCC-VOC (The WMO Global Atmosphere Watch/World Calibration Centre for Volatile Organic Compounds), 2002-2020, PI (UBA, current contract KIT-no. 35039747).
- 5. NORS, 2011-2014, PI (FP7, contract no. 284421)

Significant infrastructures

KIT will be leading the Centre for Reactive Trace Gases in situ Measurements (CiGas) and the Centre for Cloud in situ Measurements (CIS) and will be unit partner of the Centre for Reactive Trace Gases Remote Sensing (CREGARS). KIT will furthermore contribute to ACTRIS the cloud simulation chamber AIDA, the Lidar-NDACC stations in Garmisch-Partenkirchen, the FTIR-NDACC sites in Kiruna (Sweden), Izana (Spain), Karlsruhe, Garmisch-Partenkirchen and on the mountain Zugspitze, as well as the World Calibration Center for volatile organic compounds (WCC-VOC). Further extensions and upgrades of these infrastructures are planned as part of the German national ACTRIS-D project for which funding decision is pending.

The Institute of Energy and Climate Research, IEK-8: Troposphere at the Research Centre Jülich performs atmospheric long-term observations, investigates gas-phase and aerosol processes in the atmosphere, and simulates chemistry-climate interactions and air quality by numerical models.

Role in the project

FZJ contributes to ACTRIS IMP to provide transnational access to their atmospheric simulation chamber SAPHIR and the Centre for Reactive Trace Gases In Situ Measurements for NOx (CiGas- FZJ) which will allow testing, evaluating and improving the reliability of the service provision and increase the user base. FZJ will collabore with WP4 (Implementation and test operation of the Central Facilities) and WP5 (Facilitating the harmonized operation of the National Facilities).

Principal personnel involved

Dr. Ralf Tillmann (male) is head of the research group for Volatile Organic Compounds in the Troposphere at IEK-8. He has more than 15 years of experience in atmospheric science and coordinates the ACTRIS-D, -PPP and-IMP activities for FZJ.

Dr. Robert Wegener (male) is head of the research group on anthropogenic emissions within IEK8. Since 2018 he is head of the World Calibration Centre for Nitrogen Oxides (WCC-NOx) of the Global Atmosphere Watch (GAW) Program of the World Meteorological Organisation (WMO).

PD Dr. Hendrik Fuchs (male) is group leader for research on radical chemistry in IEK-8 of the Forschungszentrum. He has been working in atmospheric sciences for the last 15 years and is coordinating the scientific activities at the simulation SAPHIR at IEK-8. Hendrik Fuchs is also coordinating the activities of IEK-8 in the Eurochamp2020 project and is involved in the ACTRIS activities concerning the SAPHIR chamber.

Relevant publications

- 1. Apel, E. C. B., T.; Koppmann, R.; Bandowe, B.; Boßmeyer, J.; Holzke, C.; Tillmann, R.; Wahner, A.; Wegener, R.; Brunner, A.*; Jocher, M.*; Ruuskanen, T.*; Spirig, C.*; Steigner, D.*; Steinbrecher, R.*; Gomez Alvarez, E.*; Müller, K.*; Burrows, J.P.*; Schade, G.*; Solomon, S.J.*; Ladstätter-Weißenmayer, A.*; Simmonds, P.*; Young, D.*; Hopkins, J.R.*; Lewis, A.C.*; Legreid, G.*; Reimann, S.*; Hansel, A.*; Wisthaler, A.*; Blake, R.S.*; Ellis, A.M.*; Monks, P.S.*; Wyche, K.P.*: Intercomparison of oxygenated volatile organic compound measurements at the SAPHIR atmosphere simulation chamber, J. Geophys. Res.-Atmos., 113, D20307, 2008.
- Dorn, H. P., Apodaca, R. L., Ball, S. M., Brauers, T., Brown, S. S., Crowley, J. N., Dube, W. P., Fuchs, H., Haseler, R., Heitmann, U., Jones, R. L., Kiendler-Scharr, A., Labazan, I., Langridge, J. M., Meinen, J., Mentel, T. F., Platt, U., Pohler, D., Rohrer, F., Ruth, A. A., Schlosser, E., Schuster, G., Shillings, A. J. L., Simpson, W. R., Thieser, J., Tillmann, R., Varma, R., Venables, D. S., and Wahner, A.: Intercomparison of NO3 radical detection instruments in the atmosphere simulation chamber SAPHIR, Atmospheric Measurement Techniques, 6, 1111-1140, 10.5194/amt-6-1111-2013, 2013.
- 3. Fuchs, H., Hofzumahaus, A., Rohrer, F., Bohn, B., Brauers, T., Dorn, H. P., Haeseler, R., Holland, F., Kaminski, M., Li, X., Lu, K., Nehr, S., Tillmann, R., Wegener, R., and Wahner, A.: Experimental evidence for efficient hydroxyl radical regeneration in isoprene oxidation, Nature Geoscience, 6, 1023-1026, 10.1038/ngeo1964, 2013.
- 4. Fuchs, H., Novelli, A., Rolletter, M., Hofzumahaus, A., Pfannerstill, E. Y., Kessel, S., Edtbauer, A., Williams, J., Michoud, V., Dusanter, S., Locoge, N., Zannoni, N., Gros, V., Truong, F., Sarda-Esteve, R., Cryer, D. R., Brumby, C. A., Whalley, L. K., Stone, D., Seakins, P. W., Heard, D. E., Schoemaecker, C., Blocquet, M., Coudert, S., Batut, S., Fittschen, C., Thames, A. B., Brune, W. H., Ernest, C., Harder, H., Muller, J. B. A., Elste, T., Kubistin, D., Andres, S., Bohn, B., Hohaus, T., Holland, F., Li, X., Rohrer, F., Kiendler-Scharr, A., Tillmann, R., Wegener, R., Yu, Z. J., Zou, Q., and Wahner, A.: Comparison of OH reactivity measurements in the atmospheric simulation chamber SAPHIR, Atmospheric Measurement Techniques, 10, 4023-4053, 10.5194/amt-10-4023-2017, 2017.
- 5. Gkatzelis, G. I., Tillmann, R., Hohaus, T., Muller, M., Eichler, P., Xu, K. M., Schlag, P., Schmitt, S. H., Wegener, R., Kaminski, M., Holzinger, R., Wisthaler, A., and Kiendler-Scharr, A.: Comparison of three

aerosol chemical characterization techniques utilizing PT TOFONES davitudis uninfreshio fone 6 and aged 4/11/2019 biogenic SOA, Atmospheric Measurement Techniques, 11, 1481-1500, 10.5194/amt-11-1481-2018, 2018.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparator Phase Project), 2017-2019, Grant agreement n. 739530. associated partner
- 2. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes Towards 2020 and beyond), 2016-2020, Grant agreement No 730997
- 3. EUROCHAMP-2 (European Simulation Chambers for Investigating Atmospheric Processes), 2009-2013 (FP7, contract no. 228335) and EUROCHAMP (European Simulation Chambers for Investigating Atmospheric Processes), 2005-2010 (FP6, contract no. 505968)
- 4. WMO-GAW/WCC-NOx (World Meteorological Organization-Global Atmosphere Watch/World Calibration Center for NOx), PI, (2014 current)

Significant infrastructures

The atmospheric simulation chamber SAPHIR is an exploratory platform for reproducible studies of the atmospheric degradation of biogenic and anthropogenic trace gases and the build-up of secondary particles and pollutants. Artificial trace gas mixtures, ambient air or emissions from plants can be added to SAPHIR. It is equipped with a comprehensive, unique set of sensitive instruments for radicals, traces gases, aerosols, and physical parameters. The central facility CiGas-FZJ manages the calibration activities for the in-situ measurements of NOx within ACTRIS and GAW.

The French National Centre for Scientific Research (CNRS) is a government-funded research organization, under the administrative authority of France's Ministry of Research. With about 33.000 staff (researchers, engineers, technicians and administrative staff) and a 2014 budget of 3.29 billion euros, CNRS is the largest fundamental research organization in Europe. It is organized through ten institutes and is involved in all scientific fields including life sciences, physics, chemistry, mathematics, computer science, earth science and astronomy, humanities and social sciences, environmental sciences and sustainable development, and engineering. CNRS conducts some twenty interdisciplinary programs to promote exchange between fields, ensure economic and technological development, and to solve complex societal problems. More than 95% of the 1100 CNRS laboratories, which are spread throughout the French territory, represent joint research units with universities and industry.

CNRS is represented in the project by eight research units: Institut des Geosciences de l'Environnement (IGE), Laboratoire de Météorologie Physique (LAMP), Laboratoire Interuniversitaire des Systèmes Atmosphériques (LISA), Pierre Simon Laplace (IPSL), Institut Laboratoire d'Optique Atmosphérique (LOA), Laboratoire des Sciences du Climat et de L'Environnement (LSCE), Unité Mixte de Service de l'OSU Réunion (OSU-R), French Data Centre for Atmospheric Research (AERIS).

The **Institut des Geosciences de l'Environnement (IGE)**, is a public research laboratory in Earth and Environmental Sciences, created on 1 January 2017 by the merge of LGGE (Laboratory of Glaciology and Geophysics of the Environment) and LTHE (Laboratory of Transfers in Hydrology and Environment). The IGE is a joint research unit of CNRS, IRD, Université Grenoble Alpes (UGA) and Grenoble-INP. IGE conducts research on climate, the water cycle, cryosphere and natural and anthropized environments with the aims to better understand the processes that govern the various geophysical compartments (ocean, atmosphere physics and chemistry, cryosphere, watersheds, critical zone), their interactions and responses to human pressures, and the processes of adaptation and resilience of societies.

The Laboratoire de Météorologie Physique (LAMP), Clermont-Ferrand, has a long-standing experience in the experimental and modelling studies of clouds and their interactions with solar radiation and atmospheric gaseous and particulate compounds. The main research activities deal with the formation of new particles, the role of aerosols in the formation of iced and mixed-phase clouds and their impact on the Earth's radiation budget. It implements the gas, aerosol and cloud observation site of Puy-de-Dôme, labelled global GAW station, where some of the aerosol chemical, physical and optical properties are monitored since 1996. LaMP has co-ordinated, participated, and managed a number of EU projects from FP4 to H2020 and participates in several national and international programmes.

The Laboratoire Interuniversitaire des Systèmes atmosphériques (LISA) is a leading institute in the field of atmospheric chemistry and physics comprising around 120 scientists including 67 permanent positions. The approaches developed at LISA to study atmospheric chemistry, rain chemistry, aerosol chemistry and physics and cultural heritage preservation involve computer simulation, field measurements, satellite measurement, spectroscopy, and experimental simulation and laboratory experiments. Two research groups are involved in the EUROCHAMP-2020 project. The MEREIA group (MEsurement and REactivity of specIes of Atmospheric interest) has over 20 years of experience in the field of atmospheric chemistry. The MEREIA group operates two different indoor chambers equipped with a wide range of high technology analytical tools. This group is composed of 12 Researchers (including 5 permanent scientists) and has been successful in obtaining funds from both national and European sources. It has been involved in EUROCHAMP-1 and -2, in European projects such as FP6/MOST, FP7/MEGAPOLI, and LIFE+/PhotoPaq, in EUREKA/Eurotrac-1/2 and in several French atmospheric research programs. Currently, it is the leading unit of the ongoing EUROCHAMP-2020 project. The activities of the MEREIA group are dedicated to both field measurement of VOCs and NOy species and experimental atmospheric simulations. These latter activities are completed with multiphase experimental simulations with the operation of the CESAM chamber, a rigid indoor chamber designed to perform multiphase experiments involving secondary aerosol, mineral dust or/and cloud droplets.

The Institut Pierre-Simon Laplace (IPSL) is a CNRS research institute in environmental and climate sciences that federates nine national research laboratories of which three are participants in the project (Laboratoire des Sciences du CLimat et de l'Environnement (LSCE), Laboratoire Atmosphère, Milieux, Observations Spatiales (LATMOS),

and Laboratoire de Météorologie Dynamique (LMD)). These lab these interesting de la laboratore de Météorologie Dynamique (LMD)). These lab these interesting de la laboratore de la laboratore de Météorologie Dynamique (LMD)). These laboratore de la laboratore de

The Laboratoire d'Optique Atmosphérique (LOA) is a Joint Research Unit of CNRS and University of Lille, and has a well-known expertise in remote sensing and study of tropospheric and stratospheric aerosols, clouds and their links with shortwave, longwave radiations and climate. LOA is one of the key laboratories in the world operating the AERONET network (Service National d'Observation PHOTONS) and developing retrieval algorithms, such as GRASP, for ground-based networks (sun-photometer and LIDAR) and space-borne missions (POLDER, MODIS, PARASOL and the future 3MI in 2020). LOA is also one of the key laboratories that created the ICARE satellite database and processing centre as part of the French Data centre for Atmospheric Research, AERIS. Since 2012, LOA is also coordinating the CaPPA (Chemical and Physical Processes in the Atmosphere) project involving 7 laboratories from University of Lille and University of Littoral and Ecole des Mines de Douai. LOA is managing, for long term observation, 2 super sites dedicated to atmospheric characterization located in Lille and Dakar and is contributed to AERONET, NDACC and EARLINET network. LOA, recently, participated in several FP7 and H2020 such as ACTRIS I3 projects.

The Laboratoire des Sciences du Climat et de l'Environnement (LSCE) is a Joint Research Unit of CNRS, the Commissariat à l'Energie Atomique (CEA) and the Université Versailles-Saint Quentin (UVSQ) and part of the Institut Pierre-Simon Laplace (IPSL). LSCE, located at Gif/Yvette in the region of Paris, France covers numerous fields of research related to climate and environment and, in particular, atmospheric composition monitoring, Earth System modelling and modelling of biogeochemical cycles, geochronology and analysis of environmental geomarkers, climate variability and dynamics. LSCE regroups approximately 300 staff with about 150 permanent researchers. LSCE is currently involved in a large number of international (GAW related) atmospheric networks and is playing a major role in the ICOS European infrastructure.

The **Observatoire des Sciences de l'Univers - la Réunion (OSU-R)** is a research center under administration by CNRS, Université de la Réunion and Météo-France, located in La Réunion Island. OSU-R carries out extensive transdisciplinary and cutting-edge research in atmospheric, geophysical, geological, and ecological (marine and forestry) domains of sciences and engineering. With regards to observations, OSU-R manages geophysical stations including the Maïdo facility (atmospheric observatory at 2160 m asl), marine, forest and hydrological stations, for delivering quality long-term services and for promoting trans-disciplinary researches conducted by laboratories federated under OSUR. Among these laboratories, LACy (Laboratoire de l'Atmosphère et des Cyclones, CNRS, Université de La Réunion and Météo-France) works as a scientific operator of the Maïdo observatory and is structured in 3 groups dedicated to research on tropospheric and stratospheric processes and on tropical cyclones. The Maïdo Observatory hosts an extensive range of instruments labelled in international networks (NDACC, AERONET, SHADOZ, ICOS, GAW/WMO).

The French Data center for Atmospheric research AERIS (www.aeris-data.fr) is appointed by eleven institutes and agencies and has the objective to facilitate and enhance the use of atmospheric data, whether from satellite, aircraft, balloon, or ground observations, or from laboratory experiments. It generates advanced products and provides services to facilitate data use, to prepare campaigns, and to interface with modeling activities. It consists of four Centres for Data and Services (CDS): ICARE, which is mainly dedicated to aerosols and cloud satellite data, and constitutes one of the pillars of the ACTRIS Data Centre; ESPRI, which is dedicated to atmospheric chemistry data; SEDOO for data from large field campaigns; and SATMOS, which is dedicated to services for users of geostationary satellite data. AERIS has close relationships with different laboratories for transferring prototype products and expertise on data. It has strong expertise in data curation, storage, preservation and dissemination.

CNRS will be representing the interest of the French Research Portagnic (RPO) participating the delay interest of the French Research Portagnic (RPO) participating the delay interest of the French Research Portagnic (RPO) participating in ACTRIS-FR project. Directly involved in the project are the following joint research units: Université Grenoble Alpes (UGA), Université de Lille (ULille), et l'University Paris-Est Créteil (UPEC), Université de Versailles Saint-Quentin-en-Yvelines (UVSQ), participating in ACTRIS IMP as linked third parties (listed under section 4.2.7). The other RPOs will be associated partners to the project and are the following: Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA), Centre National d'Etudes Spatiales (CNES), École Polytechnique (EP), Météo-France (MF), Université Institut Paul-Emile-Victor (IPEV), Institut Pierre Simon Laplace (IPSL), Institut de Recherche pour le Développement (IRD), Institut Paul-Emmile-Victor (IPEV), Université Clermont Auvergne (UCA), Université de la Réunion (UR), Université Toulouse III Paul Sabatier (UPS) Aix-Marseille Université (AMU), Université Paris Diderot (UPD), Ecole des Ponts ParisTech (ENPC), Sorbonne Université, Paris (SU). Other institutions might join at a later stage.

Role in the project

The CNRS institutions and its joint research units will actively contribute to the work packages on securing the long-term stability WP1 (Engagement and enlargement of the ACTRIS community and ACTRIS membership) WP2 (Implementation of a sustainable ACTRIS organization) and WP3(Strategy for enhancing ACTRIS relevance and impact). In Implementing ACTRIS components, functionalities and services in the WP4(Implementation and test operation of the Central Facilities) WP5 (Facilitating the harmonized operation of the National Facilities) WP6 (targeting the implementation of components, functionalities and services, CNRS will coordinate work package WP7 (pilots for trans-national access to support the implementation of ACTRIS services). In Consolidating the position of ACTRIS in the national, European and international landscape CNRS will lead WP8(Consolidating ACTRIS's position in the European and international research landscape) and will collaborate with WP9 (Positioning ACTRIS in the European innovation ecosystem) for consolidating the strategic liaison with key actors in the EU and international landscape, and in the communication WP10(ACTRIS communication and public relations). CNRS will co-coordinate WP6 (Implementation of the user access to ACTRIS services), and lead several WP tasks and activities (WP2, WP4, WP6, WP7, WP8).

Principal personnel involved

Dr. Sabine Philippin (female) is a research manager based at CNRS-LAMP and has been involved in the research management of EU-funded projects since 2004 (ACCENT FP6, EUSAAR FP6, ACTRIS FP7, ACTRIS-2 H2020, ENVRIPLUS H2020, ACTRIS PPP). She has a background in atmospheric sciences with experience in aerosol characterization and near-surface measurements. In ACTRIS IMP, Sabine Philippin will lead WP7, co-lead WP6 and lead WP2/task 2.4.

Dr. Martial Haeffelin (male) is a research scientist with 25-year experience in cloud radiative effects, initially with the NASA Langley Research Center (USA), contributing to the US Atmospheric Radiation Measurement program, and now with CNRS-IPSL (France) since 2002. He is the Director of the SIRTA atmospheric observatory that hosts two ACTRIS calibration centers and provides ACTRIS TNA, also Deputy Director of IPSL for Earth Observations, and scientific coordinator of the French network of atmospheric observatories dedicated to aerosol, cloud and trace gas observations (SOERE ATMOS; 90 persons). He has a 15-year record of contribution to EU projects (EARLINET, CLOUDNET, ACTRIS). He is a member of the EU TO-PROF COST program management committee, and chair of the automatic Lidar and ceilometer working group (30 persons). He is the author and co-author of 80 peer-reviewed articles. Martial Haeffelin will lead WP4/ task 4.1.

Guillaume Brissebrat (male), Research Engineer, is the technical director of AERIS, the French data centre for atmospheric composition. He has more than 12 years of experience in database development and management and has been responsible of the Observatoire Midi-Pyrénées data service (SEDOO) for 4 years. He has been involved in international projects (AMMA, MISTRALS) as responsible of the database conception, metadata activities, and other services associated to data centers.

Anne Priem (female) is administrative and financial manager at CNRS-LOA. She has been involved in European funded projects and TNA activities' management since FP7 (DAEDALUS FP5 – GEMS FP6 – ACTRIS FP7 and ACTRIS-2 H2020).

Dr Jean-Pierre Cammas (male) is Research Director at CNRS developed the split of th

Dr. Evelyn Freney (female), CNRS-LaMP researcher, whose research focuses on aerosol chemical and physical properties. She is responsible for on-line aerosol chemistry measurements at the Puy de Dome (PUY) station and is co-responsible of the Aerosol Chemical Monitor Calibration Centre (ACMCC) within ACTRIS-2. She is author or co-author of 33 publications on aerosol properties, and is a member of the specialised committee on oceanic and atmospheric research in France (Commission spécialisée Océan Atmosphère).

Dr. Valérie Gros (female), Research Director at CNRS-LSCE, is working in the field of atmospheric chemistry since almost 20 years and is leading the group "Experimental Atmospheric Chemistry" at LSCE since 2006. She is responsible of the chemistry (gas and particulate phase) measurements at the SIRTA station and is co-responsible of the Aerosol Chemical Monitor Calibration Centre (ACMCC). She is author or co-author of 80 peer-reviewed articles. She has participated in several EU projects and supervised 12 PhD theses.

Relevant publications

- 1. Lopatin A., O. Dubovik, A. Chaikovsky, P. Goloub, T. Lapyonok, D. Tanré, and P. Litvinov, Enhancement of aerosol characterization using synergy of lidar and sun photometer coincident observations: the GARRLiC algorithm, Atmos. Meas. Tech., 6, 2065-2088, 2013
- Crippa, M.; Canonaco, F.; Lanz, V.A.; Äijälä, M.; Allan, J.D.; Carbone, S.; Capes, G.; Ceburnis, D.; Dall'Osto, M.; Day, D.A.; Decarlo, P.F.; Ehn, M.; Eriksson, A.; Freney, E. J.; Ruiz, L.H.; Hillamo, R.; Jimenez, J.L.; Junninen, H.; Kiendler-Scharr, A.; Kortelainen, A.-M.; Kulmala, M.; Laaksonen, A.; Mensah, A.A.; Mohr, C.; Nemitz, E.; O'Dowd, C.; Ovadnevaite, J.; Pandis, S.N.; Petäjä, T.; Poulain, L.; Saarikoski, S.; Sellegri, K.; Swietlicki, E.; Tiitta, P.; Worsnop, D.R.; Baltensperger, U.; Prévôt, A.S.H. 2014. Organic aerosol components derived from 25 AMS data sets across Europe using a consistent ME-2 based source apportionment approach Atmos. Chem. Phys. Vol. 14, No. 12, p. 6159-6176 DOI 10.5194/acp-14-6159-2014 (EGU)
- Duflot, V., Baray, J.-L., Payen, G., Marquestaut, N., Posny, F., Metzger, J.-M., Langerock, B., Vigouroux, C., Hadji-Lazaro, J., Portafaix, T., De Mazière, M., Coheur, P.-F., Clerbaux, C., and Cammas, J.-P.: Tropospheric ozone profiles by DIAL at Maïdo Observatory (Reunion Island): system description, instrumental performance and result comparison with ozone external data set, Atmos. Meas. Tech., 10, 3359-3373, https://doi.org/10.5194/amt-10-3359-2017, 2017.
- 4. Wiegner, Matthias & Mattis, Ina & Pattantyús-Ábrahám, Margit & Antonio Bravo-Aranda, Juan & Poltera, Yann & Haefele, Alexander & Maxime, Hervo & Görsdorf, Ulrich & Leinweber, Ronny & Gasteiger, Josef & Haeffelin, Martial & Wagner, Frank & Cermak, Jan & Komínková, Katerina & Brettle, Mike & Münkel, Christoph & Pönitz, Kornelia. (2019). Aerosol backscatter profiles from ceilometers: Validation of water vapor correction in the framework of CeiLinEx2015. Atmospheric Measurement Techniques. 12. 471-490. 10.5194/amt-12-471-2019.
- Chiriaco, Marjolaine & Dupont, Jean-Charles & Bastin, Sophie & Badosa, Jordi & Lopez, Julio & Haeffelin, Martial & Chepfer, Helene & Guzman, Rodrigo. (2018). ReOBS: A new approach to synthesize long-term multi-variable dataset and application to the SIRTA supersite. Earth System Science Data. 10. 919-940. 10.5194/essd-10-919-2018.

Relevant projects

- 1. EU H2020 projects ACTRIS: ACTRIS PPP (ACTRIS Project Preparation Phase), 2017-2019, Grant agreement n. 739530; ACTRIS-2 (Aerosol, Clouds, and Trace gases Research Infrastructure-2), 2015-2019, Grant agreement n. 654109; ACTRIS (Aerosol, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, Grant agreement n. 262254.
- 2. EU H2020 project EUROCHAMP-2020 (European Simulation Chambers for Investigating Atmospheric Processes), 2016-2020, Grant agreement n. 730997.
- 3. EU H2020 projects ENVRI-FAIR (ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research), 2019-2022, Grant agreement n. 824068 and ENVRIPLUS

- (Environmental Research Infrastructures Providing Shar Schriftenschrift Schemos and Schrift Schrift Schemos and Schrift Schemos and Schrift Schrift
- 4. EU H2020 project ERA-PLANET (The European Network for Observing our Changing Planet), 2017-2020, Grant Agreement n. 689443.
- 5. EU H2020 project PAPILA (Prediction of Air Pollution in Latin America and the Caribbean), 2017-2020, Grant agreement n. 777544.

Significant infrastructures

CNRS contributes to the project with a large number of significant infrastructures including Central Facilities (Data Centre, five Topical centres) and National Facilities (seven observational platforms and two exploratory platforms).

IMT Lille Douai is part of the Institute Mines-Telecom (IMT), the largest national higher education engineering consortium in France: IMT sign up nearly 14,000 engineering students annually (5-year program), MSc-level, engineering degree programmes in addition to 1,650 PhD students (3-year doctoral programmes) under the supervision of a permanent, full-time, internationally recognised academic and research staff. IMT Lille Douai develops high-level teaching and research in science and technology in different areas: Digital, Processes for industry and services, Energy and Environment, Materials and Structures (including Plastics processing & Composites and Civil Engineering). Our research activities are geared to the fast evolution of Engineering Sciences and Techniques. Students can acquire strong skills in innovation management and also work on projects supported by companies and by our FabLab. Our business and technology incubator is an excellent tool to further entrepreneurial projects and develop the agility of our students. IMT Research is conducted in close collaboration with industrial and academic partners (Armines, 2 Carnot institutes, the schools of IMT, French and international partner universities and various private companies).

One of the IMT Lille Douai research units deals with Atmospheric Sciences and Environmental Engineering (SAGE) and encompasses a long experience in developing and implementing methods for trace gas measurements. SAGE is in charge of the French EMEP measurement program and is one of the three partners of the national central lab for air quality survey. Research activities focus on source apportionment and atmospheric process understanding, based on receptor-oriented approaches including intensive measurement campaigns or long-term monitoring.

Role in the project

IMT Lille Douai is mainly involved in 2 of the work packages. As topical centre unit, SAGE will take part in the implementation and testing processes in WP4 (Implementation and test operation of the Central Facilities). IMT Lille Douai participates as well in the WP9 (Positioning ACTRIS in the European innovation ecosystem) leading the task 9.3(Addressing current and future innovation demand from the private sector). Especially IMT lead the task dedicated to develope specific tools and tailored actions for better connecting ACTRIS with the private sector.

Principal personnel involved

Dr. Stéphane Sauvage (Male) is Associate Professor in the Atmospheric Sciences and Environmental Engineering research unit of IMT Lille Douai. His main research topic concerns Volatile Organic Compound (VOC) speciation and their behaviour in the atmosphere. He coordinates the French EMEP measurement network including 12 background sites for long-term aerosol and gas monitoring. He has been involved in several national and international research projects (3 as co-coordinator). He has supervised more than 10 PhD and is (co-)author of more than 45 publications in peer-review journals. He is also involved in the building of the ACTRIS European Research Infrastructure especially as Unit leader of the Topical centre for reactive trace gases

Dr. Thérèse Salameh (Female) is a Research & Development Engineer in the Atmospheric Sciences and Environmental Engineering research unit of IMT Lille Douai. Her research interests focus on the measurement of trace gases including NOx and VOCs, and the determination of VOC emission sources. She has been involved in several national and international research projects. Her research has been published in several international journals, book chapters, and international conferences. She is mainly involved in the ACTRIS European research infrastructure as the manager of European Topical centre unit for reactive trace gases at IMT Lille Douai.

Relevant publications

- C. C. Hoerger, A. Claude, C. Plass-Dulmer, S. Reimann, E. Eckart, R. Steinbrecher, J. Aalto, I. Arduini, N. Bonnaire, J. Cape, A. Colomb, R. Connolly, J. Diskova, P. Dumitrean, C. Ehlers, V. Gros, H. Hakola, M. Hill, J. R. Hopkins, J. Jager, R. Junek, M. Kajos, D. Klemp, M. Leuchner, A. C. Lewis, N. Locoge, M. Maione, D. Martin, K. Michl, E. Nemitz, S. O'doherty, P. Perez Ballesta, T. M. Ruuskanen, S. Sauvage, N. Schmidbauer, T. G. Spain, E. Straube, M. Vana, M. K. Vollmer, R. Wegener, A. Wenger, ACTRIS non-methane hydrocarbon intercomparison experiment in Europe to support WMO GAW and EMEP observation networks, Atmospheric Measurement Techniques, Vol 8, pp 2715–2736,, 2015. DOI: 10.5194/amt-8-2715-2015
- T. Salameh, S. Sauvage, C. Afif, A. Borbon, N. Locoge, Source apportionment vs. emission inventories of non-methane hydrocarbons (NMHC) in an urban area of the Middle East: local and global perspectives, Atmospheric Chemistry and Physics, Vol 16, pp 3595–3607, 2016. DOI: 10.5194/acp-16-3595-2016

- 3. T. Salameh, A. Borbon, C. Afif, S. Sauvage, T. Leonardis Mth Locurge, Comptositable of Salament, A. Borbon, C. Afif, S. Sauvage, T. Leonardis Mth Locurge, Comptositable of Salament, Lebanon: new observational constraints for VOC anthropogenic emission evaluation in the Middle East, Atmospheric Chemistry and Physics, Vol 17, pp 193–209, 2017. DOI: 0.5194/acp-2016-543
- S. B. Dalsoren, C. L. Myhre, S. . Schwietzke, L. Höglund-Isaksson, D. Helmig, S. Reimann, <u>S. Sauvage</u>, A. C. Lewis, M. Wallasch, . And Al., Discrepancy between simulated and observed ethane and propane levels explained by underestimated fossil fuel emissions, Nature Geoscience, N°73, pp 1-9. DOI: 10.1038/s41561-018-0073-0
- V. Michoud, <u>S. Sauvage</u>, T. Leonardis, I. Fronval, A. Kukui, N. Locoge, S. Dusanter, Field measurements of 1 methylglyoxal using Proton Transfer Reaction-Time of Flight Mass spectrometry and comparison to the DNPH/HPLC-UV method, Atmospheric Measurement Techniques, Vol 11, pp 5729–5740,, 2018. DOI: 10.5194/amt-2017-442

Relevant projects

- 1. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 2. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530. associated partner
- 3. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes Towards 2020 and beyond), 2016-2020, grant agreement No 730997.

Significant infrastructures

IMT Lille Douai has been selected to bring into ACTRIS a unit of the central facility for reactive trace gases in-situ. In this frame, IMT Lille Douai will contribute to ensure sustainable and traceable high-quality data and data products, to develop, test and implement advanced technologies, to test prototypes of gas analytical devices, and to enhance the competence of the operative personnel by training in the field of atmospheric trace gas measurements.

The French National Institute for Industrial Environment and Risks (INERIS) is an industrial and commercial public establishment under the aegis of the French Ministry of the Environment. INERIS places its wealth of experience and its scientific and technical knowhow at the service of the government and both private and public sectors in order to guide them in their actions with regard to safety and protection of health and the environment. This support notably leads to the provision of study and consulting services. In the field of air quality, INERIS is a major player in France supporting the implementation of the air quality monitoring strategy, conducting technical and research studies to support institutional and industrial clients within the European framework, as well as developing and hosting the national air quality forecasting.

In the frame of ACTRIS, INERIS is contributing to the French SIRTA national facility, being notably in charge of aerosol in-situ measurements along with the Laboratoire des Sciences du Climat et de l'Environnement (LSCE) and to the CAIS central facility, coordinating the unit dedicated to online aerosol chemical monitors (ACMCC).

Role in the project

As the technical and scientific coordinator of the ACMCC (one of the CAIS TC unit), INERIS will mainly be involved in the implementation and testing processes of the ACTRIS central facilities, WP4 (Implementation and test operation of the Central Facilities).

Principal personnel involved

Olivier Favez (male) is working as a research engineer at INERIS since 2009, notably managing the CARA program (Particulate matter chemical characterization) for the French Reference Laboratory for Air Quality Monitoring (LCSQA), coordinating a network of 12⁺ urban background stations for the monitoring of aerosol chemistry (using off-line and/or on-line techniques) at the national level. During his professional carrier, he has been acquiring solid knowledge on the measurement of the physical and chemical properties of aerosols, as well as on data treatment tools to better understand their sources and transformation processes. He notably participated to more than 20 national and European research projects and co-authored 45 peer-reviewed scientific articles (h-index = 23). He co-initiated the creation of the Aerosol Chemical Monitor Calibration Center (ACMCC) in 2013, allowing for the first international intercomparison of aerosol mass spectrometers promoted and used in the frame of the FP7 ACTRIS project. ACMCC has then been included in H2020 ACTRIS-2 WP8 research works (for quality assurance and quality control of aerosol and trace gases in -situ measurements) and is now part of the Central Facility / Topical Centre CAIS (Centre for Aerosol In- Situ). Olivier Favez is currently leading ACMCC.

Relevant publications

- Freney, E., Zhang, Y., Croteau, P., Amodeo, T., Williams, L., Truong, F., Petit, J.-E., Sciare, J., Sarda-Estève, R., Bonnaire, N., Crenn, V., Arumae, T., Aurela, M., Bougiatioti, K., Coz, E., Elste, T., Heikkinen, L., Minguillon, M.-C., Poulain, L., Priestman, M., Stavroulas, I., Tobler, A., Vasilescu, J., Zanca, N., Alastuey, A., Artinano, B., Carbone, C., Flentje, H., Green, D., Herrmann, H., Maasikmets, M., Marmureanu, L., Prévôt, A. S. H., Wiedensohler, Canagaratna, M., Gros, V., Jayne, J. T., and Favez, O. (2019). The second ACTRIS inter-comparison (2016) for Aerosol Chemical Speciation Monitors (ACSM): Calibration protocols and instrument performance evaluations. Submitted to Aerosol Science and Technology
- Zhang, Y., O. Favez, F. Canonaco, D. Liu, G. Mocnik, T. Amodeo, J. Sciare, A.S.H. Prévôt, V. Gros, A. Albinet (2018). Evidence of major secondary organic aerosol contribution to lensing effect black carbon absorption enhancement. Nature Partner Journal Climate and Atmospheric Science, 1(47), doi: 10.1038/s41612-018-0056-2
- 3. Zhang, Y., L. Tang, P.L. Croteau, O. Favez, Y. Sun, M. R. Canagaratna, Z. Wang, F. Couvidat, A. Albinet, H. Zhang, J. Sciare, A. S. H. Prévôt, J. T. Jayne, D. R. Worsnop (2017). Field characterization of the PM_{2.5} Aerosol Chemical Speciation Monitor: insights into the composition, sources and processes of fine particles in Eastern China. Atmospheric Chemistry and Physics, 17, 14501-14517, doi: 10.5194/acp-17-14501-2017
- Crenn V., J. Sciare, P.L. Croteau, S. Verlhac, R. Fröhlich, C.A. Belis, W. Aas, M. Aijälä, A. Alastuey, B. Artiñano, D. Baisnée, N. Bonnaire, M. Bressi, M. Canagaratna, F. Canonaco, C. Carbone, F. cavalla, E. Coz, M. J. Cubison, J. K. Esser-Gietl, D. C. Green, V. Gros, L. Heikkinen, H. Herrmann, C. R. Lunder, M. C. Minguillón, G. Močnik, C. D. O'Dowd, J. Ovadnevaite, J.E. Petit, E. Petralia, L. Poulain, M. Priestman, V. Riffault, A. Ripoll, R. Sarda-Estève, J. slowik, A. Seytan, A. Wiedensohler, U. Baltensperger, A. S. H. Prévôt, J.T. Jayne, O. Favez (2015). ACTRIS ACSM intercomparison: part I Reproducibility of

- concentration and fragment results from 13 individual Character Active Chemical Special Na Mornton 4/11/2019 (Q-ACSM) and consistency with co-located instruments. Atmospheric Measurement Techniques, 8, 5063-5087
- 5. Kuhlbusch T. A.J., P. Quincey, G. Fuller, M. Viana, K. Katsouyanni, E. Weijers, A. Borowiak, R. Gehrig, C. Hüglin, P. Bruckmann, F. Kelly, O. Favez, J. Sciare, B. Hoffmann, I. Mudway, X. Querol, K.E. Yttri, K. Torseth, A. Alastuey, U. Sager, U. Quass (2014). New Directions: The future of European urban air quality monitoring. Atmospheric Environment, doi: 10.1016/j.atmosenv.2014.01.12

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530., associated partner
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network) 2011-2015, grant agreement No 262254.

Significant infrastructures

The ACMCC is operated by a consortium of French research organisms, including INERIS, CEA and CNRS laboratories (LSCE and LaMP) and is mainly based at LSCE, which located South of the Paris region. As part of the quality control procedures, the ACMCC provides a large set of independent co-located on-line/off-line aerosol measurements for chemical, physical and optical parameters (as also part of the SIRTA national facility). It offers innovation opportunities through the exchange of information between manufacturers and users (notably leading to the development and revision of standard operating procedures, best-practice documents, ...), the optimization of technological solutions, and the evaluation of new online aerosol chemical analysers.

NILU was founded in 1969 and is an independent non-profit research institute specializing in climate and air pollution research with ca 180 employees, and conducts approximately 250 projects every year for government, industry and national and international organizations. In the last years, NILU has been involved in more than 90 EU and ESA financed projects e.g. ACTRIS-1, ACTRIS-2, ACTRIS-PPP, ENVRI-FAIR, ENVRIPLIA, NextGEOSS, InGOS, MACC2, GEOMON, EUCAARI, EUSAAR, ACCENT, EARLINET-ASOS, SCOUTO3, MEGAPOLI and also ESFRI initiatives e.g. ICOS and SIOS, and ESA-CCIs. NILU is responsible for the ACTRIS Data Centre since start, and for data curation of all in situ data within ACTRIS. NILU is responsible for the widely used database infrastructure EBAS (http://ebas.nilu.no) hosting observation data of atmospheric chemical composition and physical properties. EBAS is used for ACTRIS in situ data. EBAS is nominated as a DCPC in the WMO-WIS system, and NILU has been involved in the WMO-WIGOS process. The institute is involved in developing INSPIRE guidelines, E-reporting and GEOMS (Generic Earth Observation Metadata Standard). NILU plays central roles in the WMO – GAW program and is represented in 3 of the Scientific Advisory Groups (on Aerosols, Reactive Gases and Total Deposition respectively) as well as hosting the World Data Centre for Aerosols (GAW-WDCA) and the World Data Centre for Reactive Gases (WDCRG). NILU serves as the EMEP Chemical Coordination Centre (EMEP-CCC). The EMEP program comprise more than 40 Parties and forms the basis for UNECE CLRTAP abatement policies, as well as for the EU policies on Air Quality (www.emep.int). NILU is a member to the European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM). NILU hosts also the official databases of the Arctic Monitoring and Assessment Programme (AMAP) and the OsloParis Commission (OSPAR CAMP). NILU also hosts the Earth Observation Validation Data Centre (EVDC), a database developed and operated on contract by ESA. Furthermore, NILU operates state of the art observation facilities of atmospheric trace constituents in Norway and Polar Regions: the observatories Zeppelin at Svalbard, Birkenes in southern Norway, and the Troll station in Antarctica. All sites contribute to ACTRIS, Zeppelin and Birkenes contribute to ICOS, while Zeppelin is also contributing to SIOS.

Role in the project

NILU hosts the ACTRIS Data Centre in ACTRIS-1 and ACTRIS-2, and is selected as the host candidate for ACTRIS Data Center in the future by IAC. NILU also operates three atmospheric observatories; one in the Arctic: Zeppelin Observatory, one in southern part of Norway; Birkenes Observatory, and one at Antarctica: Troll Observatory aiming for achieving the ACTRIS NF label. NILU will participate in the ACTRIS-IMP and the implementation of Central Facilities. Specifically, efforts will be committed to WP4 (Implementation and test operation of the Central Facilities), in the organization of internal structure of the CFs and lead the implementation of workflow tools for the interaction across the CFs and NFs in the data production, participate in testing. In the WP8(Consolidating ACTRIS's position in the European and international research landscape) on the exploration and strategy of the use of e-infrastructures for ACTRIS and link to EOSC, and on harmonization of data polices across frameworks. NILU will also be involved other WPs with minor roles in WP2 (Implementation of a sustainable ACTRIS organization), WP3(Strategy for enhancing ACTRIS relevance and impact), WP6(Implementation of the user access to ACTRIS services) and WP10(ACTRIS communication and public relations).

Principal personnel involved

Dr. Cathrine Lund Myhre (female) is a senior scientist at NILU and will lead task 4.2, and contribute to WP4, and WP8. She has a PhD in spectroscopy and about 20 years of experience in understanding of atmospheric composition change, including data management and data quality requirements. Lund Myhre is author or co-author of more 40 papers in peer reviewed literature with more than 2400 citations, and contributed to more than 40 scientific reports including acting as contributing author to IPCC 5thAR, WG I, Chapter 2 (*Observations: Atmosphere and Surface*). She is an experienced project leader e.g. a number of Norwegian Research Council projects, the national monitoring of greenhouse gases, and leads the ACTRIS Data Center in ACTRIS-1 and ACTRIS-2. She is involved the H2020 project ENVRI-FAIR, started January 2019, leading the implementation of FAIR principles for the Atmospheric Environmental Domain.

Dr. Markus Fiebig (male) received his PhD in meteorology from the University of Munich, Germany, in 2001. He is a senior scientist at NILU and manages the GAW World Data Centre for Aerosol. In administering the underlying database infrastructure, he works on cross domain data archive interoperability and user interaction within the WMO Global Atmosphere Watch programme, and ENVRIplus, and ENVRI-FAIR and the Norwegian Scientific Data

Network (NorDataNet). He has authored or co-authored 40 representational projects (ACTRIS2, ACTRIS1, EUSAAR, ENVRIplus).

Richard O Rud (male) is a system developer working at NILU with a background in informatics and industrial ecology. He is mainly working as a system developer on tools for data management and curation as well as machine-to-machine interfaces for data and metadata interoperability. In addition he works with data curation for the EBAS data center. At NILU he has worked on projects including ACTRIS-2, ENVRI-FAIR, ENVRIPlus, NextGEOSS and the EVDC project.

Selected relevant publications:

- Dalsøren, S. D., G. Myhre, Ø. Hodnebrog, C. Lund Myhre, A. Stohl, I. Pisso, S. Schwietzke, L. Höglund-Isaksson, D. Helmig, S. Reimann, S. Sauvage, N. Schmidbauer, K. A. Read, L. J. Carpenter, A. C. Lewis, S. Punjabi and Markus Wallasch. Discrepancy between simulated and observed ethane and propane levels explained by underestimated fossil emissions, *Nature Geoscience*, doi:10.1038/s41561-018-0073-0,v11, 178–184, 2018
- 2. Lund, M. T., Myhre, G., Haslerud, A. S., Skeie, R. B., Griesfeller, J., Platt, S. M., Kumar, R., Myhre, C. L., and Schulz, M.: Concentrations and radiative forcing of anthropogenic aerosols from 1750–2014 simulated with the OsloCTM3 and CEDS emission inventory, *Geosci. Model Dev.*, 11, 4909–4931, 2018., https://doi.org/10.5194/gmd-11-4909-2018, 2018
- 3. Myhre, G., Aas, W., Cherian, R., Collins, W., Faluvegi, G., Flanner, M., Forster, P., Hodnebrog, Ø., Klimont, Z., Mülmenstädt, J., Myhre, C. L., Olivié, D., Prather, M., Quaas, J., Samset, B. H., Schnell, J. L., Schulz, M., Shindell, D., Skeie, R. B., Takemura, T., and Tsyro, S.: Multi-model simulations of aerosol and ozone radiative forcing for the period 1990–2015, *Atmos. Chem. Phys.*, 17, 2709-2720, doi:10.5194/acp-17-2709-2017, 2017
- 4. Myhre, C. Lund, B. Ferré, S. M. Platt, A. Silyakova, O. Hermansen, G. Allen, I. Pisso, N.Schmidbauer, A.Stohl, J. Pitt, P.Jansson, J. Greinert, C.Percival, A. M. Fjaeraa, S. O'Shea, M. Gallagher, M. Le Breton, K. Bower, S.Bauguitte, S. Dalsøren, S. Vadakkepuliyambatta, R. Fisher, E. Nisbet, D. Lowry, G. Myhre, J.Pyle, M. Cain, J. Mienert Large methane release from the Arctic seabed west of Svalbard, but small release to the atmosphere. *Geophys. Res. Lett.*, 43, doi:10.1002/2016GL068999
- Nisbet, E.G., M.R. Manning, E.J. Dlugokencky, R.E. Fisher, D. Lowry, S.E. Michel, C. Lund Myhre, S.M. Platt, G. Allen, P. Bousquet, R. Brownlow, M. Cain, J.L. France, O. Hermansen, R. Hossaini, A.C. Manning, G. Myhre, J.A. Pyle, B. Vaughn, N.J. Warwick, J.W.C. White., Very strong atmospheric methane growth in the four years 2014 2017: Implications for the Paris Agreement, accepted for publication in *Global Biogeochemical Cycles*, February 2019

EU projects most relevant for the proposal where NILU has been involved

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. ACTRIS (Aerosols Clouds, and Trace gases Research Infrastructure Network), 2011-2015, grant agreement No 262254
- 4. ENVRI-FAIR ,2019-2022, Grant agreement no 824868.
- 5. NextGEOSS, (a centralised European Earth observation data hub and platform, European Commission's contribution Global Earth Observation System of Systems (GEOSS), 2016 2020, Grant agreement no 730329.

National Institute of R&D for Optoelectronics (INOE) was established in 1996 and is involved in fundamental and applied research in optoelectronics, analytical chemistry, and high-pressure physics. INOE is a non-profit, independent research institute, under the coordination of the Romanian Ministry for Research and Innovation. The five departments in INOE focus on different applications of optoelectronics (new materials, laser-based instruments, art restoration, bio-medical and environment applications). The Remote Sensing Department operates a complex research infrastructure and has multidisciplinary expertise spanning from laboratory/in-situ chemical analysis to Earth Observation (EO) techniques and applications. It contributes to the joint European and global climatological database as part of international networks (EARLINET, AERONET, MWRNET, ACTRIS), coordinates the Romanian Atmospheric 3D research Observatory (RADO), and leads the Romanian initiative for ACTRIS research infrastructure ACTRIS-RO. INOE hosts one of the Units of the Centre for Aerosol Remote Sensing, being also the leader of this ACTRIS Central Facility.

Role in the project

INOE is the national representative of the Romanian's RPOs involved in ACTRIS activities. In this respect, INOE will participate in WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP2(Implementation of a sustainable ACTRIS organization), WP3(Strategy for enhancing ACTRIS relevance and impact), WP5(Facilitating the harmonized operation of the National Facilities), WP6(Implementation of the user access to ACTRIS services), WP9(Positioning ACTRIS in the European innovation ecosystem), and WP10(ACTRIS communication and public relations), ensuring the flow of information between the ACTRIS-RO consortium and European-level ACTRIS bodies, presenting the point of view and supporting the interests of the Romanian organizations and facilities. INOE leads WP4 (Implementation and test operation of the Central Facilities), which is in charge with the establishment of the functional workflows between CFs and the NFs, refinement of the CF detailed implementation plans, and testing the provision of priority operation support for the labelling of NFs.

Principal personnel involved

Dr. Doina Nicolae (female) is the WP4 leader in ACTRIS IMP and the national representative for Romania in ACTRIS. She is the head of the Remote Sensing Department in INOE, senior scientist, PI of EARLINET, ACTRIS and AERONET Bucharest station, expert evaluator for FP7, and an expert to ISO and COST actions, (co)author for 4 books/book chapters, 87 ISI papers (491 citations), and 52 papers in peer review journals. She is also involved in coordination of numerous national and international research projects, including the coordination of the Romanian ACTRIS consortium, ACTRIS-RO. Main achievements include the development of the Romanian Atmospheric 3D research Observatory (RADO) and its integration into relevant European and global networks (EARLINET, AERONET, MWRNET, ACTRIS, GALION). She is currently coordinating a 13.5 mil. EUR ERDF project to build up the facilities for the lidar Unit @ the ACTRIS Centre for Aerosol Remote Sensing (CARS) and the new, synergetic observational platform in Bucharest (MARS). She is the leader of the ACTRIS Centre for Aerosol Remote Sensing.

Dr. Livio Belegante (male) is the leader of the Romanian node in the Lidar Calibration Centre. He is a senior scientist, engineer at INOE. His research activity covers experimental and theoretical research: experimental campaigns for environmental studies and system inter-comparisons, intensive measurements during special environmental episodes using multi-wavelength Raman Lidar with depolarization channels. He is (co)author for 44 ISI papers (224 citations), and 25 papers in peer review journals. He is the head of INOE's Unit @ the ACTRIS Centre for Aerosol Remote Sensing, and is also responsible for measurements and quality assurance of INOE's observational platform in the framework of ACTRIS.

Relevant publications

- 1. Nicolae, D., Vasilescu, J., Talianu, C., Binietoglou, I., Nicolae, V., Andrei, S., Antonescu, B., A neural network aerosol-typing algorithm based on lidar data, *Atmos. Chem. Phys.*, Vol. 18, Issue 19, pp. 14511-14537, 10.5194/acp-18-14511-2018, 2018
- 2. Papagiannopoulos, N.; Mona, L.; Amodeo, A.; D'Amico, G.; Claramunt, P. G.; Pappalardo, G.; Alados-Arboledas, L.; Luis Guerrero-Rascado, J.; Amiridis, V.; Kokkalis, P.; Apituley, A.; Baars, H.; Schwarz, A.; Wandinger, U.; Binietoglou, I.; Nicolae, D.; Bortoli, D.; Comeron, A.; Rodriguez-Gomez, A.; Sicard,

- M.; Papayannis, A.; Wiegner, M., An automatic observ has sed action of the second of t
- 3. Kokkalis, P., Amiridis, V., Allan, J.D., Papayannis, A., Solomos, S., Binietoglou, I., Bougiatioti, A., Tsekeri, A., Nenes, A., Rosenberg, P.D., Marenco, F., Marinou, E., Vasilescu, J., Nicolae, D., Coe, H., Bacak, A., Chaikovsky, A., Validation of LIRIC aerosol concentration retrievals using airborne measurements during a biomass burning episode over Athens, *Atmos. Res.*, vol. 183, pp. 255-267, doi:10.1016/j.atmosres.2016.09.007, 2017
- 4. Wandinger, U., Freudenthaler, V., Baars, H., Amodeo, A., Engelmann, R., Mattis, I., Groß, S., Pappalardo, G., Giunta, A., D'Amico, G., Chaikovsky, A., Osipenko, F., Slesar, A., Nicolae, D., Belegante, L., Talianu, C., Serikov, I., Linné, H., Jansen, F., Apituley, A., Wilson, K. M., de Graaf, M., Trickl, T., Giehl, H., Adam, M., Comerón, A., Muñoz-Porcar, C., Rocadenbosch, F., Sicard, M., Tomás, S., Lange, D., Kumar, D., Pujadas, M., Molero, F., Fernández, A. J., Alados-Arboledas, L., Bravo-Aranda, J. A., Navas-Guzmán, F., Guerrero-Rascado, J. L., Granados-Muñoz, M. J., Preißler, J., Wagner, F., Gausa, M., Grigorov, I., Stoyanov, D., Iarlori, M., Rizi, V., Spinelli, N., Boselli, A., Wang, X., Lo Feudo, T., Perrone, M. R., De Tomasi, F., and Burlizzi, P.: EARLINET instrument intercomparison campaigns: overview on strategy and results, Atmos. Meas. Tech., 9, 1001-1023, doi:10.5194/amt-9-1001-2016, 2016.
- 5. Chaikovsky, A., Dubovik, O., Holben, B., Bril, A., Goloub, P., Tanré, D., Pappalardo, G., Wandinger, U., Chaikovskaya, L., Denisov, S., Grudo, J., Lopatin, A., Karol, Y., Lapyonok, T., Amiridis, V., Ansmann, A., Apituley, A., Allados-Arboledas, L., Binietoglou, I., Boselli, A., D'Amico, G., Freudenthaler, V., Giles, D., Granados-Muñoz, M. J., Kokkalis, P., Nicolae, D., Oshchepkov, S., Papayannis, A., Perrone, M. R., Pietruczuk, A., Rocadenbosch, F., Sicard, M., Slutsker, I., Talianu, C., De Tomasi, F., Tsekeri, A., Wagner, J., and Wang, X.: Lidar-Radiometer Inversion Code (LIRIC) for the retrieval of vertical aerosol properties from combined lidar/radiometer data: development and distribution in EARLINET, *Atmos. Meas. Tech.*, 9, 1181-1205, doi:10.5194/amt-9-1181-2016, 2016.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530., WP-leader
- 2. H2020-TWINN-2015, ECARS (East European Centre for Atmospheric Remote Sensing), 2016 -2019, Grant agreement No. 602014.
- 3. H2020-INFRAIA-2014-2015, ACTRIS-2 Aerosols, Clouds, and Trace gases Research InfraStructure, 2015 2019, Grant agreement no 654109.
- 4. MULTIPLY Development of a European HSRL airborne facility, 2014- 2017, Grant agreement no ESA 4000112373/14/NL/CT.
- 5. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, grant agreement No 262254.

Significant infrastructures

Together with its national partners (associated partners to this proposal), INOE brings to ACTRIS three potential ground-based observation sites distributed over the Romanian territory, two facilities part of the Lidar Calibration Centre, a simulation chamber, and an airborne atmospheric research facility. The most advanced observation site is operated by INOE in SE Romania, and includes active and passive remote sensing, as well as in situ instruments (aerosol, water vapor and ozone lidars, sun and lunar photometers, C-ToF Aerosol Mass Spectrometer, Aerosol Chemical Speciation Monitor, Aerodynamic Particle Sizer, Aethalometer, Nephelometer, PANDORA 2S, Microwave radiometer). These instruments are used for several years to provide high-quality data products to ACTRIS aerosol near-surface and aerosol profiling databases. INOE also hosts one Unit @ the ACTRIS Centre for Aerosol Remote Sensing (involving a state-of-the art laboratory for testing of lidar components and blocks, a reference multiwavelgth Raman polarization lidar, and complementary facilities and equipment for hands-on training) for which significant investments are made currently using structural funds. The other two observation sites are instrumented with (at least) multiwavelength lidars and sun photometers, and are located in: a) Central Romania, operated by the "Babes-Bolyai" University of Cluj-Napoca, and b) North-East Romania, operated by "Al. I. Cuza" University of Iasi.

The simulation chamber (ESC-Q-UAIC) is part of EUROCHAMP and is operated by "Al. I. Cuza" University of Iasi. The chamber is equipped with a White type multiple-reflection mirrors that leads to an optical path length of (492 ± 0.2) m for sensitive in situ long path absorption monitoring of reactants and products in IR region. State-of-the-art instruments (PTR-MS, Proton Transfer Reaction Time of Flight Mass Spectrometer, HR-ToF-AMS, High

Resolution Aerosol Mass Spectrometer, and SMPS Scanning National Particles of States (GC-FID/MS with TDU, comprehensive GC×GC-FID/MS, HPLC-DAD-FD, and HPLC-ToF-MS) can be used for off- and on-line analyses.

The airborne facility which is intended to be used as an ACTRIS exploratory platform, is equipped with in situ instrumentation for probing aerosols and clouds (a Cloud, Aerosol and Precipitation Spectrometer, and an Hawkeye Cloud Particle and Precipitation Probe) and will carry, in the near future, the airborne multi wavelength High Spectral Resolution Lidar developed in the frame of the ESA/ESTEC contract MULTIPLY. The ATMOSLAB aircraft is operated by the National Institute of Aerospace Research "ELIE CARAFOLI" in Bucharest.

The Paul Scherrer Institut (PSI) in Switzerland is a centre for multi-disciplinary research and one of the world's leading user laboratories. With its 2100 employees it belongs as an autonomous institution to the Swiss ETH domain and concentrates its activities on solid-state research and material sciences, energy and environmental research as well as on biology and medicine. The Laboratory of Atmospheric Chemistry (LAC) at PSI consists of about 45 researchers. It has in-depth experience with the design of experiments to characterize physical and chemical properties of aerosols and has a strong interest in the impact of aerosols on climate. The laboratory operates several smog chamber facilities for atmospheric chemistry simulation, as well as continuous aerosol measurements at the high Alpine research station Jungfraujoch (3580 m asl) which have been performed within the Global Atmosphere Watch (GAW) program of the World Meteorological Organization (WMO) since 1995.

Role in the project

PSI will participate in WP3(Strategy for enhancing ACTRIS relevance and impact) and WP5(Facilitating the harmonized operation of the National Facilities) and will be responsible for Transnational Access to the Jungfraujoch.

Principal personnel involved

Prof. Dr. Urs Baltensperger (male) is head of the Laboratory of Atmospheric Chemistry at PSI, and professor at ETH Zürich. He was chairman of the Scientific Advisory Group (SAG) for Aerosols of the Global Atmosphere Watch (GAW) aerosol program of WMO from 1997 to 2009. He was a member of the Research Council of the Swiss National Science Foundation from 2010 to 2018. He is author and co-author of more than 400 peer-reviewed papers (including 7 in Nature and 6 in Science) and has an h-index of 84. He has supervised about 50 PhD theses and is currently supervising 15 on-going PhD theses. He obtained a number of awards (including the Fellow of the American Geophysical Union in 2012, the Vilhelm Bjerknes Award of the European Geosciences Union in 2014, the Fuchs Memorial Award in 2016), and the Spiers Memorial Award of the Royal Society of Chemistry in 2016.

Dr. Martin Gysel (male) is head of the Aerosol Physics Group in the Laboratory of Atmospheric Chemistry at PSI and lecturer at ETH Zurich. He was vice president and president of the Gesellschaft for Aerosolforschung (GAeF), Secretary General of the International Aerosol Research Assembly (IARA) and Chair of the European Aerosol Conference held in Zurich in 2017. Since 2018, he is PI of the long-term aerosol monitoring at the Jungfraujoch site, he held an ERC consolidator grant from 2014-2019 and he was and is PI of several Swiss and European funded research projects. He is author and co-author of 94 peer-reviewed papers and has an h-index of 42. He is, together with Urs Baltensperger and Ernest Weingartner, the recipient of the 18th Prof. Dr. Vilho Vaisala Award of the WMO.

Dr. David Bell (male) is the leader of the smog chamber facilities in the Laboratory of Atmospheric Chemistry at PSI. He has led 6 successfully funded Transnational Access (TNA) campaigns within Eurochamp-2020 at the smog chamber facilities in PSI for a total of 100 access days in the last year. He was a contributor on the Alaskan Layered Pollution and Chemical Analysis (ALPACA) white paper. He is author and co-author of 30 peer-reviewed papers.

Relevant publications

- F. Bianchi, J. Tröstl, H. Junninen, C. Frege, S. Henne, C. R. Hoyle, U. Molteni, E. Herrmann, A. Adamov, N. Bukowiecki, X. Chen, J. Duplissy, M. Gysel, M. Hutterli, J. Kangasluoma, J. Kontkanen, A. Kürten, H. E. Manninen, S. Münch, O. Peräkylä, T. Petäjä, L. Rondo, C. Williamson, E. Weingartner, J. Curtius, D. R. Worsnop, M. Kulmala, J. Dommen, U. Baltensperger, New particle formation in the free troposphere: A question of chemistry and timing, Science 352, 1109-1112, 2016.
- 2. E.A. Bruns, I. El Haddad, J.G. Slowik, D. Kilic, F. Klein, U. Baltensperger, A.S.H. Prévôt, Identification of significant precursor gases of secondary organic aerosols from residential wood combustion, Scientific Reports, 6, 27881, 2016.
- 3. N. Bukowiecki, E. Weingartner, M. Gysel, M.C. Coen, P. Zieger, E. Herrmann, M. Steinbacher, H.W. Gäggeler, U. Baltensperger A review of more than 20 years of aerosol observation at the high altitude research station Jungfraujoch, Switzerland (3580 m asl), Aerosol and Air Quality Research 16, 764-788, 2016.
- 4. J. Schmale, S. Henning, S. Decesari, B. Henzing, H. Keskinen, K. Sellegri, J. Ovadnevaite, M.L. Pöhlker,

- J. Brito, A. Bougiatioti, A. Kristensson, N. Kalivitis, In Artificial Conference (In International Conference (International Conferen
- 5. M. Zanatta, M. Gysel, N. Bukowiecki, T. Müller, E. Weingartner, H. Areskoug, M. Fiebig, K. E. Yttri, N. Mihalopoulos, G. Kouvarakis, D. Beddows, R. M. Harrison, F. Cavalli, J. P. Putaud, G. Spindler, A. Wiedensohler, A. Alastuey, M. Pandolfi, K. Sellegri, E. Swietlicki, J. L. Jaffrezo, U. Baltensperger, and P. Laj, A European aerosol phenomenology-5: Climatology of black carbon optical properties at 9 regional background sites across Europe, Atmospheric Environment, 145, 346-64, 2016.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, grant agreement No 262254.
- 4. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes Towards 2020 and beyond), 2016-2020, grant agreement No 730997.
- 5. ERAPLANET (European Network for Observing our Changing Planet), 2016-2021, Grant agreement no. 689443.

Significant infrastructures

Field site: The high alpine research station Jungfraujoch is situated at 3500 m asl in the Swiss Alps. It is the highest research station in Europe that is accessible all year round by rail, and it is the only accessible observation point in Europe with adequate infrastructure that is within the free troposphere most of the year. This special geographical situation offers the opportunity to monitor background concentrations but also to investigate the transport of anthropogenic pollutants from the boundary layer to the free troposphere.

Laboratories: The facilities include 3 different simulation chambers, i.e., a stationary 27 m³ chamber (airconditioned at 15 to 30°C), a mobile 9 m³ chamber (without own air condition), and a stationary 9 m³ cool chamber (air-conditioned at 10 to 30 °C). The stationary big chamber has the advantage of an air volume which is important when many instruments sample for long times, such as for intercomparison purposes. The mobile chamber can be brought to any emission source and is therefore especially suited to e.g. evaluate secondary organic aerosol (SOA) formation from test benches. The cool chamber is able to simulate SOA formation also at temperatures below 0°C, which is especially relevant for wood burning emissions, which typically occur at low temperatures. PSI also operates a full suite of state of the art instrumentation for gas phase and aerosol characterization.

Central facilities: PSI is providing calibrated concentrations of black carbon mass for intercomparison of related instruments within EUROCHAMP-2020.

Eidgenoessische Materialpruefungs- und Forschungsanstalt (EMPA) is a research institute with about 750 employees in the domain of the Swiss Federal Institute of Technology Zurich (ETHZ). The 40 employees of the Laboratory for Air Pollution/Environmental Technology are focused on the measurement and modelling of atmospheric trace components. The laboratory contributes data to the networks of EMEP and GAW by operating 16 sites within the Swiss National Air Pollution Monitoring Network (NABEL). EMPA is well in the scope of ACTRIS-IMP as it is the provider of trace gas data in Switzerland for ACTRIS and is responsible for further developing quality assurance tool within the CiGAS Topical Center.

Role in the project

EMPA will collaborate in WP4 (Implementation and test operation of the Central Facilities), on the installation and implementation of the Swiss node of the Central Facility (CF) for trace gases (CiGas). The main task of EMPA is the provision and thorough testing of new quality assurance tools in cooperation with other nodes of CiGAS and with the data center. The implemented changes will then be further evaluated in order to reach an optimal compliance with user needs. In WP5 (Facilitating the harmonized operation of the National Facilities), EMPA is leading the task 5.2 (Support for new National Facilities and Regional Partner Facilities), on expanding the network, both in existing ACTRIS countries and in new countries (e.g. in Eastern Europe). In WP8 (Consolidating ACTRIS's position in the European and international research landscape) EMPA will work on the connection and compliance of ACTRIS with international initiatives such as GEO.

Principal personnel involved

Dr. Stefan Reimann (male) is a Senior Scientist and group leader at EMPA. He is responsible for the continuous measurements of VOCs and NO_X at several sites in Switzerland, amongst which the Jungfraujoch is the highest site in Europe, where these measurements are continuously performed. In ACTRIS Stefan Reimann is the responsible scientist for the installation of a quality assurance tool for checking VOC data between submission and publication on the database. He is a co-author of the new measurement guideline for VOCs, which is under review at WMO and he is the author of about 50 research papers.

Relevant publications

- Dalsøren, S.B., G. Myhre, Ø. Hodnebrog, C. Lund Myhre, A. Stohl, I. Pisso, S. Schwietzke, L. Höglund-Isaksson, D. Helmig, S. Reimann, S. Sauvage, N. Schmidbauer, K.A. Read, L.J. Carpenter, A.C. Lewis, S. Punjabi, M. Wallasch, Discrepancy between simulated and observed ethane and propane levels explained by underestimated fossil emissions, Nature Geoscience, 178–184, 2018.
- 2. Helmig, D., S. Rossabi, J. Hueber, P. Tans, S.A. Montzka, K. Masarie, K. Thoning, C.-Plass Duelmer, A. Claude, A.C. Lewis, L. Carpenter, S. Punjabi, S. Reimann, M.K. Vollmer, R. Steinbrecher, J. Hannigan, L. Emmons, E. Mahieu, B. Franco, D. Smale, A. Pozzer, A Reversal of Long-Term Global Trends in Atmospheric Ethane and Propane from the North American Oil and Gas Boom, Nature Geoscience, 2016.
- 3. Hoerger, C.C., A. Claude, C. Plass-Duelmer, S. Reimann, E. Eckart, R. Steinbrecher, J. Aalto, J. Arduini, N. Bonnaire, J.N. Cape, A. Colomb, R. Connolly, J. Diskova, P. Dumitrean, C. Ehlers, V. Gros, H. Hakola, M. Hill, J.R. Hopkins, J. Jäger, R. Junek, M.K. Kajos, D. Klemp, M. Leuchner, A.C. Lewis, N. Locoge, M. Maione, D. Martin, K. Michl, W. Nemitz, S. O'Doherty, P. Pérez Ballesta, T.M. Ruuskanen, S. Sauvage, N. Schmidbauer, T.G. Spain, E. Straube, M. Vana, M.K. Vollmer, R. Wegener, and A. Wenger, ACTRIS non-methane hydrocarbon intercomparison experiment in Europe to support WMO GAW and EMEP observation networks, Atmos. Meas. Tech., 8, 2715–2736, 2015.
- 4. Ruckstuhl, A.F., S. Henne, S. Reimann, M. Steinbacher, B. Buchmann, C. and Hueglin, Robust extraction of baseline signal of atmospheric trace species using local regression, Atmos. Meas. Tech., 5, 2613-2624, 2012.
- Legreid, G., D. Folini, J. Staehelin, J. Balzani Lööv, M. Steinbacher, S. Reimann, Measurements of organic trace gases including oxygenated volatile organic compounds at the high alpine site Jungfraujoch (Switzerland): Seasonal variation and source allocations, J. Geophys. Res., 113, D05307, 2008.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 871115 ACTRIS IMP Part B

- 654109. Associated with document Ref. Ares(2019)6815176 04/11/2019
- 3. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network) 2011-2015, , grant agreement No 262254.
- 4. NORS (Network Of Remote Sensing ground-based observations in support of the Copernicus atmospheric service), 2007-2013, Grant agreement number: 284421.
- 5. GEOMON (Global Earth observation and monitoring) ,2007-2001, Grant agreement number: 036677.

Significant infrastructures

EMPA is responsible of ACTRIS-related VOCs and NOx measurements at the high-altitude site of Jungfraujoch (3850 m asl) and at Beromuenster in the Swiss boundary layer. Furthermore, Empa will lead the Swiss node of the Central Facility on trace gas in-situ measurements (CiGAS).

KNMI is the Dutch national weather service and centre for climate research. The institute combines operational as well as strategic research tasks under one roof. As an integral part of the Ministry of Infrastructure and Watermanagement KNMI provides on a day-to-day basis advice on weather and climate to national, regional and local authorities. KNMI is participating in many European projects on weather, climate and space research and keeps close ties with its stakeholders.

KNMI hosts the Cabauw site, which is the main site in the Dutch national atmospheric research infrastructure Ruisdael Observatory. Cabauw is one of the so-called supersites for climate monitoring in Europe, is part of ICOS and aims to be an ACTRIS National Facility where key parameters of the atmospheric state and air quality are measured, including radiation and vertical profiles. Cabauw data is used for long-term records, process studies as well as test beds for model evaluation and satellite validation. Advanced techniques for atmospheric profiling are used and are continuously developed. Quality controlled observations are part of several networks, including BSRN, Aeronet, ACTRIS/EARLINET, ACTRIS/CloudNet, and GRUAN. Through the links with the KNMI space research division has a long-standing experience and expertise with satellite missions observing atmospheric composition including GOME, SCIAMACHY and GOME-2 and plays a leading role in OMI, the Sentinel-5 Precursor/TROPOMI, and the active atmospheric sounders Aeolus and EarthCare.

Role in the project

KNMI leads the Joint Research Unit for Cabauw in which TU-Delft is a linked third party. Together with TU-Delft KNMI will contribute to ACTRIS-IMP as a contributor of a national facility (Cabauw) and the development and hosting of the cloud radar calibration central facility as a TNA pilot. KMI will collabore in WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP2(Implementation of a sustainable ACTRIS organization), KNMI will lead the task 3.4 Enchaning the local and regional impact of ACTRIS in WP3(Strategy for enhancing ACTRIS relevance and impact), WP4(Implementation and test operation of the Central Facilities), and WP5(Facilitating the harmonized operation of the National Facilities).

Principal personnel involved

Mr. Arnoud Apituley (male) is senior scientist at KNMI. He has research experience in ground based and space borne remote sensing applications including tropospheric ozone, clouds, aerosols and water vapour. His main interest is in integrating in-situ and ground based and space borne remote sensing techniques, for the study of air quality and climate change at the Cabauw Experimental Site for Atmospheric Research (CESAR). He contributed to and led experimental campaigns for air quality and climate related effects of aerosols and clouds and to several satellite validation studies. He contributed to studies using synergies between different remote sensing techniques and studies linking satellite remote sensing data to ground based observations. He is coordinator of the Sentinel-5p/TROPOMI Level 2 working group and the TROPOMI Level 2 CAL/VAL team. He is member of the WMO CIMO expert team on upper air sensing technologies, member of the GRUAN working group and site representative of the GRUAN site Cabauw/De Bilt. He is an active participant in ACTRIS and member of the Ruisdael Observatory Executive Board.

Relevant publications

- 1. Pappalardo, G., Amodeo, A., Apituley, A., Comeron, A., Freudenthaler, V., Linné, H., Ansmann, A., Bösenberg, J., D'Amico, G., Mattis, I., Mona, L., Wandinger, U., Amiridis, V., Alados-Arboledas, L., Nicolae, D., and Wiegner, M.: EARLINET: towards an advanced sustainable European aerosol lidar network, Atmos. Meas. Tech., 7, 2389-2409, doi:10.5194/amt-7-2389-2014, 2014.
- 2. U. Wandinger, V. Freudenthaler, H. Baars, A. Amodeo, R. Engelmann, I. Mattis, S. Groß, G. Pappalardo,
- 3. Giunta, G. D'Amico, A. Chaikovsky, F. Osipenko, A. Slesar, D. Nicolae, L. Belegante, C. Talianu, I. Serikov, H. Linné, F. Jansen, A. Apituley, K. M. Wilson, M. de Graaf, T. Trickl, H. Giehl, M. Adam, A. Comerón, C. Muñoz-Porcar, F. Rocadenbosch, M. Sicard, S. Tomás, D. Lange, D. Kumar, M. Pujadas, F. Molero, A. J. Fernández, L. Alados-Arboledas, J. Antonio Bravo-Aranda, F. Navas-Guzmán, J. L. Guerrero-Rascado, M. J. Granados-Muñoz, J. Preißler, F. Wagner, M. Gausa, I. Grigorov, D. Stoyanov, M. Iarlori, V. Rizi, N. Spinelli, A. Boselli, X. Wang, T. Lo Feudo, M. R. Perrone, F. De Tomasi, and P. Burlizzi, EARLINET instrument intercomparison campaigns: overview on strategy and results, Atmos. Meas. Tech., 9, 1001-1023, doi:10.5194/amt-9-1001-2016, 2016

- 4. Donovan, D. P., Klein Baltink, H., Henzing, J. S., de Roode Research Report of The Composition of Land Control of Land Cont
- 5. Piters, A. J. M., Boersma, K. F., Kroon, M., Hains, J. C., Van Roozendael, M., Wittrock, F., Abuhassan, N., Adams, C., Akrami, M., Allaart, M. A. F., Apituley, A., Beirle, S., Bergwerff, J. B., Berkhout, A. J. C., Brunner, D., Cede, A., Chong, J., Clémer, K., Fayt, C., Frieß, U., Gast, L. F. L., Gil-Ojeda, M., Goutail, F., Graves, R., Griesfeller, A., Großmann, K., Hemerijckx, G., Hendrick, F., Henzing, B., Herman, J., Hermans, C., Hoexum, M., van der Hoff, G. R., Irie, H., Johnston, P. V., Kanaya, Y., Kim, Y. J., Klein Baltink, H., Kreher, K., de Leeuw, G., Leigh, R., Merlaud, A., Moerman, M. M., Monks, P. S., Mount, G. H., Navarro-Comas, M., Oetjen, H., Pazmino, A., Perez-Camacho, M., Peters, E., du Piesanie, A., Pinardi, G., Puentedura, O., Richter, A., Roscoe, H. K., Schönhardt, A., Schwarzenbach, B., Shaiganfar, R., Sluis, W., Spinei, E., Stolk, A. P., Strong, K., Swart, D. P. J., Takashima, H., Vlemmix, T., Vrekoussis, M., Wagner, T., Whyte, C., Wilson, K. M., Yela, M., Yilmaz, S., Zieger, P., and Zhou, Y.: The Cabauw Intercomparison campaign for Nitrogen Dioxide measuring Instruments (CINDI): design, execution, and early results, Atmos. Meas. Tech., 5, 457-485, doi:10.5194/amt-5-457-2012, 2012.
- 6. Brinksma, E. J., et al. (2008), The 2005 and 2006 DANDELIONS NO2 and aerosol intercomparison campaigns, J. Geophys. Res., 113, D16S46, doi:10.1029/2007JD008808.
- 7. Further papers relevant to Cabauw see: http://www.cesar-observatory.nl/index.php?pageID=3001

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. PEOPLE-2011-ITN, 289923, ITARS (Initial training for atmospheric remote sensing), 2012-2016,
- 4. Gaia-Clim ,2015-2017, Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring, Grant agreement no 640276.
- CAMS84 (Copernicus Atmosphere Monitoring Service Validation), 2015-2018, CAMS84 2015SC3 D84

Significant infrastructures

The Cabauw tower (213 m high, 50 km far from North Sea) is ideal for meteorological research on relations between the atmospheric boundary layer, land surface and weather. The site is also representative for long-term atmospheric studies because surroundings do not differ significantly from those in 1972. Cabauw is one of very few observatories around the world that monitors such a wide scope of relevant parameter in atmospheric chemistry and physics, hydrology and meteorology. In-situ, column integrated, and profiling measurements complement each other. Cabauw is used as a main satellite validation site for e.g. Sentinel-5p/TROPOMI and ADM-Aeolus.

At Cabauw a cloud radar calibration facility will be tested under ACTRIS-IMP and is expected to become fully operational as a central facility. The cloud radar calibration facility is developed in collaboration with the UK and France (CCRES).

BIRA-IASB was established in 1964 as an independent Federal Scientific Institute. Its mandate is to acquire scientific and technological expertise, and to disseminate information, in the field of space aeronomy. This expertise concerns the physics and chemistry of the atmospheres of planets and comets and of interplanetary space, as well as the impact of the Sun on the Earth's atmosphere and magnetosphere, in particular in the context of global changes and space weather, respectively. In order to acquire this expertise, it gains knowledge based on ground-based, airborne and space-based observations, combined with data from laboratory experiments and theoretical and numerical modeling studies. The activities at BIRA-IASB encompass research and service tasks, possibly in partnership with commercial organisations like industries.

BIRA-IASB has a very strong expertise in remote-sensing techniques for studying the atmospheric composition of the Earth, planets and comets, from various platforms (space, aircraft, ground). It uses spectrometric techniques from the UV-visible to the infrared range. Members of the divisions "Reactive gases in the Atmosphere" and "Sources and sinks of atmospheric components" are key partners in international remote-sensing networks for the monitoring of the Earth atmospheric composition, like the NDACC (Network for the Detection of Atmospheric Composition Changes) – which it is co-chairing since 2013-, and TCCON (Total Carbon Column Observing Network). It is PI of NDACC-associated instruments (FTIR and MAXDOAS) in several stations in the world. It is PI of an ICOS atmospheric station at La Réunion. BIRA-IASB is also recognized internationally for its contributions to the development of satellite reactive trace gas products and the beforementioned divisions play a key-role in satellite validation using network remote-sensing trace gases data. These same divisions are strongly involved in the Copernicus programme, notably in CAMS (Copernicus Atmosphere Monitoring Service) and C3S (Copernicus Climate Change Service), Sentinel-5P, and the forthcoming atmospheric Sentinel-4 and -5 missions. They also have been involved in the ACTRIS projects.

Role in the project

BIRA-IASB is coordinating the Belgian national ACTRIS consortium and has taken the lead of the ACTRIS Topical Centre for Reactive Trace Gases Remote Sensing (CREGARS).

In the current project, BIRA-IASB will be involved in the implementation of ACTRIS components, functionalities, and services in the WP4(Implementation and test operation of the Central Facilities), WP5(Facilitating the harmonized operation of the National Facilities), WP6(Implementation of the user access to ACTRIS services) and WP7(Pilots of trans-national access to support the implementation of ACTRIS services) as well as in WP8(Consolidating ACTRIS's position in the European and international research landscape) on the Collaboration with European research infrastructure, e-infrastructures and international initiatives, and in WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership) on the Engagement and enlargement of the ACTRIS community and ACTRIS membership at the Belgian level.

Principal personnel involved

Prof. Martine De Mazière (female) is researcher at BIRA-IASB since Dec. 1988. At present, she is leading the Infrared Observations team in the 'Sources and Sinks of atmospheric components' division at BIRA-IASB, and is Head of the Division 'Scientific Directorate', and Director General ad interim since June 2011.

M. De Mazière is co-chairman of NDACC since 2013 and PI of NDACC and TCCON FTIR instruments in La Réunion and at Porto Velho (Brazil, candidate NDACC instrument). Her team is leading the validation of CAMS products using data of NDACC that is recognized being a key network. She has been leading or involved in several EU and ESA projects targeting the development of better harmonized, traceable reference ground-based remote sensing data. Her team is also strongly involved in the validation of the TROPOMI CO and CH4 products using the FTIR networks of NDACC and TCCON, resp. and in the Validation Data Analysis Facility of the S5P Mission performance Center (S5P-MPC). She is deputy coordinator of the ESA project Fiducial Reference Measurements for Greenhouse Gases. She is coordinating the ACTRIS activities in Belgium, and the development of ACTRIS CREGARS, and in particular of the Belgian CREGARS-FTIR-BE Unit.

Dr. Michel Van Roozendael (male) is researcher at BIRA-IASB since Jan. 1990. He is currently leading the UV-Vis DOAS research group and is Head of the division 'Reactive gases in the atmosphere'. Since 2004, he is cochair of the NDACC UV-Vis working group and is PI for the BIRA-IASB ground-based DOAS and MAX-DOAS monitoring activities. He is also leading the ESA-funded project on Fiducial Reference Measurements for DOAS

air-quality measurements (FRM4DOAS). Next to ground-base assistingly with decline the series of the 4/11/2019 GOME, SCIAMACHY, GOME-2 and OMI missions with a focus on tropospheric trace gas retrievals. It is currently part of the Sentinel-5 Precursor Expert Support Laboratory team and is strongly involved in the algorithm development teams of the future Copernicus Sentinel 4 and 5 missions. M. Van Roozendael is also Science Lead for satellite ozone services developed as part of the ESA Climate Change Initiative (CCI) and the Copernicus Climate Change Service (C3S).

Dr. Bart Dils (male) is researcher at BIRA-IASB since Oct. 2004. He is a member of the Infrared Observations team in the 'Sources and Sinks of atmospheric components' division at BIRA-IASB. Apart from his involvement in the day-to-day operations of the BIRA-IASB operated FTIR instruments in Porto Velho (Brazil) and Ile de la Reunion (both NDACC and TCCON), he is heavily involved in the inter-comparison of retrieved FTIR data (single station as well as from NDACC and TCCON) with various data sources such as satellite remote sensing data (SCIAMACHY, GOSAT and IASI), Chemical Transport Models as well as In situ data (Non Dispersive IR CO at the Jungfraujoch station), this within the framework of various EU and ESA projects (EVERGREEN, HYMN, ACTRIS, CCI-GHG, CCI_GHG+ among others). He is also well versed in the manipulation of the Lagrangian Particle Dispersion Model FLEXPART, often used as an aid in the interpretation of comparison results. He is supporting the involvement of BIRA-IASB in ACTRIS.

Relevant publications

- Vigouroux, C., Bauer Aquino, C.A., Bauwens, M., Becker, C., Blumenstock, T., De Mazière, M., García, O., Grutter, M., Guarin, C., Hannigan, J., Hase, F., Jones, N., Kivi, R., Koshelev, D.? Langerock, B., Lutsch, E., Makarova, M., Metzger, J.-M., Müller, J.-F., Notholt, J., Ortega, I., Palm, M., Paton-Walsh, C., Poberovskii, A., Rettinger, M., Robinson, J., Smale, D., Stavrakou, T., Stremme, W., Strong, K., Sussmann, R., Té, Y., and Toon, G., NDACC harmonized formaldehyde time series from 21 FTIR stations covering a wide range of column abundances, Atmos. Meas. Tech., 11, 5049–5073, https://doi.org/10.5194/amt-11-5049-2018, 2018.
- De Mazière, M., Thompson, A. M., Kurylo, M. J., Wild, J. D., Bernhard, G., Blumenstock, T., Braathen, G. O., Hannigan, J. W., Lambert, J.-C., Leblanc, T., McGee, T. J., Nedoluha, G., Petropavlovskikh, I., Seckmeyer, G., Simon, P. C., Steinbrecht, W., and Strahan, S. E.: The Network for the Detection of Atmospheric Composition Change (NDACC): history, status and perspectives, Atmos. Chem. Phys., 18, 4935-4964, https://doi.org/10.5194/acp-18-4935-2018, 2018.
- 3. Thorne, P.W., F. Madonna, J. Schulz, T. Oakley, B. Ingleby, M. Rosoldi, E. Tramutola, A. Arola, M. Buschmann, A.C. Mikalsen, R. Davy, C. Voces, K. Kreher, M. De Maziere, and G. Pappalardo, Making better sense of the mosaic of environmental measurement networks: a system-of-systems approach and quantitative assessment, Geoscientific Instrumentation, Methods and Data Systems, 6(2), 453-472, doi:10.5194/gi-6-453-2017, 2017.
- 4. Franco, B., Hendrick, F., Van Roozendael, M., Müller, J.-F., Stavrakou, T., Marais, E. A., Bovy, B., Bader, W., Fayt, C., Hermans, C., Lejeune, B., Pinardi, G., Servais, C., and Mahieu, E.: Retrievals of formaldehyde from ground-based FTIR and MAX-DOAS observations at the Jungfraujoch station and comparisons with GEOS-Chem and IMAGES model simulations, Atmos. Meas. Tech., 8, 1733-1756, doi:10.5194/amt-8-1733-2015, 2015.
- 5. Hendrick, F., Müller, J.-F., Clémer, K., Wang, P., De Mazière, M., Fayt, C., Gielen, C., Hermans, C., Ma, J. Z., Pinardi, G., Stavrakou, T., Vlemmix, T., and Van Roozendael, M., Four years of ground-based MAX-DOAS observations of HONO and NO2 in the Beijing area, Atmos. Chem. Phys., 14, 765-781, doi:10.5194/acp-14-765-2014, 2014.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS, Aerosols, 2011-2015, Clouds, and Trace gases Research Infrastructure Network, grant agreement No 262254.
- 3. EUROCHAMP-2, 2009-2013, European Simulation Chambers for Investigating Atmospheric Processes, grant agreement No 228335.
- 4. QA4ECV, 2014-2017, Quality Assurance for Essential Climate Variables, Grant agreement no. 607405,
- 5. GAIA-Clim, 2015-2018, Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring, Grant agreement no. 640276.

Significant infrastructures

- Associated with document Ref. Ares(2019)6815176 04/11/2019
- Planned ACTRIS Topical Centre units CREGARS-FTIR-BE and CREGARS-UVVIS-BE
- FTIR and UVVIS (MAXDOAS) contributions to La Reunion as a shared French-Belgian Reactive trace gases remote sensing observational platform
- UVVIS (MAXDOAS) contribution to the Jungfraujoch Reactive trace gases remote sensing observational platform
- UVVIS (MAXDOAS) and sunphotometer contributions to the Uccle Aerosol in-situ observational platform
- UVVIS (MAXDOAS) contribution to the Vielsalm Reactive trace gases in-situ and Aerosol in-situ observational platform
- PTR-TOF-MS exploratory platform

The University of Manchester is a UK Higher Education institution. Its mission is to conduct world leading research and deliver world leading education. The Centre for Atmospheric Science is part of the School of Earth and Environmental Sciences, and has an extensive programme of research on aerosols, clouds and trace gases. We are one of the largest such groups in UK universities, and collaborate with leading atmospheric science groups worldwide. We have a strong experimental programme, with a range of state-of-the-art facilities for field and laboratory measurements. These include the Manchester Ice Cloud Chamber (MICC) and Manchester Aerosol Chamber (MAC), both of which plan to contribute to ACTRIS (MICC as a node of the Cloud In Situ TC). The Centre for Atmospheric Science also hosts staff from the National Centre for Atmospheric Science (NCAS) and collaborates with NCAS in the delivery of its science programme.

Role in the project

UMAN's role in ACTRIS IMP will be twofold:

- a) WP1 (Engagement and enlargement of the ACTRIS community and ACTRIS membership) National coordination of UK activities in ACTRIS (Prof G Vaughan)
- b) Provision of a node of the Cloud in situ Topical Centre, as part of WP4(Implementation and test operation of the Central Facilities). Dr. Keith Bower will coordinate the use of the MICC cloud chamber, and Dr. Jonathan Crosier will oversee calibration activities. Prof Tom Choularton will be in overall charge of the node as Head of the Centre for Atmospheric Science.

UNAM will support as well WP3(Strategy for enhancing ACTRIS relevance and impact)

Principal personnel involved

Professor Geraint Vaughan (male) is Director of Observations for the National Centre for Atmospheric Science. He has 40 years experience in atmospheric science and has conducted research with ground-based lidars and wind profilers since 1984. In addition, he has coordinated research programmes in atmospheric dynamics and composition, most notably in the UK Storm Risk Mitigation programme in 2010-13 and ATTREX/CONTRAST/CAST project to study the tropical tropopause layer in 2014. He recently participated in the NAWDEX field campaign in September-October 2016 (using ground-based and airborne observations).

Professor Tom Choularton (male) is Professor of Atmospheric Physics and Head of the Centre for Atmospheric Science. He has 40 years of experience of research in cloud physics and cloud aerosol interactions having published over 200 papers. He has extensive experience of chamber work, field work and process modelling and has recently led European Union and Nationally funded projects to investigate the effects of aerosol on mixed phase cloud, cloud microphysics in the arctic and Antarctic and the initiation of glaciation of deep convective clouds in the Tropics.

Dr. Keith Bower (male) is a Senior Institute Research Fellow and Senior Project Officer at the Centre for Atmospheric Science, has considerable experience and expertise (~30 years) in field experiments and modelling studies of the microphysics and chemistry of warm, mixed phase and ice clouds and of Aerosol-Cloud interactions and the evolution of Aerosol Properties. KB has played a leading role in the design, management and coordination of over 75 major national and international field experiments, in regions from the tropics to the poles, including projects funded by ACTRIS transnational access at Jungfraujoch to examine the microphysics and cloud aerosol interactions of ground based mountain clouds. KB has also been directly involved in the development, use and maintenance of key state of the art instruments for cloud & aerosol measurements on ground, aircraft platforms and in the laboratory, including the probes that are essential to the work proposed here.

Dr Jonathan Crosier (male) is a Senior Research Fellow in Cloud Microphysics, part funded by the National Centre for Atmospheric Science. He has over 15 years of experience in conducting in-situ cloud observations, including from both airborne and ground-based platforms. He is currently leading a nationally funded research project to improve representation of cloud processes in numerical models using in-situ microphysics observations co-located with multi-frequency radar observation. He is leading the development of calibration procedures and data processing systems for various in-situ cloud instrumentation, and is leading work to upgrade the capabilities Manchester Ice Cloud Chamber.

Professor Gordon McFiggans (male) is Professor of Atmospheric Multiphase Processes with 20 years' experience

in atmospheric science, with interests in field, laboratory and management group in EU FP6 and FP7 consortia, WP leader in the MAP Strategic Research Project and EUCAARI Integrated Project, in the access to laboratory data steering group in the ACCENT Network of Excellence and the management group of the EUROCHAMP Network of Atmospheric Simulation Chambers, running the Manchester Aerosol Chamber and leading the aerosol modelling WP. He is leader of the modelling WP in the EUROCHAMP 2020 proposal. He was PI in 4 TNA activities in EUSAAR / ACTRIS.

Relevant publications

- R. P. Harris, L. Carpenter, J. D. Lee, G. Vaughan, M. T. Filus, R. L. Jones, B. OuYang, J. A. Pyle, A. D. Robinson, S. Andrews, J. Minaeian, A. Vaughan, J. R. Dorsey, M. W. Gallagher, M. Le Breton, R. Newton, C. J. Percival, H. M. A. Ricketts, S. J-B. Bauguitte, G. J. Nott, A. Wellpott, M. J. Ashfold, J. Flemming, R. Butler, P. I. Palmer, P. H. Kaye, C. Stopford, C. Chemel, H. Boesch, Neil Humpage, A. Vick, A. R. MacKenzie, R. Hyde, P. Angelov, A. J. Manning, E. Meneguz. Co-ordinated Airborne Studies in the Tropics (CAST). Bull. Amer. Meteorol. Soc., 98, 145-162, doi: 10.1175/BAMS-D-14-00290.1, 2017.
- L. L. Pan, E. L. Atlas, R. J. Salawitch, S. B. Honomichl, J. F. Bresch, W. J. Randel, E. C. Apel, R. S. Hornbrook, A. J. Weinheimer, D. C. Anderson, S. J. Andrews, S. P. Beaton, T. L. Campos, L. J. Carpenter, D. Chen, B. Dix, V. Donets, S. R. Hall, T. F. Hanisco, C. R. Homeyer, L. G. Huey, J. B. Jensen, L. Kaser, D. E. Kinnison, T. K. Koenig, J.-F. Lamarque, Chuntao Liu, Jiali Luo, Z. J. Luo, D. D. Montzka, J. M. Nicely, R. B. Pierce, D. D. Riemer, T. Robinson, P. Romashkin, A. Saiz-Lopez, S. Schauffler, O. Shieh, G. Vaughan, K. Ullmann, R. Volkamer, G. Wolfe, M. H Stell and S. Baidar. The CONvective TRansport of Active Species in the Tropics (CONTRAST) Experiment. Bull. Amer. Meteorol. Soc., 98, 106-128, doi: 10.1175/BAMS-D-14-00272.1, 2017.
- Leon, D.C., J.R. French, S. Lasher-Trapp, A.M. Blyth, S.J. Abel, S. Ballard, A. Barrett, L.J. Bennett, K. Bower, B. Brooks, P. Brown, C. Charlton-Perez, T. Choularton, P. Clark, C. Collier, J. Crosier, Z. Cui, S. Dey, D. Dufton, C. Eagle, M.J. Flynn, M. Gallagher, C. Halliwell, K. Hanley, L. Hawkness-Smith, Y. Huang, G. Kelly, M. Kitchen, A. Korolev, H. Lean, Z. Liu, J. Marsham, D. Moser, J. Nicol, E.G. Norton, D. Plummer, J. Price, H. Ricketts, N. Roberts, P.D. Rosenberg, D. Simonin, J.W. Taylor, R. Warren, P.I. Williams, and G. Young, 2016: The Convective Precipitation Experiment (COPE): Investigating the Origins of Heavy Precipitation in the Southwestern United Kingdom. Bull. Amer. Meteor. Soc., 97, 1003–1020, https://doi.org/10.1175/BAMS-D-14-00157.1
- Vaughan, G., J. Methven, D. Anderson, B. Antonescu, L. Baker, T.P. Baker, S.P. Ballard, K.N. Bower, P.R. Brown, J. Chagnon, T.W. Choularton, J. Chylik, P.J. Connolly, P.A. Cook, R.J. Cotton, J. Crosier, C. Dearden, J.R. Dorsey, T.H. Frame, M.W. Gallagher, M. Goodliff, S.L. Gray, B.J. Harvey, P. Knippertz, H.W. Lean, D. Li, G. Lloyd, O. Martínez–Alvarado, J. Nicol, J. Norris, E. Öström, J. Owen, D.J. Parker, R.S. Plant, I.A. Renfrew, N.M. Roberts, P. Rosenberg, A.C. Rudd, D.M. Schultz, J.P. Taylor, T. Trzeciak, R. Tubbs, A.K. Vance, P.J. van Leeuwen, A. Wellpott, and A. Woolley, 2015: Cloud Banding and Winds in Intense European Cyclones: Results from the DIAMET Project. Bull. Amer. Meteor. Soc., 96, 249–265, https://doi.org/10.1175/BAMS-D-13-00238.1
- 5. The origins of ice crystals measured in mixed phase clouds at High-Alpine site Jungfraujoch. Lloyd, G., Choularton, T. W., Bower, K., Gallagher, M. W., Connolly, P. J., Flynn, M., Farrington, R., Crosier, J., Schlenczek, O., Fugal, J. & Henneberger, J., 2015, In: Atmospheric Chemistry and Physics. 15, 22, p. 12953-12969 17 p DOI: 10.5194/acp-15-12953-2015

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes Towards 2020 and beyond), 2016-2020, Grant agreement No 730997.
- 3. EUROCHAMP-2 (European Simulation Chambers for Investigating Atmospheric Processes), 2009-2013, grant agreement No 228335.
- 4. EUCAARI (European Integrated project on Aerosol, Cloud, Climate, and Air Quality Interactions), 2007-2010, Grant agreement No 036833.
- 5. CLACE (Cloud and Aerosol Characterization Experiment), 2004-2017, UK NERC

Significant infrastructures

UMAN hosts two medium scale infrastructures – the Manchester Aerosol Chamber (MAC, 871115 ACTRIS IMP – Part B

UKRI is a new UK body, established in 2018, which works in partnership with universities, research organisations, businesses, charities, and government to create the best possible environment for research and innovation to flourish. Operating across the whole of the UK with a combined budget of more than £7 billion, UKRI brings together the UK's seven Research Councils, as well as Innovate UK and Research England. It is an independent organisation with a strong voice for research and innovation, both to government and internationally, principally funded through the Science Budget by the Department for Business, Energy and Industrial Strategy (BEIS). UKRI has been commissioned by BEIS to develop the first UK research and innovation infrastructure roadmap.

The Science and Technology Facilities Council (STFC), is one of UKRI's component Research Councils, and is one of two elements that will participate in ACTRIS IMP. It is primarily responsible for supporting, coordinating and promoting research, innovation and skills development in the areas of Astronomy, Space Science and Technology (including Earth Observation), Nuclear and Particle Physics, Particle Astrophysics and Scientific Computing. It also works in partnership with other UKRI component Research Councils, including the Natural Environment Research Council (NERC), for which it provides the environmental science community with observational facilities (the NERC Facility for Atmospheric Radar Research, NFARR) and e-infrastructure. The latter is coordinated through the Centre for Environmental Data Analysis (CEDA) at the STFC Rutherford Appleton Laboratory, and furnishes petabyte scale storage and cloud computing for big data challenges in environmental science.

The STFC Chilbolton Observatory, the main location of NFARR, is operated by RAL Space, a department of the STFC Rutherford Appleton Laboratory. It supports the research community in universities, government, and in other Research Councils by providing access to a portfolio of instruments including radars, lidars, radiometers, beacon receivers, and a wide variety of in-situ meteorological sensors, together with hands-on training. This capability permits detailed bespoke observations of particular atmospheric events and processes during intensive campaigns, often co-ordinated with research aircraft. These sit alongside long-term measurements, including profiles from vertically pointing cloud radars.

The Centre for Ecology and Hydrology (CEH) is a research centre within UKRI's Natural Environment Research Council. NERC's purpose is to promote and support high-quality basic, strategic and applied research, surveys, long-term observation and monitoring in environmental and related sciences to advance knowledge and technology. NERC's Centre for Ecology and Hydrology at Edinburgh leads the Atmospheric Chemistry and Effects (ACE) Science Area. CEH is the UK's Centre of Excellence for integrated research in terrestrial and freshwater ecosystems and their interaction with the atmosphere. It provides National Capability based on innovative, independent and interdisciplinary science and long-term environmental monitoring, forming an integral part of NERC's vision and strategy. ACE scientists specialize in both concentration and flux measurements of trace atmospheric gases and aerosols. The CEH Atmospheric Composition Change Group operates the Auchencorth Moss WMO-GAW and EMEP level II/II atmospheric observatory, for both research and long-term monitoring.

Role in the project

UKRI will contribute to WP4(Implementation and test operation of the Central Facilities), WP5(Facilitating the harmonized operation of the National Facilities) and WP9(Positioning ACTRIS in the European innovation ecosystem) with the most significant contribution to the work on ACTRIS Central Facilities (WP4) and the harmonisation of National Facilities (WP5).

Principal personnel involved

Dr. Christopher Walden (male) is Head of the NERC Facility for Atmospheric Radar Research (NFARR), which is operated by STFC on behalf of NERC. He is affiliated to the National Centre for Atmospheric Science (NCAS), and has management responsibility for coordinating NFARR's work with the scientific requirements of researchers at the national level. He is active on national committees for atmospheric research using radar and on hydrological applications of radar. His background is in mathematical modelling of the melting layer and its effects on radio wave propagation. He has worked extensively with datasets from microwave and millimetre-wave propagation experiments (both terrestrial and earth-space), and has expertise in the interpretation of polarimetric Doppler radar measurements to diagnose propagation effects. He is responsible for radar calibrations and data quality assurance for Chilbolton's 3-, 35- and 94-GHz radars. He is involved in the development of standardized cloud radar calibration procedures within ACTRIS-2, and has responsibility for the ACTRIS/Cloudnet observing station at Chilbolton. He

has been active within ACTRIS PPP, helping to define and shape the spirate ture hand proposed operational stipport 4/11/2019 activities and user services of the Centre for Cloud Remote Sensing (CCRES).

Dr. Christine Braban (female), h-index: 17, publications: 47. Dr Braban is an environmental scientist who leads the Atmospheric Composition group in the Biosphere-Atmosphere Interactions science area at NERC CEH in Edinburgh. Dr Braban is an experienced project manager and coordinates the UK Eutrophying and Acidifying Atmospheric Pollutants monitoring project for the UK Department for Environment, Food & Rural Affairs (Defra) and contributes to both the ACTRIS-2 project (as NERC PI) and to the EMEP Task Force for Measurements and Modelling. She has a background in laboratory and field measurements relevant to atmospheric chemistry, recently with a focus on atmospheric ammonia and reactive oxidized nitrogen. Dr Braban was UK Research Excellence Grant PI of the EMRP ammonia metrology research project (ENV55) and is PI for CEH as a partner on two Strategic Priorities Fund Clean Air projects starting in February 2019. Dr Braban is on CEN WG11 and WG42.

Relevant publications

- Illingworth, A. J., Battaglia, A., Bradford, J., Forsythe, M., Joe, P., Kollias, P., Lean, K., Lori, M., Mahfouf, J., Melo, S., Midthassel, R., Munro, Y., Nicol, J., Potthast, R., Rennie, M., Stein, T. H., Tanelli, S., Tridon, F., Walden, C. J. and Wolde, M.: "WIVERN: A New Satellite Concept to Provide Global In-Cloud Winds, Precipitation, and Cloud Properties", Bull. Amer. Meteor. Soc., 99, 1669–1687, 2018. DOI: 10.1175/BAMS-D-16-0047.1
- Illingworth, A. J., Hogan, R. J., O'Connor, E., Bouniol, D., Brooks, M. E., Delanoé, J., Donovan, D. P., Eastment, J. D., Gaussiat, N., Goddard, J. W., Haeffelin, M., Baltink, H. K., Krasnov, O. A., Pelon, J. Piriou, J., Protat, A., Russchenberg, H. W., Seifert, A., Tompkins, A. M., van Zadelhoff, G., Vinit, F., Willén, U., Wilson, D. R. and Wrench, C. L.: "Cloudnet: Continuous Evaluation of Cloud Profiles in Seven Operational Models Using Ground-Based Observations", Bull. Amer. Meteor. Soc., 88, 883–898, 2007. DOI: 10.1175/BAMS-88-6-883
- 3. Hogan, R. J., Bouniol, D., Ladd, D. N., O'Connor, E. J. and Illingworth, A. J.: "Absolute Calibration of 94/95-GHz Radars Using Rain", J. Atmos. Oceanic Technol., 20, 572–580, 2003. DOI: 10.1175/1520-0426(2003)20<572:ACOGRU>2.0.CO;2
- 4. Tang, Yuk S.; Braban, Christine F.; Dragosits, Ulrike; Dore, Anthony J.; Simmons, Ivan; van Dijk, Netty; Poskitt, Janet; Dos Santos Pereira, Gloria; Keenan, Patrick O.; Conolly, Christopher; Vincent, Keith; Smith, Rognvald I.; Heal, Mathew. R; Sutton, Mark A., "Drivers for spatial, temporal and long-term trends in atmospheric ammonia and ammonium in the UK", Atmos. Chem. Phys., **18** (2). 705-733, 2018. DOI: 10.5194/acp-18-705-2018
- 5. Malley, Christopher S.; von Schneidemesser, Erika; Moller, Sarah; Braban, Christine F.; Hicks, W. Kevin; Heal, Mathew R., "Analysis of the distributions of hourly NO₂ concentrations contributing to annual average NO₂ concentrations across the European monitoring network between 2000 and 2014", Atmos. Chem. Phys., **18** (5). 3563-3587, 2018. DOI: 10.5194/acp-18-3563-2018

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. CLOUDNET (Development of European pilot network of stations for observing cloud profiles), 2001-2005, Grant agreement ID: EVK2-CT-2000-00065.
- 4. EuroTRMM (Exploitation of TRMM data for an improved weather and climate forecast), 1998-2001, Grant agreement ID: ENV4970421

Significant infrastructures

The Chilbolton Observatory is home to a wide range of scientific infrastructure to enable research in atmospheric science, radio communications, astronomy and space science and technology. These include LOFAR-UK, part of the Europe-wide Low Frequency Array radio telescope, and the Space Monitoring Facility for tracking and characterisation of orbiting satellites, together with satellite ground-station operations. The main activities at the Observatory involve facility and service provision to the atmospheric science research community through NFARR,

which it delivers with guidance from NERC's National Cent of Atimosphieric Science. For (2014) 405 years, 4/11/2019 Chilbolton has supported an experimental programme in radio science, radio-wave propagation, atmospheric science and meteorology.

The radars at Chilbolton include the 3 GHz system (CAMRa) on the 25 m diameter antenna, which is capable of high-resolution (spatial and temporal) Doppler and polarimetric measurements of rain and clouds. The ability to calibrate this instrument accurately using the polarimetric techniques makes it a reference instrument against which cloud radar calibrations may be compared. In addition, zenith-pointing polarimetric, Doppler 35 GHz and 94 GHz cloud radars are routinely operated for detailed microphysical studies of cloud processes and cloud climatology. A transportable, scanning 35 GHz cloud radar system is also hosted at Chilbolton, further enhancing the available capability. The combination of the 3, 35 and 94 GHz radars with polarimetric and Doppler capabilities, combined with other co-located instrumentation, and radio-frequency engineering expertise places Chilbolton in an excellent position to serve ACTRIS as a unit of the Centre for Cloud Remote Sensing (CCRES).

Chilbolton was one of the pilot cloud profiling sites for the FP5 CLOUDNET project, and an ACTRIS/CLOUDNET observing station has been in operation at Chilbolton for more than 15 years, exploiting the 35 and 94 GHz radars on site. This station is being proposed as a National Facility within ACTRIS. Capability at the site will be enhanced in the next few years, with the incorporation of a Raman lidar, with the ambition being for this to form an ACTRIS observational platform for aerosol profiling.

Within ACTRIS PPP Chilbolton was part of the consortium approved as host candidates for CCRES. The Chilbolton unit will support other CCRES units in developing technical solutions for both calibration of cloud radars and the assessment/correction of rain-induced attenuation effects (including radome/antenna wetting). This will exploit the CAMRa radar as a reference for evaluating retrievals and corrections applied to cloud radars from different manufacturers, which will underpin the acquisition of quality-assured data and provision of quality-controlled data products across geographically separated observing platforms.

Auchencorth Moss, operated by CEH, is Scotland's largest air quality monitoring and research infrastructure. The site hosts all the major UK air quality and climate monitoring networks. Within ACTRIS it is an observing site for in-situ trace gases and aerosols. It is a flagship UK site for long term monitoring of greenhouse gases and exchange with the peatland and is an ecosystem station in the ICOS ERIC. It also is integral to the Burnsmuir Landscape in the European Long-Term Ecosystem and Socio-Ecological Research Infrastructure (eLTER). The site was established for scientific research into methane fluxes in 1994, and as a monitoring site for sulphur dioxide and for acid deposition measurement and modelling for the UK in 1995. In 2006, it became a UK air pollution supersite for the European Monitoring and Evaluation Programme (EMEP) under the United Nations Convention on Long Range Transboundary Air Pollution (CLRTAP), and in 2014 achieved World Meteorological Organisation Global Atmospheric Watch (WMO-GAW) Regional Station status.

The Cyprus Institute (CyI, www.cyi.ac.cy) is a non-profit research and educational institution with scientific and technological focus. It consists of 3 research Centres that address challenging problems both at the regional and international levels. The novelty of the Institute derives from its structure that consists of issue-oriented, rather than discipline oriented research centres, in an interdisciplinary environment. The Government of Cyprus supports The Cyprus Institute, viewing its establishment as important to its overall policy of transforming Cyprus into a regional centre for research and education. Overall, CyI is intended as an important research resource for Cyprus, the Eastern Mediterranean, the Middle East and North Africa, and as a gateway between the European Union and the region. The Atmosphere and Climate Division (ACD, http://acd.cvi.ac.cv) of the Cyprus Institute will be directly involved in ACTRIS IMP. This division was launched in 2008 in close collaboration with the Massachusetts Institute of Technology (MIT), the Max Planck Institute for Chemistry in Mainz, Germany, the Cyprus Research Promotion Foundation (RPF), and many national institutions and organizations in Cyprus and the region on societally relevant issues related to Environment and Climate. Research at ACD addresses issues of regional interest but of global importance, including an assessment of environmental (air pollution) climate change impacts, development and articulation of adequate mitigation and adaptation strategies, formulation of strategies towards a carbon-free energy economy for Cyprus and the region. ACD has been instrumental in providing evidence that the Eastern Mediterranean and Middle East region (EMME) is a climate change "hotspot" and relating this to public health, ecosystem development, and water scarcity. These studies have attained international recognition, notably for their emphasis on the EMME. The research has been nationally embedded through strong collaborations with the Ministry of Health, the Ministry of Agriculture, Natural Resources and Environment, and the Ministry of Energy, Commerce, Industry and Tourism. The Atmosphere and Climate Division has established a number of unique environmental monitoring facilities (see below) and operates Master/Doctoral Programme on Environmental Sciences in close collaboration with the CyI Graduate School and several Advanced Partners in Europe through dual collaboration programmes.

Role in the project

As confirmed by the Directorate General for European programmes, coordination and development (Republic of Cyprus), the Cyprus Institute is acting as the Cyprus RPO for ACTRIS IMP. Leveraging its strategic location at the crossroads of 3 continents, CyI will promote the widening of ACTRIS community to new users from the North Africa and the Middle East WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), CyI will lead the task 3.2(Building the strategy for innovation in ACTRIS) in WP3(Strategy for enhancing ACTRIS relevance and impact), ensure harmonization of national (Cyprus) facilities for WP5(Facilitating the harmonized operation of the National Facilities), liaise ACTRIS with regional (North Africa/Middle East) initiatives WP8(Consolidating ACTRIS's position in the European and international research landscape) and promote technology transfer with its local private stakeholder cluster WP9(Positioning ACTRIS in the European innovation ecosystem).

Principal personnel involved

Dr Jean Sciare (Male; CV available at: https://www.cyi.ac.cy/images/rescvpdf/Jean_Sciare-Cyl_CV.pdf) is the Director of EEWRC at the Cyprus Institute with a tenured Professorship in Atmospheric Sciences in the Atmosphere and Climate Division of EEWRC since 2015. He is also the Scientific PI of two facilities: the Cyprus Atmospheric Observatory (CAO; http://www.cyi.ac.cy/index.php/cao.html), National (Cyprus) Facility candidate for ACTRIS and the Unmanned System Research Laboratory (USRL; http://usrl.cyi.ac.cy), candidate for new pilot TNA in ACTRIS IMP.

Research director of CNRS till 2014, he has settled at LSCE (CNRS-CEA, Gif/Yvette, France) the first EU calibration center for on-line aerosol chemical instruments (ACMCC) that is now part of ACTRIS Central Facilities. He has more than 15 years of experience in atmospheric chemistry, focusing on the various impacts of aerosols (climate, air quality, health, global security). He has been leading a large number of French/Cypriot research projects (IPEV, ANR, ADEME, CNRS, CEA, PRIMEQUAL, RPF) and participated in many EU FP5, FP6, FP7, and H2020 projects (ELCID, BIOGEST, OOMPH, LAB-Claire, MEGAPOLI, BACCHUS, ACTRIS, ACTRIS2, ACTRISPPP, to name a few), performing field campaigns in contrasted environments (North/South Pole, Amazonian forest, megacities in Africa, Asia, and Europe, oceanographic cruises, aircraft). He has coordinated for 20 years atmospheric monitoring activities in the Austral Ocean (Kerguelen, Crozet, and Amsterdam Isl.) in collaboration with the French Polar Institute and WMO-GAW. He is (co-)author of c.a. 120 international refereed publications and more than 150

presentations at international conferences for atmospheric chem / AAAC plays with the received hat international conferences for atmospheric chem / AAAC plays with the received hat international conferences for atmospheric chem / AAAC plays with the received hat international conferences for atmospheric chem / AAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international conferences for atmospheric chem / AAAAC plays with the received hat international chem / AAAAC plays with the received hat international chem / AAAAC plays with the received hat international chem / AAAAC plays with the received hat international chem / AAAAC plays with the received hat in the received hat in the received hat in the received hat in the rec

Dr. George Biskos (Male; https://www.cyi.ac.cy/images/rescvpdf/George_BiskosCyl_CV.pdf) is Associate Professor and heading the Cyl Instrumentation lab that develops and test (in weather chamber) lightweight/miniaturized atmospheric sensors for the unmanned systems operated by Cyl. GB holds a BSc (University of the Aegean) and MSc (Imperial College, London) degree in Environmental Science and Engineering, and a PhD (Cambridge University) in Engineering. He has been a postdoctoral researcher and then a research associate at Harvard University (USA) and has held faculty positions at the University of the Aegean (Greece), at Delft University of Technology (The Netherlands). His research expertise falls in the broader field of aerosol science and technology, with activities ranging from the development of instruments for measuring aerosol particles to implementing aerosol-based nanotechnology tools to produce nanomaterials for gas sensors. He has supervised 20 MSc and 4 PhD students who have successfully completed their studies, as well as 4 postdoctoral researchers. Currently he is supervising 3 PhD students and 1 postdoc. Dr. Biskos has authored/co-authored more than 60 journal publications and has participated in a number of national (UK, US, Greece, Netherlands, Cyprus) and international projects.

Relevant publications

Complete list of publications of the Atmosphere and Climate division is available at: http://www.cyi.ac.cy/index.php/atmosphere-and-climate-division-publications

- 1. Kleanthous, S., Vrekoussis, M., Mihalopoulos, N., Kalabokas, P., Lelieveld, J (2014): On the temporal and spatial variation of ozone in Cyprus", Science of the Total Environment, 476–477 (2014) 677–687.
- 2. Lelieveld, J., P. Hadjinicolaou, E. Kostopoulou, C. Giannakopoulos, A. Pozzer, M. Tanarhte and E. Tyrlis (2014) Model projected heat extremes and air pollution in the eastern Mediterranean and Middle East in the 21st century, Reg. Env. Change, 14, 1937-1949.
- 3. Zittis G., Hadjinicolaou P. and Lelieveld J., 2014, Comparison of WRF Model Physics Parameterizations over the MENA-CORDEX Domain, American Journal of Climate Change, 3, 490-511. doi: 10.4236/ajcc.2014.35042.
- 4. Abdelkader, M., Metzger, S., Astitha, M., Levin, Z., and Lelieveld, J.: Dust–air pollution dynamics over the Eastern Mediterranean, Atmos. Chem. Phys. Discuss., 15, 7493-7534, doi:10.5194/acpd-15-7493-2015, 2015
- 5. Pikridas, M., Vrekoussis, M., Sciare, J., Kleanthous, S., Vasiliadou, E., Kizas, C., ... & Mihalopoulos, N. (2018). Spatial and temporal (short and long-term) variability of submicron, fine and sub-10 μm particulate matter (PM1, PM2.5, PM10) in Cyprus. Atmospheric Environment, in press.

Relevant projects

- 1. ERC Advanced Grant project (Consistent Computation of the Chemistry-Cloud Continuum and Climate Change in Cyprus), 2009-2014, Grant agreement no 226144.
- 2. DARECLIMED (Data Repositories and Computational Infrastructure for Environmental and Climate Studies in the Eastern Mediterranean), 2011-2013, Grant agreement no 262263.
- 3. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 4. BACCHUS (Impact of Biogenic versus Anthropogenic emissions on Clouds and Climate: towards a Holistic Understanding), 2013-2017, Grant agreement no 312090.
- 5. Coordinator of the Cyprus Research Promotion Foundation Integrated Project "AQ-SERVE" (Air Quality Services for a cleaner air in Cyprus; 2019-2021.

Significant infrastructures

The Cyprus Atmospheric Observatory (ACTRIS-2 TNA station; http://www.cyi.ac.cy/index.php/cao.html)

The mission of the Agia Marina Xyliatou atmospheric station is to provide high quality long-term observations of key atmospheric pollutants relevant to air quality and climate change. Located at a rural site of Cyprus, this station is co-operated with the Department of Labour Inspection, in charge of the air quality network in Cyprus. The station is ideally located to document and contrast long-range transported pollution from three continents (Europe, Africa, and West Asia) and dust aerosols from the two largest desert regions in the world (Sahara, Middle East). It offers

on-site facilities and supportive infrastructure for research, de photographical difference of the stranspheric measurements. This station benefits from EU funds that facilitate the transnational access of international scientific community on a merit-based priority scheme. Objectives are:

- Provide quality controlled long-term atmospheric observations of key atmospheric pollutants (gases/aerosols) relevant to climate change and air quality; observations that have not been performed previously in the region
- Provide efficient facilities to conduct field research studies, offer hands-on training in educational programs or test new sensors in atmospheric conditions through a transnational access scheme

The Unmanned Systems Research Laboratory (USRL; http://usrl.cyi.ac.cy):

Established in 2010, USRL relies on a young and very promising technical team with eight (8) highly qualified and motivated staff (with background related electric/electronic/mechanical/composite material engineering and system/software development) supervised by two (2) experienced professional pilots flying commercial (Airbus) airliners. Such accumulated technical expertise and capacity to build the full automation of UAVs is rarely available in research institutions which are more oriented in UAV-based applications.

Over the last 4 years, USRL has intensely diversified its UAV fleet with fixed and rotary wings aircraft of various capacities (autonomy, payload, altitude ceiling, etc). USRL has become also specialized in the integration of atmospheric sensors in UAVs taking into the specific constrains for weight distribution, atmospheric sampling requirements (isokinetic sampling, drying, inlet geometry), data acquisition, power, possible interference with the aircraft automation (autopilot, communication with the Ground control Station, etc).

In order to be in capacity to perform intensive flight programs with the maximum flexibility, USRL has built an asphalte UAV runway (12x200m; Figure 19) and obtained a private airspace (NOTAM of 25km² with altitude up to 2.5km) granted permanently by the Cyprus civil aviation authorities at a remote site of Cyprus and above the CyI Cyprus Atmospheric Observatory, c.a. at 45km from the CyI premises in Nicosia. A fully autonomous mobile (truck) ground control station has been fully equipped to monitor and control UAVs during flight operations. This offers additional possibility to deploy UAVs in any remote place in Cyprus (and abroad) with maximum autonomy.

All this research infrastructure is operational since beginning of 2016 and have shown their performances during several international field campaigns (EU-FP7 BACCHUS campaign on dust-cloud interactions and Ice Nuclei characterization in April 2016; AQABA oceanographic cruise around the Arabian Peninsula; ERC-A-LIFE campaign on aerosol absorption properties in March-April 2017; ERC D-TECT campaign on dust characterization; Cyprus research projects on stack emissions, greenhouse gases profiling, etc)

4.1.19 University of Warsaw (UW)

The University of Warsaw (http://www.uw.edu.pl) was founded in 1816. It is a non-profit public university, the largest higher education establishment in Poland - among the top 3% of the world's best universities (latest Shanghai Ranking). The University of Warsaw (UW) has an endowment of 283 million Euro with an additional research-budget of 88 million Euro with funding provided primarily by the Polish Ministry of Science and Higher Education (MNiSW), the National Center for Research and Development (NCBiR), the National Science Center (NCN), and international entities. UW comprises a total of 21 faculties and 20 research units. It cooperates with over 1100 foreign entities and is a member of about 100 international associations and networks. Over 50.000 people study at UW each year. UW has about 3.5 thousand teaching and research staff, being high level experts in many fields. At the European level over 260 European research projects have been implemented in the EU Framework programmes (a.o. 14 ERC grants), 98 projects in FP7, REGPOT Project and 3 CIP Projects. In Program Horizon 2020, UW won over 50 grants (a.o. 7 ERC Grants, 3 ERC Starting Grants, 3 ERC Consolidator Grants) and ERC PoC grant, ITNs, RISE and IFs under MSCA, Twinning grant and several RI grants, COSME grant and 6 grants under SESAR JU. University of Warsaw is a partner institution in the EIT Food and EIT Climate KICs. UW Research Services Office was granted by the Minister of Science and Higher Education a status of the Regional Contact Point of EU Research Programmes for the period of 2014-2020 for the Mazovia Region.

The Faculty of Physics (http://www.fuw.edu.pl) is a research and teaching center of the UW, the largest physics and astronomy department in Poland, comprising the Institutes of Theoretical Physics, Experimental Physics, Geophysics, The Astronomical Observatory and The Department of Mathematical Methods in Physics.

The ACTRIS IMP project will be carried out at the Institute of Geophysics (http://www.igf.fuw.edu.pl) at the Faculty of Physics at the University of Warsaw. The Institute is closely collaborating with many international research institutions (e.g. Meteo-France, NCAR, TROPOS, AWI, INOE, KNMI, NILU, Max-Planck Institutes). The Institute was/is a partner in 2 FP5 (PACE, CESSAR), 3 FP6 (QUANTIFY, EUCAARI, ACCENT), and 4 FP7 (ACTRIS, COPAL, EUFAR, EUCLIPSE) projects, and 3 ESA projects (POLIMOS, SAMIRA, MULTIPLY). The main scientific areas developed at the Institute are related to research on aerosol optical and radiative properties assessed by in situ and ground-based/satellite remote sensing, as well as cloud modelling and cloud micro-physics research. During the last decade the Institute developed a research infrastructure for atmospheric studies, which is unique in Poland: The Radiative Transfer Laboratory (RT-Lab, established in 2008) and The Remote Sensing Laboratory (RS-Lab, in 2015) both co-located in Warsaw and two mobile vans dedicated to in-situ and remote observations, respectively. The infrastructure is equipped with instrumentation for meteorology and radiation observations, active/passive remote sensing, and in situ sensors. Both Laboratories provide an open access to their infrastructure for registered scientists (www.poland.aod.pl) and organize interdisciplinary field-campaigns. In relation to ACTRIS activities, the Institute is a founder and a main contributor to the national aerosol research network (Poland-AOD) and the international research networks (EARLINET, ACTRIS) and actively contributes to the joint European/Worldwide climatological databases.

Role in the project

UW represents the ACTRIS-related science community of Poland in the ACTRIS IMP. UW role is to lead the work foreseen for Poland, thus UW shall be responsible for communication and coordination of activities. More specifically, UW will actively contribute to work packages WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP2(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP4(Implementation and test operation of the Central Facilities) and WP5(Facilitating the harmonized operation of the National Facilities), and WP9(Positioning ACTRIS in the European innovation ecosystem), while IGF-PAS (LTP) will participate in WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP2(Engagement and enlargement of the ACTRIS community and ACTRIS membership) and WP5(Facilitating the harmonized operation of the National Facilities).

Principal personnel involved

Dr Iwona Stachlewska (female), an Assistant Professor at Faculty of Physics of the University of Warsaw, Plenipotentiary of Faculty Dean for admission matters, Head of the Remote Sensing Laboratory. She is a Ministry delegate to IAC ACTRIS-PPP. Her main expertise is in development of lidar systems and methodology for lidar data retrieval, establishing and managing observational sites, participation/leading of large interdisciplinary field campaigns, exploration of synergies of lidar with in-situ and remote sensors. She is co-founder and contributor to the

Relevant publications

- 1. Proestakis E., et al. (including I.S.Stachlewska), EARLINET evaluation of the CATS L2 aerosol backscatter coefficient product, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-45, 2019
- 2. Stachlewska I.S., et al. 2018: Modification of Local Urban Aerosol Properties by Long-Range Transport of Biomass Burning Aerosol, Remote Sensing, vol. 10(3), pp. art. 412, 10.3390/rs10030412
- 3. Baars H., et al.(including I.S. Stachlewska): An overview of the first decade of PollyNET: an emerging network of automated Raman-polarization lidars for continuous aerosol profiling, Atmos. Chem. Phys., 16, 5111-5137, 2016.
- 4. Engelmann R., et al. (including I.S. Stachlewska): The automated multiwavelength Raman polarization and water-vapor lidar PollyXT: the neXT generation, Atmos. Meas. Tech., 9, 1767-1784, doi:10.5194/amt-9-1767-2016, 2016.
- 5. EARLINET-ACTRIS Product/Services:

UW established an active link to the ACTRIS community by implementing in March 2015 the EARLINET-ACTRIS site in Warsaw and in December 2017 the AERONET site in Warsaw. High quality data are stored regularly in the ACTRIS Data Base, proving this collaboration fruitful.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, grant agreement No 262254.
- 4. SAMIRA (SAtellite based Monitoring Initiative for Regional Air quality), 2016-2019.
- 5. iAREA (Impact of absorbing aerosols on radiative forcing in the European Arctic, Polish-Norwegian Research Programme), 2013-2016, project leader

Significant infrastructures

UW, IGF-PAS (LTP) and associate partner's related to ACTRIS projects plan to bring into ACTRIS at least one of the observational platforms located at Warsaw, Belsk and/or Raciborz.

UW will establish at least one high-performance observational site located in Poland.

Lund University is the strongest research university in Sweden and is consistently ranked among the top 100 universities in the world. The Aerosol Group at the Division of Nuclear Physics, Physics Department, Lund University has conducted climate and health-related aerosol research for more than 30 years. Relevant areas of interest are aerosol measurement technology, aerosol-cloud-climate interactions, source-apportionment studies, satellite cloud remote sensing, aerosol dynamics and atmospheric chemistry process modelling, and Earth system modelling.

Role in the project

ULUND contributes to WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP3(Strategy for enhancing ACTRIS relevance and impact) and WP5(Facilitating the harmonized operation of the National Facilities). Furthermore, ULUND represents the scientific ACTRIS community of Sweden.

Principal personnel involved

Prof. Dr. Erik Swietlicki (male). Professor in Aerosol Physics and Leader of the Aerosol Group at the Division of Nuclear Physics with more than 30 years of experience in atmospheric aerosol science. National contact person for ACTRIS Sweden. His research is motivated by the effects of atmospheric aerosols on climate, environment and human health. Participated in 10 EU projects, including FP6 EUCAARI, FP6 EUSAAR, FP7 ACTRIS, H2020 ACTRIS-2 and ACTRIS PPP, also as WP and Task Leader. Acted as President of the European Aerosol Assembly and the Nordic Society for Aerosol Research. Awarded doctorates as main supervisor: 11. Faculty Opponent (PhD thesis): 11. Co-author of 187 peer reviewed scientific publications. Citations: 9501, h-index: 51.

Dr. Birgitta Svenningsson (female). Lecturer and deputy coordinator of the strategic research area MERGE. Her main research interests are in the fields of aerosol particle-water interactions and cloud droplet formation as well as in atmospheric formation of aerosol particles from anthropogenic and biogenic precursors. Main supervisor for 1 PhD student and 2 graduated PhD students and assisting supervisor for several. She has been the main supervisor for 3 Post Docs. Co-author of 65 peer reviewed scientific publications. Citations: 2724, h-index: 30.

Dr. Adam Kristensson (male). Senior researcher whose current main research interests are in the fields of ship emissions and background aerosol particles. Operational manager for the ULUND ACTRIS site Hyltemossa. He is and Nordic Society (NOSA) Board member and main supervisor for 1 PhD student performing research at the Hyltemossa field site, and assistant supervisor for 1 PhD student, previously for 2 PhD students and 3 Post Docs. Co-author of 35 peer reviewed scientific publications. Citations in Web-Of-Science: 1160, h-index: 16.

Relevant publications

- 1. Scott, C.E, Monks, S.A., Spracklen, D.V., ..., Swietlicki, E., et al., 2018. Impact on short-lived climate forcers increases projected warming due to deforestation. *Nature Communications*, vol 9, DOI: 10.1038/s41467-017-02412-4.
- 2. Schmale, J., Henning, S., ..., Kristensson, A., ..., Swietlicki, E., et al. 2018. Long-term cloud condensation nuclei number concentration, particle number size distribution and chemical composition measurements at regionally representative observatories. *Atmospheric Chemistry and Physics*, vol. 18, 2853-2881. DOI: 10.5194/acp-18-2853-2018.
- 3. Eriksson, A.C., Wittbom, C., Roldin, P., ..., Svenningsson, B., ..., and Swietlicki, E., 2017. Diesel soot aging in urban plumes within hours under cold dark and humid conditions. *Scientific Reports*, vol. 7, DOI: 10.1038/s41598-017-12433-0.
- 4. Martinsson, J., Azeem, H.A., ..., Swietlicki, E., et al. 2017. Carbonaceous aerosol source apportionment using the Aethalometer model evaluation by radiocarbon and levoglucosan analysis at a rural background site in southern Sweden. *Atmospheric Chemistry and Physics*, vol. 17, 4265-4281, DOI: 10.5194/acp-17-4265-2017.
- 5. Paasonen, P., ..., Swietlicki, E., et al. 2013. Warming-induced increase in aerosol number concentration likely to moderate climate change. *Nature Geoscience*, DOI: 10.1038/NGEO1800.

Relevant projects

1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.

- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research In strengised 12th, 2015-2019; Grant agreement No 262254.
- 3. EUSAAR, 2006-2011, European Supersites for Atmospheric Aerosol Research, Grant agreement no 026140.
- 4. EUCAARI, 2007-2012, European integrated project on aerosol cloud climate and air quality interactions, Grant agreement no 036833.
- 5. EU FP7 PEGASOS, 2001-2014, Pan-European Gas-Aerosols-Climate Interaction Study, Grant agreement no 265148.

Significant infrastructures

The core ULUND facilities related to ACTRIS are a) the ACTRIS field station Hyltemossa (HTM, 2017-, previously at Vavihill 1999-2018) that was established 2015 as an ICOS Sweden atmospheric and ecosystem site; b) extensive instrumentation for aerosol particle measurements and analysis; and c) advanced aerosol laboratory facilities for instrument testing and calibration.

4.1.21 European Commission - Joint Research Centre - eccorate for Energy, Transport and Climate 4/11/2019 (JRC)

As the European Commission's science and knowledge service, the Joint Research Centre's mission is to support EU policies with independent evidence throughout the whole policy cycle. The JRC is a key player in supporting the successful investment in knowledge and innovation foreseen by the Horizon 2020 Work Programme. An initiative to open up JRC infrastructures and associate them to the European Strategy Forum on Research Infrastructures is ongoing.

The mission of JRC-Directorate C (Energy, Transport and Climate) is to provide support to Community policies and technology innovation related to energy, transport and climate, and in particular to provide scientific and technical analyses in support to integrated air quality, climate change and related policies.

JRC-Directorate C encompasses seven units, of which the Air and Climate Unit provides scientific support for the development and evaluation of European policies in the fields of urban, regional, global air pollution and climate change. The Air and Climate Unit is currently involved i.a. in measurements of air pollution and greenhouse gases, and in the harmonization of atmospheric measurement techniques, making use of 2 major infrastructures: the European Commission Atmospheric Observatory, and the European Reference Laboratory for Air Pollution, which have been providing both measurement data and calibration support and services under ACTRIS and ACTRIS-2.

Role in the project

The JRC will focus on the development of the workflow from the National Facilities to the Data Centre via the Central Facilities WP4(Implementation and test operation of the Central Facilities), such contributing to the ACTRIS Data Management Plan. It will also participate in the definition of the procedures for NF labelling, and to capacity-building and human capital development at new NFs and RPOs through exchange of expertise and training WP5(Facilitating the harmonized operation of the National Facilities).

Principal personnel involved

Dr. J.P. Putaud (male) has been managing the Atmospheric Observatory for short-lived species in Ispra (IT) for more than 15 years. He has close to 30 years of experience in aerosol chemistry and physics, especially on atmospheric sampling and analysis of gaseous and particulate species at low concentrations. He is a member of the EMEP Task Force on Measurements and Modelling. He is convener of the CEN TC 264 Working Group 35 addressing the measurement of particulate organic and elemental carbon in the atmosphere. He (co-) authored more than 70 peer-reviewed papers in atmospheric chemistry and physics published in international journals, and he is Associate Editor of AMT. He participated in more than 10 EC funded projects.

Dr. F. Cavalli (female) has been the scientist responsible for the chemical characterization of airborne particulate matter at the Atmospheric Observatory in Ispra (IT) for more than ten years. She has more than 20 years' experience in airborne particulate matter measurements relevant to air quality and climate change. Active in the field of measurement standardization and harmonization under the implementation of Air Quality Directives, she developed the measurement protocol for atmospheric particulate organic & elemental carbon (Cavalli et al., 2010) adopted by the European Standard EN16909:2017. She is the manager of the accredited European Reference Laboratory for Air Pollution - organic & elemental carbon division; providing access to calibration support and services within the European Research Infrastructure ACTRIS. She (co-) authored more than 40 peer-reviewed papers in atmospheric chemistry and physics international journals. She is a member of the EMEP Task Force on Measurements and Modelling.

Relevant publications

- 1. Putaud, J.P., and 38 co-authors, A European Aerosol Phenomenology 3: physical and chemical characteristics of particulate matter from 60 rural, urban, and kerbside sites across Europe, Atmos. Environ. 44, 1308-1320, 2010.
- 2. Cavalli, F., Viana, M., Yttri, K. E., Genberg, J., and Putaud, J.-P.: Toward a standardised thermal-optical protocol for measuring atmospheric organic and elemental carbon: the EUSAAR protocol, Atmos. Meas. Tech., 3, 79-89, doi:10.5194/amt-3-79-2010, 2010.
- 3. Putaud, J.P., F. Cavalli, S. Martins dos Santos, and A. Dell'Acqua, Long-term trends in aerosol optical characteristics in the Po Valley, Italy, Atmos. Chem. Phys., 14, 9129–9136, 2014.
- 4. Cavalli, F., A. Alastuey, H. Areskoug, J. Cech, D. Ceburnis, J. Genberg, R.M. Harrison, J.L. Jaffrezo, G.

- Kiss, P. Laj, N. Mihalopoulos, N. Perez, P. Quincey, Chwarz, Wellegrin Gt. Spindlef? E.95 Wellegrin Gt. Spindlef. E.95 Wellegrin Gt.
- 5. Calibration support and service for organic and elemental carbon analysers provided since 2006 to partners and associated partners in the EU-funded projects EUSAAR, ACTRIS, and ACTRIS-2, as well as to external users like National Reference Laboratories for Air Pollution. About 300 accesses so far.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, grant agreement No 262254.
- 3. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 4. EARLINET-ASOS (European Aerosol Research Lidar Network Advanced Sustainable Observation System), 2016-2020, grant agreement No 025991.
- 5. EUSAAR (European Supersites for Atmospheric Aerosol Research), 2006-2011, Grant agreement No 026140.

Significant infrastructures

The JRC has been developing and operating one of the most comprehensive atmospheric observatory within ACTRIS. It has produced a unique set of 15-yr long data series for a suite of essential climate variables including physical, chemical and optical properties of the aerosol. JRC's atmospheric observatory combines in-situ measurements of aerosols and trace gas with remote sensing of aerosols. It is collocated with JRC's ICOS observatory.

The JRC has also been developing and leading the Central Facility Unit dedicated to the determination of particulate Organic and Elemental Carbon (OC & EC) in the atmosphere. It has developed the EN standard for measuring OC & EC (EN16909), and templates for reporting OC &EC concentrations and uncertainties. It is accredited for OC and EC measurements under ISO 17025.

The Division of Biomedical Physics at Medical University Innsbruck focuses on multiple aspects of solar radiation related to air quality and health. One specific research area is trace gas and aerosol ground based remote sensing. Our speciality is design, calibration, operation and maintenance of remote sensing instrumentation, such as Pandora spectrometers, sun photometers and broad band detectors.

Role in the project

We will operate the CF unit CREGARS-UVVIS-AT in ACTRIS and lead a task in WP5(Facilitating the harmonized operation of the National Facilities), task 5.4 (Upgrade operating strategies and technology development at the National Facilities), in WP9(Positioning ACTRIS in the European innovation ecosystem) MUI leads the task9.1 (Analysis of the current position of ACTRIS in the European innovation ecosystem) and collaborate with task 9.2 and 9.3. Furthermore, we coordinate the Actris Austria Consortium (https://actris.at) and collaborate with WP4(Implementation and test operation of the Central Facilities).

Principal personnel involved

Dr. Jochen Wagner (male),

the ACTRIS national contact point in Austria and coordinator of the Actris Austria Consortium, obtained his PhD in Meteorology from University of Natural Resources and Life Sciences, Vienna in 2011. Apart from academic positions at different Universities in Austria, he has been working at the German Weather Service (DWD) in Germany and the European Academy (EURAC) in Italy. He applied his expertise in radiative transfer and remote sensing of the atmosphere both in basic research and applied projects in photovoltaic energy yield calculations and weather forecasts. Since 2014 he has been working as project manager in international projects (interreg IV project SOLAR TIROL, ffg-project X-PANDA).

Dr. Axel Kreuter (male),

leads the Solar Radiation and air quality group within the Institute for Biomedical physics. He obtained his PhD in quantum optics and spectroscopy from the University Innsbruck in 2004. Afterwards he switched to atmospheric science becoming an expert in spectral radiative outdoor measurements in the UV and visible wavelength range and the retrieval of aerosol and trace gas properties. He has 7 publications in this field as first author. He is not limited to academic research and teaching, but also applies his extensive knowledge in application-related projects (e.g. Pandonia global network). More recently he became a leading expert in data visualization for scientist.

Relevant publications

- 1. Kreuter, A., M. Blumthaler, M., Tiefengraber, R. Kift, A. Webb (2017), Sky radiance at a coastline and effects of the land and ocean reflectivities. (Atmos. Chem. Phys., 17, 14353–14364, 2017)
- 2. Zhao, X., V. Fioletov, A. Cede, J. Davies, and K. Strong, Accuracy, precision, and temperature dependence of Pandora total ozone measurements estimated from a comparison with the Brewer triad in Toronto, Atmos. Meas. Tech., 9, 5747-5761, 2016.
- 3. Kreuter, A., S. Wuttke, and M. Blumthaler (2013), Improving Langley calibrations by reducing diurnal variations of aerosol Angstrom parameters, Atmos. Meas. Tech., 6, 99-103, 2013 www.atmos-meastech.net/6/99/2013/doi:10.5194/amt-6-99-2013
- 4. Wuttke, S., A. Kreuter, and M. Blumthaler (2012), Aerosol climatology in an Alpine valley, J. Geophys. Res.,117, D20202, doi:10.1029/2012JD017854
- 5. www.pandonia.net

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530, associated partner.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
 - 3.X-Panda (Improving global air quality measurements:
 - 4. Extending the Pandonia network to Argentina), 2017 2019, Grant agreement no 10445670, Beyond Europe 2nd Call, ffg-Austria
- 5. IAO (Innsbruck Atmospheric Observatory) for Environmental Research in Alpine and Urban Terrain, a long

- term national research frastpaictarewith document Refe Ares (2019) 68 fat Thry 0,4/11/2019 https://forschungsinfrastruktur.bmbwf.gv.at/en/fi/innsbruck-atmospheric-observatory-iao-for-environmental-research-in-alpine-and-urban-terrain 3190
- 6. AMiDA (Atmospheric Mission Data Packaging), 2018-2020, Grant agreement no.: ESA-AO/1-9139/18/I-SBo, ESA project

Significant infrastructures

At MUI, several routine measurements of solar radiation, such as UV and short wave total radiation are performed. Also, the operation of a sun photometer is an on-going project providing a long term aerosol climatology [Wuttke, 2012]. A new calibration method in sun photometry was introduced for this instrument [Kreuter, 2013]. An integral part of our infrastructure is the optical laboratory. There has also been a project related to the development and characterization of a diode array spectrometer. Furthermore, the Austrian long term UV-monitoring network is operated by MUI (http://www.uv-index.at/). The operation includes annual calibration of all participating instruments (UV-Biometer), data base management and online real-time dissemination of the data. We have extensive experience in setting up and operating measurement networks going back much longer than three years. This includes the absolute radiometric calibration of spectroradiometers with respect to direct and global irradiance and radiance.

The ZAMG is a service agency affiliated to the Austrian Federal Ministry of Education, Science and Research. Since 19990, ZAMG has been allowed legally to act partially as legal person (so called "Teilrechtsfähigkeit"). Since 2003 ZAMG has the ISO 9001 certificate which is up-to-date. The ZAMG consists of the head quarter in Vienna, four regional offices in Austria and two observatories, the Conrad Observatory (Geophysical Observatory) and the Sonnblick Observatory (Observatory for Geosciences). The ZAMG has currently app. 300 staff members. ZAMG provides state-of the-art in-house supercomputer facilities and powerful databases containing quality-controlled meteorological measurements to calibrate our models and perform ongoing climate change assessments. Remote sensing products are assessed and applied for weather forecasting purposes as well as climate services. The ZAMG contributes to ACTRIS-IMP by offering and providing all kinds of access to the Sonnblick Observatory, which will be a central facility unit in future.

Role in the project

The ZAMG Sonnblick Observatory contributes to ACTRIS IMP by supporting the different work packages, especially in WP4(Implementation and test operation of the Central Facilities), WP5(Facilitating the harmonized operation of the National Facilities) an WP6(Implementation of the user access to ACTRIS services), ZAMG will offer transnational access and will contributes to discussion and paper work to support the implementation and test operation of the CFs and NFs focusing on aerosol and cloud in situ. The ZAMG operates the Sonnblick Observatory which will be a CF unit and a NF within ACTRIS. Hence ZAMG is listed as beneficiary organization.

Principal personnel involved

Dr. Elke Ludewig (female) studied Meteorology at the University of Hamburg and the Max-Planck-Institute for Meteorology Hamburg, Germany, where she obtained her diploma in Meteorology 2010. In the following years she was a scholar of the International Max-Planck Research School for Maritime Affairs and finished her PhD in Earth System Science in 2014. 2015 she was the head of the meteorological observatory of the Neumayer Station III, Antarctica, where she did an overwintering from 2014-2016. In May 2016 she joined the ZAMG and became the head of the Sonnblick Observatory. She is responsible for several research and monitoring projects at the Sonnblick Observatory, like WMO programs GAW; GCW or BSRN but also EU Interreg projects like protectAlps (projectcode AB 173) or the H2020 INTERACT project. Within ACTRIS-IMP she will organize and built up a central facility unit for cloud in situ measurements and will support transnational access activities.

Christian Maier, MSc (male) studied atmospheric sciences and is system engineer of the Sonnblick Observatory since 2018. C. Maier developed and maintains the virtual access of the Sonnblick Observatory and controls the data management, measuring techniques, installations and the IT of the Sonnblick Observatory.

Relevant publications

- 1. Baumann-Stanzer K., M. Greilinger, A. Kasper-Giebl, C. Flandorfer, A. Hieden, C. Lotteraner, M. Ortner, J. Vergeiner, G. Schauer, M. Piringer (2018): Evaluation of WRF-Chem Model Forecasts of a Prolonged Sahara Dust Episode over the Eastern Alps. Aerosol and Air Quality Research, DOI: 10.4209/aaqr.2018.03.0116
- 2. Greilinger M, Schauer G, Baumann-Stanzer K, Skomorowski P, Schöner W and Kasper-Giebl A (2018) Contribution of Saharan Dust to Ion Deposition Loads of High Alpine Snow Packs in Austria (1987–2017). Front. Earth Sci. 6:126. doi: 10.3389/feart.2018.00126
- 3. Marion Greilinger, Luka Drinovec, Griša Močnik, Anne Kasper-Giebl,
- 4. Evaluation of measurements of light transmission for the determination of black carbon on filters from different station types, Atmospheric Environment, Volume 198, 2019, Pages 1-11, ISSN 1352-2310, https://doi.org/10.1016/j.atmosenv.2018.10.017.
- 5. D. Materic, E.Ludewig, K. Xu, T. Röckmann, R. Holzinger (2018): Analysis of organic matter in surface snow by PTR-MS-implications for dry deposition dynamics in the Alps.

Relevant projects

1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530, associated partner.

- 2. INTERACT (International Network for Terrestrial Resea and Motivity of the Artic), 2001-2004; Grant 4/11/2019 agreement no. 730938.
- 3. Chemical On-Line cOmpoSition and Source Apportionment of fine aerosol, COLOSSAL, COST Action CA16109, participant since 2018
- 4. WMO-GAW Programme (the Sonnblick Observatory is a global station within GAW since 2016)

Significant infrastructures

The ZAMG will bring the Sonnblick Observatory into ACTRIS as a national facility for aerosol in situ, a national facility for cloud in situ and as a central facility unit for cloud in situ.

ICPF CAS serves as a center for fundamental and applied research in chemical, biochemical, catalytic, and environmental engineering. This multidisciplinary character represents a big advantage in solving large and complex projects and in collaboration with external stakeholders, including industry and governmental bodies. Besides these activities, ICPF acts as a graduate school for Ph.D. studies in the field of chemical, biochemical, environmental engineering and processes, physical chemistry, organic chemistry, industrial chemistry, and biotechnology. In past decade, ICPF successfully solved many research projects funded by the Czech Science Foundation, Technological Agency of the Czech Republic, the Ministry of Industry and Trade, the Ministry of Education, Youth and Sports, Ministry of the Environment, etc. ICPF is also carrying out a project of TA CR "GAMA Centre of ICPF", focused on Proof-Of-Concept activities, which was granted to workplaces with an excellent system of dealing with intellectual property and high application potential of their R&D. ICPF also participated in solving many international projects from programs such as Norwegian funds, Research Fund for Coal and Steel, FP7, NATO Horizon 2020 or Marie Sklodowska-Curie actions.

The Department of Aerosol Chemistry and Physics (DACP) of the ICPF participating in the ACTRIS IMP project is the leader of aerosol science in the Czech Republic and deals with research in many branches of aerosol science. DACP carries out studies on atmospheric aerosols, behaviour of aerosols in indoor and workplace environment, the preparation of composite nanoparticles by the aerosol process, kinetics of nucleation and growth of atmospheric systems, filtration efficiency of different nanomaterials and also emission sampling of aerosol particles at elevated temperatures and pressures. The laboratory also performs long-term standardized measurements of atmospheric aerosols at a qualitatively higher level. The obtained data allow to incorporate the impact of aerosols into the forecasting meteorological models to refine their predictions and as a basis for modelling the impact of aerosols on climate. Moreover, DACP is the cradle of Czech Aerosol Society. In the past decades, the group solved many projects funded by Czech grant agencies as well as ministries and has participated in several EC funded projects, namely SUB-AERO, URBAN-AEROSOL, URBAN-EXPOSURE and projects preceding or directly connected to ACTRIS IMP, such as EUSAAR, EUCAARI, ACTRIS, ACTRIS-2 and ACTRIS PPP. During the past 5 years, senior team members have served as PIs in several nationally funded projects in the field of aerosol research.

Role in the project

DACP (ICPF CAS) will host calibration laboratory for aerosol physics (Prague Aerosol Calibration Centre – PACC, calibrations of MPSS, APSS, CPC, OPS) as a part of Centre for Aerosol in Situ (CAIS) within ACTRIS IMP. Furthermore, the special calibration workshops open to instrument manufacturers and users with custom built instruments will be offered as addition to standard operation of PACC within the ACTRIS TNA pilot action within ACTRIS IMP. DACP also plans to upgrade the measurement station in the campus of ICPF to become Aerosol In-Situ ACTRIS National Facility. Moreover, DACP takes care of most of the aerosol In-Situ measurements at National Atmospheric Observatory Kosetice (NAOK, CHMI). The ICPF performs most of the tasks within ACTRIS IMP from all the Institutions cooperating in ACTRIS CZ, so it makes it the most suitable organization for being direct beneficiary within ACTRIS IMP. ICPF will lead the taks 1.4 (Developing the ACTRIS Regional Partner Facility concept) in WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership). Furthermore ICPF will collaborate as well with WP2(Implementation of a sustainable ACTRIS organization), WP3(Strategy for enhancing ACTRIS Developing the ACTRIS Regional Partner Facility concept elevance and impact), WP4(Implementation and test operation of the Central Facilities), WP5(Facilitating the harmonized operation of the National Facilities), WP6(Implementation of the user access to ACTRIS services) and WP9(Positioning ACTRIS in the European innovation ecosystem).

Principal personnel involved

Dr. Jakub Ondráček (male) is the research scientist of the ICPF and he has experience in aerosol science over 14 years. He is specialized in aerosol instrumentation and measurements of aerosol physical properties. He was involved in most of the national and international projects of DACP for last 10 years (involved in European projects EUSAAR and EUCAARI, ACTRIS, ACTRIS 2, ACTRIS PPP, ACTRIS CZ and ACTRIS-CZ RI as ICPF team member). He is supposed to become a head of calibration laboratory for aerosol physics hosted by ICPF (Prague Aerosol Calibration Centre – PACC, calibrations of MPSS, APSS, CPC, OPS) as a part of Centre for Aerosol in Situ (CAIS) within ACTRIS IMP.

Dr. Vladimír Ždímal (male), leading scientist of the ICPF, is a head of the Department of Aerosols Chemistry and Physics. He has gained over 20 years in the aerosol field specializing in nucleation studies and determination of particle number size distribution and their dynamics. He was involved in European projects EUSAAR and EUCAARI as ICPF team member, later on he served as representative of ICPF within the project ACTRIS and ACTRIS-2. In

the ACTRIS-CZ and ACTRIS CZ-RI projects he serves as Co-in treatorate presenting IGPRef. Ares(2019)6815176 - 04/11/2019 **Dr. Jaroslav Schwarz (male)** is the senior research scientist at ICPF and has been working in the field of aerosol science, measurement technology and applications over 20 years with main focus on aerosol chemistry. He was PI of several national and co-PI of one EU project and participated in many national and several international projects.

Relevant publications

- Beddows, D.C.S., Dall'Osto, M., Harrison, R. M., Kulmala, M., Asmi, A., Wiedensohler, A., Laj, P., Fjaeraa, A.M., Sellegri, K., Birmili, W., Bukowiecki, N., Weingartner, E., Baltensperger, U., Ždímal, V., Zíková, N., Putaud, J.-P., Marinoni, A., Tunved, P., Hansson, H.-C., Feibig, M., Kivekäs, N., Swietlicki, E., Lihavainen, H., Asmi, E., Ulevicius, V., Aalto, P.P., Mihalopoulos, N., Kalivitis, N., Kalapov, I., Kiss, G., de Leeuw, G. Henzing, B., O'Dowd, C., Jennings, S.G., Flentje, H., Meinhardt, F., Ries, L., Denier van der Gon, H.A.C., Visschedijk, A.J.H.: Variations in Tropospheric Submicron Particle Size Distributions Across the European Continent 2008–2009. Atmos. Chem. and Phys. 14(8), 4327-4348 (2014).
- 2. Mann, G.W., Carslaw, K.S., Reddington, C.L., Pringle, K.J., Schulz, M., Asmi, A., Spracklen, D.V., Ridley, D.A., Woodhouse, M.T., Lee, L.A., Zhang, K., Ghan, S.H., Easter, R.C., Liu, X., Stier, P., Lee, Y.H., Adams, P.J., Tost, H., Lelieveld, J., Bauer, S.E., Tsigaridis, K., van Noije, T.P.C., Strunk, A., Vignati, E., Bellouin, N., Dalvi, M., Johnson, C.E., Bergman, T., Kokkola, H., von Salzen, K., Yu, F., Luo, G., Petzold, A., Heintzenberger, J., Clarke, A., Ogren, J.A., Gras, J., Baltensperger, U., Kaminski, U., Jennings, S.G., O'Dowd, C.D., Harrison, R. M., Beddows, D.C.S., Kulmala, M., Viisanen, Y., Ulevicius, V., Mihalopoulos, N., Ždímal, V., Fiebich, M., Hansson, H.-C., Swietlicki, E., Henzig, J.S.: Intercomparison and Evaluation of Aerosol Microphysical Properties among AeroCom Global Models of a Range of Complexity. Atmos. Chem. and Phys. Roč. 14(9), 4679-4713 (2014).
- 3. Kulmala, M., Asmi, A., Lappalainen, H.K., Baltensperger, U., Brenguier, J.-L., Facchini, M.C., Hansson, H.-C., Hov, O., O'Dowd, C.D., Pöschl, U., Wiedensohler, A., Boers, R., Boucher, O., de Leeuw, G., Denier van der Gon, H.A.C., Feichter, J., Krejčí, R., Laj, P., Lihavainen, H., Lohmann, U., McFiggans, G., Mentel, T., Pilinis, C., Riipinen, I., Schulz, M., Stohl, A., Swietlicki, E., Vignati, E., Alves, C., Amann, M., Ammann, M., Arabas, S., Artaxo, P., Baars, H., Beddows, D.C.S., Bergström, R., Beukes, J.P., Bilde, M., Burkhart, J.F., Canonaco, F., Clegg, S.L., Coe, H., Crumeyrolle, S., D'Anna, B.D., Decesari, S., Gilardoni, S., Fischer, M., Fjaeraa, A.M., Fountoukis, C., George, C., Gomes, L., Halloran, P., Hamburger, T., Harrison, R.M., Herrmann, H., Hoffmann, T., Hoose, C., Hu, M., Hyvärinen, A., Hörrak, U., Iinuma, Y., Iversen, T., Josipovic, M., Kanakidou, M., Kiendler-Scharr, A., Kirgevak, A., Kiss, G., Klimont, Z., Kolmonen, P., Komppula, M., Kristiansson, J.-E., Laakso, L., Laaksonen, A., Labonnote, L., Lanz, V.A., Lehtinen, K.E.J., Rizzo, L.V., Makkonen, R., Manninen, H.E., McMeeking, G., Merikanto, J., Minikin, A., Mirme, S., Morgan, W.T., Nemitz, E., O'Donell, D., Panwar, T.S., Pawlowska, H., Petzold, A., Pienaar, J.J., Pio, C., Plass-Duelmer, C., Prévot, A.S.H., Pryor, S., Reddington, C.L., Roberts, G., Rosenfeld, D., Schwarz, J., Seland, O., Sellegri, K., Shen, X.J., Shiraiwa, M., Siebert, H., Sierau, B., Simpson, D., Sun, J.Y., Topping, D., Tunved, P., Vaattovaara, P., Vakkari, V., Veefkind, J.P., Visschedijk, A., Vuollekoski, H., Vuolo, R., Wehner, B., Wildt, J., Woodward, S., Worsnop, D.R., van Zadelhoff, G.-J., Zardini, A.A., Zhang, K., van Zyl, P.G., Kerminen, V.-M., Carslaw, K.S., Pandis, S.N.: General Overview: European Integrated project on Aerosol Cloud Climate and Air Quality Interactions (EUCAARI)- Integrating Aerosol Research from Nano to Global Scales. Atmos. Chem. Phys. 11(24), 13061–13143 (2011).
- 4. Asmi, A., Wiedensohler, A. Laj, P., Fjaeraa, A.-M., Sellegri, K., Birmili, W., Weingartner, E., Baltensperger, U., Ždímal, V., Zíková, N., Putaud, J.-P., Marioni, A., Tunved, P., Hansson, H., Fiebig, M., Kivekäs, N., Lihavainen, H., Asmi, E., Ulevicius, V., Aalto, P.P., Swietlicki, E., Kristensson, E., Mihalopoulos, N., Kalivitis, N., Kalapov, I., Kiss, G., de Leeuw, G., Henzig, B., Harrison, R.M., Beddows, D., O'Dowd, C., Jennings, S.G., Flentje, H., Weinhold, K., Meinhardt, F., Ries, L., Kulmala, M.: Number Size Distributions and Seasonality of Submicron Particles in Europe 2008–2009. Atmos. Chem. Phys. 11(11), 5505-5538 (2011).
- 5. Putaud, J.-P., Van Dingenen, R., Alastuey, A., Bauer, H., Birmili, W., Cyrys, J., Flentje, H., Fuzzi, S., Gehrig, R., Harrison, R.M., Hansson, H.C., Herrmann, H., Hitzenberger, R., Hüglin, C., Jones, A.M., Kasper-Giebl, A., Kiss, G., Kousa, A., Kuhlbusch, T.A.J., Löschau, G., Maenhaut, W., Molnar, A., Moreno, T., Pekkanen, J., Perrino, C., Pitz, M., Puxbaum, H., Querol, X., Rodriguez, S., Salma, I., Schwarz, J., Smolík, J., Schneider, J., Spindler, G., ten Brink, H., Tursic, J., Viana, M., Wiedensohler, A., Raes, F.: A European Aerosol Phenomenology 3: Physical and Chemical Characteristics of Particulate Matter from 60 Rural, Urban, and Kerbside Sites Across Europe. Atmos. Environ. 44(10), 1308-1320 (2010).

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. ACTRIS participation of Czech Republic, MEYS, No. LM2015037, 2015-2022, project partner.
- 4. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, Grant agreement No 262254.
- 5. EUSAAR (European Supersites for Atmospheric Aerosol Research), 2006-2011, Grant agreement No, 026140.

Significant infrastructures

Central Facility Unit:

calibration laboratory for aerosol physics (Prague Aerosol Calibration Centre – PACC, calibrations of MPSS, APSS, CPC, OPS) as a part of Centre for Aerosol in Situ (CAIS).

Observational platforms:

Aerosol In-Situ National Facility at Suchdol, Prague.

Aerosol In-Situ part of the National Atmospheric Observatory Kosetice (NAOK, CHMI) within ACTRIS CZ consortia (CHMI, ICPF, GCRI and RECETOX).

In ACTRIS IMP the Greek ACTRIS community will be represented by the National Observatory of Athens (NOA). The National Center for Scientific Research "DEMOKRITOS" (NCSR-D) will act as a Linked Third Party to NOA. The following Institutes will act as Associated Partners: University of Crete (UoC), National Technical University of Athens (NTUA) and Aristotle University of Thessaloniki (AUTH).

The National Observatory of Athens (NOA) is the oldest Greek public research centre (founded in 1842). It hosts the UNESCO Chair for Natural Disasters and operates the Greek GEO Office (Group on Earth Observations).

NOA's Institute for Environmental Research & Sustainable Development (IERSD) maintains the longest and most complete climatologic record in Greece of meteorological (>120yrs) and solar radiation (>60yrs) parameters. It was also the first organisation that started a systematic study of urban pollution in Athens, in 1980. The Institute's research orientation includes: meteorological monitoring (260 stations), experimental research on air quality, atmospheric chemistry, aerosols and solar radiation, climate change research, synoptic and mesoscale atmospheric modeling, applied research (buildings, indoor air pollution, energy conservation, consultant services, e.t.c.), environmental management, surface and underground hydrology.

The Institute for Astronomy, Astrophysics, Space Applications and Remote Sensing (IAASARS) is one of the three institutes of the National Observatory of Athens, the oldest research institution in Greece. The main activities of the Institute involve basic and applied research in a number of topics in astrophysics, from distant galaxies to the solar neighbourhood, as well as ground based and space-borne remote sensing, earth observation and signal processing. The institute is also committed to outreach and science dissemination for the general public and operates a very popular visitor centre in Penteli.

Role in the project

NOA will contribute to WP3(Strategy for enhancing ACTRIS relevance and impact) coordinating the task 3.3 (Integrated assessment of ACTRIS societal impacts) and collaborating with the Taks 3.4. NOA will contribute also to WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP5(Facilitating the harmonized operation of the National Facilities), WP8(Consolidating ACTRIS's position in the European and international research landscape), WP9(Positioning ACTRIS in the European innovation ecosystem) and WP10(ACTRIS communication and public relations). NCSR-D and other relevant WPs

Principal personnel involved

Prof. N. Mihalopoulos (male) is the Director of IERSD/NOA and Greek coordinator of ACTRIS PPP. He has more than 290 publications in peer reviewed journals devoted to atmospheric chemistry and physics (1 in Nature and 1 in Science; 12200 citations, h-index 59). His research activities focus on biogeochemical cycling of elements and aerosol physicochemical characterisation. He is responsible for the monitoring station of Finokalia and participated as PI or co-PI in several (more than 45) EU and National funded projects.

- **Dr. V. Amiridis (male)** is a Senior Researcher at IAASARS/NOA and National delegate of the ministry for ACTRIS PPP. His main interests include research on the physical and optical properties of aerosols and their vertical distribution, with expertise in ground based lidar and satellite remote sensing techniques and methodologies. He has 125 publications in peer reviewed articles with 3060 citation (h-index 31), and has participated and/or co-ordinated as PI in national, ESA and EU projects. He also received and ERC consolidated grant.
- **Dr. E. Gerasopoulos (male)** is a Research Director at IERSD/NOA. His main interests include research on the physical, optical and chemical properties of aerosols with expertise in in-situ and remote sensing techniques and methodologies. He has about 86 publications in peer reviewed articles concentrating about 2900 citation (h-index 33) and has participated and/or co-ordinated as PI in several national and EU projects.
- **Dr. Sevastianos Mirasgedis (male)** is a Senior Researcher at NOA. He has been working for more than 20 years on issues of energy, climatic change and economy, focusing on their complex interdependences and interactions. He has been a Lead Author in the 4th and 5th IPCC Assessment Report on Climate Change as well as in Global Energy Assessment (2013), covering issues related to the building sector. He has participated in 36 Research Projects, acting as Project Leader (7 projects) or Senior Researcher (29 projects). He has co-authored more than 110 scientific articles, 46 of which in peer-reviewed journals and the citations to his work exceed 1400 (h-index 20).
- **Dr. A. Bougiatioti (female)** is a Senior Researcher at IERSD/NOA. Her research focuses on atmospheric chemistry and physics, with expertise in cloud condensation nuclei (CCN), aerosol chemical composition and size distribution.

She knows how to operate state-of-the-art instrumentation and described the spective of the analysis of the state of the publications in peer reviewed journals, with 1500 citations (h-index 21), has received a national grant (NSRF 2007-2013) and participated in EU projects (ACTRIS, ACTRIS-2, ACTRIS PPP).

Dr. Eleni Liakakou (female) is a Researcher at IERSD/NOA since 2011, conducting research on air quality and aerosol chemical composition. She has received 2 grants (Ph.D. and post-doctoral) and participated in 15 research projects. She has 16 publications in peer reviewed journals, with 380 citations (h-index 10), and participated in EU projects (ACTRIS, ACTRIS-2, ACTRIS PPP).

The National Center for Scientific Research "DEMOKRITOS" (NCSR-D) will act as a Linked Third Party to NOA. **Dr. K. Eleftheriadis (male),** Research Director at National Center for Scientific Research Demokritos, has more than 145 publications in peer reviewed journals (2740 citations, h-index 29) regarding atmospheric aerosol science, measurement methodology and applications. He is responsible for the DEM Research Aerosol Station of NCSR-D and Helmos mountain and he has participated in several national, European and international projects.

Relevant publications

- 1. Gratsea, M., Vrekoussis, M., Richter, A., Wittrock, F., Schönhardt, A., Burrows, J., Kazadzis, S., Mihalopoulos, N., Gerasopoulos, E., Slant column MAX-DOAS measurements of nitrogen dioxide, formaldehyde, glyoxal and oxygen dimer in the urban environment of Athens, Atmospheric Environment, Volume 135, June 01, 2016, Pages 118-131.
- 2. Bougiatioti, A., Bezantakos, S., Stavroulas, I., Kalivitis, N., Kokkalis, P., Biskos, G., Mihalopoulos, N., Papayannis, A., Nenes, A., Biomass-burning impact on CCN number, hygroscopicity and cloud formation during summertime in the eastern Mediterranean, Atmospheric Chemistry and Physics, Volume 16, Issue 11, 14 June 2016, Pages 7389-7409.
- 3. Athanasopoulou, E., Protonotariou, A., Papangelis, G., Tombrou, M., Mihalopoulos, N., Gerasopoulos, E., Long-range transport of Saharan dust and chemical transformations over the Eastern Mediterranean, Atmospheric Environment, Volume 140, 1 September 2016, Pages 592-604.
- 4. Tsekeri, A., Amiridis, V., Marenco, F., Nenes, A., Marinou, E., Solomos, S., Rosenberg, P., Trembath, J., Nott, G.J., Allan, J., Le Breton, M., Bacak, A., Coe, H., Percival, C., Mihalopoulos, N., Profiling aerosol optical, microphysical and hygroscopic properties in ambient conditions by combining insitu and remote sensing, Atmospheric Measurement Techniques, Volume 10, Issue 1, 6 January 2017, Pages 83-107.
- 5. Fourtziou, L., Liakakou, E., Stavroulas, I., Theodosi, C., Zarmpas, P., Psiloglou, B., Sciare, J., Maggos, T., Bairachtari, K., Bougiatioti, A., Gerasopoulos, E., Sarda-Est?ve, R., Bonnaire, N., Mihalopoulos, N*., Multitracer approach to characterize domestic wood burning in Athens (Greece) during wintertime, Atmospheric Environment, Volume 148, 1 January 2017, Pages 89-101.

Relevant projects

- 1 ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530, WP leader.
- 2 ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3 "THESPIA-Foundation of synergistic and integrated methodologies and monitoring tools, management and forecasting of environmental Parameters and pressures", 2013-2015, (National Institutional program).
- 4 THESPIA-2, 2017-2020, Foundation of synergistic and integrated methodologies and monitoring tools, management and forecasting of environmental Parameters and pressures", (National Institutional program), Grant agreement MIS 5002517.
- 5 PANAČEA, PanHellenic Infrastructure For Atmospheric Composition and Climate Change, 2018-2021, One of the 28 projects of the Greek Road Map for National Infrastructures, Grant agreement MIS: 5021516, ID:7535 (2018/1).

Significant infrastructures

The Finokalia station is run by the Environmental Chemical Processes Laboratory (ECPL) of the University of Crete. The Finokalia station is located in the SE Mediterranean (35 20N, 25 40E, 150m asl.) and it is a unique station in the area regarding the long record in O3, oxidants, aerosol chemical composition and precipitation chemistry. It is located far from any local source of pollution, facing the sea within a sector 270o to 90o and the air is representative of synoptic scale atmospheric composition. Finokalia is equipped with in-situ meteorological instrumentation as well as continuous measurements of gaseous (O3, CO, NOx, and NOy), particulate (optical properties, chemical composition, mass and mass size distribution) and wet deposition. Due to the frequent presence of dust events the 871115 ACTRIS IMP – Part B

site is ideal for studying the interaction of gaseous compounds with heterogeneous surfaces (like/dustandseersalt).04/11/2019
The Athens Supersite (AS) includes Thissio, Pendeli, Demokritos and NTUA stations situated at Athens (37.97 N, 23.72 E) and covers several sites from urban background, to sub-urban background and regional background. AS stations are equipped with in-situ meteorological instrumentation as well as instruments for in-situ and remote sensing measurements for gaseous (e.g. O3, CO, NOx, and NOy) and particulate (e.g optical properties, mass and mass size distribution, aerosol chemical composition) compounds including lidars, and photometers.

The Helmos Hellenic Atmospheric Aerosol and Climate Change station (HAC)2 which is a new high-altitude station in Greece, part of the NCSR 'Demokritos' Environmental Radioactivity Laboratory. The regular measurements of atmospheric aerosols parameters and concentrations of climate gases, started at the end of 2015. The name (HAC)2 is taken from the Helmos mountain, on which the station has been built, at the northern Peloponnese, at Neraidorachi peak 2340 m ASL. It is the only station at high altitude for atmospheric research in the region of the eastern Mediterranean and aims to study physical-chemical characteristics of aerosols and climate gases.

4.1.26 Foundation for Research & Technology, Hellas (FO TA) sociated with document Ref. Ares(2019)6815176 - 04/11/2019

The Foundation for Research and Technology-Hellas (FORTH) is one of the largest research centers in Greece with well-organized facilities, highly qualified personnel and a reputation as a top-level research foundation worldwide. The Institute of Chemical Engineering Sciences (ICE-HT) was established in 1984, and is one of the six research institutes that constitute FORTH. Currently, ICE-HT runs approximately 60 RTD projects in cooperation with industrial partners, universities, and research institutes from all over the world. ICE-HT has its own 6000 square meter facility, and more than 115 staff members and research associates (40 of which are PhD holders). The Institute has well equipped laboratories that have been used in a variety of research and technology problems involving physicochemical phenomena. ICE-HT is in close cooperation with the Department of Chemical Engineering in the University of Patras. Energy and the Environment is one of the three major areas of research and development of ICE-HT. The Laboratory for Air Quality Studies (LAQS) in FORTH has approximately 25 years of experience in the study of urban, regional, and global air quality and climate and has participated during the last 10 years in the EUCAARI, MEGAPOLI, CITYZEN, ACTRIS, ECLIPSE, PEGASOS, EUROCHAMP2020 and FORCeS EU projects. The group consists of about 20 researchers and its work focuses on air quality and climate change.

Role in the project

FORTH will collaborate with WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), FORT will lead task 1.1(ACTRIS community building and widening of the community participation), and WP8(Consolidating ACTRIS's position in the European and international research landscape)

Principal personnel involved

Dr. Spyros Pandis is Professor in the Chemical Engineering Department of the University of Patras in Greece and the Director of the Laboratory of Air Quality Studies (LAQS) in the Institute of Chemical Engineering Sciences (ICEHT) of the Foundation for Research and Technology, Hellas (FORTH). He is also Research Professor of Chemical Engineering and Engineering and Public Policy in Carnegie Mellon University in the US. He received his PhD from the California Institute of Technology in 1991 and joined the faculty of Carnegie Mellon University in 1993 and of the University of Patras in 2004. His research includes theoretical and experimental studies of atmospheric chemistry as it relates to urban and regional pollution and topics related to global climate change. He is one of the most cited researchers in Geosciences (Thompson Reuters). He has been the Coordinator of two EU projects and the Principal Investigator of ten projects in the US funded by the EPA, National Science Foundation, Dept. of Energy, etc. He has been awarded the Ken Whitby Award by the American Association for Aerosol Research, the CAREER award by the US National Science Foundation, the Book of the Year Award by the American Meteorological Society, the Vaughn Lectureship by Caltech, the Sinclair Award by the American Association for Aerosol Research, the Cecil Award for excellence in environmental engineering research by the American Institute of Chemical Engineering, the Lacey Lectureship by Caltech, and an ERC Senior Investigator award. He has been the recipient of the Elias Chair in Carnegie Mellon University, the Kun Li award for Excellence in Chemical Engineering education, and the Benjamin Teare award for Excellence in Engineering education. He is the ex-president of the American Association for Aerosol Research and one of the editors of Aerosol Science & Technology.

Dr. Athanasios Nenes is an Affiliate Scientist at ICEHT/FORTH and Professor of Atmospheric Processes and Head of the Laboratory of Atmospheric Processes and their Impacts (LAPI) at the Ecole Polytechnique Federale de Lausanne, Switzerland. His research focuses on atmospheric chemistry, aerosol-cloud-climate interactions, air quality and biogeochemical cycles, through a combination of theory, measurement and modelling. Over the last 5 years, his group has developed tools for advanced sensitivity analysis of large codes and model reduction/data discovery through emulation and network analysis. Prof. Nenes is an author in 262 peer-reviewed manuscripts (ISI citations: 12800, h=60), 15 of which in high-impact journals such Science, Nature Geoscience and PNAS. He is a member of the UN/WMO on the GESAMP WG 38 on "The Atmospheric Input of Chemicals to the Ocean", and a co-author of the 2016 US National Academies Report on the "Future of. Atmospheric Chemistry Research". He is recipient of a 2016 ERC Consolidator grant, the AGU Ascent award, the Whitby and Friedlander Awards of the AAAR, the Vaughn Lectureship by Caltech and the Houghton Award by the American Meteorological Society. He served as Atmospheric Sciences secretary of the American Geophysical Union and is currently the incoming president of the Atmospheric Sciences section of the European Geophysical Union. He has been the advisor of 21 PhD students (16 completed, 5 current).

Relevant publications

- 1. Robinson A. L., N. M. Donahue, M. K. Shrivastava, E. A. Wietkamp, A. M. Sage, A. P. Grieshop, T. E. Lane, J. R. Pierce and S. N. Pandis (2007) Rethinking organic aerosols: Semivolatile emissions and photochemical aging, *Science*, **315**, 1259-1262.
- 2. Megaritis, A. G., C. Fountoukis, P. E. Charalampidis, H. A. C. Denier van der Gon, C. Pilinis, and S. N. Pandis (2014) Linking climate and air quality over Europe: effects of meteorology on PM_{2.5} concentrations, *Atmos. Chem. Phys.*, **14**, 10283-10298.
- 3. Kanakidou, M., J. H. Seinfeld, S. N. Pandis, I. Barnes, F. J. Dentener, M. C. Facchini, R. van Dingenen, B. Ervens, A. Nenes, C. J. Nielsen, E. Swietlicki, J.P. Putaud, Y. Balkanski, S. Fuzzi, J. Horth, G. K. Moortgat, R. Winterhalter, C. E. L. Myhre, K. Tsigaridis, E. Vignati, E. G. Stephanou, J. Wilson (2005) Organic aerosol and global climate modelling: A review, *Atmos. Chem. Phys.*, 5, 1053-1123.
- 4. Weber, R.J., Guo, H., Russell, A.G., Nenes, A. (2016) High aerosol acidity despite declining atmospheric sulfate concentrations over the past 15 years, *Nature Geosci.*, doi:10.1038/ngeo2665.
- 5. Bracco, A., Falasca, F., Nenes, A., Fountalis, I., Dovrolis, C. (2018) Advancing climate science with knowledge-discovery through data mining, *Clim. Atmos. Sci.*, 1, doi:10.1038/s41612-017-0006-4.

Relevant projects

- 1. EUCAARI (European Integrated project on Aerosol, Cloud, Climate, and Air Quality Interactions) ,2007-2010, Grant agreement No 036833.
- 2. EU FP7 PEGASOS (Pan-European Gas-Aerosols-Climate Interaction Study) , 2001-2014, Grant agreement no 265148.
- 3. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes Towards 2020 and beyond), 2016-2020, grant agreement No 730997.
- 4. ATMOPACS: European Research Council advanced grant (coordinator, 5 years)
- 5. PYROTRACH: European Research Council consolidator grant (coordinator, 5 years)

Significant infrastructures

FORTH-SC is a state-of-the-art indoor Teflon atmospheric simulation chamber. It is a 15 m³ Teflon reactor in a 30 m³ temperature controlled UV-equipped room. Instrumentation around the chamber includes: HR-AMS, PTR-MS, SMPS, ultrafine-SMPS, APS, thermodenuder, SO₂, NO_x, CO, CO₂, O₃, NH₃ monitors, MAAP, TEOM, nephelometer, Dry-Ambient Aerosol Size Spectrometer (DAASS). Its unique characteristic is the air pollution source laboratory underneath it allowing studies of evolution of pollutants from specific sources (wood burning, open burning, gasoline and diesel engines, scooters, food cooking, etc.).

The **FORTH-MSC** is a mobile laboratory including two 2 m³ atmospheric simulation chambers. It can be used for field studies with natural or artificial sunlight. It includes the same instrumentation as the stationary laboratory. It has the unique ability to perform ambient air perturbation experiments (starting with ambient air) changing the conditions in the first chamber and keeping the second as baseline

The FORTH atmospheric simulation chambers can been used for testing/intercomparisons of new instruments, characterization of sources and the physicochemical evolution of their emissions, atmospheric "perturbation" experiments, health studies, studies of exposure of art to air pollution, etc.

4.1.27 Institute for Nuclear Research and Nuclear Energy (INRNE-BAS)

Bulgarian Academy of Sciences (BAS) was founded in 1869 and is one of the oldest institutions in Bulgaria. The mission of BAS is to develop the scientific knowledge in conformity with the human values and the country's national interest. BAS is the leading scientific organization in Bulgaria unifying 41 Institutes in the field of natural sciences and humanities.

At the Bulgarian Academy of Science there are two institutes that are involved in ACTRIS activities: the Institute for Nuclear Research and Nuclear Energy (INRNE-BAS) and the Institute of Electronics (IE-BAS). The Bulgarian participation in ACTRIS IMP is represented by INRNE-BAS.

INRNE-BAS is the leading Bulgarian Institute for fundamental and applied researches in the field of elementary particles and nuclear physics, high energy physics and nuclear energy, radiochemistry, radioactive wastes treatment, monitoring of the environment and scientific instrumentation development. The Institute's staff of about 200 (110 of them are scientific researchers) works in more than 25 research groups. Besides the representation, INRNE runs the atmospheric measurement site BEO Moussala.

Role in the project

The role of INRNE in ACTRIS IMP is to act as the voice of Bulgarian ACTRIS community in shaping the research infrastructure. INRNE will participate in work packages WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP2(Implementation of a sustainable ACTRIS organization), WP3 (Strategy for enhancing ACTRIS relevance and impact), WP5(Facilitating the harmonized operation of the National Facilities) WP6(Implementation of the user access to ACTRIS services), and WP9 (Positioning ACTRIS in the European innovation ecosystem).

Principal personnel involved

Associated Prof. Christo Angelov (male) He is head of the BEO "Moussala" laboratory with research areas in the field of physical and optical property of aerosols, radioactivity in the atmosphere and aerosols, climatology and climate change.

Assistant Prof. Ivo Kalapov (male). He is in charge of the BEO Moussala measurement site and is responsible for the engineering and maintenance. His main research areas are scientific instrumentation, climatology, physical and optical property of aerosols. He has been the national level coordinator in the projects mentioned below, and has been the person in charge of data submission.

Relevant publications

- 1. "A European aerosol phenomenology 6: scattering properties of atmospheric aerosol particles from 28 ACTRIS sites", Atmos. Chem. Phys., 18, 7877–7911, IF: 5.72, 2018
- 2. "Identification of topographic features influencing aerosol observations at high altitude stations", Atmos. Chem. Phys., 18, 12289–12313, IF: 5.72, 2018
- 3. "106Ru aerosol activity observation above southeast Europe in October 2017", Comptes rendus de l'Acade'mie bulgare des Sciences, Vol 71, No 5, pp. 613-618, ISSN 1310-1331, IF: 0,270, 2018
- 4. "Climate change impact on ⁷Be activity seasonal variations in air aerosols near Moussala BEO", Comptes rendus de l'Acade'mie bulgare des Sciences, Vol 70, No 9, pp. 1215- 1218, ISSN 1310- 1331, IF: 0,251, 2017.
- 5. "Classifying aerosol type using in situ surface spectral aerosol optical properties", Atmos. Chem. Phys., 17, 12097-12120, IF: 5.72, 2017.

Relevant projects

- 1. EU H2020 INFRADEV-2 project ACTRIS PPP (Aerosols, Clouds and Trace Gases Research Infrastructure Preparatory Phase Project), 2017-2019. Grant agreement n. 739530.
- 2. EU H2020 project ACTRIS 2 (Aerosol, Clouds, and Trace gases Research Infrastructure), 2015-2019, Grant agreement n. 654109.
- 3. EU FP7 project ACTRIS (Aerosol, Clouds, and Trace gases Research Infrastructure network), 2011-2015, Grant agreement n. 262254.
- 4. EU FP7 project BACCHUS (Impact of Biogenic versus Anthropogenic emissions on Clouds and Climate:towards a Holistic UnderStanding), 2014-2017, Grant Agreement n. 603445.

5. EU FP6 project EUSAAR (European Supersites for threspherio it Acrosol Research 3,0 12013652061-104/11/2019 Contract n. 026140.

Significant infrastructures

Together with its national partner IE-BAS, INRNE-BAS plans to bring to ACTRIS two ground-based observational platforms, BEO Moussala and Sofia Lidar Station.

In the high mountain environmental station "BEO Moussala" INRNE-BAS carries out regular measurements and studies in the field of aerosols (physical and optical properties of aerosols), radioactivity in aerosols and radioactivity the atmosphere. Atmosphere and trace gases (CO2, NOx, O3) are monitored also.

Founded in 1845, University College Cork (UCC) is one of the largest universities in Ireland (>20,000 students and 2,600 staff) and provides education across the whole range of academic disciplines. The Centre for Research into Atmospheric Chemistry (CRAC) at UCC has been in existence for 20 years and performs cutting edge research on: (i) laboratory simulations of atmospheric chemistry; (ii) field measurements of particulate matter and bioaerosols; (iii) development of new instrumental approaches for atmospheric analysis. The Centre has four laboratories equipped with state-of-the-art facilities, including the new Irish Atmospheric Simulation Chamber (IASC) facility and an atmospheric monitoring station on the UCC campus.

Role in the project

UCC contributes to WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP5(Facilitating the harmonized operation of the National Facilities) and WP9(Positioning ACTRIS in the European innovation ecosystem) in ACTRIS IMP. Furthermore, UCC will represent the scientific ACTRIS community of Ireland.

Principal personnel involved

Professor John Wenger (male) is Professor of Chemistry at UCC with over 20 years experience of research in atmospheric chemistry. His main area of expertise is in the use of simulation chambers to investigate the atmospheric oxidation of volatile organic compounds, with particular emphasis on kinetics, mechanisms and aerosol formation. Over the last 10 years he has also developed research interests in field measurements related to the chemical composition and sources of aerosols. His work has resulted in around 100 peer-reviewed publications (h-index 30, >4000 citations). Prof. Wenger was principal investigator in EUROCHAMP, EUROCHAMP-2 and currently plays a key role in EUROCHAMP-2020, leading the Innovation Platform.

Professor Andy Ruth (male) is a Professor in Physics at UCC with almost 25 years experience of research in laser spectroscopy. His main areas of expertise are the development of spectroscopic methods with applications in atmospheric trace gas detection, fundamental molecular spectroscopy and laser remote sensing. He pioneered the field of broad band cavity enhanced spectroscopy with incoherent light sources, a technique that is currently used in many different environmental applications. His work has resulted in close to 80 peer-reviewed publications (h-index 20, >1100 citations). Prof. Ruth is the Irish representative in EARLINET and also led UCC involvement in ACTRIS and ACTRIS 2 as associated partner.

Relevant publications

- 1. Riva, M., Healy, R. M., Flaud, P.-M., Perraudin, E., <u>Wenger, J. C.</u> and Villenave, E. "Gas- and particle-phase products from the photooxidation of acenaphthene and acenaphthylene by OH radicals", Atmos. Env. 151 (2017) 34-44.
- 2. Kourtchev, I., Giorio, C., Manninen, A., Wilson, E., Mahon, B., Aalto, J., Kajos, M., Venables, D., Ruuskanen, T., Levula, J., Loponen, M., Connors, S., Harris, N., Zhao, D., Kiendler-Scharr, A., Mentel, T., Rudich, Y., Hallquist, M., Doussin, J.-F., Maenhaut, W., Bäck, J., Petäjä, T., Wenger, J., Kulmala, M., and Kalberer, M. "Enhanced Volatile Organic Compounds emissions and organic aerosol mass increase the oligomer content of atmospheric aerosols", Scientific Reports 6 (2016) 35038.
- 3. Kourtchev,I J.-F. Doussin, C. Giorio, B. Mahon, E. M. Wilson, N. Maurin, E. Pangui, D. S. Venables, J. C. Wenger, and M. Kalberer. "Molecular composition of fresh and aged secondary organic aerosol from a mixture of biogenic volatile compounds: a high-resolution mass spectrometry study", Atmos. Chem. Phys. 15 (2015) 5683-5695.
- 4. G. Pappalardo, <u>A.A. Ruth</u>, et al., "Four-dimensional distribution of the 2010 Eyjafjallajökull volcanic cloud over Europe observed by EARLINET", Atmos. Chem. Phys. 13 (2013) 4429-4450.
- 5. H.-P. Dorn, R.L. Apodaca, S.M. Ball, T. Brauers, S.S. Brown, J.N. Crowley, W.P. Dubé, H. Fuchs, R. Häseler, U. Heitmann, R.L. Jones, A. Kiendler-Scharr, I. Labazan, J. M. Langridge, J. Meinen, T.F. Mentel, U. Platt, D. Pöhler, F. Rohrer, <u>A.A. Ruth</u>, E. Schlosser, G. Schuster, A.J.L. Shillings, W. R. Simpson, J. Thieser, R. Tillmann, R. Varma, D.S. Venables, A. Wahner, "Intercomparison of NO₃ radical detection instruments in the atmosphere simulation chamber SAPHIR", Atmos. Meas. Tech. 6 (2013) 1111-1140.

Relevant projects

1. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric

- Processes Towards 2020 and beyond), 2016-2020, grain grace patented Note 17 2000 Tent Ref. Ares (2019) 6815176 04/11/2019
- 2. EUROCHAMP-2 (European Simulation Chambers for Investigating Atmospheric Processes), 2009-2013, grant agreement No 228335.
- 3. EUROCHAMP (European Simulation Chambers for Investigating Atmospheric Processes), 2004-2009, grant agreement No 505968.
- 4. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109
- 5. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, grant agreement No 262254.

Significant infrastructures in Ireland

The Irish Atmospheric Simulation chamber (IASC) Facility located at UCC is a large (27 m³) exploratory platform for studies of atmospheric processes. It is equipped with a full range of instrumentation, including a chemical ionization mass spectrometer and unique custom-built cavity-based spectroscopy system for in situ measurements of gases, radicals and particles. The chamber facility is used for experimental studies of VOC oxidation, SOA formation and characterisation, development of spectroscopic techniques, evaluation of new instruments, sensors and associated technologies.

The UCC Atmospheric Monitoring Station (UCC-AMS) is an observational platform located on the UCC campus (urban background site). It is equipped with trace gas analyzers (nitrogen oxides and ozone) and a PM_{2.5} instrument (BAM) for *in situ* measurements. The facility also comprises a (1+1) Raman lidar for aerosol remote sensing the free troposphere, and a robotic 8 channel Cimel Sun photometer for optical extinction measurements (AERONET). A small automated weather mast (measuring temperature, pressure, humidity and precipitation), with daily uploads of data to Met Eireann, supplements the activities.

The Mace Head Atmospheric Research Station, operated on the Atlantic coastline by NUIG since 1958, is one of Europe's most significant background observation stations. It is both a part of the WMO Global Atmosphere Watch (GAW) programme and the European Monitoring and Evaluation Programme (EMEP). The station is also a member of other networks (e.g. AGACE, ICOS, CloudNet, TROPOF). The facility operates a sophisticated operational system providing near-real-time delivery of atmospheric composition and meteorological products through its website (www.macehead.org). Its operations include greenhouse gas and CFC/HFC monitoring, real time operational aerosol mass spectrometry and a suite of ground-based remote sensing of cloud physics, aerosol profiles, and atmospheric thermodynamic profiling.

Aarhus University (AU) was founded in 1928. It has 39,000 students; about 1,800 PhD students - of which one in four has a foreign nationality - and close to 900 postdoctoral scholars together with 11,500 employees. AU's four faculties cover the entire research spectrum – basic research, applied research, strategic research and research-based advice to the authorities. AU is participating in 252 H2020 projects – 25 as coordinator – and has hosted/is currently hosting 45 ERC projects. AU has a very successful track record of managing both individual fellowships and large international projects.

Department of Environmental Science (ENVS) at Aarhus University runs basic and problem-oriented research within organic, chemical and physical connections in the environment and within economic, political and social conditions in the interaction between environment and society. The department carries out research-based consultancy for the public sector and provides research-based advice. The academic expertise ranges from atmospheric chemistry and physics towards environmental chemistry, microbiology and biotechnology to environmental economics, environmental geography, political science and sociology. An important task is to provide research-based consultancy for the public sector and advice in the environmental field. We are about 130 employees and students and we work closely together with researchers from many Danish and foreign institutions. Villum Research Station is a research facility in high Arctic North Greenland (81°36' N, 16°40' W). Aarhus University operates the state-owned research station. The station hosts scientific projects focusing on atmospheric, marine and terrestrial research. Furthermore, long-term monitoring of climate change and its effects on the arctic ecosystems is carried out at the station.

Role in the project:

AU contributes to WP1 (Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP2, (Implementation of a sustainable ACTRIS organization) and WP5 (Facilitating the harmonized operation of the National Facilities). Furthermore, AU represents the scientific ACTRIS community of Denmark.

Principal personnel involved

Prof Henrik Skov (male) is the Head of Villum Research Station, Station Nord. Henrik Skov is a PhD in atmospheric chemistry and will contribute to WP 1, 2 and 5. He has worked more than 20 years in the Arctic and been head of the Arctic activities in the Department the last 17 years. In 2013, he received a grant for building a new interdisciplinary research Station; Villum Research Station at Station Nord. Henrik Skov has 100 peer reviewed articles, and 320 other type of scientific presentations. He has a web of Science h index = 33 and citations 2,919. He is reviewer in several scientific journals and co-editor of Dansk Kemi.

- Dr. Andreas Massling (male), Senior Researcher, Department of Environmental Science. Expert in aerosol physics.
- Dr. Jacob Klenø Nøjgaard (male), Senior Researcher, Department of Environmental Science. Expert in aerosol chemistry.
- **Dr. Rossana Bossi (female),** Senior Researcher, Department of Environmental Science. Expert in analytical chemistry
- Dr. Niels Bohse Hendriksen (male), Senior Researcher, Department of Environmental Science. Expert in microbiology
- Dr. Lise Lotte (female), senior Researcher, Department of Bioscience. Expert in micrometeorology and fluxes.

Relevant publications

- 1. Boy, M, Thomson, E. S. Acosta Navarro, J.-C. Arnalds, O. Batchvarova, E. Bäck, J. Berninger, F. Bilde, M. Dagsson-Waldhauserova, P. Dalirian, M. de Leeuw, G. Dragosics, M. Duplissy, E.-M. Duplissy, J. Ekman, A. M. L. Fang, K. Gallet, J.-C. Glasius, M. Gryning, S.-E. Grythe, H. Hansson, H.-C. Hansson, M. Isaksson, E. Iversen, T. Jonsdottir, I. Kasurinen, V. Kirkevåg, A. Korhola, A. Krejci R. Lappalainen, H. K. Lauri, A. Leppäranta, M. Lihavainen, H. Markkonen, R. Massling, A. Meinander, O. Douglas Nilsson, E. Olafsson, H. Pettersson, J. B.C. Prisle, N. L. Riipinen, I. Roldin, P. Ruppel, M. Salter, M. Sand, M. Seland, Ø. Seppä, H. Skov, H. Soares, J. Stohl, A. Ström, J. Svensson, J. Swietlicki, E. Tabakova, K. Thorsteinsson, T. Virkkula, A. Weyhenmeyer, G. A. Zieger, P. and Kulmala, M. (2019). Interactions between the atmosphere, cryosphere and ecosystems at northern high latitudes. ACP 19, 2015–2061, https://doi.org/10.5194/acp-19-2015-2019.
- 2. Dall'Osto, M. Beddows, D.C.S. Tunved, P. Harrison, R. M. Lupi, A. Vitale, V. Becagli, S. Traversi, R. Park, K.T. Yoon, Y.J. Massling, A. Skov, H. Stroam, J. and Krejci, R. (2018) Apportioning aerosol natural and

- anthropogenic sources thorough simultaneous aerosol simultaneous aerosol
- 3. Kamp, J. Skov, H. Jensen, B. and Sørensen, S.S. (2018) Fluxes of Gaseous Elemental Mercury (GEM) in High Arctic during Atmospheric Mercury Depletion Events (AMDEs). ACP. Vol. 18, 6923–6938. https://doi.org/10.5194/acp-18-6923-2018.
- 4. Dall'Osto, M. Lange, R. Geels, C. Beddows, D. C. S. Harrison, R. M. Simo, R. Nøjgaard, J. K. Boertmann, D. Skov H. and Massling, A. (2018) Open pack ice drives new particle formation in North East Arctic. Nature, Scientific Reports. Vol. 8, Article number: 6109, https://doi:10.1038/s41598-018-24426-8.
- 5. Lange, R. Dall'Osto, M. Skov, H. Nøjgaard, J. K. Nielsen, I. E. Beddows, D.C.S. Simo, R. Harrison, R. M. and Massling, A. (2018). Characterization of distinct Arctic aerosol accumulation modes and their sources. Atm. Env. Vol. 183, 1-10.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. The Danish contribution to AMAP (Arctic Monitoring and Assessment Programme) atmospheric part.
- 3. EVAL- SLCF (Updating and evaluation of existing measurements 2015 and 2016; new measurements of short lived greenhouse forcers in 2017 and 2018)
- 4. Meteorological, permafrost and pollutant observations in High Arctic
- 5. ERA-planet projects iGOSP and iCUPE

Significant infrastructures in Denmark

Villum Research Station is an observational facility at the military outpost Station Nord in high arctic North Greenland (81°36' N, 16°40' W). The station is a substantial upgrade of an existing air pollution monitoring station at Station Nord. Villum Research Station is situated at the north-eastern corner of Greenland, on the small peninsula Princess Ingeborg Peninsula. The nearest town is Longyearbyen on Svalbard (Norway), 720 km east of Station Nord, while the nearest town in Greenland is Ittoqqortoormiit, 1,250 km south of Station Nord. Station Nord is a gateway to the national park of NE Greenland, and a support and refurbishment base for the Danish dog sledge patrol Sirius.

Villum Research Station is owned by the Greenland Government and is being operated by Aarhus University (Denmark). The station was founded in 2013-2014 from means provided by the Danish private foundation, Villum Foundation. The station hosts individual scientific projects focusing on atmospheric sciences, microbiologicy, biology, geology and glaciology. In addition to this, the station is also used as a permanent base for an extensive long-term monitoring programme with focus on atmospheric pollution but also including effects of climate Change on Arctic marine and terrestrial ecosystems.

The station is open for access throughout the year, and it can host up to 14 scientists at a time.

The Villum Research Station is part of a number of networks and programs, including EMEP, WMO-GAW, IASOA, INTERACT, ICOS and NordGIS. Finally, it is a candidate to become a SMEAR station.

Aarhus University Research on Aerosols smog chamber facility (AURA) is an Exploratory facility. Cold room chamber facility for studies of aerosol formation, growth and processes. Operational in the temperature range -15 to 25° C. EUROCHAMP 2020 associated partner. It contains;

Sea spray simulation chambers for simulation of bubble mediated aerosol formation

Laminar flow tube system for studies of aerosol thermodynamic properties

State of the art atmospheric analytical chemistry laboratory for molecular speciation of aerosol constituents.

Department of Chemistry, University of Copenhagen has an exploratory infrastructure. It consist of a photochemical reactor with long path FTIR detection for pollution reactivity and product studies, an aerosol continuous flow chamber with online GC-MS for kinetics and particle studies and pollution sensor development and testing chamber for calibration and characterization of pollution sensors.

4.1.30 Universitat Politècnica de Catalunya (UPC) Associated with document Ref. Ares(2019)6815176 - 04/11/2019

Universitat Politècnica de Catalunya -Barcelonatech, UPC, Barcelona, Spain) is a public institution, one of the largest technical universities in Spain, devoted to higher education and research in the fields of architecture, science and engineering. The Remote Sensing Lab (RSLab), within CommSensLab (recognized as Unit of Excellence María de Maeztu by the Spanish Ministry of Science, Innovation and Universities for its highly competitive strategic research programme in the frontiers of knowledge) in the Department of Signal Teory and Communications addresses a wide range of research topics, including optical and microwave, active and passive remote sensing. In the Department of Engineering Design, the Earth Sciences research group has a renowned experience in atmospheric modelling, including air quality, emission inventories, meteorological and photochemical modelling, mineral dust and data assimilation, and owns observation instruments such as a micro-pulse lidar, a sun-photometer, and pyranometers. Within RSLab, the lidar group holds 26 years of experience in lidar system design, operation, data inversion algorithms and exploitation of results. In particular it designed and built, and currently operates and exploits the lidar system of the Barcelona EARLINET station and complementary instrumentation relevant to atmospheric aerosol remote sensing. Moreover, its premises are close to those of the CSIC institute also participating in ACTIRS IMP, which generates local/regional synergies creating a supersite with the combined capabilities of both institutions. UPC is a member of EARLINET since its inception and has participated in the FP5 EARLINET project (contract No. EVR1-CT-1999-40003), the FP6 EARLINET-ASOS (contract No. 025991 (RICA)), where it was responsible for the networking action 2 "Exchange of expertise", the FP7 project ACTRIS (grant agreement No. 262254), where it led the Work Package 2 "Remote sensing of vertical aerosol distribution", and it participates currently in H2020 ACTRIS-2 (grant agreement No. 654109), where it leads task 2.1 "Exchange of expertise" within the Work Package 2 "Profiling of aerosols and clouds". In H2020 ACTRIS PPP (grant agreement No. 739530), it coordinates the same JRU as in the present project and participates especially in WP1, WP5, and WP8.

Role in the project

The JRU coordinated by UPC participates in ACTRIS IMP WP4(Implementation and test operation of the Central Facilities), WP5(Facilitating the harmonized operation of the National Facilities), WP6(Implementation of the user access to ACTRIS services), and WP9(Positioning ACTRIS in the European innovation ecosystem) with specific participation of UPC in WP5 (Facilitating the harmonized operation of the National Facilities), where it leads task 5.5 (Exchange of expertise and training of National Facility operators). The involvement of the JRU linked third parties is detailed in section 4.2. In addition, since its establishment in 2013 through a Memorandum of Understanding, extended to new members in 2017, UPC coordinates ACTRIS-Spain, which is constituted by the JRU members, by beneficiary CEAM and its linked third party CSIC, by beneficiary UVA and its linked third party AEMET, and by two other institutions (University of Valencia and University Miguel Hernández) participating in ACTRIS IMP associated partners.

Principal personnel involved

Dr. Adolfo Comerón (male) is a professor in the Department of Signal Theory and Communications of UPC. He coordinates ACTRIS-Spain and has been the UPC PI in the FP5 project EARLINET, in the FP6 project EARLINET-ASOS, in the FP7 project ACTRIS; he is currently UPC PI in the H2020 projects ACTRIS-2 and ACTRIS PPP. He was elected member of the International Coordination-group on Laser Atmospheric Studies working group for the term 2004-2010.

Mrs. Irene Jorge (female) has been a project manager at the Technology Transfer Centre of the Universitat Politècnica de Catalunya (UPC) since 2011. Ms. Jorge has a bachelor's degree in Environmental Science and a master's degree in Urban Planning. She has managed EU-funded researcher projects since the FP7 (2007-2013) and has been in charge of the administrative and financial issues related to project implementation since then. She is also a dissemination manager for the European H2020 project <u>GEECCO</u> Gender Equality in Engineering through Communication and Commitment.

Relevant publications

1. Sorribas, M., E. Andrews, J.A. Ogren, A. del Águila, R. Fraile, P. Sheridan, M. Yela (2019), Climatological study for understanding the aerosol radiative effects at southwest Atlantic coast of Europe, Atmospheric Environment, 2019, https://doi.org/10.1016/j.atmosenv.2019.02.017.

- 2. Pandolfi, M., L. Alados-Arboledas, A. Alastuey, M. Baltensperger, P. Bonasoni, N. Bukowiecki, M. Collaud Coen, S. Conil, E. Coz, V. Crenn, V. Dudoiti, M. Ealo, K. Eleftheriadis, O. Favez, P. Fetfatzis, M. Fiebig, H. Flentje, P. Ginot, M. Gysel, B. Henzing, A. Hoffer, A. Holubova Smejkalova, I. Kalapov, N. Kalivitis, G. Kouvarakis, A. Kristensson, M. Kulmala, H. Lihavainen, C. Lunder, K. Luoma, H. Lyamani, A. Marinoni, N. Mihalopoulos, M. Moerman, J. Nicolas, C. O'Dowd, T. Petäjä, J-E. Petit, J-M. Pichon, N. Prokopciuk, J.-P. Putaud, S. Rodríguez, J. Sciare, K. Sellegri, E. Swietlicki, G. Titos, T. Tuch, P. Tunved, V. Ulevicius, A. Vaishya, M. Vana, A. Virkkula, S. Vratolis, E. Weingartner, A. Wiedensohler, P. Laj (2018), An European aerosol phenomenology 6: scattering properties of atmospheric aerosol particles from 28 ACTRIS sites. Atmos. Chem. Phys., 18, pp. 7877–7911, https://doi.org/10.5194/acp-18-7877-2018
- 3. Di Tomaso, E., N. A. J. Schutgens, O. Jorba, C. Pérez García-Pando (2017), Assimilation of MODIS Dark Target and Deep Blue observations in the dust aerosol component of NMMB-MONARCH version 1.0, Geosci. Model Dev., 10, pp. 1107-1129, https://doi.org/10.5194/gmd-10-1107-2017.
- 4. Granados-Muñoz, M. J., F. Navas-Guzmán, J. L. Guerrero-Rascado, J. A. Bravo-Aranda, I. Binietoglou, S. N. Pereira, S. Basart, J. M. Baldasano, L. Belegante, A. Chaikovsky, A. Comerón, G. D'Amico, O. Dubovik, L. Ilic, P. Kokkalis, C. Muñoz-Porcar, S. Nickovic, D. Nicolae, F. J. Olmo, A. Papayannis, G. Pappalardo, A. Rodríguez, K. Schepanski, M. Sicard, A. Vukovic, U. Wandinger, F. Dulac, and L. AladosArboledas (2016), Profiling of aerosol microphysical properties at several EARLINET/AERONET sites during July 2012 ChArMEx/EMEP campaign, Atmos. Phys. Chem. 16:11, pp. 7043-7066. doi: 10.5194/acp-16-7043-2016.
- 5. Sicard, M., G. D'Amico, A. Comerón, L. Mona, L. Alados-Arboledas, A. Amodeo, H. Baars, J. M. Baldasano, L. Belegante, I. Binietoglou, J. A. Bravo-Aranda, A. J. Fernández, P. Fréville, D. GarcíaVizcaíno, A. Giunta, M. J. Granados-Muñoz, J. L. Guerrero-Rascado, D. Hadjimitsis, A. Haefele, M. Hervo, M. Iarlori, P. Kokkalis, D. Lange, R. E. Mamouri, I. Mattis, F. Molero, N. Montoux, A. Muñoz, C. Muñoz Porcar, F. Navas-Guzmán, D. Nicolae, A. Nisantzi, N. Papagiannopoulos, A. Papayannis, S. Pereira, J. Preißler, M. Pujadas, V. Rizi, F. Rocadenbosch, K. Sellegri, V. Simeonov, G. Tsaknakis, F. Wagner, and G. Pappalardo (2015), EARLINET: potential operationality of a research network, Atmos. Meas. Tech., 8:11, pp. 4587-4613, doi:10.5194/amt-8-4587-2015.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network), 2011-2015, grant agreement No 262254.
- 4. AEROMET (Aerosol metrology for atmospheric science and air quality), 2017-2019, Grant Agreement 16ENV07.
- 5. NORS (Demonstration Network Of ground-based Remote Sensing Observations in support of the Copernicus Atmospheric Service), 2011-2014, Grant agreement No. n°284421.

Significant infrastructures

UPC is running a mutiwavelength lidar with elastic channels at 1064 nm, 532 nm, and 355 nm, N2 Raman channels at 607 nm and 387 nm, a water vapor Raman channel at 407 nm and capability of depolarization measurements at 532 nm and 355 nm. The system belongs to EARLINET and operates at the UPC Campus Nord site in Barcelona (41.389 N, 2.112 E), in a urban residential and services area, close to urban thoroughfares, at the foot of a range of hills reaching between 300 m and 500 m, near the end of the range yielding to the wide Llobregat river valley, and at 6 km of the Barcelona harbour area. Complementary remote sensing instruments at the same site include a micropulse lidar operating at 532 nm integrated into MPLNET, and a CIMEL sun–photometer CE-318-4 integrated into AERONET. Ancillary instrumentation includes pyranometers that are part SolRad-Net. The site meets the technical requirements to become a National Facility observational platform for aerosol remote sensing with optimum setup. Radiosondes are launched daily at 00:00 UTC and 12:00 UTC from a site 700 m away. UPC premises are close (300 m) to those of the CSIC institute also participating in ACTRIS IMP, where instrumentation for aerosol in-situ measurements is operated, qualifying technically the site as a National Facility observational platform with optimum setup for aerosol in-situ measurements. The combination of UPC and CSIC infrastructures in Barcelona results in an

effective supersite for aerosol measurements, both remote-sensing in the same with CSIC sites at Montseny (regional background) and Montsec (mountain site).

The other JRU members contribute with a wide range of remote sensing an in-situ observational infrastructures, as well as computational infrastructures, described in detail in section 4.2. JRU-member BSC is part of the Data Centre unit in charge of generating Level 3 products.

4.1.31 Fundación Centro de Estudios Ambientales del Me Prancio (CE) AND pument Ref. Ares (2019) 6815176 - 04/11/2019

The Mediterranean Centre for Environmental Studies (CEAM) is a centre of research, development and technological innovation to improve the natural environment in the Mediterranean.

CEAM's activity centers on offering comprehensive proposals forenvironmental management of the atmosphere, ecosystems, human activities, and their interactions. For developing sustainable management options adapted to Mediterranean conditions, the work at CEAM requires the participation of multidisciplinary teams and accurate knowledge of both natural processes and processes amended by human activities. Its scientific and technical team at CEAM includes experts in meteorology and climate, atmospheric chemistry and atmospheric pollutants dynamics, numerical simulation, high-precision analytical instruments for laboratory and field use, the carbon cycle, ecosystems dynamics, fire ecology and forest restoration.

The department involved in the present project is the Atmospheric Chemistry Area, which operates EUPHORE (European Photoreactor). This photochemical reactor is one of the major research installations in Spain and in Europe, used in the research and follow-up of atmospheric chemical processes. Its characteristics allow the simulation of these processes under near-real conditions thanks to its large size, its use of natural light due to the fact that these facilities have an extensive and outstanding analytical infrastructure. The mission of the Atmospheric Chemistry area is to reduce or fight atmospheric pollution by studying the degradation processes of the biogenic and anthropogenic compounds emitted to the atmosphere, which can have profound effects on human health and on vegetation. The EUPHORE atmospheric simulators are available for use by any group whose research is related to atmospheric pollution, and also for industry.

CEAM and CSIC form a Joint Research Unit. The group of atmospheric pollution of CEAM is an Associated unit of CSIC-IDAEA, and CSIC belongs to the CEAM Management Board.

Role in the project

CEAM will participate in WP5(Facilitating the harmonized operation of the National Facilities), WP6(Implementation of the user access to ACTRIS services), and in WP9(Positioning ACTRIS in the European innovation ecosystem). CEAM will offer pilots for trans-national access. In addition, CEAM representative is one of the Spanish National Contact Point of ACTRIS.

Principal personnel involved

Dr Amalia Muñoz (female) obtained her PhD in chemistry at the University of Valencia, Spain. She is the head of the Atmospheric Chemistry group and coordinator of the European PHOto-Reactor facility (EUPHORE), one of the biggest outdoor atmospheric simulation chambers worldwide for studying atmospheric chemistry processes. She has been the PI of several EU funded projects from FP programs (e.g. FP7-228335, FP7-GA-2011-295132, FP6-505968) and coordinator of two projects from EU LIFE+ program (LIFE13 ENV/ES/000603 and LIFE17 ENV/ES/000205). Nowadays, she is the PI of one H2020 project- Eurochamp2020 (GA730997). She has organized several international workshops and international experimental campaigns with the participation of more than 200 international researchers. From 2006 she has been member of several scientific Committees (e.g.: Eurochamp Steering Committee, User Selection Panel of transnational activities of Eurochamp2 project). She is also an associate researcher of the "Air Pollution Unit 2" CEAM as Associated Unit R+D+i to the Spanish National Research Council (CSIC), and the responsible researcher from CEAM of the "Atmospheric Pesticide Research Group" of Valencia.

Relevant publications

- 1. López, A., Yusà, V., Muñoz, A., Vera, T., Borrás, E., Ródenas, M., and Coscolla, C., 2017. Risk assessment of airborne pesticides in a Mediterranean region of Spain. Science of the Total Environment, 574:724-734. http://dx.doi.org/10.1016/j.scitotenv.2016.08.149
- Newland, M. J., Rickard, A. R., Alam, M. S., Vereecken, L., Muñoz, A., Ródenas, M., and Bloss, W. J., 2015. Kinetics of stabilised Criegee intermediates derived from alkene ozonolysis: reactions with SO2, H2O and decomposition under boundary layer conditions. Physical Chemistry Chemical Physics, 17:4076-4088. http://dx.doi.org/10.1039/C4CP04186K
- 3. Newland, M. J., Rickard, A. R., Vereecken, L., Muñoz, A., Ródenas, M., and Bloss, W. J., 2015. Atmospheric isoprene ozonolysis: impacts of stabilized Criegee intermediate reactions with SO2, H2O and dimethyl sulfide. Atmospheric Chemistry and Physics, 15:9521-9536. http://dx.doi.org/10.5194/acp-15-9521-2015

- 4. Muñoz, A., Vera, T., Sidebottom, H., Mellouki, A., Bos specieris, commente, Eprand Wazani 2019 2011. Studies on the Atmospheric Degradation of Chlorpyrifos-Methyl. Environmental Science & Technology, 45(5):1880-1886.
- 5. Hamilton, J. F., Lewis, A. C., Carey, T. J., Wenger, J., Borrás, E., and Muñoz, A., 2009. Reactive oxidation products promote secondary organic aerosol formation from green leaf volatiles. Atmospheric Chemistry and Physics, 9:3815-3823.

Relevant projects

- 1. EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes Towards 2020 and beyond), 2016-2020, grant agreement No 730997.
- 2. EC-LIFE: Pesticide reduction using friendly and environmentally controlled technologies, LIFE17 ENV/ES/000205
- 3. EC-LIFE,2014-2017, Air pollution treatment in European environments by means of photocatalytic textiles (LIFE+ 2013 ENV/ES/000603.
- 4. EUROCHAMP-2 (European Simulation Chambers for Investigating Atmospheric Processes), 2009-2013, grant agreement No 228335, a continuation of EUROCHAMP (European Simulation Chambers for Investigating Atmospheric Processes), 2004-2009, grant agreement No 505968.
- 5. Fate and Impact of atmospheric Pollutants (FP7-PEOPLE-2011-IRSES, 2012-2016).

Significant infrastructures

EUPHORE (European PHOto Reactor) is the only outdoor simulation chamber facility in Spain for the study of atmospheric chemical processes. With recognized prestige worldwide gained over its more than 20-year existence, the characteristics of its two twin 200 m3 domes allow the simulation of these processes under near-real conditions thanks to its large size and to the use of natural light. EUPHORE chambers are equipped with a large and varied number of analytical instruments, including state-of-the-art systems, for measuring physical parameters as well as a diverse range of biogenic and anthropogenic compounds and its intermediates and products in both the gas and the particle phases.

The simulation chambers are equipped with a broad number of analytical instruments in order to analyse VOCs, radical species, aerosols, O3, NO, NO2, PAN, organic nitrates, hydroperoxides and organic acids. For in-situ measurements highly sensitive and selective techniques such as LP-FTIR and LP-UV/VIS DOAS spectroscopy are available, and a CEAS is under development. For the sensitive analysis of reaction products several ozone and NOx monitors, as well as, HONO-LOPAP monitor, HCHO Hantzsch monitor, PTRMS, GC-MS and GC-MS/MS systems can be employed for sampling the trace gas components directly from the gas phase, with pre-concentration techniques or solvent trapping. For the measurement of OH and OH2 radicals a Laser Induced Fluorescence LIF is available. To measure aerosol formation from biogenic or anthropogenic precursor VOCs during oxidation, the EUPHORE installation is equipped with SMPS systems and a continuous-operating microbalance (TEOM) providing particle numbers and mass concentration. Other off-line techniques, such HPLC and LC-MS or GC-MS for the analysis of different range of compounds, both in gas and particle phase, are also available. During 2019 a HR-CI-API-TOF-MS for the analysis of chemical composition of both gas and aerosols will be acquired.

The University of Valladolid was founded in the XIII century and is one of the oldest universities in Europe. It comprises 25 faculties with 30.000 students and 2.000 teachers and researchers in all fields. The Group of Atmospheric Optics (GOA) belongs to the Optics Department of the Science Faculty and has a long record in atmospheric research by optical methods for more than 20 years (http://goa.uva.es). Since 2006 the GOA group operates an AERONET calibration facility, in close collaboration with AERONET headquarters in NASA, the Laboratory of Atmospheric Optics in Lille and the Izaña Atmospheric Research Center, in Tenerife, belonging to the Meteorological State Agency of Spain (AEMET). This calibration facility has participated in the ACTRIS and ACTRIS-2 projects.

The GOA-UVA and the Izaña Observatory-AEMET form a Joint Research Unit, with extensive collaboration in the fields of solar radiation and column aerosol properties, with the umbrella of 2 official agreements (2007-2010 and 2010-2014) that have supported the AERONET calibrations, 2 PhD theses and a number of joint publications.

Role in the project

The GOA expertise in sun photometer measurements, calibration and quality assurance will collaborate in the AERONET-Europe calibration centre WP4(Implementation and test operation of the Central Facilities), and in collaborate with WP6 (Implementation of the user access to ACTRIS services). Furthermore, Izaña observatory, acting as third party of UVA, will provide calibration of master Sun photometers and keep traceability of those absolute calibrations. Furthermore, the UVA office for European projects at FUNGE (see third party description below) and law departments at UVA and AEMET will contribute to the organizational aspects of ACTRIS.

Principal personnel involved

Dr. Carlos Toledano (male), principal investigator for ACTRIS-PPP at UVA. He is currently principal investigator of ACTRIS-2 and ACTRIS-PPP at UVA, graduated in Physics at Complutense University in Madrid (1999) and received his PhD at University of Valladolid in 2005. For 2 years he was postdoctoral fellow at the Meteorological Institute, University of Munich (Germany). He is researcher at University of Valladolid since 2008. His research is focused on the investigation of the atmospheric components, mainly aerosol, by optical methods, regarding aerosol characterization, data quality assurance and field campaigns. He has more than 75 peer-reviewed publications in SCI journals and received the 3M Foundation Award 2008 for Environmental Science. Currently he is in charge of the operations, calibration and quality assurance of the GOA calibration facility that is part of AERONET and participates in the European infrastructure project ACTRIS.

Prof. Dr. Victoria Cachorro (female), is the scientific director of the Group of Atmospheric Optics (GOA). She graduated in Physics at Valladolid University in 1978 and received her Phd at University of Valladolid in 1985. She is University Professor since 2002. Her research experience includes both experimental work and modelling of spectral solar radiation and its application to atmospheric aerosol research by remote sensing techniques. She is leader of the Iberian Network for Aerosol Measurements (RIMA), federated to AERONET and the GOA calibration facility. She has supervised 12 PhD theses and has more than 100 peer-reviewed publications and has been principal investigator in more than 20 national and European projects. She was member of the Internacional Radiation Comission (IAMAS) in 2009-2012.

Relevant publications

- C. Toledano; R. González; D. Fuertes; E. Cuevas; T. F. Eck; S. Kazadzis; N. Kouremeti; J. Gröbner; P. Goloub; L. Blarel; R. Román; Á. Barreto; A. Berjón; B. N. Holben; V. E. Cachorro. Assessment of Sun photometer Langley calibration at the high-elevation sites Mauna Loa and Izaña. Atmospheric Chemistry and Physics, 18, pp. 14555-14567, 2018.
- 2. Barreto, Á., Cuevas, E., Granados-Muñoz, M.-J., Alados-Arboledas, L., Romero, P. M., Gröbner, J., Kouremeti, N., Almansa, A. F., Stone, T., Toledano, C., Román, R., Sorokin, M., Holben, B., Canini, M., and Yela, M.: The new sun-sky-lunar Cimel CE318-T multiband photometer a comprehensive performance evaluation, Atmos. Meas. Tech., 9, 631-654, doi:10.5194/amt-9-631-2016, 2016.
- 3. B. Torres, O. Dubovik, C. Toledano, A. Berjon, V. E. Cachorro, T. Lapyonok, P. Litvinov, P. Goloub, Sensitivity of aerosol retrieval to geometrical configuration of ground-based sun/sky radiometer observations. Atmospheric Chemistry and Physics, 14, 847-875, (2014)
- 4. B. Torres, C. Toledano, A. Berjón, D. Fuertes, V. Molina, R. Gonzalez, M. Canini, V. E. Cachorro, P.

- Goloub, T. Podvin, L. Blarel, O. Dubovik, Y. Bennoun. ANE Complete Measure Reference of AERONET. Atmospheric Measurement Techniques, 6, 2207–2220, (2013)
- García, R.D., O.E, García, E. Cuevas, V.E. Cachorro, P.M. Romero-Campos, R. Ramos and A.M. de Frutos, Solar radiation measurements compared to simulations at the BSRN Izaña station. Mineral dust radiative forcing and efficiency study, JGR-Atmospheres, Vol 119, 1-16, DOI: 10.1002/2013JD020301, 2014

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure -2), 2015-2019, Grant agreement no 654109, a continuation of ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network) , 2011-2015, grant agreement No 262254
- 3. Development of GRASP radiative transfer code for the retrieval of aerosol microphysics vertical profiles from space measurements and its impact in ACE mission. Marie Curie RISE action, 2018-2022.
- 4. Lunar spectral irradiance measurement and modelling for absolute calibration of EO optical sensors. Funded by ESA, 2017-2019.
- Specific collaboration agreement between the Spanish Meterological Agency and the University of Valladolid regarding the radiometry, ozone and aerosol programs carried out at Izaña Atmospheric Research Center, as well as the adaptation and integration of AEMET Cimel network within AERONET, 2011-2014

Significant infrastructures

UVA provides the GOA calibration facility, which is an infrastructure for radiometric calibrations. This facility operates since 2004 and is in charge of AERONET calibrations since 2006. It basically consists of an observation platform for radiation measurements (Sun, sky, Moon), as well as a laboratory for radiometric calibrations that includes integrating spheres, calibrated lamps, etc. Both are located at Valladolid, Spain. Other radiometric observations, ceilometer and all-sky camera are also collocated with the AERONET Sun photometers.

4.1.33 EULS

The Estonian University of Life Sciences (EULS) is a public University, organized in 5 institutes and it is the only university in Estonia whose priorities in academic and research activities are centered on sustainable development of natural resources. The academic structure is composed of research and development institutes or institutions, research centers and other structural units. The Estonian University of Life Sciences coordinates and leads the activities at the Station for Measuring Ecosystem Atmosphere Relations (SMEAR Estonia). The Institute of Agricultural and Environmental Sciences and the Institute of Forestry and Rural Engineering are involved in the activities at the SMEAR Estonia station.

The SMEAR Estonia station hosts air quality, aerosol and radiation measurements including biosphere-atmosphere, meteorological and forest ecosystem related measurements.

Role in the project

EULS is acting as the national focal point in coordinating the activities of ACTRIS IMP in Estonia and will contribute to WP1 (Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP5 (Facilitating the harmonized operation of the National Facilities) and WP9(Positioning ACTRIS in the European innovation ecosystem).

Principal personnel involved

Dr. Steffen M. Noe, (male), Senior Scientist, SMEAR Estonia coordinator. His scientific work and experience deals with measuring and mathematical modelling of processes of ecosystem-atmosphere interactions, carbon and nitrogen cycling, environmental adaption strategies. He has started in 2008 the first flux tower measurements in Estonia and planned the SMEAR Estonia station. He has led several national and international measurement campaigns in Estonia and gained strong experience in leading multinational research teams. He is the Estonian representative in the ERA-Planet project and the leader of the data provision work package (WP5) of the iCUPE (ERA-Planet strand 4) project, member of the Task Force on reactive Nitrogen (LRTAP) and participated in the ACTRIS PPP project as beneficiary representative and is the associated partner EULS representative in the ACTRIS2 project. He represents Estonia in the ICOS RINGO project and is partner in the GlobalSMEAR and PEEX projects. He acts as editor in the special issues of the Integrated Land Ecosystem – Atmosphere Studies (iLEAPS) and Interactions between climate change and the Cryosphere: SVALI, DEFROST, CRAICC in the journals Atmospheric Chemistry and Physics, Biogeosciences and The Cryosphere.

Relevant publications

- 1. Ezhova, E., Ylivinkka, I., Kuusk, J., Komsaare, K., Vana, M., Krasnova, A., Noe, S., Arshinov, M., Belan, B., Park, S.-B., Lavric, J. V., Heimann, M., Petäjä, T., Vesala, T., Mammarella, I., Kolari, P., Bäck, J., Rannik, U., Kerminen, V.-M., and Kulmala, M. (2018). Direct effect of aerosols on solar radiation and gross primary production in boreal and hemiboreal forests, Atmos. Chem. Phys., 18, 17863-17881.
- Li, X., Xiao, J., He, B., Arain, M., Beringer, J., Desai, A. R., Emmel, C., Hollinger, D. Y., Krasnova, A., Mammarella, I., Noe, S. M., Serrano Ortiz, P., Rey-Sanchez, C., Rocha, A. V. and Varlagin, A. (2018). Solar-induced chlorophyll fluorescence is strongly correlated with terrestrial photosynthesis for a wide variety of biomes: First global analysis based on OCO-2 and flux tower observations. Glob Change Biol., 24, 3990-400.
- 3. Yli-Pirilä P., Copolovici L., Kännaste A., Noe S., Blande J.D., Mikkonen S., Klemola T., Pulkkinen J., Virtanen A., Laaksonen A., Joutensaari J., Niinemets Ü., Holopainen J. (2016). Herbivory by an Outbreaking Moth Increases Emissions of Biogenic Volatiles and Leads to Enhanced Secondary Organic Aerosol Formation Capacity. Environmental Science & Technology, 50 (21), 11501–11510.
- 4. Noe, S.M., Krasnov, D., Krasnova, A., Cordey, H. P. E. & Niinemets, Ü. (2016). Seasonal variation and characterisation of reactive trace gas mixing ratios over a hemi-boreal mixed forest site in Estonia. Boreal Environment Research, 21, 332-344.
- Vana, M., Komsaare, K., Hõrrak, U., Mirme, S., Nieminen, T., Kontkanen, J., Manninen, H.E., Petäjä, T., Noe, S.M. & Kulmala, M. (2016). Characteristics of new-particle formation at three SMEAR stations. Boreal Environment Research, 21, 345-362.

Relevant projects

1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.

- 2. ACTRIS-2 (Aerosols, Clouds and Trace gases Research 1 abate and 152019), 42015-2019, 4340 aprentific no.4/11/2019 654109, associated partner.
- 3. ERA-Planet (The European network to coordinate Earth Observation for our changing planet), 2016-2021, grant agreement 689443.
- 4. ICOS RINGO (Readiness of Icos for Necessities of Integrated Global Observations), 2017-2021, grant agreement 730944.
- 5. Estonian Environmental Observatory, Estonian national science infrastructure roadmap, grant agreement 3.2.0304.11-0395.

Significant infrastructures

The SMEAR Estonia station is maintained by the Institute of Agricultural and Environmental Sciences together with the Institute of Forestry and Rural Engineering of EULS. The measurement station has been built to serve as in-situ monitoring platform of the atmosphere-biosphere interactions and to participate in ACTRIS and other relevant research infrastructures such as ICOS and ANAEE. The set of atmospheric measurements and equipment that already exists covers measurements of atmospheric trace gases and aerosol precursors, air ion and aerosol number concentrations and fluxes.

The SMEAR Estonia station is part of the Estonian Environmental Observatory (EEOBS), which is listed on the Estonian national research infrastructure roadmap. SMEAR Estonia is a comprehensive large-scale research infrastructure to assess atmospheric and ecosystem parameters in-situ. The major objectives are multidisciplinary research and developments to increase understanding of air quality, health and environmental management in current and future climate conditions and to provide decision frameworks to policy makers on environmental and economical sustainability. Contributing national partners are the Institute of Physics of the University of Tartu (UT) and the Estonian Environmental Research Center (EERC) acting as an approved laboratory and monitoring facility of Estonia. The national partners add further measurement locations in Estonia (rural areas and cities) and calibration services.

The University of Évora is organized in 4 Schools: Arts, Sciences and Technology, Social Sciences and Nursing and offers 41 undergraduate and 120 postgraduate degrees. Research and Development (R&D) covers several scientific areas through a network of 14 Research Units, all of them submitted to international evaluation, under the coordination of the Institute for Research and Advanced Studies. Furthermore, the University of Évora established three Chairs in areas of excellence: Biodiversity, Renewable Energies and Heritage, which are sponsored by private capital holders. Over the last years, the University has fostered a close link with the community. Such interaction has been possible through the creation of working networks and dissemination of knowledge such as the participation in the Science and Technology Park as well as through the establishment of protocols and contracts for the supply of services in partnerships with Companies, Universities, Associations and Institutes. The main R&D areas are: Agronomy and Biodiversity; Geophysics, Environment and Landscaping; Materials and Surface Science; Economics and Business Studies; Computer Sciences and Software Interoperability; Social and Political Sciences, History, History of Art, Science and Cultures; Applied Mathematics; Education; Linguistics and Literature; Elderly Healthcare. The 150 running R&D projects are developed through national and international partnerships, FP7 and H2020 funding, FCT (Technology and Science Foundation) as well as by private sponsorship. Furthermore, one of the Research unit of the University of Evora is the Institute of Earth Sciences (ICT), formed in 2012 from three research units including the Gephysics Center of Évora (CGE)

Role in the project:

UE contributes to WP1(Engagement and enlargement of the ACTRIS community and ACTRIS membership), WP3(Strategy for enhancing ACTRIS relevance and impact) and WP5(Facilitating the harmonized operation of the National Facilities). Furthermore, UE represents the scientific ACTRIS community of Portugal.

Principal personnel involved

Prof. Daniele Bortoli (male) is the responsible for the atmospheric observatory and optical instrumentation at the University of Evora. He is a PhD in Atmospheric Physics since 2005. His main interest are: Differential Optical Absorption Spectroscopy (DOAS); Remote Sensing with ground based; satellite or aircraft borne equipment's; Radiative transfer in the Atmosphere; Atmospheric Process of Ozone depletion; Physics and Photochemical process of NO2 BrO, OClO, SO2; Air quality in urban and rural areas; Climate change and Global warming; Optic and passive and active optical instrumentation. DB has 100 peer reviewed articles, and 130 other type of scientific presentations. He has a web of Science h index = 14 and almost 650 citation, the most remarkable is "Increase in tropospheric nitrogen dioxide over China observed from space", Richter A; Burrows JP; Nuss H; et al., NATURE, 437, 7055, 129-132 https://doi.org/10.1038/nature04092. He is reviewer in several scientific journals.

Prof. Maria João Costa (female), Senior Researcher, Department of Physics and Mechatronic Engineering. concluded her PhD from the University of Évora in 2004. She is a Professor of Physics at the University of Évora, Portugal. She is currently the coordinator of the Atmospheric Sciences Water and Climate Group of the Institute of Earth Sciences and the Director of the Master Course in Earth and Atmospheric Sciences. Her main research interests concern remote sensing of the atmosphere radiative transfer modelling and atmospheric radiative effects. She has authored/ co-authored more than 90 peer-refereed publications, coordinated several research projects and supervised/co-supervised over 15 students. Expert in aerosol physics.

Prof. Rui Salgado (male), Senior Researcher, Department of Physics and Mechatronic Engineering. Ph.D. in Physics, University of Évora, Portugal, 2006. Assistant Professor, Physics Department, School of Sciences and Technology, University of Évora, since 2006. Scientific coordinator of the ALEX2014 project and field campaigns, University of Évora. Member of Meso-NH Steering Committee. Member of the direction (2010-2012) and president of the General Assembly Table (desde 2012) of the Portuguese Association of Meteorology and Geophysics (APMG). Expert in atmospheric modelling, micrometeorology and fluxes.

Dr. Miguel Potes (male), Researcher, Department of Physics and Mechatronic Engineering. Ph.D. in Earth and Space Sciences, University of Évora, Portugal, 2013. Post-doctoral fellowship at ICT, since 2014. European Meteorological Society (EMS) Young Scientist Award 2015. Award presented at the EMS Annual Meeting, September 2015, Sofia, Bulgaria.

Relevant publications

- Nikolaos Papagiannopoulos, Lucia Mona, Aldo Amodeo, Giuseppe D'Amico, Pilar Gumà Claramunt, Gelsomina Pappalardo, Lucas Alados-Arboledas, Juan Luís Guerrero-Rascado, Vassilis Amiridis, Arnoud Apituley, Holger Baars, Anja Schwarz, Ulla Wandinger, Ioannis Binietoglou, Doina Nicolae, Daniele Bortoli, Adolfo Comerón, Alejandro Rodríguez-Gómez, Michaël Sicard, Panagiotis Kokkalis, Alex Papayannis, and Matthias Wiegner, (2018), An automatic observation-based typing method for EARLINET, Atmos. Chem. Phys., 18, 15879–15901, https://doi.org/10.5194/acp-18-15879-2018
- 2. Nicoll, K. A., Harrison, R. G., Silva, H. G., Salgado, R., Melgâo, M., Bortoli, D. (2018). Electrical sensing of the dynamical structure of the planetary boundary layer. Atmospheric Research, 202, 81–95https://doi.org/10.1016/j.atmosres.2017.11.009
- 3. Valenzuela, A., Costa, M. J., Guerrero-Rascado, J. L., Bortoli, D., Olmo, F. J. (2017). Solar and thermal radiative effects during the 2011 extreme desert dust episode over Portugal. Atmospheric Environment, 148, 16-29. https://doi.org/10.1016/j.atmosenv.2016.10.037
- 4. Salgueiro, V., Costa, M. J., Silva, A. M., Lanconel li, C., Bortoli, D. (2017). Cloud parameter retrievals from Meteosat and their effects on the shortwave radiation at the surface. International Journal of Remote Sensing, 38(4), 1137–1161. https://doi.org/10.1080/01431161.2017.1280630
- 5. Potes, M., Salgado, R., Costa, M. J., Morais, M., Bortoli, D., Kostadinov, I., Mammarella, I. (2017). Lake-atmosphere interactions at Alqueva reservoir: A case study in the summer of 2014. Tellus, Series A: Dynamic Meteorology and Oceanography, 69(1). https://doi.org/10.1080/16000870.2016.1272787

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530, associated partner
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure -2), 2015-2019, Grant agreement no 654109, associated partner
- 3. ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network) , 2011-2015, grant agreement No 262254, associated partner
- 4. NanoSen-AQM (Development and field validation of a low-cost nano-sensor system for real-time monitoring of ambient air quality), 2018-2021 grant agreement SOE2/P1/E0569, EU-INTERREG-SUDOE
- 5. ALOP (ALentejo Observation and Prediction systems), 2016-2019, grant agreement ALT20-03-0145-FEDER-000004, EU Portugal 2020 / Alentejo 2020 FEDER.

Significant infrastructures in Portugal

Observatory of Atmospheric Sciences– Évora (http://www.cge.uevora.pt/en/laboratobservat-mainmenu-101/fca-da-atmosfera-mainmenu-102)

Localization and type: Évora, 38.56783° N, 7.91150° W, 293 m asl; background urban station

Observations: aerosols; CIMEL solar photometer (AERONET); Raman LIDAR PAOLI (PollyXT Type) (EARLINET); UV-VIS MAX-DOAS spectrometer (SPATRAM); meteorological station; Ceilometer CL31; HATPRO Microwave radiometer (MWRnet); spectral and broadband radiometers, Skycam; TEOM, Aerodynamic Particle Sizer (APS), Multi-Angle Absorption Photometer (MAAP); nephelometer TSI 3563. in addition to the main observatory, the UE team is also responsible for:

Observatory CdR:

Localization and type:: Cabo da Roca, 38.78333° N, 9.50000° W, 140 m asl.; costal

Observations: aerosols; CIMEL solar photometer (AERONET)

Observatory of Sines:

Localization and type: Sines, 37.95402° N, 8.865486° W, 10 m asl.; costal

Observations: UV and broadband solar radiation

Observatory of Alqueva:

Localization and type: Albufeira de Alqueva, 38.223542° N, 7.459495° W, 83 m asl.; rural background Observations: CO2 and water vapour fluxes; spectral reflectivity; infrared and broadband solar radiation; meteorological stations.

Mitra station:

Localization and type: Herdade da Mitra, 38°31'31.4"N, 8°00'59.8"W, 257 m asl.; rural background Observations: infrared and solar radiation; meteorological stations.

GOA-UVa in situ measurement station (http://webx.ubi.pt obs) ociated with document Ref. Ares(2019)6815176 - 04/11/2019

Localization and type: Covilhã, 40.275N, 7.510W, 704 m asl., rural background

Observations: nephelometer TSI 3563; PSAP 3 wl; APS TSI 3321; CPC TSI 3022A; Oregon WMR928NX; AirVisual Node: https://airvisual.com/portugal/covilha; uRAD monitor model A: https://www.uradmonitor.com;-PM10/PM1.

Pico Mountain Observatory (http://pico-mt.mtu.edu/)

Localization and type: (38.0478N, 28.4038W), maritime background

Observations: Aethalometer (AE31) for estimation of the black carbon mass concentration and aerosol absorption angstrom exponent.

4.2.1 Ilmatieteen laitos (FMI) (Coordinator)

No third parties involved.

4.2.2 Helsingin yliopisto (UHEL)

No third parties involved.

4.2.3 Consiglio Nazionale Delle Ricerche (CNR)

No third parties involved.

4.2.4 Leibniz-Institut für Troposphärenforschung e.V (TROPOS)

No third parties involved.

4.2.5 Karlsruher Institut für Technologie (KIT)

No third parties involved.

4.2.6 Forschungszentrum Jülich (FZJ)

No third parties involved.

4.2.7 Centre National de Recherche Scientifique (CNRS)

Does the participant plan to subcontract certain tasks (please note that core tasks of the action should not be sub-contracted)	N
If yes, please describe and justify the tasks to be subcontracted	
Does the participant envisage that part of its work is performed by linked third parties ¹	Y
If yes please describe the third party the link of the participant to the third party of	nd describe and

If yes, please describe the third party, the link of the participant to the third party, and describe and justify the foreseen tasks to be performed by the third party

CNRS forms a Joint Research Units with the three Linked Third Parties UGA, LILLE, and UPEC. University Grenoble Alpes (UGA)

UGA is located in the middle of the Rhône-Alpes region, 2nd French region in terms of research activities. It is a research-intensive university in an international and high tech environment with 45 000 full time students, of which 3 100 doctoral students which enhanced nearly 700 theses submitted each year. It comprises 3 000 lecturers and researchers and 2 500 administrative and technical staff, 80 laboratories organised in six core areas: Mathematics- Information sciences-Technologies-Communication; Chemistry-Life sciences-Health-Biotechnologies; Particle physics-astrophysicsgeosciences-Environment-Ecology; Material sciences-Nanosciences-Engineering; Law-Political sciences-Economy-Sociology-Management; Arts-Humanities-Social sciences. The University Grenoble Alpes is a partner of major international and national research centres are located in the Grenoble area as ESRF, ILL, EMBL, CEA. UGA has a long-standing experience in European framework programmes (FP) with participation more than 100 projects under the FP6 and FP7.

Role in the project

UGA will be involved in WP3, 8

Principal personnel involved

Dr. Paolo Laj (male) holds a PhD in Physical Sciences, in Atmospheric Physics and Chemistry. His research thematic deals with the composition of the free troposphere and with the metrology of aerosol particles. He published more than 120 publications since 1990 in the field of atmospheric aerosols processes and variability, clouds physics and chemistry, precipitation chemistry, glaciochemistry with h factor of 43. He is the winner of the 2002 CNRS Bronze medal award, and obtained the Hägen-Smit

_

A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action (Article 14 of the Model Grant Agreement).

Prize in 2014. He is currently Senior scientist at Univer 1821/06-04/11/2019

at European level, he is actually the scientific co-coordinator of the Cluster Project ENVRIplus, and of ACTRIS-2, and has been co-coordinator of ACTRIS I3 (FP7) and coordinator of EUSAAR (FP6). Paolo Laj also has different responsibilities in international instances: member of the Scientific Committee of the initiative called "Sixth Global Environment Outlook", chairman of the SAG commission Global Atmosphere Watch OMM from 2015, member of the AOPC (Atmosphere Ocean Panel for Climate) of GCOS (Global Climate Observing System). He is also a scientific expert for Italy (National evaluation commission of scientific research) and Switzerland (for international cooperation). Dr. Paolo Laj works 75 % at UGA, France and 25 % at UHEL. At CNRS/UGA Dr. Paolo Laj will be involved in WP3 and will lead WP8 of ACTRIS IMP.

University Paris-Est Créteil (UPEC)

UPEC is the largest multidisciplinary university in Ile-de-France and is located 20 minutes from the heart of Paris. It may be described as a bold and successful enterprise: in little more than 40 years since its foundation in 1970, UPEC has managed to establish itself both as a regionally-grounded institution and an internationally-oriented university. With 30,000 students, 1,600 professors and researchers, 31 research centers, 15 schools and institutes and 266 international partners, it is a major actor in European higher education and research.

Role in the project

UPEC will be involved in WP3, WP5, WP6, WP7, WP10

Principal personnel involved

Pr. Jean-Francois Doussin (male) is full Professor at the University of Paris East at Créteil (UPEC) and is the head of the MEREIA group at CNRS-LISA. He has over 20 years of experience in the field of atmospheric chemistry and physics. His work, using results from both simulation chamber and field campaigns, has produced 91 peer-reviewed articles and over 80 conference contributions. Pr. Jean-François DOUSSIN was PI in several national and international projects. He was the PI of the UPEC contribution to EUROCHAMP-1 and EUROCHAMP-2, and is now the Scientific Coordinator of the ongoing EUROCHAMP-2020 project. Since 2008, J.-F. Doussin is the scientific director of the CESAM facility (Multiphase Experimental Atmospheric Simulation Chamber), a user-oriented open facility characterized "National Instruments" by CNRS (http://:cesam.cnrs.fr). At the national level, between 2012 and 2014, J.-F. Doussin was the chair of the French national scientific committee of Oceanographic and Atmospheric Sciences (CSOA). In 2014, he was appointed scientific officer of the Oceanographic and Atmospheric Sciences Division of the Geosciences institute of CNRS (CNRS-INSU) being in charge of the Research Infrastructures and the strategy in the European Research Area. J.-F. Doussin will lead WP6/task 6.2 and be involved in WP2,6.

Pr. Bénédicte Picquet-Varrault (female) is Professor of Chemistry and Atmospheric Sciences at the University of Paris-Est Créteil (UPEC). At CNRS-LISA, her main research interest is the study of the gas-phase reactivity of atmospheric organic species using simulation chambers. For several years, her research has focused on the sources (NO3 chemistry) and the reactivity of organic nitrates in order to evaluate their impact on the transport of reactive nitrogen. She is author of 34 peer-reviewed articles and more than 50 conference contributions. She has been PI of several national projects in the field of atmospheric chemistry.

Université de Lille (ULille)

UL is a State University created in 1562. Up to recently composed of three different campuses (Lille 1, 2 and 3), it just merged to form the UL which has been selected as one of the 9 French university's "Initiatives, Science, Innovations, Territories and Economy" clusters. The Science and Technology campus (Lille 1) has over 20 000 students and 2000 researchers, professors and associate professors and 1 300 staff, plus 1100 PhD students (45% are International), and hosts 80 visiting professors/year and offers 120 post-doctoral positions/year. At doctorate level, Lille 1 includes 5 Regional Doctoral Schools. Its Research Excellence Domain are in Science and Technology of Information and Communication (STIC), in Chemistry and Materials, in Mathematics, in Mechanics, in Energetic and Civil Engineering, in Physics, in Environment Sciences, in Biology and Biotechnologies, and in Social and economic sciences. Lille 1 has numerous partnerships and is top-flight centre for science and technology, economics and management, both at national and international level (state key laboratories). Lille 1 is involved as partner or coordinator in 19 H2020 and 16 Interreg projects. The 35 laboratories at Lille 1 are equipped with cutting edge science facilities and technological platforms from both a national and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and an international perspective () Associated with decumination and a second with the decumination of the dec

the Shanghai classification). Moreover, these laboratories participate in numerous European and international projects. Lille 1, is one of the 12 premier French campuses which benefit from extra funding from the French State and is a key centre for science and technology mostly joint research units with CNRS, INSERM, INRIA and INRA. Lille 1 is involved in 9 equipments of excellence, 5 laboratories of excellence, with strong partnerships with competitiveness clusters, major industrial groups, medium sized firms and SMEs. Lille 1 provides technology platforms to experiment innovating technologies or performs research provisions to meet business needs, owns 89 patents, managed about 200 industrial contracts with 70 new industrial contracts negotiated per year. Lille 1 has an incubator "Cre-Innov" and 50 starts-up were created since 2002. http://www.univ-lille.fr Role in the project

LILLE will be involved in WP4 and WP6.

Principal personnel involved

Dr. Philippe Goloub (male) is full professor at Lille University since 2003. In LOA, he focuses his research activities on aerosols and clouds remote sensing from both space and ground-based measurements, with emphasis on polarization. He is in charge of the PHOTONS/AERONET sunphotometer network, a national observatory devoted to aerosol characterization and monitoring since 2001 and leader of AERONET-EUROPE TNA during ACTRIS I3 in FP7 and ACTRIS-2, and unit head of the Topical Centre for Aerosol Remote Sensing in France. Since 2013, he has been leading the Aerosol Radiation Interaction group (30 persons) and the observation activities in the labex CaPPA project (Chemical and Physical Processes in the Atmosphere, http://labex-cappa.univ-lille1.fr/). He is in charge of the atmospheric platform (fixed and mobile) operated by LOA and PI of the Lille EARLINET site. Co-author of more than 120 publications in peer reviewed journals, he has been involved is many bilateral bilateral collaborative projects with Spain, China, Belarus, Ukraine.

Université de Versailles Saint-Quentin-en-Yvelines (UVSQ)

UVSQ is a State University created in 1991. It comprises 5 different campuses with 20,000 students, 540 PhD students (40% are International), 1000 researchers, professors and associate professors and 680 staff. The UVSQ offers more than 200 degree programs for a wide range of disciplines: sciences, letters and languages, law, political science, humanities, health, economics, management, sciences for the engineer, technology. The University participles to 220 International Agreements. It is composed by 39 research structures: 30 laboratories, 8 scientific centres and 1 observatory. It stands out in many scientific fields such as space, climate and environment, heritage, health, epidemiology, disability, sociology, materials, complex systems and public policies. The research of UVSQ relies on a set of technological platforms acquired with the support of its partners. Services on these same platforms can be offered to academic or industrial users.

Role in the project

UVSQ will be involved in WP4

Principal personnel involved

Dr. Andrea Pazmino (female) has 17 years' experience in atmospheric chemistry. She has a PhD degree on Atmosphere, Climate and Remote Sensing awarded by Paris 6 University in 2005 and a permanent position of assistant professor in UVSQ University since 2007. A. Pazmiño is the principal investigator of SAOZ (UV-Visible spectrometer) French Network (part of NDACC, Network for Detection of Atmospheric Composition Change) since 2009, and is the unit head of the Topical Centre for Reactive Trace Gases Remote Sensing in France. The research activities of A. Pazmiño concern the evolution of the stratosphere as a result of human activities and its link to climate change, ozone loss in polar regions, trends analysis and satellite validation. Her expertise includes the measurement of ozone, NO2 by passive instruments as the SAOZ spectrometer. She has contributed to 40 publications in peer-reviewed literature and to more than 100 presentations and papers in proceedings of symposia.

Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)

4.2.8 Institut Mines-Télécom (IMT)

No third parties involved.

4.2.9 Institut national de l'environnement industriel et de sépace (ENERIS) cument Ref. Ares (2019) 6815176 - 04/11/2019 No third parties involved.

4.2.10 Norsk Institutt for Luftforskning (NILU)

No third parties involved.

4.2.11 National Institute of R&D for Optoelectronics (INOE)

No third parties involved.

4.2.12 Paul Scherrer Institut (PSI)

No third parties involved.

4.2.13 Eidgenössische Materialprüfungs und Forschungsanstalt (EMPA)

No third parties involved.

4.2.14 Koninklijk Nederlands Meteorologisch Instituut (KNMI)

Does the participant plan to subcontract certain tasks (please note that core tasks of the	N
not be sub-contracted)	l

Does the participant envisage that part of its work is performed by linked third parties Y

Delft University of Technology is one of the leading and largest technical universities in Europe. The TU Delft Climate Institute is a research institute of the university dedicated to pre-competitive research in the fields of radar and telecommunication. The work of this project fits in the research program of the remote sector, which aims to develop innovative measurement techniques, systems and methodologies for the observation of natural at large distances, to translate relevant research expertise into educational programs, and to educate students by involving them in cutting edge research programs. The key elements in the research program are: 1) Experimental research of clouds and precipitation with radar. 2) Theoretical research of the scattering process. 3) The inverse problem: how to retrieve geo-physical parameters from the radar data? 4) Sensor synergy: how to combine different sensors to optimize the retrieval of atmospheric parameters?

Role in the project

TUD is a linked third party. Together with TU-Delft will contribute to ACTRIS-IMP as a contributor of a national facility (Cabauw) and the development and hosting of the cloud radar calibration central facility as a TNA pilot.

Principal personnel involved

Prof. dr. Herman Russchenberg (male) is Director of Director TU Delft Climate Institute. He has extensive experience in remote sensing of clouds and precipitation with ground-based radar, lidar and microwave radiometry. He is one of the initiators of this work in The Netherlands in the frame of the CLARA-project. Dr. Russchenberg is experienced in theoretical as well experimental research of the scattering process and the retrieval of geo-physical parameters from radar and lidar measurements. He has performed several studies for the European Space Agency, dealing with radar observations of clouds and precipitation. He participated in the Cloudnet program, and in the COST 720 project on integration of atmospheric sensors. He is project leader of Ruisdael Observatory.

Relevant publications

- 1. Pfitzenmaier, L., Unal, C.M.H., Dufournet, Y., Russchenberg, H.W.J. Observing ice particle growth along fall streaks in mixed-phase clouds using spectral polarimetric radar data (2018) Atmospheric Chemistry and Physics, 18 (11), pp. 7843-7862.
- 2. Mamali, D., Mikkilä, J., Henzing, B., Spoor, R., Ehn, M., Petäjä, T., Russchenberg, H., Biskos, G. Long-term observations of the background aerosol at Cabauw, The Netherlands (2018) Science of the Total Environment, 625, pp. 752-761.

A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action (Article 14 of the Model Grant Agreement).

- 3. Grosvenor, D.P., Sourdeval, O., Zuidema, Ackerman, the Acceptan, the Acceptant the
- Mamali, D., Marinou, E., Sciare, J., Pikridas, M., Kokkalis, P., Kottas, M., Binietoglou, I., Tsekeri, A., Keleshis, C., Engelmann, R., Baars, H., Ansmann, A., Amiridis, V., Russchenberg, H., Biskos, G. Vertical profiles of aerosol mass concentration derived by unmanned airborne in situ and remote sensing instruments during dust events (2018) Atmospheric Measurement Techniques, 11 (5), pp. 2897-2910.
- 5. Rusli, S.P., Donovan, D.P., Russchenberg, H.W.J. Simultaneous and synergistic profiling of cloud and drizzle properties using ground-based observations (2017) Atmospheric Measurement Techniques, 10 (12), pp. 4777-4803.

Relevant projects

- 1. ACTRIS PPP (Aerosol, Clouds, and Trace gases Research Infrastructure Preparatory Phase Project), 2017-2019, Grant agreement n. 739530.
- 2. ACTRIS-2 (Aerosols, Clouds, Trace gases, Research Infrastructure 2), 2015-2019, Grant agreement no 654109.
- 3. PEOPLE-2011-ITN, 289923, ITARS (Initial training for atmospheric remote sensing), 2012-2016,
- 4. CLOUDNET (Development of European pilot network of stations for observing cloud profiles), 2001-2005, Grant agreement ID: EVK2-CT-2000-00065.

Significant infrastructures

Cabauw. See description under 4.2.14.

Does the participant envisage the use of contributions in kind provided by third particle N and 12 of the General Model Grant Agreement)

4.2.15 Koninklijk Belgisch Instituut voor Ruimte-Aeronomie (BIRA-IASB)

No third parties involved.

4.2.16 University of Manchester (UMAN)

No third parties involved.

4.2.17 UK Research and Innovation (UKRI)

No third parties involved.

4.2.18 The Cyprus Institute (CyI)

No third parties involved.

4.2.19 University of Warsaw (UW)

Does the participant plan to subcontract certain tasks (please note that core tasks of the action should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties ³	Y

A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action (Article 14 of the Model Grant Agreement).

The Institute of Geophysics, Polish Academy of Sinces (FGFVPAS); (Institute Geofficial) 6-04/11/2019

Polskiej Akademii Nauk, IGF PAN) is a scientific institution representing the main stream of Polish basic research in Earth sciences. It is the only institution in Poland that performs monitoring of geophysical fields in seismology, geomagnetism, and selected areas of atmospheric physics. Research areas of IGF PAS are:

- Seismology and lithospheric research
- Geomagnetism
- Theoretical geophysics
- Atmospheric physics
- Hydrology and hydrodynamics
- Polar and marine research

Role in the project

IGF PAS will contribute to WP1, WP2, WP5

Principal personnel involved

Dr. hab. Aleksander Pietruczuk (male), Associate Professor at Department of Atmospheric Physics at IGF PAS. His main expertise is aerosol optical properties retrieval and analysis, as well as observational site management. He has been a head of the Observatory in Belsk and currently he is a PI of the EARLINET-ACTRIS site in Belsk and the AERONET sites in Belsk and Raciborz.

Relevant publications

- 1. Chaikovsky, A., et al. (including A. Pietruczuk): Lidar-Radiometer Inversion Code (LIRIC) for the retrieval of vertical aerosol properties from combined lidar/radiometer data: development and distribution in EARLINET Atmospheric Measurement Techniques 9 (2016), 1181-120.
- 2. Binietoglou, I., et al. (including A. Pietruczuk): A methodology for investigating dust model performance using synergistic EARLINET/AERONET dust concentration retrievals. Atmospheric Measurement Techniques 9 (2015): 3577-3600.
- 3. Kabashnikov V., et al. (including A.Pietruczuk): Localization of aerosol sources in East-European region by back-trajectory statistics, International Journal of Remote Sensing 35 (19), (2014) 6993-7006
- 4. Pappalardo G., et al. (including A. Pietruczuk): Four-dimensional distribution of the 2010 Eyjafjallajökull volcanic cloud over Europe observed by EARLINET, Atmospheric Chemistry and Physics 13 (2013), 4429-4450
- 5. Pappalardo G., et al. (including A. Pietruczuk): EARLINET correlative measurements for CALIPSO: first intercomparison results, doi:10.1029/2009JD012147, J. Geophys. Res., 115, (2010), D00H19,

Relevant projects

- 1. ACTRIS PPP "Aerosols, Clouds, and Trace gases Research InfraStructure Preparatory Phase Project", 2017-2019, linked third party
- 2. ACTRIS-2 "Aerosols, Clouds, and Trace gases Research InfraStructure 2", 2015-2019, associated partner
- 3. ACTRIS "Aerosols, Clouds and Trace gases Research Infrastructure Network", 2011-2015, partner
- 4. EPOS Preparatory Phase, 2010-2014

Significant infrastructures

IGF-PAS (LTP) plans to put an effort to establish at least one high-performance observational site located in Poland.

Does the participant envisage the use of contributions in kind provided by third	
parties (Articles 11 and 12 of the General Model Grant Agreement)	

4.2.20 Lunds Universitet (ULUND)

No third parties involved.

4.2.21 (Joint Research Centre (JRC) of the European Commission) JRC

No third parties involved.

4.2.22 Medical University of Innsbruck (MUI)

No third parties involved.

4.2.23 Zentralanstalt für Meteorologie und Geodynamik (ZAMG)

No third parties involved.

4.2.24 Institute of Chemical Process Fundamentals (ICPF)

Does the participant plan to subcontract certain tasks (please note that core tasks of the action should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties ⁴	Y

Czech Hydrometeorological Institute (CHMI)

The task of Czech Hydrometeorological Institute is to carry out the function of the Czech Republic's central governmental institution for the fields of air quality, hydrology, water quality, climatology and meteorology. The institute is structured into 3 main divisions (meteorology, hydrology and air quality protection) and 5 regional branch offices. The activities of the CHMI are carried out by a staff of approximately 800 people. CHMI brings into ACTRIS the National Atmospheric Observatory Košetice, which was established in 1988 and has been in continuous operation for more than 25 years being part of many European and global networks (ACTRIS-EUSAAR, EMEP, ICP-IM, GAW). At the national level, CHMI is a beneficiary in the ACTRIS-CZ project of large research infrastructures supported by the Czech ministry of Education. CHMI is responsible for implementation of trace gases monitoring within ACRTIS.

A)

B) Role in the project

CHMI will participate in working groups WP5 (as an owner of National Atmospheric Observatory Košetice, which should be the essential ACTRIS national facility for the Czech Republic), WP6 and WP8 (in the part Reinforce cooperation with European Research Infrastructures and e-infrastructures).

Principal personnel involved

Dr. Milan Vána (male), Ph.D.: Education: 1996 - Ph.D. Degree - Physical geography and geo-ecology, specialization climatology, (Charles University, Faculty of Science, Prague). He is the head of Košetice Observatory since 1994. He is also ACTRIS-CZ manager, the National contact person in ACTRIS, ACTRIS PPP and ACTRIS-2 project, Contact person for the Czech Republic in GAW (Global Atmosphere Watch) programme, National Focal Point for the Czech Republic in EMEP (TFMM and HTAP) and in ICP-IM./WGE He participated in a number of research projects related to atmospheric monitoring and research including ACTRIS.

Relevant publications

 Hoerger, C. C., Claude, A., Plass-Duelmer, C., Reimann, S., Eckart, E., Steinbrecher, R., Aalto, J., Arduini, J., Bonnaire N., Cape, J. N., Colomb, A., Connolly, R., Diskova, J., Dumitrean, P., Ehlers, C., Gros, V., Hakola, H., Hill, M., Hopkins, J. R., Jager, J., Junek, R., Kajos, M. K., Klemp, D., Leucher, M., Lewis, A. A., Locoge, N., Maione, M., Martin, D., Michl, K., Niemitz, E., O'Doherty, S., Ballesta, P. P., Ruuskanen, T. M., Sauvage, S., Schmidbauer, N., Spain, T. G., Straube, E., Vana, M., Vollmer, M. K., Wegner, R., Wegner,

⁴ A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action (Article 14 of the Model Grant Agreement).

- A., 2015. ACTRIS non-methane hydrocarbo https://doi.org/10.1019/support WMO GAW and EMEP observation networks. *Atmos. Meas. Tech.* 8, p. 2715–2736, doi: 10.5194/amt-8-2715-2015.
- 2. Pandolfi M., Alados-Arboledas L., Alastuey A., Andrade M., Angelov C., Artinano B., Backman J., Baltensperger U., Bonasoni P., Bukowiecki N., Coen M. C., Conil S., Coz E., Crenn V., Dudoitis V., Ealo M., Eleftheriadis K., Favez O., Fetfatzis P., Fiebig M., Flentje H., Ginot Patrick, Gysel M., Henzing B., Hoffer A., Holubova Smejkalova A., Kalapov I., Kalivitis N., Kouvarakis G., Kristensson A., Kulmala M., Lihavainen H., Lunder C., Luoma K., Lyamani H., Marinoni A., Mihalopoulos N., Moerman M., Nicolas J., O'dowd C., Petaja T., Petit J. E., Pichon J. M., Prokopciuk N., Putaud J. P., Rodriguez S., Sciare J., Sellegri K., Swietlicki E., Titos G., Tuch T., Tunved P., Ulevicius V., Vaishya A., Vana M., Virkkula A., Vratolis S., Weingartner E., Wiedensohler A., Laj P., 2018. A European aerosol phenomenology–6: scattering properties of atmospheric aerosol particles from 28 ACTRIS sites. Atmospheric Chemistry and Physics, 18(11), 7877-7911.
- 3. W. Aas, S. Tsyro, E. Bieber, R. Bergstrom, D. Ceburnis, T. Ellermann, H. Fagerli, M. Frolich, R. Gehrig, U. Makkonen, E. Nemitz, R. Otjes, N. Perez, C. Perrino, A. S. H. Prevot, J.-P. Putaud, D. Simpson, G. Spindler, M. Vana, And K. E. Yttri. 2012. Lessons learnt from the first EMEP intensive measurement periods. Atmos. Chem. Phys., 12, 8073–8094, 2012
- 4. Kalina, J., Scheringer, M., Borůvková, J., Kukucka, P., Přibylová, P., Sáňka, O., Melymuk, L., Váňa M., Klánová, J., 2018. Characterizing Spatial Diversity of Passive Sampling Sites for Measuring Levels and Trends of Semivolatile Organic Chemicals. *Environmental science & technology*, *52*(18), 10599-10608.
- 5. Mbengue, S., Fusek, M., Schwarz, J., Vodička, P., Holubová Šmejkalová, A., Holoubek, I., 2018. Four years of highly time resolved measurements of elemental and organic carbon at a rural background site in Central Europe. *Atmospheric Environment*, 182, 335-346

Relevant projects

- 1. ACTRIS Participation of the Czech Republic (ACTRIS-CZ). Grant No. LM2015037. The Ministry of Education, Youth and Sports of the Czech Republic, 2016-2022
- 2. ACTRIS PPP, No 739530, EU H2020, 2017-2019, beneficiary
- 3. ACTRIS-2 Aerosols, Clouds, and Trace gases Research InfraStructure Network, IA, No.654109, EU H2020, 2015-2019, beneficiary
- 4. ACTRIS Aerosols, Clouds, and Trace gases Research InfraStructure Network, EU INFRA-2010-1.1.16-262254, EC 7.FP, 2011-2015.
- 5. EUSAAR European Supersites for Atmospheric Aerosol Research, I3, No. FP6-026140, EC, 6. FP, 2006-2011.

Significant infrastructures

Observational platforms:

National Atmospheric Observatory Kosetice (NAOK). The observatory has been involved in EUSAAR (2006-2011), ACTRIS (2011-2015) and ACTRIS-2 (2015-1019) projects. Moreover, Košetice Observatory represents the Czech Republic in long-term monitoring programmes under CLRTAP (EMEP - LEVEL 2 station and ICP-IM and WMO (GAW regional station). Within the Air Quality Protection Department, the Observatory is supported by the accredited Central Imission Labs in Prague - Libuš.

Station Ústí nad Labem – monitoring of atmospheric aerosols

Does the participant envisage the use of contributions in kind provided by third	N
parties (Articles 11 and 12 of the General Model Grant Agreement)	

4.2.25 National Observatory of Athens (NOA)

Does the participant plan to subcontract certain tasks (please note that core tasks of	N
the action should not be sub-contracted)	

Does the participant envisage that part of its work is performed by the Reduction Ares (20 y 9) 6815176 - 04/11/2019 parties 5

The National Center for Scientific Research "DEMOKRITOS" (NCSR-D)

C

- D) The NCSR "Demokritos" conducts excellent basic and applied research providing high-technology services to the Industry and the Society. The Environmental Radioactivity Laboratory (ERL) in the Institute of Nuclear & Radiological Sciences & Technology, Energy & Safety (INRASTES) possesses a highly integrated expertise focused on:
- E) a) Physicochemical properties of atmospheric aerosol, with respect also to climatic active aerosol species, b)Urban, regional and indoor air quality, c) Radiation protection and exposure to aerosol contaminants such as heavy metals and organic pollutants, d) Source apportionment/Receptor modelling of atmospheric pollutants e) Development of novel sampling and measurement techniques f) Inhalation dosimetry studies ERL has participated in a number of projects funded by European and national programs. In addition, since 2007 it operates the Demokritos Regional Research Aerosol station, member of the Global Atmosphere Watch (GAW) and ACTRIS networks and since 2016 the Helmos Mt Free Troposphere Aerosol and Climate Change station (2314 masl). Since 2001 it operates instrumentation for measurements and data analysis at the IASOA, GAW and ACTRIS Zeppelin station, Ny Aalesund Svalbard in the European High Arctic for monitoring Black Carbon and Aerosol absorption. The laboratory is accredited under EN ISO/IEC 17025: 2005 Standard EN12341,EN14902. Its members contribute to the TC264 WG15 and WG35 committees and to the IAEA Regional Programme for application of Nuclear techniques to source apportionment of air pollutants.

F)

G) Role in the project

NCSR-D will contribute to Task 3.4 Linking European activities to National strategies in ACTRIS providing a link with national ACTRIS organizations including the Regional Partner Facilities and the national stakeholders, collecting a series of case studies at selected regional sites to identify best practices and strategies that contributed to successful development of ACTRIS at local level. *Principal personnel involved*

Dr. Konstantinos ELEFTHERIADIS, since 1996, Director of Research at NCSR Demokritos, Head of the Aerosol Group, research expertise on Physicochemical aerosol characterization with respect to climatic active aerosol species, nano-particle metrology, development of novel sampling and measurement techniques for aerosol particles, exposure of humans to aerosol contaminants such as heavy metals and radioactive pollutants, and retrieval of emission source impact, source apportionment and receptor modelling. PI for Demokritos in several EU FP and DG-ENV LIFE+ programmes, IAEA Regional projects & other National programmes. Coordinator of the FP7 REGPOT-EnTeC for enhancing the capacity of NCSR Atmospheric Research and Technology Infrastructure, including the Athens GAW/ACTRIS Demokritos station, the Mt. Helmos Free troposphere Aerosol and GHG station and the QA/QC physical aerosol properties lab facility. has more than 145 publications in peer reviewed journals (2740 citations, h-index 29)

Dr. Evangelia DIAPOULI is Assistant Researcher at the Institute of Nuclear & Radiological Sciences and Technology, Energy & Safety, NCSR "Demokritos". She holds a Chemical Engineering Diploma and PhD from the National Technical University of Athens (2000, 2008), an MSc in Environmental Engineering from Johns Hopkins University, USA (2002). Has 15 years of experience in the study of atmospheric aerosol including indoor pollution, aerosol source apportionment and population and occupational risk assessment, development of standardized methods, including the quantification of carbonaceous species in PM and PM source apportionment. She has participated in 8 European and

A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action (Article 14 of the Model Grant Agreement).

Stergios Vratolis is a Chemical Engineer, with research expertise in design and function of experimental measurement systems for the size distribution and physical properties of aerosols, data reporting to ACTRIS (Aerosols, Clouds, and Trace gases Research InfraStructure Network) database, combining chemical and physical properties of aerosols in order to estimate their impact on climate and humans.

Relevant publications

- 1. Pandolfi M., Alados-Arboledas L., Alastuey A., Andrade M., Angelov C., Artinano B., Backman J., Baltensperger U., Bonasoni P., Bukowiecki N., Coen M. C., Conil S., Coz E., Crenn V., Dudoitis V., Ealo M., Eleftheriadis K., Favez O., Fetfatzis P., Fiebig M., Flentje H., Ginot Patrick, Gysel M., Henzing B., Hoffer A., Holubova Smejkalova A., Kalapov I., Kalivitis N., Kouvarakis G., Kristensson A., Kulmala M., Lihavainen H., Lunder C., Luoma K., Lyamani H., Marinoni A., Mihalopoulos N., Moerman M., Nicolas J., O'dowd C., Petaja T., Petit J. E., Pichon J. M., Prokopciuk N., Putaud J. P., Rodriguez S., Sciare J., Sellegri K., Swietlicki E., Titos G., Tuch T., Tunved P., Ulevicius V., Vaishya A., Vana M., Virkkula A., Vratolis S., Weingartner E., Wiedensohler A., Laj P., 2018. A European aerosol phenomenology–6: scattering properties of atmospheric aerosol particles from 28 ACTRIS sites. *Atmospheric Chemistry and Physics*, 18(11), 7877-7911.
- 2. Kalogridis, A.-C., Vratolis, S., Liakakou, E., Gerasopoulos, E., Mihalopoulos, N., and Eleftheriadis, K.: Assessment of wood burning versus fossil fuel contribution to wintertime black carbon and carbon monoxide concentrations in Athens, Greece, (2018), Atmos. Chem. Phys., 18, 10219-10236
- 3. Zanatta, M., Laj, P., Gysel, M., Baltensperger, U., Vratolis, S., Eleftheriadis, K., Kondo, Y., Dubuisson, P., Winiarek, V., Kazadzis, S., Tunved, P., and Jacobi, H.-W.: Effects of mixing state on optical and radiative properties of black carbon in the European Arctic, (2018), Atmos. Chem. Phys., 18, 14037-14057, doi.org/10.5194/acp-18-14037-2018.
- 4. Diapouli, E., Kalogridis, A.-C., Markantonaki, C., Vratolis, S., Fetfatzis, P., Colombi, C., Eleftheriadis, K., Annual variability of black carbon concentrations originating from biomass and fossil fuel combustion for the suburban aerosol in Athens, Greece, (2017) Atmosphere, 8, art. no. 234, DOI: 10.3390/atmos8120234
- 5. Diapouli, E., Manousakas, M., Vratolis, S., Vasilatou, V., Maggos, T., Saraga, D., Grigoratos, T., Argyropoulos, G., Voutsa, D., Samara, C., Eleftheriadis, K. (2017) Evolution of air pollution source contributions over one decade, derived by PM10 and PM2.5 source apportionment in two metropolitan urban areas in Greece, *Atmospheric Environment*, 164, pp. 416-430. DOI: 10.1016/j.atmosenv.2017.06.016

Relevant projects

- 1. The European network for observing our changing planet (ERA-PLANET) SC5-15-2015: Strengthening the European Research Area in the domain of Earth Observation 2016-2020, Full cost (33%): € 50,730,791
- 2. European Association of National Metrology Institutes EMPIR, Metrology for light absorption by atmospheric aerosols, 2017 2019, Full cost (100%): € 896,924
- COST COLOSSAL (2017-2021) ACTRIS IMP will benefit from the establishment of a clear user-community connected to the Topical Center for Aerosol in-Situ measurements organized in Colossal

Significant infrastructures

Observational platforms:

- 1.Demokritos Regional Research Aerosol station, member of the Global Atmosphere Watch (GAW) and ACTRIS networks
- 2. and since 2016 the Helmos Mt Free Troposphere Aerosol and Climate Change station (2314 masl).

Does the participant envisage the use of contributions in kind provided by this	d N
parties (Articles 11 and 12 of the General Model Grant Agreement)	

4.2.26 Foundation for Research & Technology, Hellas FORTH

No third parties involved.

4.2.27 Institute for Nuclear Research and Nuclear Energy - Bulgarian academy of science (INRNE-BAS)

Does the participant plan to subcontract certain tasks (please note that core tasks of the action should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties	Y

The Institute of Electronics at the Bulgarian Academy of Sciences (IE-BAS)

was founded in 1963 as a non-profit public organization for scientific investigations, education, and spreading of scientific knowledge in fields such as Physical Electronics, Photonics, Quantum Electronics, and Radiophysics. Shortly after its foundation, the Institute of Electronics became a leading scientific institution in Bulgaria in these areas of applied physics and engineering within the Bulgarian Academy of Sciences and in Bulgaria.

Through the years, the Institute's research field and structure have developed dynamically in response to the changes taking place in the main trends in applied physics and technologies: materials science and technologies, physics of nano-sized objects and nanotechnologies, nanoelectronics, photonics, quantum optics, environmental physics and monitoring, opto-electronics, biomedical photonics and biomedical applications.

The Laser Radars Laboratory at IE-BAS was established in 1974 as a specialized unit for development of experimental methods and systems for high spatial and temporal resolution laser remote sensing of the stratification of the atmospheric aerosols and pollutants. Sofia Lidar Station located at the IE-BAS is the only lidar station in Bulgaria that is part of the European Lidar Network EARLINET, where regular lidar observations have been carried out for more than 15 years.

Role in the project

IE-BAS will participate in work packages WP1 "Engagement and enlargement of the ACTRIS community and ACTRIS membership", WP2 "Implementation of a sustainable ACTRIS organization", WP5 "Facilitating the harmonized operation of the National Facilities", and WP9 "Positioning ACTRIS in the European innovation ecosystem".

Principal personnel involved

Dr. Tanja Dreischuh (female) is a senior scientist at IE-BAS with research interests and experience in lidar remote sensing of atmosphere, turbid media and thermonuclear plasma. She has been the head of the Laser Radars Laboratory since 2014. She has participated in several international and national research projects related to atmospheric monitoring and research, including ACTRIS, ACTRIS 2 and ACTRIS PPP.

Dr. Zahary Peshev (male) is a senior scientist working at the Laser Radars Laboratory of IE-BAS. His research interests and experience are in the fields of laser physics and applications, atmospheric physics and measurements, particularly in atmospheric aerosol remote sensing and aerosol characterization by using lidars. He has been participating in the research activities and regular lidar observations of atmospheric aerosols as a member of the team of Sofia Lidar Station in the framework of the European Lidar Network (Projects ASOS, ACTRIS, ACTRIS 2 and ACTRIS PPP).

Dr. Ivan Grigorov (male) is a research scientist with experience in lidar atmospheric research. He is responsible for aerosol measurements and data processing using a Cu-vapor lidar and for the online publication of the lidar database. He participated in several EU projects, including EARLINET-ASOS, ACTRIS, ACTRIS 2 and ACTRIS PPP.

Relevant publications

 Wandinger, U., Freudenthaler, V., Baars, H., Amodeo, A., Engelmann, R., Mattis, I., Groß, S., Pappalardo, G., Giunta, A., D'Amico, G., Chaikovsky, A., Osipenko, F., Slesar, A., Nicolae, D., Belegante, L., Talianu, C., Serikov, I., Linné, H., Jansen, F., Apituley, A., Wilson, K. M., de Graaf, M., Trickl, T., Giehl, H., Adam, M., Comerón, A., MuñozPorcar, C., Rocadenbosch, F., Sicard, M., Tomás Asangie; D., Wichard, D., Prijadas (2M.9)6815176 - 04/11/2019 Molero, F., Fernández, A. J., Alados-Arboledas, L., Bravo-Aranda, J. A., Navas-Guzmán, F., Guerrero-Rascado, J. L., Granados-Muñoz, M. J., Preißler, J., Wagner, F., Gausa, M.,

F., Guerrero-Rascado, J. L., Granados-Muñoz, M. J., Preißler, J., Wagner, F., Gausa, M., Grigorov, I., Stoyanov, D., Iarlori, M., Rizi, V., Spinelli, N., Boselli, A., Wang, X., Lo Feudo, T., Perrone, M. R., De Tomasi, F., and Burlizzi, P., "EARLINET instrument intercomparison campaigns: overview on strategy and results", Atmos. Meas. Tech. 9, 1001-1023 (2016).

- 2. J.L. Pérez-Díaz, O. Ivanov, Z. Peshev, M.A. Álvarez-Valenzuela, I. Valiente-Blanco, T. Evgenieva, T. Dreischuh, O. Gueorguiev, P. Todorov, A. Vaseashta. "Fogs: Physical Basis, Characteristic Properties, and Impacts on the Environment and Human Health", Water 9, 807 (2017).
- 3. Dreischuh T., Grigorov I., Peshev Z., Deleva A., Kolarov G., Stoyanov D., "Lidar Mapping of Near-Surface Aerosol Fields", in "Aerosols Science and Case Studies", InTech, pp. 85-107 (2016). ISBN: 978-953-51-4963-7, DOI:10.5772/65274.
- 4. Peshev Z., Dreischuh T., Evgenieva Ts., Deleva A., Tonev D., Stoyanov D., "Lidar observations of long-range transported Saharan dust over Sofia, Bulgaria: a case study of dust mixed with local aerosols", J. Appl. Remote Sens. 10, 036009 (2016). DOI:10.1117/1.JRS.10.036009, 036009

Relevant projects

- 1. EU H2020 project ACTRIS PPP Aerosols, Clouds and Trace Gases Research Infrastructure Preparatory Phase Project (INFRADEV-2). Grant agreement n. 739530 (2017-2019).
- 2. EU H2020 project ACTRIS 2 (Aerosol, Clouds, and Trace gases Research Infrastructure). Grant agreement n. 654109 (2015-2019).
- 3. EU FP7 project ACTRIS I3 (Aerosol, Clouds, and Trace gases Research Infrastructure network). Grant agreement n. 262254 (2011-2015).
- 4. EU FP6 project EARLINET-ASOS (European Aerosol Research Lidar Network Advanced Sustainable Observation System). Grant agreement n. 025991 (2006-2011).
- 5. EU FP7 project Contract of Association between the European Atomic Energy Community (EURATOM) and INRNE. Grant agreement n. FU07-CT-2007-00059 (2007-2012).

Significant infrastructures

Since 2002, the Laser Radars Laboratory at IE-BAS has been involved in regular and synchronized lidar measurements of the atmospheric aerosol within the framework of the European Aerosol Research Lidar Network (EARLINET), by using two lidar systems certified and included (as Sofia Lidar Station) into the structure and activities of the Network – an aerosol lidar with a Nd:YAG-laser (1064 nm, 532 nm) and an aerosol lidar with a CuBr-vapor laser (510.6 nm, 578.2 nm). IE-BAS plans to upgrade the Sofia lidar measurement station to become aerosol remote-sensing ACTRIS National Facility.

J	
Does the participant envisage the use of contributions in kind provided by third	l N
parties (Articles 11 and 12 of the General Model Grant Agreement)	

4.2.28 University College Cork, National University of Ireland, Cork (UCC)

No third parties involved.

4.2.29 Aarhus Universitet (AU)

No third parties involved.

4.2.30 Universitat Politècnica de Catalunya (UPC)

Does the participant plan to subcontract certain tasks (please note that core tasks of	N
the action should not be sub-contracted)	

In this project UPC is leading a Joint Research Unit with a long history of co-operation. From this JRU the following institutions are linked third parties to UPC in this project:

Barcelona supercomputing Center (BSC)

The Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC) is the Spanish national supercomputing facility and a hosting member of the PRACE distributed supercomputing infrastructure. The Center houses MareNostrum, one of the most powerful supercomputers in Europe. The mission of BSC is to research, develop and manage information technologies in order to facilitate scientific and societal progress.

The Earth Sciences Department is one of the four BSC departments and has the goal to apply the latest advances of high performance computing and big data to earth system modelling. The department is organized around four closely interacting groups: Climate Prediction, Computational Earth Sciences, Earth Sciences Services, and Atmospheric Composition, which is the group involved in this proposal. During last 5 years (2014-2019), BSC-ES was granted 13 EU H2020 projects, 5 EU Copernicus projects, 10 national projects, 2 projects funded by the European Space Agency, 3 projects funded by the French Ministry of Sciences, 1 project funded by the Flanders Research Foundation, 1 project from ERA-NET ERA4CSand 1 ERC Consolidator Grant. During that same period, BSC-ES also participated in 21 RES and 4 PRACE projects. BSC-CNS has been awarded with the Severo Ochoa's Centre of Excellence project of the Spanish government since its first call (2011). The BSC-ES international activity includes the coordination of the two World Meteorological Organisation (WMO) regional centres specialized in sand and dust warning and forecasting, as well as the participation in climate services initiatives like the Climate Services Partnership (CSP). Members of the BSC-ES participate in committees of the World Climate Research Programme (WCRP), such as the CLIVAR Scientific Steering Group or the Working Group on Seasonal to Interannual Prediction (WGSIP). The Atmospheric Composition (AC) group, which is the group involved in this proposal, aims at better understanding the chemical composition of the atmosphere and its effects upon air quality, weather and climate, while improving predictions from local to global scales. This goal is addressed through the development and use of the NMMB/BSC Chemical Transport Model (NMMB/BSC-CTM; http://www.bsc.es/earthsciences/nmmbbsc-project), an online multi-scale non-hydrostatic chemical weather prediction system that can be run either globally or regionally, and includes aerosol data assimilation. A core activity of the group is mineral dust modelling and forecasting from regional to global scales. As a result of this expertise, the BSC hosts, in collaboration with the Spanish meteorological agency (AEMET), both the Regional Center for North Africa, Middle East and Europe of the WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS; http://sdswas.aemet.es/), and the WMO first Regional Specialized Meteorological Center with activity specialisation on Atmospheric Sand and Dust Forecast, known as the Barcelona Dust Forecast Center (http://dust.aemet.es/). The AC group is a reference in dust modelling at different scales, and, as such, hosts a long-term AXA Chair on Sand and Dust Storms, and has been recently awarded with the ERC Consolidator Grant FRAGMENT (GA 773051), held by Dr. Carlos Pérez García-Pando.

H) Role in the project

BSC effort is mainly focused on WP4 (Implementation and test operation of the Central Facilities) tasks.

I) Principal personnel involved

Dr. Carlos Peréz García-Pando (male) Dr. Carlos Pérez García-Pando (male) is AXA Professor, Ramón y Cajal Researcher and Head of the Atmospheric Composition Group at BSC. He holds a long-term Chair on Dust Storms at BSC funded by the AXA Research Fund and an ERC Consolidator Grant entitled FRAGMENT (GA773051), starting in October 2018. His research group (the AC group) is composed of ~20 people including senior researchers, postdocs, PhD students and technical support staff. His research focuses on understanding the physical and chemical processes controlling atmospheric aerosols, and evaluating their effects upon climate, ocean biogeochemistry, air quality and health. His core area of expertise is atmospheric mineral dust. He is also a model developer with

a large experience in supercomputers. Previously he has the search problems and the Novaske Mathana 176 - 04/11/2019

Centers for Environmental Prediction, the International Research Institute for Climate and Society, the NASA Goddard Institute for Space Studies and Columbia University. He has participated in ~30 international and national projects (in 7 of them as PI or co-PI). In the US, he has been PI and co-PI of competitive projects funded by the Department of Energy, His work has resulted in ~60 peer-reviewed publications, 20 chapters in books, proceedings and reports, more ~200 contributions to conferences/workshops/seminars (~30 as invited speaker) and the edition of a book of proceedings (Google scholar; citations 3655).

Research Center on Energy, Environment and Technology (CIEMAT)

CIEMAT- Research Center on Energy, Environment and Technology, is a public research body with a 1,350 staff and several research centers in Spain. Its main activity is structured around technical Departments focused on the study, development, promotion and optimization of energy sources and also on the research of their environmental impact at different scales. The Department of Environment carries out all the R&D activities related to environmental assessments and within this, atmospheric pollution can be considered as one of its strongest fields of expertise, as measurement and characterization of atmospheric processes involving gaseous pollutants and aerosols have been the main focusses of interest for more than 30 years.

The Group involved in this proposal operates and maintains a research station in Madrid that initiated as an EARLINET Lidar station participating in EARLINET-ASOS (FP6) and ACTRIS (FP7). Presently it participates in ACTRIS-2 (H2020) as an ACTRIS station with profiling and in-situ monitoring. It counts with an important set of state-of- the-art instruments for in situ measurements of ambient aerosol properties (optical, online chemical speciation, aerosol formation processes and hygroscopicity) and other atmospheric parameters and gases to improve the understanding of physicochemical processes related with atmospheric aerosols and the atmosphere.

J) Role in the project

CIEMAT effort is mainly focused on WP5 (Facilitating the harmonized operation of the National Facilities), WP6 (Implementation of the user access to user access to ACTRIS services) and WP9 (Positioning ACTRIS in the European innovation ecosystem) tasks.

K)

L) Principal personnel involved

Dr. Begoña Artíñano (female) is a Senior Researcher at CIEMAT. She is head of the Atmospheric Pollution Characterization Unit at CIEMAT and has more than 30 year experience in atmospheric processes and aerosol properties characterization. She is main responsible of the in-situ measurements of the Madrid ACTRIS station, and IP of a number of national, FP5 and FP7 EU- Programmes funded research projects. She is currently the CIEMAT scientific contact in ACTRIS-PPP.

Dr. Manuel Pujadas (male) is a Senior Researcher at CIEMAT. He is head of the Emission Pollutant Unit at Department of Environment and has more than 30 year experience in remote sensing of atmospheric pollutants and emission processes. He is the responsible of the remote sensing measurements at the Madrid ACTRIS station and has been IP of CIEMAT in different research national and EU funded projects, included EARLINET-ASOS, ACTRIS and ACTRIS-2.

Instituto Nacional de Técnica Aeroespacial (INTA)

INTA (Spanish acronym for National Institute for Aerospace Technology) is a public institution, specialized in aeronautic and aerospace research and development. The institute carries out R&D and commercial activities. INTA has a total staff of about 1400, more than 1000 dedicated to R&D activities, testing and certification.

The Atmospheric Research and Instrumentation Area (AIIA, INTA), a research unit of the Department of Earth Observation and Atmosphere at INTA, is devoted to the physic-chemistry experimental research and monitoring activities in the field of the terrestrial atmosphere. Both commercial and homemade hi-tech multi-platform instrumentation is used for this purpose (including satellite, balloonborne, aircraft and ground-based). Stratospheric ozone, aerosols monitoring, air quality and UV radiation, and their impacts on nature are main fields of interest.

Since 1990 AIIA has been involved in EC projects (EASERAME; tSCUVS; SCUVS; Scuv

3, TASTE, STREAMER, QUILT, SCOUT-O3, QUOBI, GEOMON, NORS, EUSAAR, ACTRIS, ACTRIS2, ACTRIS-PPP). The team has participated in the satellite validation spectrometers such as GOME, SCIAMACHY, GOMOS, MIPAS, ILAS-II, GOME-II, OMI, TROPOMI, etc., using INTA ground-based stations. Quality-controlled observations are part of several networks, including AERONET, MPLNET, NDACC, ACTRIS, NOAA/ESRL, EUBREWNET.

AIIA operates El Arenosillo Atmospheric Sounding Station facilities (ESAt/ARN) in South West of the Iberian Peninsula ((37.18N, 6.78W, 40 m a.s.l.). The site is located in a protected rural environment (the Doñana National Park), 0.7 km from the coast of the Atlantic Ocean, in the mouth of the Guadalquivir valley, and close to the Mediterranean Sea and North African coast. AIIA has been performing a long-term programme to measure atmospheric components as trace gases and aerosol in the atmosphere since the eighties. ESAt experience is in vertical distribution of aerosols and clouds (active remote sensing, MPLNET lidars); in-situ measurements of the optical and microphysical properties of near-surface aerosols; columnar-derived properties of aerosols (AERONET sun-lunar photometer); gases monitoring (in-situ instrumentation, and MAXDOAS passive remote sensing/profiling retrieval); surface radiation monitoring and simulation (global, direct and diffuse, up and down). Radiative impact research of principal climate-relevant aerosols: Saharan dust intrusions, smoke/biomass burning arrivals and Cirrus clouds.

M)

N) Role in the project

INTA effort is mainly focused on WP5 (Facilitating the harmonized operation of the National Facilities) and tasks.

O)

P) Principal personnel involved

Dr. Margarita Yela (female), is a researcher at INTA since 1992, PhD in Atmospheric Physics. At present is leading Atmospheric Research and Instrumentation Area at INTA. She is PI of NDACC DOAS monitoring activities at Izaña Observatory (Spain), Marambio and Belgrano station (Antarctica) and Ushuaia (Argentina). She has been working in the field of spectroscopic measurements of atmospheric trace gases since 1993. Her research background covers meteorology, tropospheric gas trace, tropospheric and stratospheric ozone, UV radiation, and dust/aerosols. Her activities are within the international monitoring and research networks such as: NDACC (Network for the Detection of Atmospheric Composition Change), AERONET (AErosol RObotic NETwork), MPL-NET (MicroPulse Lidar NETwork),

She has participated in 38 National and European funded projects (13 FWP and 4 ESA) and contributed to more than 75 peer reviewed papers in her field of research. At present, she is involved in CAMS and in the validation of the TROPOMI NO2 and O3 products using the DOAS networks of NDACC.

Universidad de Granada (UGR)

The University of Granada (Universidad de Granada, UGR, Granada, Spain) is a public institution, one of the largest universities in Spain, devoted to the higher education and research in the fields of architecture, humanities, health sciences, law, experimental sciences and engineering. The Atmospheric Physics Group (GFAT) of the Andalusian Institute for Earth System Research (IISTACEAMA) develops its research activity on the different components of the Earth energy balance. Along the last two decades the group gained a good experience in the study of aerosol, clouds and their interaction with the atmospheric radiation field, using in-situ and remote sensing, passive and active, tools combined with the use of retrieval algorithms of microphysical properties for nonspherical aerosols, based on T-matrix kernels. The group has also a good skill on the use of eddy covariance techniques applied to the study of turbulent exchanges between surface and atmosphere, with special focus on greenhouse gases. UGR is part of EARLINET and AERONET networks.

The University of Granada, UGR, operates the Andalusian Global ObseRvatory of the Atmosphere (AGORA), located in Southern Spain, includes several experimental sites. The main site is the UGR station (37° 9'49.21"N, 3°36'17.94"W, 680 m s.n.m.), located in Granada. The station, which belongs to the Andalusian Institute for Earth System Research, IISTA_CEAMA of the University of Granada, combines long-term monitoring of vertical distribution of atmospheric aerosol, based on active and

passive remote sensing, with in-situ measurements for the harmier and the control of the control

as the monitoring of atmospheric and solar radiation at several spectral ranges. AGORA includes additional facilities in Sierra Nevada Mountains, which due to their proximity offer a unique opportunity to combine the vertical remote sounding of the atmospheric column from UGR station with in-situ measurements at different elevations in Sierra Nevada slopes. Thus, several high mountain locations have been used in the frame of different experimental campaigns during the past years, including an AERONET seasonal site (Cerro Poyos, 37.11°N; 3.49°W; 1830 m asl). These mountain sites include some buildings that belong to the University of Granada and the access to infrastructure of the Sierra Nevada National Park. A high mountain location was set up in 2016 at 37.09 N; 3.38 W; 2550 m asl. The high mountain station, Sierra Nevada Station, SNS, allows for the characterization of regional and long-range transport episodes and for the validation of inversion algorithms used to retrieve aerosol and cloud microphysical properties with LIDAR and RADAR techniques.

The main research activities at AGORA focus on the study of the atmosphere, the Earth's surface and their interactions using remote sensing and in-situ techniques. AGORA combines complementary stations with different atmospheric conditions, high-degree of expertise and many facilities providing an ideal environment for a wide range of aerosol research, from urban to remote background conditions. AGORA favors integrated studies by using a broad range of instrumentation from active and passive remote sensing to a variety of in-situ methodologies. The location of the installations in the most meridian sector of the European continent near the African coast allows a detailed analysis of the Saharan dust prior to be mixed in highly polluted areas of Europe and the use of a high mountain stations allow the detection of the impact of the anthropogenic aerosol (originated at the metropolitan area of Granada) contribution modulated for the daily and seasonal cycle of the Planetary Boundary Layer. AGORA, due to its location at the slopes of Sierra Nevada Mountains, offers a unique combination of remote sounding and in-situ techniques at different elevations, which is an added value for validation of vertical profiles of aerosol and cloud microphysical properties retrieved by inversion of remote sensing data acquired at the valley level and for PBL-free troposphere interactions studies.

Q) Role in the project

UGR effort is mainly focused on WP6 (Implementation of the user access to ACTRIS services) tasks.

R)

S) Principal personnel involved

Prof. Lucas Alados Arboledas (male) is Director of the Andalusian Research Institute for the Earth System and PI of the Atmospheric Physics Group (GFAT) of the IISTA-CEAMA research center. GFAT develops its activity in the frame of AERONET and EARLINET networks. He has led different projects focused on the study of atmospheric aerosols and their role in the Earth energy balance using multiwavelength lidar with depolarization-measurement capabilities and sun/star/lunar radiometers, and near surface in-situ techniques. He has been PI of UGR in the FP7 project ACTRIS and is currently PI of UGR in the H2020 project ACTRIS2. His lidar related activities have been acknowledged by the European Aerosol Research Lidar Network (EARLINET), which has elected LAA as a council member for the period 2012-2016 and reelected for a new period 2016-2020. He has been co-chair of the EAA's working group "Atmospheric Aerosols" since 2009. Since 2017 he cooperates with the Agencia Estatal de Investigación in the management of the research projects program on atmosphere and climate change.

T) Relevant publications and relevant project

For relevant projects and publications of third parties linked to UPC, see the list provided in the beneficiary section 4.1.11.

Does the participant envisage the use of contributions in kind pro	ovided by third	N
parties (Articles 11 and 12 of the General Model Grant Agreement).		

4.2.31 Centre d'Estudis Ambientals del Mediterrani (CEA Associated with document Ref. Ares(2019)6815176 - 04/11/2019

Does the participant plan to subcontract certain tasks (please note that core tasks of the action should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties	Y

Spanish National Research Council (CSIC)

The Spanish National Research Council (CSIC, www.csic.es) is the largest public institution dedicated to research in Spain and the third largest in Europe, covering from basic research to advanced technological development. Its research is driven by its centres and institutes (more than 100), which are spread across all the autonomous regions, and its more than 15,000 staff, of whom more than 3,000 are staff researchers and the same number again are graduates and postgraduates. The Group of Environmental Geochemistry and Atmospheric Research (EGAR; www.idaea.csic.es/EGAR) belong to the Institute of Environmental Assessment and Water Studies (IDÆA). This group is specialist in atmospheric aerosol monitoring, sampling, characterization and source apportionment. These activities provide scientific knowledge on which assessment of air pollutant effects on different aspects of the environment, from human health to climate, can be based. The team operates several ground based stations in urban (Barcelona), rural (Montseny) and remote (Montsec) areas. The research team provides external expert support to Spanish environmental authorities and participates in the workgroup on particulate matter of the Clean Air For Europe (CAFE) program of the DG Environment for the evaluation of the EU air quality directives.

Research on atmospheric pollution by IDAEA-CSIC is carried out in strong collaboration with other Spanish research organizations such as University of Huelva, Centro de Estudios Ambientales del Mediterráneao (CEAM), Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Instituto de Tecnología Cerámica-Universitat Jaume I (ITC-UJI) and Centro de Investigación Atmosférica de Izaña-Agencia Estatal de Meteorología (CIAI-AEMET). These organizations are official "Associated Units" to CSIC for research on atmospheric pollution.

U) Role in the project

CSIC effort in ACTRIS IMP focuses on WP5 (Facilitating the harmonized operation of the National facilities).

Principal personnel involved

- **Dr. Andrés Alastuey (male):** is a Research Professor with more than 20 years of experience on environmental geochemistry, namely on atmospheric pollution. He is Deputy Director of IDAEA and Representative of CSIC in the foundation board of CEAM. He is Assessor of the Spanish Ministry of the Environment for PM and air quality. He has participated/coordinated around 70 research projects funded by the EU, other Spanish or international research bodies, the Ministry of the Environment and other private companies. He is supervisor/co-supervisor of 10 PhDs and co-author of around 350 papers in SCI journals. He is included in the Essential Science Indicators of the ISI Web of knowledge in the fields of Geosciences and Environment/Ecology (total number of quotations is
- >15000). Hirsch index = 74. Research ID: E-1706-2014; ORCID: 0000-0002-5453-5495. He is the scientist responsible of the EGAR network of stations measuring atmospheric aerosols, composed of urban background stations (Barcelona), regional background (Montseny) and remote background (Montsec). I led de participation of IDAEA CSIC in the ACTRIS RI (Aerosols, Clouds, and Trace gases Research InfraStructure) network).
- **Dr. Xavier Querol (male):** he is a Research Professor with more than 25 years in environmental geochemistry and air quality. He is devoting his research activity on the study of the aerosol constituents in urban, rural and remote atmospheres for quantification of the major source contributions and for elucidation of the transformation processes occurring under different climate conditions. He was in the working groups of the EC in preparing and drafting of the new directives of European air quality. He has participated in working groups and scientific advisory committees of the UN (UNECE and IPPC), WHO (REVIHAAP, HRAPIE), DGMACE (Clean Air for Europe, Expert Group of Stakeholders reviewing European Air Quality Policy). Since 2011, he is Vice-chairman of the United Nations Scientific Committee-CLTRAP EMEP (European Monitoring and Evaluation

Program, Convention on Long-range Transboundary Definition UNECEDIENE & ABSTROIT OF 04/11/2019

Spanish Ministry of Environment and Autonomous councils for Air Quality management. So far, he has published more than 600 papers in journals included in the SCI. He is supervisor/co-supervisor of more than 25 PhDs. He is included in the Essential Science Indicators of the ISI Web of knowledge in the fields of Environment/Ecology and geosciences. Hirsch index =85. Research ID: E-2800-2014.

Dr. Ma Cruz Minguillón (female): Ramón y Cajal fellow. PhD in 2007. Her main expertise focus on air quality and impact of mitigation measures, carbonaceous aerosol (among others, by using aerosol mass spectrometers), indoor air quality and new technologies for air quality measurements. Responsible of the ACSM instruments. Coordinator of the Action COST COLOSSAL Dr. Marco Pandolfi (male). Ramón y Cajal fellow. PhD in 2000. His main expertise focus on optical porperties of aerosols and air quality. Responsible of optical properties measurement at EGAR

V) Relevant publications

network.

- 1. Pandolfi, M., Alados-Arboledas, L., Alastuey, A., Andrade, M., Angelov, C., Artiñano, B., Backman, J., Baltensperger, U., Bonasoni, P., Bukowiecki, N., Collaud Coen, M., Conil, S., Coz, E., Crenn, V., Dudoitis, V., Ealo, M., Eleftheriadis, K., Favez, O., Fetfatzis, P., Fiebig, M., Flentje, H., Ginot, P., Gysel, M., Henzing, B., Hoffer, A., Holubova Smejkalova, A., Kalapov, I., Kalivitis, N., Kouvarakis, G., Kristensson, A., Kulmala, M., Lihavainen, H., Lunder, C., Luoma, K., Lyamani, H., Marinoni, A., Mihalopoulos, N., Moerman, M., Nicolas, J., O& apos; Dowd, C., Petäjä, T., Petit, J.-E., Pichon, J. M., Prokopciuk, N., Putaud, J.-P., Rodríguez, S., Sciare, J., Sellegri, K., Swietlicki, E., Titos, G., Tuch, T., Tunved, P., Ulevicius, V., Vaishya, A., Vana, M., Virkkula, A., Vratolis, S., Weingartner, E., Wiedensohler, A. and Laj, P.: A European aerosol phenomenology – 6: scattering properties of atmospheric aerosol particles from 28 ACTRIS sites, Atmos. Chem. Phys., 18(11), 7877–7911, doi:10.5194/acp-18-7877-2018, 2018.
- 2. Carnerero, C., Pérez, N., Reche, C., Ealo, M., Titos, G., Lee, H.-K., Eun, H.-R., Park, Y.-H., Dada, L., Paasonen, P., Kerminen, V.-M., Mantilla, E., Escudero, M., Gómez-Moreno, F. J., Alonso-Blanco, E., Coz, E., Saiz-Lopez, A., Temime-Roussel, B., Marchand, N., Beddows, D. C. S., Harrison, R. M., Petäjä, T., Kulmala, M., Ahn, K.-H., Alastuey, A. and Querol, X.: Vertical and horizontal distribution of regional new particle formation events in Madrid, Atmos. Chem. Phys., 18(22), 16601-16618, doi:10.5194/acp-18-16601-2018, 2018.
- 3. Querol, X., Alastuey, A., Gangoiti, G., Perez, N., Lee, H. K., Eun, H. R., Park, Y., Mantilla, E., Escudero, M., Titos, G., Alonso, L., Temime-Roussel, B., Marchand, N., Moreta, J. R., Revuelta, M. A., Salvador, P., Artíñano, B., García dos Santos, S., Anguas, M., Notario, A., Saiz-Lopez, A., Harrison, R. M., Millán, M. and Ahn, K.-H.: Phenomenology of summer ozone episodes over the Madrid Metropolitan Area, central Spain, Atmos. Chem. Phys., 18(9), 6511–6533, doi:10.5194/acp-18-6511-2018, 2018.
- 4. Alastuey, A., Querol, X., Aas, W., Lucarelli, F., Pérez, N., Moreno, T., Cavalli, F., Areskoug, H., Balan, V., Catrambone, M., Ceburnis, D., Cerro, J. C., Conil, S., Gevorgyan, L., Hueglin, C., Imre, K., Jaffrezo, J.-L., Leeson, S. R., Mihalopoulos, N., Mitosinkova, M., O'Dowd, C. D., Pey, J., Putaud, J.-P., Riffault, V., Ripoll, A., Sciare, J., Sellegri, K., Spindler, G. and Yttri, K. E.: Geochemistry of PM10 over Europe during the EMEP intensive measurement periods in summer 2012 and winter 2013, Atmos. Chem. Phys., 16(10), 6107–6129, doi:doi:10.5194/acp-16-6107-2016, 2016.
- 5. Pandolfi, M., X. Querol, A. Alastuey, J. L. Jimenez, O. Jorba, D. Day, A. Ortega, M. J. Cubison, A. Comerón, M. Sicard, C. Mohr, A. S. H. Prévôt, M. C. Minguillón, J. Pey, J. M. Baldasano, J. F. Burkhart, R.Seco, J. Peñuelas, B. L. van Drooge, B. Artiñano, C. Di Marco, E. Nemitz, S. Schallhart, A. Metzger, A. Hansel, J. Lorente, S. Ng, J. Jayne, and S. Szidat. Title: Effects of sources and meteorology on particulate matter in the Western Mediterranean Basin: An overview of the DAURE campaign (2014)., J. Geophys. Res. Atmos., Vol. 119, 4978-5010. doi:10.1002/2013JD021079, 2014.

W) Relevant projects

- 1. ACTRIS Aerosols, Clouds, and Trace gas Resociated with Plasuriering Feb. 2010-1. Funding scheme Combination
 - Propuesta: 262254. FP7- INFRASTRUCTURES-2010-1. Funding scheme Combination of CP & CSA. 01/04/2011 -31/03/2015. 7.8 M Euros. Coordinator: Gelsomina Papalardo Consiglio Nazionale delle Ricerche (CNR); CSIC PI: Andrés Alastuey (IDAEA-CSIC)
- 2. BREATHE (BRain dEvelopment and Air polluTion ultrafine particles in scHool ChildrEn). Advanced Grand ERC FP7. 2011 2015. 2.5 M Euros. PI: Dr. Jordi Sunyer, (CREAL); CSIC IP: Xavier Querol (IDAEA-CSIC)
- 3. AIRUSE LIFE+. Testing and Development of air quality mitigation measures in Southern Europe. LIFE11 ENV/ES/000584. 2012- 2016. 2.368.719 Euros. PI: Xavier Querol (IDAEA-CSIC)
- 4. ACTRIS2 Aerosols, Clouds, and Trace gases Research Infrastructure. European Commission. Research and Innovation action (RIA). Coontract 654109. Coordinator: Gelsomina Papalardo Consiglio Nazionale delle Ricerche (CNR). 01/04/2015 hasta 31/03/2019. CSIC PI: Andrés Alastuey (IDAEA-CSIC)
- **5.** ACTRIS PPP Aerosols, Clouds and Trace gases Preparatory Phase Project grant agreement No 739530. H2020-INFRA/0274. CSA (COOR. & SUP. ACTION). Coordinator: ILMATIETEEN LAITOS. 01/01/2017 -31/12/2019. CSIC PI Andrés Alastuey. (IDAEA-CSIC)

X) Significant infrastructures

The Monitoring network of the EGAR- from IDAEA-CSIC, is a unique infrastructure for atmospheric research located in NE Spain. It is integrated by a cluster of three observational platforms for atmosprehic aerosols: Montseny (MSY, Regional background, 720 m a.s.l.), Montsec (MSA, mountain site, 1590 m a.s.l.) and Barcelona–Palau Reial (Urban background). The MSY and MSA sites belong to the ACTRIS (http://www.actris.net/) and GAW (http://gaw.empa.ch/gawsis/) networks. It is a well-equipped infrastructure for in-situ characterization of aerosols (optical, physical, and chemical offline and online) and trace gases (NOx, SO2, O3, CO). Access to the network permits to investigate different environments, connecting Air Quality and Climate Research. It is the only site in the Western Mediterranean Basin, a unique region for atmospheric research given the high insolation, the specific meteorology, the elevated emissions of anthropogenic and natural pollutants, and the frequent impact of dust outbreaks.

Equipment at each of the sites (unless specified):

Aerosols ground measurements

Absorption measurements: MAAP and Aethalometer AE33

Scattering: Nephelometer AURORA 3000

Particle Number: CPC

Particle Number Size Distribution: SMPS

PMx optical particle counters

Chemical composition of PM10, PM2.5, and PM1 (only PM10 at MSA), including ions, OC and EC, major and trace elements with 24h time resolution

Online non-refractory PM1 chemical composition: Q-ACSM at MSY and ToF-ACSM at BCN (since 2019)

Online EC and OC at BCN: thermal-optical method

Vertical measurements

Ceilometer Luft CHM-15K at MSY and MSA Lidar measurements (from UPC) at BCN AOD (aerosol optical depth) by CIMEL

Gases:

NOx, O3, SO2 and CO measured by Catalan Government

Meteorological measurements

Laboratory for chemical analysis of atmospheric particles, including

Laboratory of filter samples treatment

ICP-MS and ICP-AES lab for determination of major Arage and Arage

Thermal-optical analysis of OC and

4.2.32 Universidad de Valladolid (UVA)

Does the participant plan to subcontract certain tasks (please note that core tasks of the action should not be sub-contracted)	N
Does the participant envisage that part of its work is performed by linked third parties	Y

UVA forms a Joint Research Unit with The Izaña Observatory of the Spanish Meterological Agency.

The Izaña Observatory of the Spanish Meterological Agency (AEMET)

The Izaña Observatory of the Spanish Meterological Agency (AEMET) was inaugurated on 1st. January, 1916. It has a long history of meteorological observations for more than 100 years, especially radiation data. The unique location of the Izaña Atmospheric Research Center, allows in particular the absolute calibration of the master photometer instruments, necessary for the calibration of AERONET field photometers. Izaña has been declared in July 2014 as Testbed station for Aerosols and Water Vapor Remote Sensing Instruments by the Commission for Instruments and Methods of Observations of the World Meteorological Organization (http://www.wmo.int/pages/prog/www/IMOP/Testbeds-and-LC.html).

Y) Role in the project

The Izaña Atmospheric Research Center of AEMET, is formally a linked third party to UVA through a Joint Research Unit between UVA and AEMET. In the AERONET-Europe (part of the Centre for Aerosol Remote Sensing) AERONET-Europe CF, the activity related to absolute calibration of reference instruments and testing of new instrumentation is carried out at Izaña facility. AEMET will contribute to the implementation of ACTRIS, with Dr. Natalia Prats Porta (female) and Dr. Emilio Cuevas- Agulló (male) being the main contributors.

Z) Principal personnel involved

Dra. Natalia Prats, Graduate in Physics at University of Valencia, Spain (2002), began her studies in the field of atmospheric aerosols at the Johannes-Gutenberg University of Mainz (Germany), working under the supervision of Prof. Dr. Ruprecht Jaenicke (2003-2004). In 2004 involved in the Group of Atmospheric Optics at the University of Valladolid through the national scholarship program awarded by the Spanish Ministry of Eduaction and Science for a period of four years (August 2004-July 2008) to obtain her PhD in February 2009, qualified as "Cum Laude". During this period stayed in other national and international research groups, as ESAt-INTA (Huelva, Spain), CEAMA (Granada, Spain), ALOMAR (Andoya, Norwey) and Institute of Experimental Physics, University of Vienna (Vienna, Austria). After she obtained her PhD, she made a stay for 3 months as invited scientist at LOA (Lille, France). During 2010-2016 she was working as meteorological forecaster at the Meteorological State Agency of Spain, AEMET (Las Palmas de Gran Canaria, Spain). Since October 2016 she is working at the Izaña Atmospheric Research Center belonging to AEMET as Project Manager and also involved in the homogenization of the Ozone Sounding data registered since 1992. Recently, she is in charge of the Aerosol In-Situ Laboratory, which activities are developed within the scientific priorities of the Global Atmosphere Watch programme, with the main task of maintaining the long-term observations of aerosols. The investigations of the group are focused on: 1) long-term multi-decadal variability and trends of aerosols; 2) aerosols and climate and 3) aerosols and air quality. Amoung others, she is involved in the ACTRIS-Preparatoy Phase Project (H2020-INFRADEV-2016-2) and the "Multidecadal variability and trends of aerosol properties in the North Atlantic -AEROATLAN" project (CGL2015-66299-P). She has 9 peer-reviewed journal papers and more than 30 contributions to congress.

Dr. Emilio Cuevas-Agulló (Mr.), joined the Meteor real wights with the meteor of the m

1987. He is the Director of the Izaña Atmospheric Research Center (IARC), a WMO (World Meteorological Organization) GAW (Global Atmospheric Watch) station of global importance. His research background covers meteorology (Master Degree in Atmospheric Physics) tropospheric ozone, atmospheric dynamics and stratosphere-troposphere exchange (PhD in 1996), tropospheric and stratospheric ozone, UV radiation, and dust/aerosols. His activities are within the GAW Program umbrella and other international monitoring and research networks such as: NDACC (Network for the Detection of Atmospheric Composition Change), AERONET (AErosol RObotic NETwork) and MPL-NET (MicroPulse Lidar NETwork). He has participated in 24 projects financed by European Commission (EC) and the National R+D Plan. He has been Principal Investigator (PI) in five EC contracts. He is co-author of over 80 papers in peer-reviewed literature.

Relevant publications:

see AEMET-UVA joint publication

Relevant projects

- 1. Sand and Dust Storm Early Warning System in the Magreb Region (SDS-Africa), AECID (Agencia Española de Cooperación Internacional para el Desarrollo)
- 2. Global Atmospheric Watch in the Magreb-Sahara Region (GAW-Sahara), AECID

Significant infrastructures

AEMET provides the unique observation platform of Izaña Observatory, located at Tenerife, Spain (2400m a.s.l.). The platform is equipped with state-of-the-art radiometric instrumentation, in many cases consisting of reference instruments of world-wide networks. A laboratory for radiometric calibrations equipped with integrating spheres, reference calibrated lamps, spectrometer, and angular response calibration, is also available. Moreover, Izaña observatory is a facility for the investigation of chemical composition and related physical characteristics of the atmosphere and their trends, mostly under free troposphere conditions, and within the Saharan Air Layer in summer. Long term monitoring of in-situ greenhouse gases and reactive gases is carried out at Izaña since 1984. It is also worth mentioning that sun photometer, lidar, ceilometer and aerosol in-situ observations are carried out also at AEMET headquarters in Santa Cruz de Tenerife (sea level).

Does the participant envisage the use of contributions in kind provided by third	Y
parties (Articles 11 and 12 of the General Model Grant Agreement)	
FUNDACION GENERAL DE LA UNIVERSIDAD DE VALLADOLID	
(FGUVA) is a non-profit institution totally controlled by UNIVERSIDAD DE	
VALLADOLID (UVA), created in order to handle the administrative and financial	
tasks of UVA in R&D European projects, including issues related to employment	
and payment of personnel, purchase of equipment, consumables, etc. FGUVA does	
not perform technical or scientific work/ tasks in the project. The contribution of	
FGUVA is free of charge and always used under the premises of UVA.	

4.2.33 Eesti Maaülikool (EULS)

No third parties involved.

4.2.34 University of Evora (UE)

No third parties involved.

In this section the various issues listed in the Horizon 2020 ethical self assessment are assessed:

- 1. ACTRIS IMP does not involve use of Human Embryos or Stem Cells.
- 2. ACTRIS IMP includes involvement of human participants in form of questionnaires and surveys in order to evaluate the user base and socio-economic impact of ACTRIS and its services. No physical intervention with the participants is required. All participants will be adult volunteers, not representing any identified vulnerable groups, and fully able to give their informed consent. As ACTRIS IMP is not a medical project, the participants are not in a patient relationship to ACTRIS IMP or to organizations linked to the project. The questionnaires and surveys will be conducted according to national and EU legislation, and following the H2020 ethical standards.

Detailed descriptions on the identification and engagement of the survey participants and on the informed consent procedures will be provided in ACTRIS IMP deliverable 11.2, due in month 4.

- 3. ACTRIS IMP does not involve research using human cells or tissues.
- 4. ACTRIS IMP does involve processing of personal data through 1) questionnaires and surveys conducted within the project and 2) collecting the project participant contact information for efficient project management. The type of personal data gathered consists typically of name (which usually reveals also gender), employer, position in the organization and contact e-mail. No special categories of personal data or health data will be collected, and no profiling or systematic monitoring of the participants is planned. In the questionnaires any personal data will be separated from other data as early as possible, making the rest of the data ready for further processing. Data may be exported from one country to another (including non-EU countries) in cases where the information is provided in a different country than the one where the data is processed. Transfer of processed personal that includes data is planned. The protocols for gathering, using, processing, storing and destroying the data produced in ACTRIS IMP will be described in detail in the ACTRIS IMP data management plan (deliverable 11.3, due in month 6). Special attention will be paid for issues dealing with personal data and GDPR. This deliverable will also include an approval statement by the Data Protection Officer of the coordinating institute (FMI) of ACTRIS IMP.
- 5. ACTRIS IMP will not include any research on animals.
- 6. ACTRIS IMP will include work carried outside EU, more specifically in Norway, Switzerland, and UK (assuming that Brexit takes place). These countries are generally not considered having a high potential for ethical risks. A signed confirmation of the strict following of H2020 ethical standards will be collected from the PI of each ACTRIS IMP beneficiary in these countries. No physical research materials will be transferred to or from these countries, nor used in ACTRIS IMP. The details on the work in these countries will be given in deliverable 11.1, including the abovementioned confirmations.
- 7. ACTRIS IMP does not involve use of elements that are considered harmful to the environment, animals or plants, nor those considered as harmful to humans, including research staff.
- 8. ACTRIS IMP does not involve dual-use items.
- 9. ACTRIS IMP is a civil project and does not include any military partners or technologies.
- 10. ACTRIS IMP is a project for coordinated implementation of research infrastructure ACTRIS, so the result of the project is a well-functioning operational research infrastructure. It is unlikely that this research infrastructure for environmental monitoring and data provision would be misused to cause harm to humans.
- 11. The gender dimension and gender balance in the project at all levels will be closely followed and reported near the end of the project in deliverable 11.7.

Please indicate if your project will involve:

- □□activities or results raising security issues: (NO)
- $\square\,\square$ 'EU-classified information' as background or results: (NO)

Part		Estimated eligible costs (per budget category)											EU contribution		Additional information			
Part			A. Direct per	rsonnel costs		costs of		D. Other	direct costs			Total costs			4			Other information:
Part		A.2 Natural person contract A.3 Seconded person [A.6 Personnel for	s under direct ons providing access	A.5 Beneficiaries t	that are natural			D.2 Equipment D.3 Other goods and services [D.4 Costs of large research	of internally invoiced goods		providing trans- national access to research infrastructure"					costs of in-kind contributions not used on	of costs under	international
Part	Form of costs ⁶	Actual	Unit ⁷	Un	it ⁸	Actual	Actual	Actual	Unit ⁹	25%	Unit ¹²	i = a+b+c+d						
		a	Total b	No hours	Total c	d	[e]	f	Total g	+b+c+f+g	Total i1	+[e]+f+g+h	k	1	m	n	Yes/No	
	1. FMI	315 000.00	0.00	0.00	0.00	0.00	0.00	203 180.00	0.00	129 545.00	0.00	647 725.00	100.00	647 725.00	647 725.00	0.00	No	n/a
Carbon C	2. UHEL	0.00	321 000.00	0.00	0.00	0.00	0.00	80 000.00	0.00	100 250.00	21 000.00	522 250.00	100.00	522 250.00	522 250.00	0.00	No	n/a
Color	3. CNR	355 000.00	0.00	0.00	0.00	0.00	0.00	96 000.00	0.00	112 750.00	20 250.00	584 000.00	100.00	584 000.00	584 000.00	ļ		n/a
C.Y.Z. 130000				0.00						72 600.00		385 000.00						n/a
Corner																		n/a
Color																		n/a
Column C																-		n/a
Curic Curi																		
CANNO 105000 0.00																		
The Interference \$2.63 \$2.50 \$0.00 \$																		n/a
S.HIT 28,000				0.00	0.00								100.00					0.00
	•			0.00	0.00								100.00					n/a
1.1 NOF. 176 200.0 0.00	9. INERIS	14 000.00	0.00	0.00	0.00		0.00	18 000.00	0.00	8 000.00	0.00	40 000.00	100.00	40 000.00	40 000.00	0.00	No	n/a
12. PSI 0.00 22 000.00 0.00	10. NILU	0.00	214 510.00	0.00	0.00	0.00	0.00	45 000.00	0.00	64 877.50	0.00	324 387.50	100.00	324 387.50	324 387.50	0.00	No	n/a
13. EMPA 38. 500.0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 12. 000.0 0.00 60.000.0 100.00 60.000.0 60.000.0 60.000.0 0.00 0.00 No m/s 14. KNMI	11. INOE	176 200.00	0.00	0.00	0.00	0.00	0.00	55 800.00	0.00	58 000.00	0.00	290 000.00	100.00	290 000.00	290 000.00	0.00	No	n/a
14 15 15 15 15 15 15 15	12. PSI	0.00	22 000.00	0.00	0.00	0.00	0.00	16 400.00	0.00	9 600.00	24 000.00	72 000.00	100.00	72 000.00	72 000.00	0.00	No	n/a
-TUD 34 716.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00	13. EMPA	38 500.00	0.00	0.00	0.00	0.00	0.00	9 500.00	0.00	12 000.00	0.00	60 000.00	100.00	60 000.00	60 000.00	0.00	No	n/a
Total beneficiary 72 621.00 0.0	14. KNMI	37 905.00	0.00	0.00	0.00	0.00	0.00	19 600.00	0.00	14 376.25	13 320.00	85 201.25	100.00	85 201.25	85 201.25	0.00	No	n/a
15. BIRA-IASB	- TUD	34 716.00	0.00	0.00	0.00	0.00	0.00	9 000.00	0.00	10 929.00	4 680.00	59 325.00	100.00	59 325.00	59 325.00	0.00	No	n/a
16. UNIMAN 40 278.00 0.0	Total beneficiary	72 621.00	0.00			0.00	0.00	28 600.00	0.00	25 305.25	18 000.00	144 526.25		144 526.25	144 526.25	n/a	n/a	0.00
17. UKRI 25 600.00 0.00																		n/a
18. CY1 69 300.00 0.00 0.00 0.00 0.00 0.00 0.00 0																		n/a
19. UNIWARSAW 28 400.00 0.00																		n/a
-IGF-PAS 20 100.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 16 000.00 0.00 80 000.00 80 000.00 80 000.00 80 000.00 n/a n/a 20. ULUND 26 900.00 0.00 0.00 0.00 12 000.00 0.00 9 725.00 0.00 48 625.00 48 625.00 0.00 No n/a 21. JRC 0.00 25 282.00 0.00 0.00 0.00 11 000.00 0.00 9 070.50 0.00 45 352.50 100.00 45 352.50 0.00 No n/a 22. MUI 46 640.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 65 800.00 65 800.00 0.00 0.00 No n/a																		n/a
Total beneficiary 48 500.00 0.00 0.00 0.00 15 500.00 0.00 16 000.00 0.00 80 000.00 80 000.00 80 000.00 80 000.00 n/a n/a n/a 20. ULUND 26 900.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 48 625.00 48 625.00 48 625.00 0.00 No n/a 21. JRC 0.00 25 282.00 0.00 0.00 0.00 0.00 0.00 9 070.50 0.00 45 352.50 45 352.50 0.00 No n/a 22. MUI 46 640.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 No n/a																		n/a
20. ULUND 26 900.00 0.00				0.00	0.00								100.00					n/a
21. JRC 0.00 25 282.00 0.00 0.00 0.00 0.00 11 000.00 0.00 9 070.50 0.00 45 352.50 100.00 45 352.50 45 352.50 0.00 No n/s 22. MUI 46 640.00 0.00 <td>•</td> <td></td> <td></td> <td>0.00</td> <td>0.00</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>100.00</td> <td></td> <td></td> <td></td> <td></td> <td>0.00</td>	•			0.00	0.00								100.00					0.00
22. MUI 46 640.00 0.00 0.00 0.00 0.00 0.00 0.00																		n/a n/a
																		n/a
1/01/2001 (*10/2001 UUU) (*10/2001 U	23. ZAMG	24 095.00	0.00	0.00	0.00	0.00	0.00	14 035.00			18 000.00	65 662.50	100.00	65 662.50	65 662.50	0.00	No	n/a

ESTIMATED BUDGET FOR THE ACTION

Associated with document Ref. Ares(2019)6815176 - 04/11/2019

	Estimated eligible ¹ costs (per budget category)											EU contribution Additional information				tion	
		A. Direct personnel costs cost subcont					D. Other o	lirect costs	E. Indirect costs ²	F. Special unit costs	Total costs	Reimbursement rate %	Maximum EU contribution ³	Maximum grant amount ⁴	Information for indirect costs	Information for auditors	Other information:
	A.1 Employees (or A.2 Natural persons contract A.3 Seconded perso [A.6 Personnel for part to research infrastrum]	s under direct ons providing access	A.4 SME owners A.5 Beneficiaries persons without sa	that are natural			D.1 Travel D.2 Equipment D.3 Other goods and services [D.4 Costs of large research infrastructure]	D.5 Costs of internally invoiced goods and services		F.1 "Costs for providing trans- national access to research infrastructure"					Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/ linked third parties not receiving funding/ international partners
Form of costs ⁶	Actual	Unit ⁷	Un	iit ⁸	Actual	Actual	Actual	Unit ⁹	Flat-rate ¹⁰ 25%	Unit ¹²							
	a	Total b	No hours	Total c	d	[e]	f	Total g	$h = 0.25 \text{ x (a} +b+c+f+g +[i1]^{13}+[i2]^{13}-n)$	Total i1	j = a+b+c+d +[e]+f+g+h +[i1]+[i2]	k	1	m	n	Yes/No	
24. ICPF	53 500.00	0.00	0.00	0.00	0.00	0.00	12 500.00	0.00	16 500.00	0.00	82 500.00	100.00	82 500.00	82 500.00	0.00	No	n/a
- CHMI	27 500.00	0.00	0.00	0.00	0.00	0.00	5 500.00	0.00	8 250.00	0.00	41 250.00	100.00	41 250.00	41 250.00	0.00	No	n/a
Total beneficiary	81 000.00	0.00			0.00	0.00	18 000.00	0.00	24 750.00	0.00	123 750.00		123 750.00	123 750.00	n/a	n/a	0.00
25. NOA	50 250.00	0.00	0.00	0.00	0.00	0.00	6 500.00	0.00	14 187.50	0.00	70 937.50	100.00	70 937.50	70 937.50	0.00	No	n/a
- NCSR-D	9 250.00	0.00	0.00	0.00	0.00	0.00	2 000.00	0.00	2 812.50	0.00	14 062.50	100.00	14 062.50	14 062.50	0.00	No	n/a
Total beneficiary	59 500.00	0.00			0.00	0.00	8 500.00	0.00	17 000.00	0.00	85 000.00		85 000.00	85 000.00	n/a	n/a	0.00
26. FORTH	24 000.00	0.00	0.00	0.00	0.00	0.00	18 000.00	0.00	10 500.00	0.00	52 500.00	100.00	52 500.00	52 500.00	0.00	No	n/a
27. INRNE-BAS	16 800.00	0.00	0.00	0.00	0.00	0.00	8 000.00	0.00	6 200.00	0.00	31 000.00	100.00	31 000.00	31 000.00	0.00	No	n/a
- IE-BAS	15 200.00	0.00	0.00	0.00	0.00	0.00	8 000.00	0.00	5 800.00	0.00	29 000.00	100.00	29 000.00	29 000.00	0.00	No	n/a
Total beneficiary	32 000.00	0.00			0.00	0.00	16 000.00	0.00	12 000.00	0.00	60 000.00		60 000.00	60 000.00	n/a	n/a	0.00
28. UCC	47 172.00	0.00	0.00	0.00	0.00	0.00	17 000.00	0.00	16 043.00	0.00	80 215.00	100.00	80 215.00	80 215.00	0.00	No	n/a
29. AU	32 338.00	0.00	0.00	0.00	0.00	0.00	5 000.00	0.00	9 334.50	0.00	46 672.50	100.00	46 672.50	46 672.50	0.00	No	n/a
30. UPC	11 640.00	0.00	0.00	0.00	0.00	0.00	1 000.00	0.00	3 160.00	0.00	15 800.00	100.00	15 800.00	15 800.00	0.00	No	n/a
- BSC	9 000.00	0.00	0.00	0.00	0.00	0.00	1 000.00	0.00	2 500.00	0.00	12 500.00	100.00	12 500.00	12 500.00	0.00	No	n/a
- CIEMAT	8 066.00	0.00	0.00	0.00	0.00	0.00	2 000.00	0.00	2 516.50	0.00	12 582.50	100.00	12 582.50	12 582.50	0.00	No	n/a
- INTA	4 600.00	0.00	0.00	0.00			5 400.00	0.00	2 500.00		12 500.00	100.00	12 500.00	12 500.00	0.00	No	n/a
- UGR	5 820.00	0.00	0.00	0.00			4 000.00	0.00	2 455.00		12 275.00	100.00	12 275.00		0.00	No	n/a
Total beneficiary	39 126.00	0.00			0.00		13 400.00	0.00	13 131.50		65 657.50		65 657.50		n/a	n/a	0.00
31. CEAM	8 858.00	0.00	0.00	0.00			4 800.00	0.00	3 414.50		49 072.50	100.00	49 072.50		0.00	No	n/a
- CSIC	5 788.00	0.00	0.00	0.00			4 000.00	0.00	2 447.00		12 235.00	100.00	12 235.00	12 235.00	0.00	No	n/a
Total beneficiary	14 646.00	0.00			0.00		8 800.00	0.00	5 861.50	32 000.00	61 307.50		61 307.50	61 307.50	n/a	n/a	0.00
32. UVA	9 500.00	0.00	0.00	0.00			500.00	0.00	2 500.00	0.00	12 500.00	100.00	12 500.00	12 500.00	0.00	No	n/a
- AEMET	5 074.00	0.00	0.00	0.00			4 800.00	0.00	2 468.50	0.00	12 342.50	100.00	12 342.50	12 342.50	0.00	No	n/a
Total beneficiary	14 574.00	0.00			0.00	0.00	5 300.00	0.00	4 968.50	0.00	24 842.50		24 842.50		n/a	n/a	0.00
33. EULS	25 600.00	0.00	0.00	0.00			10 000.00	0.00	8 900.00	0.00	44 500.00	100.00	44 500.00	44 500.00	0.00	No	n/a
34. UEvora	25 000.00	0.00	0.00	0.00			10 500.00	0.00	8 875.00		44 375.00	100.00	44 375.00	44 375.00	0.00	No	n/a
Total consortium	2 281 751.00	582 792.00	J		0.00	0.00	980 455.00	0.00	961 249.50	193 750.00	4 999 997.50	J I	4 999 997.50	4 999 997.50			0.00

¹ See Article 6 for the eligibility conditions.

² Indirect costs already covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary/linked third party that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant, unless it can demonstrate that the operating grant does not cover any costs of the action (see Article 6.2.E).

³ This is the theoretical amount of EU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the Commission decided to grant for the action) (see Article 5.1).

The 'maximum grant amount' is the maximum grant amount decided by the Commission. It normally corresponds to the requested grant, but may be lower.

Depending on its type, this specific cost category will or will not cover indirect costs. Specific unit costs that include indirect costs are: costs for energy efficiency measures in buildings, access costs for providing trans-national access to research infrastructure and costs for clinical studies.

⁶ See Article 5 for the forms of costs.

ESTIMATED BUDGET FOR THE ACTION

Associated with document Ref. Ares(2019)6815176 - 04/11/2019

- ⁷ Unit: hours worked on the action; costs per unit (hourly rate): calculated according to the beneficiary's usual accounting practice.
- ⁸ See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).
- ⁹ Unit and costs per unit: calculated according to the beneficiary's usual accounting practices.
- 10 Flat rate: 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E).
- 11 See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).
 12 See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc).
- Only specific unit costs that do not include indirect costs.
 See Article 9 for beneficiaries not receiving funding.
- ¹⁵ Only for linked third parties that receive funding.

ANNEX 2a

ADDITIONAL INFORMATION ON THE ESTIMATED BUDGET

Research infrastructure unit cost

Access costs for providing trans-national access to research infrastructure

Unit cost table (access to research infrastructure unit cost)

Short name Short name			Installation	Unit of access	Amount per unit	Estimated No of units	Total unit cost (cost per
provider	infrastru cture	No	Short name				unit x estimated no of units)
UHEL	SMEAR II	1	Hyytiälä	UWD	700,00	30	21 000,00
CNR	ACTRIS DC- ARES	1	SHARE	SWD	450,00	45	20 250,00
TROPOS	ACD- C/OGTAC	1	ACD-C/OGTAC CC	DAY	1 100,00	20	22 000,00
FZJ	SAPHIR- CiGas-FZJ	1	SAPHIR-CiGas-FZJ	DAY	5 000,00	5	25 000,00
CNRS	CARS-ASP- FR	1	Calibration AE	CAL	1 350,00	10	13 500,00
PSI	JFJ	1	JFJ	DAY	800,00	30	24 000,00
KNMI	Cabauw	1	Cabauw-KNMI	UWD	370,00	36	13 320,00
TUD	Cabauw	2	Cabauw-TUD	UWD	130,00	36	4 680,00
ZAMG	SBO	1	SBO	UWD	400,00	45	18 000,00
CEAM	EUPHORE	1	EUPHORE	DAY	4 000,00	8	32 000,00

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HELSINGIN YLIOPISTO (UHEL), established in YLIOPISTONKATU 3, HELSINGIN YLIOPISTO 00014, Finland, VAT number: FI03134717, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('2')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CONSIGLIO NAZIONALE DELLE RICERCHE (CNR), established in PIAZZALE ALDO MORO 7, ROMA 00185, Italy, VAT number: IT02118311006, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('3')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LEIBNIZ INSTITUT FUER TROPOSPHAERENFORSCHUNG e.V. (TROPOS), established in Permoserstrasse 15, LEIPZIG 04318, Germany, VAT number: DE159729585, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('4')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ACCESSION FORM FOR BENEFICIARIES

KARLSRUHER INSTITUT FUER TECHNOLOGIE (KIT), established in KAISERSTRASSE 12, KARLSRUHE 76131, Germany, VAT number: DE266749428, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('5')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

FORSCHUNGSZENTRUM JULICH GMBH (FZJ), established in WILHELM JOHNEN STRASSE, JULICH 52428, Germany, VAT number: DE122624631, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('6')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (CNRS), established in RUE MICHEL ANGE 3, PARIS 75794, France, VAT number: FR40180089013, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('7')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

INSTITUT MINES-TELECOM (IMT), established in 37 ET 39 RUE DAREAU, PARIS 75014, France, VAT number: FR55180092025, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('8')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

INSTITUT NATIONAL DE L ENVIRONNEMENT ET DES RISQUES INERIS (INERIS), established in Parc Technologique Alata, VERNEUIL EN HALATTE 60550, France, VAT number: FR73381984921, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('9')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

NORSK INSTITUTT FOR LUFTFORSKNING STIFTELSE (NILU), established in INSTITUTTVEIEN 18, KJELLER 2027, Norway, VAT number: NO941705561MVA, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('10')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

NATIONAL INSTITUTE OF RESEARCH AND DEVELOPMENT FOR OPTOELECTRONICS (INOE), established in ATOMISTILOR STREET 409, MAGURELE RO77125, Romania, VAT number: RO9113623, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('11')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

PAUL SCHERRER INSTITUT (PSI), established in FORSCHUNGSTRASSE 111, VILLIGEN PSI 5232, Switzerland, VAT number: CHE116133392MWST, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('12')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

EIDGENOSSISCHE MATERIALPRUFUNGS- UND FORSCHUNGSANSTALT (EMPA), established in UEBERLANDSTRASSE 129, DUBENDORF 8600, Switzerland, VAT number: CHE116133475MWST, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('13')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT-KNMI (KNMI), established in UTRECHTSEWEG 297, DE BILT 3731 GA, Netherlands, VAT number: NL821693992B01, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('14')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

INSTITUT ROYAL D'AERONOMIE SPATIALEDE BELGIQUE (BIRA-IASB), established in AVENUE CIRCULAIRE 3, BRUXELLES 1180, Belgium, VAT number: BE0349010750, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('15')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

THE UNIVERSITY OF MANCHESTER (UNIMAN), established in OXFORD ROAD, MANCHESTER M13 9PL, United Kingdom, VAT number: GB849738956, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('16')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

UNITED KINGDOM RESEARCH AND INNOVATION (UKRI), established in POLARIS HOUSE NORTH STAR AVENUE, SWINDON SN2 1FL, United Kingdom, VAT number: GB287461957, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('17')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

THE CYPRUS INSTITUTE (CYI), established in CONSTANTINOU KAVAFI 20, LEFKOSIA 2121, Cyprus, VAT number: CY10167225J, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('18')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

UNIWERSYTET WARSZAWSKI (UNIWARSAW), established in KRAKOWSKIE PRZEDMIESCIE 26/28, WARSZAWA 00 927, Poland, VAT number: PL5250011266, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('19')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

LUNDS UNIVERSITET (ULUND), established in Paradisgatan 5c, LUND 22100, Sweden, VAT number: SE202100321101, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('20')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

MEDIZINISCHE UNIVERSITAT INNSBRUCK (MUI), established in CHRISTOPH PROBST PLATZ 1, INNSBRUCK 6020, Austria, VAT number: ATU57495455, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('22')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

ZENTRALANSTALT FUR METEOROLOGIE UNDGEODYNAMIK (ZAMG), established in HOHE WARTE 38, WIEN 1190, Austria, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('23')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

USTAV CHEMICKYCH PROCESU AV CR, v. v. i. (ICPF), established in ROZVOJOVA 135, PRAHA 6 165 02, Czechia, VAT number: CZ67985858, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('24')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

NATIONAL OBSERVATORY OF ATHENS (NOA), established in LOFOS NYMFON, ATHINA 11810, Greece, VAT number: EL090050779, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('25')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

IDRYMA TECHNOLOGIAS KAI EREVNAS (FORTH), established in N PLASTIRA STR 100, IRAKLEIO 70013, Greece, VAT number: EL090101655, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('26')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

INSTITUTE OF NUCLEAR RESEARCH AND NUCLEAR ENERGY - BULGARIAN ACADEMY OF SCIENCES (INRNE-BAS), established in Tzarigradsko Shose 72, SOFIA 1784, Bulgaria, VAT number: 2226027192, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('27')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITY COLLEGE CORK - NATIONAL UNIVERSITY OF IRELAND, CORK (UCC), established in WESTERN ROAD, CORK T12 YN60, Ireland, VAT number: IE0006286E, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('28')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

AARHUS UNIVERSITET (AU), established in NORDRE RINGGADE 1, AARHUS C 8000, Denmark, VAT number: DK31119103, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('29')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITAT POLITECNICA DE CATALUNYA (UPC), established in CALLE JORDI GIRONA 31, BARCELONA 08034, Spain, VAT number: ESQ0818003F, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('30')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

FUNDACION CENTRO DE ESTUDIOS AMBIENTALES DEL MEDITERRANEO (CEAM), established in Parque Tecnologico, C/ Charles R. Darwin 14, PATERNA, VALENCIA 46980, Spain, VAT number: ESG46957213, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('31')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

UNIVERSIDAD DE VALLADOLID (UVA), established in PLAZA SANTA CRUZ 8 PALACIO DE SANTA CRUZ, VALLADOLID 47002, Spain, VAT number: ESQ4718001C, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('32')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

EESTI MAAULIKOOL (EULS), established in KREUTZWALDI 1, TARTU 51014, Estonia, VAT number: EE100018015, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('33')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

ACCESSION FORM FOR BENEFICIARIES

UNIVERSIDADE DE EVORA (UEvora), established in LARGO DOS COLEGIAIS 2, EVORA 7000 803, Portugal, VAT number: PT501201920, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('34')

in Grant Agreement No 871115 ('the Agreement')

between ILMATIETEEN LAITOS **and** the European Union ('the EU'), represented by the European Commission ('the Commission'),

for the action entitled 'Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE





ANNEX 3b

ADMINISTRATIVE ARRANGEMENT WITH THE JOINT RESEARCH CENTRE (JRC) FOR A HORIZON 2020 FRAMEWORK PROGRAMME GRANT

This **Administrative Arrangement** is **between** the following parties:

on the one part,

DG Directorate-General for Research and Innovation

represented for the purposes of signature of this Arrangement by Pascale CID, Head of Unit, Directorate-General for Research and Innovation, Innovative Administration, Financial Management & Program Support I,

and

on the other part,

the Joint Research Centre (JRC), represented by the Director of the Energy, Transport and Climate.

With this Administrative Arrangement, the parties agree to consider the JRC as beneficiary in Grant Agreement No 871115 ('the Grant Agreement') between ILMATIETEEN LAITOS (FMI) and the European Union ('the EU'), represented by the European Commission ('the Commission'), for the action "Aerosol, Clouds and Trace Gases Research Infrastructure Implementation Project (ACTRIS IMP)"

The **JRC** accepts the grant and agrees to implement the action, as specified in Annex 1 to the Grant Agreement, under its own responsibility and in accordance with the Grant Agreement, with all the obligations and conditions it sets out.

The parties agree to the following specific provisions for the JRC:

- the JRC becomes part of the Grant Agreement not via an accession form but via an administrative arrangement (Preamble);
- the JRC is considered a 'beneficiary' (preamble);

- the periodic financial report must contain information on the amount of each interim payment and payment of the balance to be paid by the DG to the JRC (Article 20.3);
- the part of the pre-financing payment(s) related to the JRC is not paid to the coordinator, but kept by the DG for the JRC (Article 21.2).

In addition to these specificities, the parties agree:

1. Start of participation

The JRC will assume rights and obligations under the Grant Agreement with effect from the date of entry into force of the Grant Agreement.

2. Payments

Payments will be transferred according to the Commission's accounting rules on internal invoicing and will be made from the operational budget line of the DG to the Legal Entity File (LEF) number of the JRC, mentioning the Recovery Order (RO) number. The JRC will submit a debit note for each payment (including the pre-financing).

The DG will make the following payments (see Article 21 of the Grant Agreement) to the JRC:

- a **pre-financing payment** of EUR **24 188.00** (twenty four thousand one hundred and eighty eight EURO), within 30 days from the submission of a debit note by the JRC after the signature of the Administrative Arrangement
 - The JRC agrees that the amount of EUR 2 267.63 (two thousand two hundred and sixty seven EURO and sixty three eurocents), representing its contribution to the Guarantee Fund (see Article 21.2 of the Grant Agreement), is transferred in its name by the DG to the Guarantee Fund
- one or more **interim payments** (see Article 21.3 of the Grant Agreement)
- a payment of the balance (see Article 21.4 of the Grant Agreement).

3. Late-payment interest

No interest will be paid on delayed payments between the JRC and the DG.

4. Certificate on the financial statements and/or certificate on the methodology

The JRC Quality assurance and risk management unit will act as the competent public officer for providing the certificate pursuant to Articles 18.1.2 and 20.4 of the Grant Agreement.

5. Amendments

Any amendment to the Administrative Arrangement will be signed in the electronic exchange system (see Articles 52 and 55 of the Grant Agreement).

6. Interpretation

If the Grant Agreement conflicts with any provision of the Administrative Arrangement with regard to relations between the DG and the JRC, the latter will prevail.

7. Termination

If the Grant Agreement is terminated (see Article 50.1 or 50.3 of the Grant Agreement), this Administrative Arrangement will terminate automatically in parallel.

If the participation of the JRC is terminated (see Article 50.2 or 50.3 of the Grant Agreement), the Administrative Arrangement will be terminated under the conditions set out in the Grant Agreement — *mutatis mutandis*.

8. Entry into force

The Administrative Arrangement will enter into force on the day of signature by the JRC.

SIGNATURE For the JRC

FINANCIAL STATEMENT FOR [BENEFICIARY [name]/ LINKED THIRD PARTY [name]] FOR REPORTING PERIOD [reporting period]

	Eligible costs (per budget category)														Receipts		EU contribution			Additional information
	A.	A. Direct personnel costs				[C. Direct costs of fin. support]	D	. Other direct co	E. Indirect costs ²		[F. Costs of] Total costs			Receipts		Maximum EU contribution 3	Requested EU contribution		Information for indirect costs :	
	equivalent)		A.4 SME owners without salary A.5 Beneficiaries that are natural persons without salary					large research infrastructure]	D.5 Costs of internally invoiced goods and services		[F.1 Costs of]		[F.2 Costs of]		Receipts of the action, to be reported in the last reporting period, according to Article 5.3.3				co	Costs of in-kind ontributions not sed on premises
Form of costs 4	Actual	Actual Unit		nit	Actual	Actual	Actual	Actual	Unit	Flat-rate 5	. U	nit	[Unit][Lump sum]							
	a	Total b	No hours	Total c	d	[e]	f	[g]	Total h	i=0,25 x (a+b+ c+f+[g] + h+ [j 1] 6 [j 1] 6-[j2] -p)	No units	Total [j1]	Total <i>[j2]</i>	k = a+b+c+d+[e] +f + [g] +h+ i + [j1] +[j2]	I	m	n	o		р
[short name beneficiary/linked third party]																				

The beneficiary/linked third party hereby confirms that:

The information provided is complete, reliable and true.

The costs declared are eligible (see Article 6).

The costs can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 17, 18 and 22).

For the last reporting period: that all the receipts have been declared (see Article 5.3.3).

① Please declare all eligible costs, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace other costs that are found to be ineligible.

¹ See Article 6 for the eligibility conditions

The indirect costs claimed must be free of any amounts covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.2.E). If you have received an operating grant during this reporting period, you cannot claim indirect costs unless you can demonstrate that the operating grant does not cover any costs of the action.

This is the theoretical amount of EU contribution that the system calculates automatically (by multiplying the reimbursement rate by the total costs declared). The amount you request (in the column 'requested EU contribution') may be less,

⁴ See Article 5 for the forms of costs

Flat rate: 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E)

⁶ Only specific unit costs that do not include indirect costs

H2020 Model Grant Agreements: H2020 General MGA — Multi: v5.0 – dd.mm.2017

ANNEX 5

MODEL FOR THE CERTIFICATE ON THE FINANCIAL STATEMENTS

- > For options [in italics in square brackets]: choose the applicable option. Options not chosen should be deleted.
- For fields in [grey in square brackets]: enter the appropriate data

TABLE OF CONTENTS

TERMS OF REFERENCE FOR AN INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME

Terms of Reference for an Independent Report of Factual Findings on costs declared under a Grant Agreement financed under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the 'Terms of Reference (ToR)' under which

[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]

agrees to engage

[insert legal name of the auditor] ('the Auditor')

to produce an independent report of factual findings ('the Report') concerning the Financial Statement(s)¹ drawn up by the [Beneficiary] [Linked Third Party] for the Horizon 2020 grant agreement [insert number of the grant agreement, title of the action, acronym and duration from/to] ('the Agreement'), and

to issue a Certificate on the Financial Statements' ('CFS') referred to in Article 20.4 of the Agreement based on the compulsory reporting template stipulated by the Commission.

The Agreement has been concluded under the Horizon 2020 Research and Innovation Framework Programme (H2020) between the Beneficiary and [OPTION 1: the European Union, represented by the European Commission ('the Commission')][OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission ('the Commission')][OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] ('the Agency'), under the powers delegated by the European Commission ('the Commission').]

The [Commission] [Agency] is mentioned as a signatory of the Agreement with the Beneficiary only. The [European Union][Euratom][Agency] is not a party to this engagement.

1.1 Subject of the engagement

The coordinator must submit to the [Commission][Agency] the final report within 60 days following the end of the last reporting period which should include, amongst other documents, a CFS for each beneficiary and for each linked third party that requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 20.4 of the Agreement). The CFS must cover all reporting periods of the beneficiary or linked third party indicated above.

The Beneficiary must submit to the coordinator the CFS for itself and for its linked third party(ies), if the CFS must be included in the final report according to Article 20.4 of the Agreement.

The CFS is composed of two separate documents:

- The Terms of Reference ('the ToR') to be signed by the [Beneficiary] [Linked Third Party] and the Auditor;

By which costs under the Agreement are declared (see template 'Model Financial Statements' in Annex 4 to the Grant Agreement).

- The Auditor's Independent Report of Factual Findings ('the Report') to be issued on the Auditor's letterhead, dated, stamped and signed by the Auditor (or the competent public officer) which includes the agreed-upon procedures ('the Procedures') to be performed by the Auditor, and the standard factual findings ('the Findings') to be confirmed by the Auditor.

If the CFS must be included in the final report according to Article 20.4 of the Agreement, the request for payment of the balance relating to the Agreement cannot be made without the CFS. However, the payment for reimbursement of costs covered by the CFS does not preclude the Commission [Agency,] the European Anti-Fraud Office and the European Court of Auditors from carrying out checks, reviews, audits and investigations in accordance with Article 22 of the Agreement.

1.2 Responsibilities

The [Beneficiary] [Linked Third Party]:

- must draw up the Financial Statement(s) for the action financed by the Agreement in compliance with the obligations under the Agreement. The Financial Statement(s) must be drawn up according to the [Beneficiary's] [Linked Third Party's] accounting and bookkeeping system and the underlying accounts and records;
- must send the Financial Statement(s) to the Auditor;
- is responsible and liable for the accuracy of the Financial Statement(s);
- is responsible for the completeness and accuracy of the information provided to enable the Auditor to carry out the Procedures. It must provide the Auditor with a written representation letter supporting these statements. The written representation letter must state the period covered by the statements and must be dated;
- accepts that the Auditor cannot carry out the Procedures unless it is given full access to the [Beneficiary's] [Linked Third Party's] staff and accounting as well as any other relevant records and documentation.

The Auditor:

- [Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].
- [Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].
- [Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].

The Auditor:

- must be independent from the Beneficiary [and the Linked Third Party], in particular, it must not have been involved in preparing the [Beneficiary's] [Linked Third Party's] Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with this ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the [Beneficiary] [Linked Third Party].

The Commission sets out the Procedures to be carried out by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement, the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with²:

- the International Standard on Related Services ('ISRS') 4400 Engagements to perform Agreed-upon Procedures regarding Financial Information as issued by the International Auditing and Assurance Standards Board (IAASB);
- the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the [Commission][Agency] requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there is no conflict of interests in establishing this Report between the Auditor and the Beneficiary [and the Linked Third Party], and must specify - if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7).

Under Article 22 of the Agreement, the Commission, the Agency, the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from [the European Union] [Euratom] budget. This includes work related to this engagement. The Auditor must provide access to all working papers (e.g. recalculation of hourly rates, verification of the time declared for the action) related to this assignment if the Commission [, the Agencyl, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by [dd Month yyyy].

1.6 Other terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not *contradict the terms specified above.*]

[legal name of the Auditor] [dd Month yyyy] Signature of the Auditor

[legal name of the [Beneficiary][Linked Third Party]] [name & function of authorised representative] [name & function of authorised representative] [dd Month yyyy] Signature of the [Beneficiary][Linked Third Party]

Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

Independent Report of Factual Findings on costs declared under Horizon 2020 Research and Innovation Framework Programme

(To be printed on the Auditor's letterhead)

To
[name of contact person(s)], [Position]
[[Beneficiary's] [Linked Third Party's] name]
[Address]
[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')],

we

[name of the auditor] ('the Auditor'),

established at

[full address/city/state/province/country],

represented by

[name and function of an authorised representative],

have carried out the procedures agreed with you regarding the costs declared in the Financial Statement(s)³ of the [Beneficiary] [Linked Third Party] concerning the grant agreement [insert grant agreement reference: number, title of the action and acronym] ('the Agreement'),

with a total cost declared of [total amount] EUR,

and a total of actual costs and unit costs calculated in accordance with the [Beneficiary's] [Linked Third Party's] usual cost accounting practices' declared of

[sum of total actual costs and total direct personnel costs declared as unit costs calculated in accordance with the [Beneficiary's] [Linked Third Party's] usual cost accounting practices] EUR

and hereby provide our Independent Report of Factual Findings ('the Report') using the compulsory report format agreed with you.

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') examined.

By which the Beneficiary declares costs under the Agreement (see template 'Model Financial Statement' in Annex 4 to the Agreement).

The Procedures were carried out solely to assist the [Commission] [Agency] in evaluating whether the [Beneficiary's] [Linked Third Party's] costs in the accompanying Financial Statement(s) were declared in accordance with the Agreement. The [Commission] [Agency] draws its own conclusions from the Report and any additional information it may require.

The scope of the Procedures was defined by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence. Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, the Auditor does not give a statement of assurance on the Financial Statements.

Had the Auditor carried out additional procedures or an audit of the [Beneficiary's] [Linked Third Party's] Financial Statements in accordance with International Standards on Auditing or International Standards on Review Engagements, other matters might have come to its attention and would have been included in the Report.

Not applicable Findings

We examined the Financial Statement(s) stated above and considered the following Findings not applicable:

Explanation (to be removed from the Report):

If a Finding was not applicable, it must be marked as 'N.A.' ('Not applicable') in the corresponding row on the right-hand column of the table and means that the Finding did not have to be corroborated by the Auditor and the related Procedure(s) did not have to be carried out.

The reasons of the non-application of a certain Finding must be obvious i.e.

- i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable;
- ii) if the condition set to apply certain Procedure(s) are not met the related Finding(s) and those Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than euro' the Procedure and Finding related to 'beneficiaries with accounts established in euro' are not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

List here all Findings considered not applicable for the present engagement and explain the reasons of the non-applicability.

Exceptions

Apart from the exceptions listed below, the [Beneficiary] [Linked Third Party] provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and evaluate the Findings.

Explanation (to be removed from the Report):

- If the Auditor was not able to successfully complete a procedure requested, it must be marked as 'E' ('Exception') in the corresponding row on the right-hand column of the table. The reason such as the inability to reconcile key information or the unavailability of data that prevents the Auditor from carrying out the Procedure must be indicated below.
- If the Auditor cannot corroborate a standard finding after having carried out the corresponding procedure, it must also be marked as 'E' ('Exception') and, where possible, the reasons why the Finding was not fulfilled and its possible impact must be explained here below.

List here any exceptions and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, include the corresponding amount.

Example (to be removed from the Report):

- 1. The Beneficiary was unable to substantiate the Finding number 1 on ... because
- 2. Finding number 30 was not fulfilled because the methodology used by the Beneficiary to calculate unit costs was different from the one approved by the Commission. The differences were as follows: ...
- 3. After carrying out the agreed procedures to confirm the Finding number 31, the Auditor found a difference of ______EUR. The difference can be explained by ...

Further Remarks

In addition to reporting on the results of the specific procedures carried out, the Auditor would like to make the following general remarks:

Example (to be removed from the Report):

- 1. Regarding Finding number 8 the conditions for additional remuneration were considered as fulfilled because ...
- 2. In order to be able to confirm the Finding number 15 we carried out the following additional procedures:

Use of this Report

This Report may be used only for the purpose described in the above objective. It was prepared solely for the confidential use of the [Beneficiary] [Linked Third Party] and the [Commission] [Agency], and only to be submitted to the [Commission] [Agency] in connection with the requirements set out in Article 20.4 of the Agreement. The Report may not be used by the [Beneficiary] [Linked Third Party] or by the [Commission] [Agency] for any other purpose, nor may it be distributed to any other parties. The [Commission] [Agency] may only disclose the Report to authorised parties, in particular to the European Anti-Fraud Office (OLAF) and the European Court of Auditors.

This Report relates only to the Financial Statement(s) submitted to the [Commission] [Agency] by the [Beneficiary] [Linked Third Party] for the Agreement. Therefore, it does not extend to any other of the [Beneficiary's] [Linked Third Party's] Financial Statement(s).

There was no conflict	of interest ⁴ between the Auditor and the Beneficiary [and Linked Third Page 11]	artyj
in establishing this Rep	port. The total fee paid to the Auditor for providing the Report was EUR	
(including EUR	of deductible VAT).	

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance.

[legal name of the Auditor]
[name and function of an authorised representative]
[dd Month yyyy]
Signature of the Auditor

A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

⁻ was involved in the preparation of the Financial Statements;

⁻ stands to benefit directly should the certificate be accepted;

⁻ has a close relationship with any person representing the beneficiary;

⁻ is a director, trustee or partner of the beneficiary; or

⁻ is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Agreed-upon procedures to be performed and standard factual findings to be confirmed by the Auditor

The European Commission reserves the right to i) provide the auditor with additional guidance regarding the procedures to be followed or the facts to be ascertained and the way in which to present them (this may include sample coverage and findings) or to ii) change the procedures, by notifying the Beneficiary in writing. The procedures carried out by the auditor to confirm the standard factual finding are listed in the table below.

If this certificate relates to a Linked Third Party, any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

The 'result' column has three different options: 'C', 'E' and 'N.A.':

- > 'C' stands for 'confirmed' and means that the auditor can confirm the 'standard factual finding' and, therefore, there is no exception to be reported.
- E' stands for 'exception' and means that the Auditor carried out the procedures but cannot confirm the 'standard factual finding', or that the Auditor was not able to carry out a specific procedure (e.g. because it was impossible to reconcile key information or data were unavailable),
- ➤ 'N.A.' stands for 'not applicable' and means that the Finding did not have to be examined by the Auditor and the related Procedure(s) did not have to be carried out. The reasons of the non-application of a certain Finding must be obvious i.e. i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable; ii) if the condition set to apply certain Procedure(s) are not met then the related Finding(s) and Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than the euro' the Procedure related to 'beneficiaries with accounts established in euro' is not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

Ref	Procedures	Standard factual finding	Result (C/E/ N.A.)
A	ACTUAL PERSONNEL COSTS AND UNIT COSTS CALCULATED BY THE BENEFICIAL COST ACCOUNTING PRACTICE	ARY IN ACCORDANCE WITH ITS	USUAL
	The Auditor draws a sample of persons whose costs were declared in the Financial Statement(s) to carry out the procedures indicated in the consecutive points of this section A.		
	(The sample should be selected randomly so that it is representative. Full coverage is required if there are fewer than 10 people (including employees, natural persons working under a direct contract and personnel seconded by a third party), otherwise the sample should have a minimum of 10 people, or 10% of the total, whichever number is the highest)		
	The Auditor sampled people out of the total of people.		

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.1	For the persons included in the sample and working under an employment contract or equivalent act (general procedures for individual actual personnel costs and personnel costs declared as unit costs) To confirm standard factual findings 1-5 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary: o a list of the persons included in the sample indicating the period(s) during which they worked for the action, their position (classification or category) and type of contract; the payslips of the employees included in the sample; reconciliation of the personnel costs declared in the Financial Statement(s) with the accounting system (project accounting and general ledger) and payroll system; information concerning the employment status and employment conditions of personnel included in the sample, in particular their employment contracts or equivalent; the Beneficiary's usual policy regarding payroll matters (e.g. salary policy, overtime policy, variable pay); applicable national law on taxes, labour and social security and any other document that supports the personnel costs declared. The Auditor also verified the eligibility of all components of the retribution (see Article 6 GA) and recalculated the personnel costs for employees included in the sample.	1) The employees were i) directly hired by the Beneficiary in accordance with its national legislation, ii) under the Beneficiary's sole technical supervision and responsibility and iii) remunerated in accordance with the Beneficiary's usual practices. 2) Personnel costs were recorded in the Beneficiary's accounts/payroll system. 3) Costs were adequately supported and reconciled with the accounts and payroll records. 4) Personnel costs did not contain any ineligible elements. 5) There were no discrepancies between the personnel costs charged to the action and the costs recalculated by the Auditor.	
	Further procedures if 'additional remuneration' is paid To confirm standard factual findings 6-9 listed in the next column, the Auditor: o reviewed relevant documents provided by the Beneficiary (legal form, legal/statutory)	6) The Beneficiary paying "additional remuneration" was a non-profit legal entity.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	obligations, the Beneficiary's usual policy on additional remuneration, criteria used for its calculation, the Beneficiary's usual remuneration practice for projects funded under national funding schemes); o recalculated the amount of additional remuneration eligible for the action based on the supporting documents received (full-time or part-time work, exclusive or non-exclusive dedication to the action, usual remuneration paid for projects funded by national schemes) to arrive at the applicable FTE/year and pro-rata rate (see data collected in the course of carrying out the procedures under A.2 'Productive hours' and A.4 'Time recording system'). 'ADDITIONAL REMUNERATION' MEANS ANY PART OF THE REMUNERATION WHICH EXCEEDS WHAT THE PERSON WOULD BE PAID FOR TIME WORKED IN PROJECTS FUNDED BY NATIONAL SCHEMES.	7) The amount of additional remuneration paid corresponded to the Beneficiary's usual remuneration practices and was consistently paid whenever the same kind of work or expertise was required. 8) The criteria used to calculate the additional remuneration were objective and generally applied by the Beneficiary recordings of	1.11.21)
	IF ANY PART OF THE REMUNERATION PAID TO THE EMPLOYEE QUALIFIES AS "ADDITIONAL REMUNERATION" AND IS ELIGIBLE UNDER THE PROVISIONS OF ARTICLE 6.2.A.1, THIS CAN BE CHARGED AS ELIGIBLE COST TO THE ACTION UP TO THE FOLLOWING AMOUNT: (A) IF THE PERSON WORKS FULL TIME AND EXCLUSIVELY ON THE ACTION DURING THE FULL YEAR: UP TO EUR 8 000/YEAR; (B) IF THE PERSON WORKS EXCLUSIVELY ON THE ACTION BUT NOT FULL-TIME OR NOT FOR THE FULL YEAR: UP TO THE CORRESPONDING PRO-RATA AMOUNT OF EUR 8 000, OR (C) IF THE PERSON DOES NOT WORK EXCLUSIVELY ON THE ACTION: UP TO A PRO-RATA AMOUNT CALCULATED IN ACCORDANCE TO ARTICLE 6.2.A.1.	by the Beneficiary regardless of the source of funding used. 9) The amount of additional remuneration included in the personnel costs charged to the action was capped at EUR 8,000 per FTE/year (up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).	
	Additional procedures in case "unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices" is applied:	10) The personnel costs included in the Financial Statement were calculated in accordance with	
	Apart from carrying out the procedures indicated above to confirm standard factual findings 1-5 and, if applicable, also 6-9, the Auditor carried out following procedures to confirm standard	the Beneficiary's usual cost accounting practice. This methodology was consistently	

Ref	Procedures	Standard factual finding	Result (C/E/
	factual findings 10.12 listed in the next columns	used in all H2020 actions.	N.A.)
	factual findings 10-13 listed in the next column:		
	 obtained a description of the Beneficiary's usual cost accounting practice to calculate unit costs;. 	11) The employees were charged under the correct category.	
	 reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; 	12) Total personnel costs used in calculating the unit costs were	
	 verified the employees included in the sample were charged under the correct category (in accordance with the criteria used by the Beneficiary to establish personnel categories) by reviewing the contract/HR-record or analytical accounting records; 	consistent with the expenses recorded in the statutory accounts.	
	 verified that there is no difference between the total amount of personnel costs used in calculating the cost per unit and the total amount of personnel costs recorded in the statutory accounts; 	element used by the Beneficiary in its unit-cost	
	 verified whether actual personnel costs were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, objective and supported by documents. 	calculation were relevant for calculating personnel costs and corresponded to objective and verifiable information.	
	For natural persons included in the sample and working with the Beneficiary under a direct contract other than an employment contract, such as consultants (no subcontractors).	14) The natural persons worked under conditions similar to those of an employee, in	
	To confirm standard factual findings 14-17 listed in the next column the Auditor reviewed following information/documents provided by the Beneficiary:	particular regarding the way the work is organised, the tasks	
	 the contracts, especially the cost, contract duration, work description, place of work, ownership of the results and reporting obligations to the Beneficiary; 	that are performed and the premises where they are performed.	
	 the employment conditions of staff in the same category to compare costs and; 	15) The results of work carried out	
	 any other document that supports the costs declared and its registration (e.g. invoices, accounting records, etc.). 	belong to the Beneficiary, or, if not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		results were generated by itself. 16) Their costs were not	
		significantly different from those for staff who performed similar tasks under an employment contract with the Beneficiary.	
		17) The costs were supported by audit evidence and registered in the accounts.	
	For personnel seconded by a third party and included in the sample (not subcontractors)	18) Seconded personnel reported to	
	To confirm standard factual findings 18-21 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary:	the Beneficiary and worked on the Beneficiary's premises (unless otherwise agreed with	
	 their secondment contract(s) notably regarding costs, duration, work description, place of work and ownership of the results; 	3 /	
	o if there is reimbursement by the Beneficiary to the third party for the resource mad available_(in-kind contribution against payment): any documentation that supports the costs declared (e.g. contract, invoice, bank payment, and proof of registration in it accounting/payroll, etc.) and reconciliation of the Financial Statement(s) with the accounting system (project accounting and general ledger) as well as any proof that the amount invoiced by the third party did not include any profit;	not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those	
	o if there is no reimbursement by the Beneficiary to the third party for the resource mad available (in-kind contribution free of charge): a proof of the actual cost borne by th Third Party for the resource made available free of charge to the Beneficiary such as statement of costs incurred by the Third Party and proof of the registration in the Third Party's accounting/payroll;	payment:	

			Result
Ref	Procedures	Standard factual finding	(C / E / N.A.)
	o any other document that supports the costs declared (e.g. invoices, etc.).	Beneficiary's accounts. The third party did not include any profit.	
		If personnel is seconded free of charge:	
		21) The costs declared did not exceed the third party's cost as recorded in the accounts of the third party and were supported with documentation.	
A.2	PRODUCTIVE HOURS	22) The Beneficiary applied method [choose one option and	
	To confirm standard factual findings 22-27 listed in the next column, the Auditor reviewed relevant documents, especially national legislation, labour agreements and contracts and time	delete the others]	
	records of the persons included in the sample, to verify that:	[A: 1720 hours]	
	 the annual productive hours applied were calculated in accordance with one of the methods described below, 	[B : the 'total number of hours worked']	
	 the full-time equivalent (FTEs) ratios for employees not working full-time were correctly calculated. 	[C: 'standard annual productive hours' used correspond to usual accounting	
	If the Beneficiary applied method B, the auditor verified that the correctness in which the total number of hours worked was calculated and that the contracts specified the annual workable hours.	practices] 23) Productive hours were calculated annually.	
	If the Beneficiary applied method C, the auditor verified that the 'annual productive hours' applied when calculating the hourly rate were equivalent to at least 90 % of the 'standard annual workable hours'. The Auditor can only do this if the calculation of the standard annual workable	24) For employees not working full-time the full-time equivalent (FTE) ratio was correctly applied.	

Ref	Procedures	Standard factual finding	Result (C/E/ N.A.)
	hours can be supported by records, such as national legislation, labour agreements, and contracts.	If the Beneficiary applied method B.	
	BENEFICIARY'S PRODUCTIVE HOURS' FOR PERSONS WORKING FULL TIME SHALL BE ONE OF THE FOLLOWING METHODS:	25) The calculation of the number of 'annual workable hours',	
	A. 1720 Annual productive hours (pro-rata for persons not working full-time)	overtime and absences was verifiable based on the	
	B. THE TOTAL NUMBER OF HOURS WORKED BY THE PERSON FOR THE BENEFICIARY IN THE YEAR (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL NUMBER OF HOURS WORKED' IN THE NEXT COLUMN). THE CALCULATION OF THE TOTAL NUMBER OF HOURS WORKED WAS DONE AS	documents provided by the Beneficiary.	
	FOLLOWS: ANNUAL WORKABLE HOURS OF THE PERSON ACCORDING TO THE EMPLOYMENT CONTRACT, APPLICABLE LABOUR AGREEMENT OR NATIONAL LAW PLUS OVERTIME WORKED MINUS ABSENCES (SUCH AS SICK LEAVE OR SPECIAL LEAVE).	25.1) The Beneficiary calculates the hourly rates per full financial year following	
	C. THE STANDARD NUMBER OF ANNUAL HOURS GENERALLY APPLIED BY THE BENEFICIARY FOR ITS PERSONNEL IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES (THIS METHOD IS ALSO REFERRED TO AS 'STANDARD ANNUAL PRODUCTIVE HOURS' IN THE NEXT COLUMN). THIS NUMBER MUST BE AT LEAST 90% OF THE STANDARD ANNUAL WORKABLE HOURS.	financial year following procedure A.3 (method B is not allowed for beneficiaries calculating hourly rates per month).	
		If the Beneficiary applied method C.	
	'ANNUAL WORKABLE HOURS' MEANS THE PERIOD DURING WHICH THE PERSONNEL MUST BE WORKING, AT THE EMPLOYER'S DISPOSAL AND CARRYING OUT HIS/HER ACTIVITY OR DUTIES UNDER THE EMPLOYMENT CONTRACT, APPLICABLE COLLECTIVE LABOUR AGREEMENT OR NATIONAL WORKING TIME LEGISLATION.	26) The calculation of the number of 'standard annual workable hours' was verifiable based on the documents provided by the Beneficiary.	

			Result
Ref	Procedures	Standard factual finding	(C / E / N.A.)
		27) The 'annual productive hours' used for calculating the hourly rate were consistent with the usual cost accounting practices of the Beneficiary and were equivalent to at least 90 % of the 'annual workable hours'.	
A.3	HOURLY PERSONNEL RATES I) For unit costs calculated in accordance to the Beneficiary's usual cost accounting practice (unit	28) The Beneficiary applied [choose one option and delete the other]:	
	costs): If the Beneficiary has a "Certificate on Methodology to calculate unit costs" (CoMUC) approved by the Commission, the Beneficiary provides the Auditor with a description of the approved methodology and the Commission's letter of acceptance. The Auditor verified that the Beneficiary has indeed used the methodology approved. If so, no further verification is necessary.	[Option I: "Unit costs (hourly rates) were calculated in accordance with the Beneficiary's usual cost accounting practices"]	
	If the Beneficiary does not have a "Certificate on Methodology" (CoMUC) approved by the Commission, or if the methodology approved was not applied, then the Auditor:	[Option II: Individual hourly rates were applied]	
	 reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; recalculated the unit costs (hourly rates) of staff included in the sample following the 	For option I concerning unit costs and if the Beneficiary applies the methodology approved by the Commission (CoMUC):	
	results of the procedures carried out in A.1 and A.2. II) For individual hourly rates: The Auditor: reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates;	29) The Beneficiary used the Commission-approved methodology to calculate hourly rates. It corresponded to the organisation's usual cost	
	o reviewed the documentation provided by the Beneficiary, including manuals and internal	dology to calculate hourly rates. It corresponded to the	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	o recalculated the hourly rates of staff included in the sample (recalculation of all hourly rates if the Beneficiary uses annual rates, recalculation of three months selected randomly for every year and person if the Beneficiary uses monthly rates) following the results of the procedures carried out in A.1 and A.2;	activities irrespective of the source of funding.	
	 (only in case of monthly rates) confirmed that the time spent on parental leave is not deducted, and that, if parts of the basic remuneration are generated over a period longer than a month, the Beneficiary has included only the share which is generated in the month. 	For option I concerning unit costs and if the Beneficiary applies a methodology not approved by the	
	"Unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices": It is calculated by dividing the total amount of personnel costs of the category to which the employee belongs verified in line with procedure A.1 by the number of FTE and the annual total productive hours of the same category calculated by the	Commission: 30) The unit costs re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	
	BENEFICIARY IN ACCORDANCE WITH PROCEDURE A.2. HOURLY RATE FOR INDIVIDUAL ACTUAL PERSONAL COSTS: IT IS CALCULATED FOLLOWING ONE OF THE TWO OPTIONS BELOW: A) [OPTION BY DEFAULT] BY DIVIDING THE ACTUAL ANNUAL AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF ANNUAL PRODUCTIVE HOURS	For option II concerning individual hourly rates: 31) The individual rates recalculated by the Auditor were the same as the rates applied by the Beneficiary.	
	VERIFIED IN LINE WITH PROCEDURE A.2 (FULL FINANCIAL YEAR HOURLY RATE); B) BY DIVIDING THE ACTUAL MONTHLY AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY 1/12 OF THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2.(MONTHLY HOURLY RATE).	31.1) The Beneficiary used only one option (per full financial year or per month) throughout each financial year examined.	
		31.2) The hourly rates do not include additional remuneration.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.4	TIME RECORDING SYSTEM To verify that the time recording system ensures the fulfilment of all minimum requirements and that the hours declared for the action were correct, accurate and properly authorised and supported by documentation, the Auditor made the following checks for the persons included in the sample that declare time as worked for the action on the basis of time records: o description of the time recording system provided by the Beneficiary (registration, authorisation, processing in the HR-system);	32) All persons recorded their time dedicated to the action on a daily/ weekly/ monthly basis using a paper/computer-based system. (delete the answers that are not applicable)	
	 its actual implementation; time records were signed at least monthly by the employees (on paper or electronically) and authorised by the project manager or another manager; 	33) Their time-records were authorised at least monthly by the project manager or other superior.	
	 the hours declared were worked within the project period; there were no hours declared as worked for the action if HR-records showed absence due to holidays or sickness (further cross-checks with travels are carried out in B.1 below); the hours charged to the action matched those in the time recording system. 	34) Hours declared were worked within the project period and were consistent with the presences/absences recorded in HR-records.	
	Only the hours worked on the action can be charged. All working time to be charged should be recorded throughout the duration of the project, adequately supported by evidence of their reality and reliability (see specific provisions below for persons working exclusively for the action without time records).	35) There were no discrepancies between the number of hours charged to the action and the number of hours recorded.	
	If the persons are working exclusively for the action and without time records For the persons selected that worked exclusively for the action without time records, the Auditor verified evidence available demonstrating that they were in reality exclusively dedicated to the action and that the Beneficiary signed a declaration confirming that they have worked exclusively for the action.	36) The exclusive dedication is supported by a declaration signed by the Beneficiary and by any other evidence gathered.	

Ref	Procedures	Standard factual finding	Result
Kei	Troccuires	Standard factual finding	(C / E / N.A.)
В	COSTS OF SUBCONTRACTING		
B.1	The Auditor obtained the detail/breakdown of subcontracting costs and sampled cost items selected randomly (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest). To confirm standard factual findings 37-41 listed in the next column, the Auditor reviewed the	37) The use of claimed subcontracting costs was foreseen in Annex 1 and costs were declared in the Financial Statements under the	
	following for the items included in the sample:	subcontracting category. 38) There were documents of	
	o the use of subcontractors was foreseen in Annex 1;	requests to different providers,	
	 subcontracting costs were declared in the subcontracting category of the Financial Statement; 	different offers and assessment of the offers before selection of	
	o supporting documents on the selection and award procedure were followed;	the provider in line with internal procedures and	
	o the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the subcontract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment).	procurement rules. Subcontracts were awarded in accordance with the principle of best value for money.	
	In particular,	(When different offers were not collected the Auditor explains	
	i. if the Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the subcontracting complied with the Terms and Conditions of the Agreement.	the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The Commission will analyse this information to evaluate	
	ii. if the Beneficiary did not fall under the above-mentioned category the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement	whether these costs might be accepted as eligible)	
		39) The subcontracts were not awarded to other Beneficiaries	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	For the items included in the sample the Auditor also verified that: o the subcontracts were not awarded to other Beneficiaries in the consortium; there were signed agreements between the Beneficiary and the subcontractor; there was evidence that the services were provided by subcontractor;	of the consortium. 40) All subcontracts were supported by signed agreements between the Beneficiary and the subcontractor. 41) There was evidence that the services were provided by the	
C C.1	COSTS OF PROVIDING FINANCIAL SUPPORT TO THIRD PARTIES The Auditor obtained the detail/breakdown of the costs of providing financial support to	subcontractors.	
	third parties and sampled cost items selected randomly (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest). The Auditor verified that the following minimum conditions were met: a) the maximum amount of financial support for each third party did not exceed EUR 60 000, unless explicitly mentioned in Annex 1; b) the financial support to third parties was agreed in Annex 1 of the Agreement and the other provisions on financial support to third parties included in Annex 1 were respected.	42) All minimum conditions were met	

D	OTHER ACTUAL DIRECT COSTS		
D.1	COSTS OF TRAVEL AND RELATED SUBSISTENCE ALLOWANCES	43) Costs were incurred, approved and	
	The Auditor sampled cost items selected randomly (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest).	reimbursed in line with the Beneficiary's usual policy for travels.	
	The Auditor inspected the sample and verified that:	44) There was a link between the trip	
	o travel and subsistence costs were consistent with the Beneficiary's usual policy for travel. In this context, the Beneficiary provided evidence of its normal policy for travel costs (e.g. use of first class tickets, reimbursement by the Beneficiary on the basis of actual costs, a lump sum or per diem) to enable the Auditor to compare the travel costs charged	and the action. 45) The supporting documents were consistent with each other regarding	-
	with this policy; travel costs are correctly identified and allocated to the action (e.g. trips are directly linked to the action) by reviewing relevant supporting documents such as minutes of meetings, workshops or conferences, their registration in the correct project account, their consistency with time records or with the dates/duration of the workshop/conference;	subject of the trip, dates, duration and reconciled with time records and accounting.	
		46) No ineligible costs or excessive or reckless expenditure was declared.	
	o no ineligible costs or excessive or reckless expenditure was declared (see Article 6.5 MGA).		
D.2	DEPRECIATION COSTS FOR EQUIPMENT, INFRASTRUCTURE OR OTHER ASSETS The Auditor complete and acceptation collected renderly (full coverage is required if there	47) Procurement rules, principles and guides were followed.	
	The Auditor sampled cost items selected randomly (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the	40)	
total, whichever number is the highest). For "equipment, infrastructure or other assets" [from now on called "asset(sample the Auditor verified that:		48) There was a link between the grant agreement and the asset charged to	
	For "equipment, infrastructure or other assets" [from now on called "asset(s)"] selected in the sample the Auditor verified that:	the action.	
	 the assets were acquired in conformity with the Beneficiary's internal guidelines and procedures; 	49) The asset charged to the action was traceable to the accounting records and the underlying documents.	

50) The depreciation method used to o they were correctly allocated to the action (with supporting documents such as delivery charge the asset to the action was in note invoice or any other proof demonstrating the link to the action) line with the applicable rules of the they were entered in the accounting system; and Beneficiary's country Beneficiary's usual accounting the extent to which the assets were used for the action (as a percentage) was supported by policy. reliable documentation (e.g. usage overview table); 51) The amount charged corresponded The Auditor recalculated the depreciation costs and verified that they were in line with the to the actual usage for the action. applicable rules in the Beneficiary's country and with the Beneficiary's usual accounting policy (e.g. depreciation calculated on the acquisition value). 52) No ineligible costs or excessive or The Auditor verified that no ineligible costs such as deductible VAT, exchange rate losses, reckless expenditure were declared. excessive or reckless expenditure were declared (see Article 6.5 GA). COSTS OF OTHER GOODS AND SERVICES 53) Contracts for works or services did **D.3** not cover tasks described in Annex The Auditor sampled cost items selected randomly (full coverage is required if there 1. are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest). 54) Costs were allocated to the correct action and the goods were not For the purchase of goods, works or services included in the sample the Auditor verified that: placed in the inventory of durable the contracts did not cover tasks described in Annex 1; equipment. they were correctly identified, allocated to the proper action, entered in the accounting system (traceable to underlying documents such as purchase orders, invoices and 55) The costs were charged in line with the Beneficiary's accounting policy accounting); and were adequately supported. the goods were not placed in the inventory of durable equipment; the costs charged to the action were accounted in line with the Beneficiary's usual 56) No ineligible costs or excessive or accounting practices; reckless expenditure were declared. For internal invoices/charges only no ineligible costs or excessive or reckless expenditure were declared (see Article 6 GA). the cost element was charged, In addition, the Auditor verified that these goods and services were acquired in conformity with without any mark-ups.

the Beneficiary's internal guidelines and procedures, in particular:

- o if Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the procurement contract complied with the Terms and Conditions of the Agreement.
- o if the Beneficiary did not fall into the category above, the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement.

For the items included in the sample the Auditor also verified that:

o the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the contract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Auditor also verified that the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment);

SUCH GOODS AND SERVICES INCLUDE, FOR INSTANCE, CONSUMABLES AND SUPPLIES, DISSEMINATION (INCLUDING OPEN ACCESS), PROTECTION OF RESULTS, SPECIFIC EVALUATION OF THE ACTION IF IT IS REQUIRED BY THE AGREEMENT, CERTIFICATES ON THE FINANCIAL STATEMENTS IF THEY ARE REQUIRED BY THE AGREEMENT AND CERTIFICATES ON THE METHODOLOGY, TRANSLATIONS, REPRODUCTION.

D.4 AGGREGATED CAPITALISED AND OPERATING COSTS OF RESEARCH INFRASTRUCTURE

The Auditor ensured the existence of a positive ex-ante assessment (issued by the EC Services) of the cost accounting methodology of the Beneficiary allowing it to apply the guidelines on direct costing for large research infrastructures in Horizon 2020.

57) Procurement rules, principles and guides were followed. There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. The purchases were made in accordance with the principle of best value for money.

(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The Commission will analyse this information to evaluate whether these costs might be accepted as eligible)

58) The costs declared as direct costs for Large Research Infrastructures (in the appropriate line of the Financial Statement) comply with the methodology described in the positive ex-ante assessment report.

	In the cases that a positive ex-ante assessment has been issued (see the standard factual findings 58-59 on the next column), The Auditor ensured that the beneficiary has applied consistently the methodology that is explained and approved in the positive ex ante assessment;	59) Any difference between the methodology applied and the one positively assessed was extensively described and adjusted accordingly.	
	In the cases that a positive ex-ante assessment has NOT been issued (see the standard factual findings 60 on the next column), The Auditor verified that no costs of Large Research Infrastructure have been charged as direct costs in any costs category;	60) The direct costs declared were free	
	 In the cases that a draft ex-ante assessment report has been issued with recommendation for further changes (see the standard factual findings 60 on the next column), The Auditor followed the same procedure as above (when a positive ex-ante assessment has NOT yet been issued) and paid particular attention (testing reinforced) to the cost items for which the draft ex-ante assessment either rejected the inclusion as direct costs for Large Research Infrastructures or issued recommendations. 	from any indirect costs items related to the Large Research Infrastructure.	
D.5	Costs of internally invoiced goods and services The Auditor sampled cost items selected randomly (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest).	61) The costs of internally invoiced goods and services included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice.	
	To confirm standard factual findings 61-65 listed in the next column, the Auditor: o obtained a description of the Beneficiary's usual cost accounting practice to calculate costs of internally invoiced goods and services (unit costs);	62) The cost accounting practices used to calculate the costs of internally invoiced goods and services were applied by the Beneficiary in a	
	 reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; 	consistent manner based on objective criteria regardless of the source of funding.	
	 ensured that the methodology to calculate unit costs is being used in a consistent manner, based on objective criteria, regardless of the source of funding; verified that any ineligible items or any costs claimed under other budget categories, in 	63) The unit cost is calculated using the actual costs for the good or service recorded in the Beneficiary's	
	particular indirect costs, have not been taken into account when calculating the costs of	accounts, excluding any ineligible cost or costs included in other	

		internally invoiced goods and services (see Article 6 GA);	budget categories.	
	 verified whether actual costs of internally invoiced goods and services were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, and correspond to objective and verifiable information. 	64) The unit cost excludes any costs of items which are not directly linked		
	 verified that any costs of items which are not directly linked to the production of the invoiced goods or service (e.g. supporting services like cleaning, general accountancy, administrative support, etc. not directly used for production of the good or service) have not been taken into account when calculating the costs of internally invoiced goods and services. verified that any costs of items used for calculating the costs internally invoiced goods and services are supported by audit evidence and registered in the accounts. 		to the production of the invoiced goods or service. 65) The costs items used for calculating the actual costs of internally invoiced goods and services were relevant, reasonable and correspond to objective and verifiable information.	
E	USE (OF EXCHANGE RATES		
E.1	The Arates rules otherwhighes COSTS EURO JOURN (https://correction.org/library.com/librar	RECORDED IN THE ACCOUNTS IN A CURRENCY OTHER THAN EURO SHALL BE CONVERTED INTO AT THE AVERAGE OF THE DAILY EXCHANGE RATES PUBLISHED IN THE C SERIES OF OFFICIAL INTO ALL OF THE EUROPEAN UNION Www.ecb.int/stats/exchange/eurofxref/html/index.en.html), DETERMINED OVER THE ESPONDING REPORTING PERIOD. DAILY EURO EXCHANGE RATE IS PUBLISHED IN THE OFFICIAL JOURNAL OF THE EUROPEAN IF FOR THE CURRENCY IN QUESTION, CONVERSION SHALL BE MADE AT THE AVERAGE OF THE	66) The exchange rates used to convert other currencies into Euros were in accordance with the rules established of the Grant Agreement and there was no difference in the final figures.	
		HLY ACCOUNTING RATES ESTABLISHED BY THE COMMISSION AND PUBLISHED ON ITS WEBSITE /ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm),		

DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.		
b) For Beneficiaries with accounts established in euros		
The Auditor sampled cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest): Costs incurred in another currency shall be converted into euro by applying the	67) The Beneficiary applied its usual accounting practices.	
BENEFICIARY'S USUAL ACCOUNTING PRACTICES.		

[legal name of the audit firm]
[name and function of an authorised representative]
[dd Month yyyy]
<Signature of the Auditor>

ANNEX 6

MODEL FOR THE CERTIFICATE ON THE METHODOLOGY

- > For options [in italics in square brackets]: choose the applicable option. Options not chosen should be deleted.
- For fields in [grey in square brackets]: enter the appropriate data.

TABLE OF CONTENTS

TERMS OF REFERENCE FOR AN AUDIT ENGAGEMENT FOR A METHODOLOGY CERTIFICATE IN CONNECTION WITH ONE OR MORE GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON THE METHODOLOGY CONCERNING GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME

Terms of reference for an audit engagement for a methodology certificate in connection with one or more grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the 'Terms of Reference (ToR)' under which

[OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')]

agrees to engage

[insert legal name of the auditor] ('the Auditor')

to produce an independent report of factual findings ('the Report') concerning the [Beneficiary's] [Linked Third Party's] usual accounting practices for calculating and claiming direct personnel costs declared as unit costs ('the Methodology') in connection with grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme.

The procedures to be carried out for the assessment of the methodology will be based on the grant agreement(s) detailed below:

[title and number of the grant agreement(s)] ('the Agreement(s)')

The Agreement(s) has(have) been concluded between the Beneficiary and [OPTION 1: the European Union, represented by the European Commission ('the Commission')][OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission ('the Commission')][OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] ('the Agency'), under the powers delegated by the European Commission ('the Commission').].

The [Commission] [Agency] is mentioned as a signatory of the Agreement with the Beneficiary only. The [European Union] [Euratom] [Agency] is not a party to this engagement.

1.1 Subject of the engagement

According to Article 18.1.2 of the Agreement, beneficiaries [and linked third parties] that declare direct personnel costs as unit costs calculated in accordance with their usual cost accounting practices may submit to the [Commission] [Agency], for approval, a certificate on the methodology ('CoMUC') stating that there are adequate records and documentation to prove that their cost accounting practices used comply with the conditions set out in Point A of Article 6.2.

The subject of this engagement is the CoMUC which is composed of two separate documents:

- the Terms of Reference ('the ToR') to be signed by the [Beneficiary] [Linked Third Party] and the Auditor;
- the Auditor's Independent Report of Factual Findings ('the Report') issued on the Auditor's letterhead, dated, stamped and signed by the Auditor which includes; the standard statements ('the Statements') evaluated and signed by the [Beneficiary] [Linked Third Party], the agreed-upon procedures ('the Procedures') performed by the Auditor and the standard factual findings

('the Findings') assessed by the Auditor. The Statements, Procedures and Findings are summarised in the table that forms part of the Report.

The information provided through the Statements, the Procedures and the Findings will enable the Commission to draw conclusions regarding the existence of the [Beneficiary's] [Linked Third Party's] usual cost accounting practice and its suitability to ensure that direct personnel costs claimed on that basis comply with the provisions of the Agreement. The Commission draws its own conclusions from the Report and any additional information it may require.

1.2 Responsibilities

The parties to this agreement are the [Beneficiary] [Linked Third Party] and the Auditor.

The [Beneficiary] [Linked Third Party]:

- is responsible for preparing financial statements for the Agreement(s) ('the Financial Statements') in compliance with those Agreements;
- is responsible for providing the Financial Statement(s) to the Auditor and enabling the Auditor to reconcile them with the [Beneficiary's] [Linked Third Party's] accounting and bookkeeping system and the underlying accounts and records. The Financial Statement(s) will be used as a basis for the procedures which the Auditor will carry out under this ToR;
- is responsible for its Methodology and liable for the accuracy of the Financial Statement(s);
- is responsible for endorsing or refuting the Statements indicated under the heading 'Statements to be made by the Beneficiary/ Linked Third Party' in the first column of the table that forms part of the Report;
- must provide the Auditor with a signed and dated representation letter;
- accepts that the ability of the Auditor to carry out the Procedures effectively depends upon the [Beneficiary] [Linked Third Party] providing full and free access to the [Beneficiary's] [Linked Third Party's] staff and to its accounting and other relevant records.

The Auditor:

- [Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].
- [Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].
- [Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].

The Auditor:

- must be independent from the Beneficiary [and the Linked Third Party], in particular, it must not have been involved in preparing the Beneficiary's [and Linked Third Party's] Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with these ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the [Beneficiary] [Linked Third Party].

The Commission sets out the Procedures to be carried out and the Findings to be endorsed by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with¹:

- the International Standard on Related Services ('ISRS') 4400 Engagements to perform Agreed-upon Procedures regarding Financial Information as issued by the International Auditing and Assurance Standards Board (IAASB);
- the Code of Ethics for Professional Accountants issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the Commission requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there was no conflict of interests in establishing this Report between the Auditor and the Beneficiary [and the Linked Third Party] that could have a bearing on the Report, and must specify – if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7 of the Agreement).

Under Article 22 of the Agreement, the Commission, [the Agency], the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from [the European Union] [Euratom] budget. This includes work related to this engagement. The Auditor must provide access to all working papers related to this assignment if the Commission, the Agency, the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by [dd Month yyyy].

1.6 Other Terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]

[legal name of the Auditor] [name & title of authorised representative] [dd Month yyyy] Signature of the Auditor

[legal name of the [Beneficiary] [Linked Third Party]] [name & title of authorised representative] [dd Month yyyy] Signature of the [Beneficiary] [Linked Third Party]

Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.

Independent report of factual findings on the methodology concerning grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme

(To be printed on letterhead paper of the auditor)

To
[name of contact person(s)], [Position]
[[Beneficiary's] [Linked Third Party's] name]
[Address]
[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')],

we [name of the auditor] ('the Auditor'),
established at
[full address/city/state/province/country],
represented by
[name and function of an authorised representative],

have carried out the agreed-upon procedures ('the Procedures') and provide hereby our Independent Report of Factual Findings ('the Report'), concerning the [Beneficiary's] [Linked Third Party's] usual accounting practices for calculating and declaring direct personnel costs declared as unit costs ('the Methodology').

You requested certain procedures to be carried out in connection with the grant(s)

[title and number of the grant agreement(s)] ('the Agreement(s)').

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes: the standard statements ('the Statements') made by the [Beneficiary] [Linked Third Party], the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') confirmed by us.

The engagement involved carrying out the Procedures and assessing the Findings and the documentation requested appended to this Report, the results of which the Commission uses to draw conclusions regarding the acceptability of the Methodology applied by the [Beneficiary] [Linked Third Party].

The Report covers the methodology used from [dd Month yyyy]. In the event that the [Beneficiary] [Linked Third Party] changes this methodology, the Report will not be applicable to any Financial Statement¹ submitted thereafter.

The scope of the Procedures and the definition of the standard statements and findings were determined solely by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence.

Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, we do not give a statement of assurance on the costs declared on the basis of the [Beneficiary's] [Linked Third Party's] Methodology. Had we carried out additional procedures or had we performed an audit or review in accordance with these standards, other matters might have come to its attention and would have been included in the Report.

Exceptions

Apart from the exceptions listed below, the [Beneficiary] [Linked Third Party] agreed with the standard Statements and provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and corroborate the standard Findings.

List here any exception and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, also indicate the corresponding amount.

• • • •

Explanation of possible exceptions in the form of examples (to be removed from the Report):

i. the [Beneficiary] [Linked Third Party] did not agree with the standard Statement number ... because...;

ii. the Auditor could not carry out the procedure ... established because (e.g. due to the inability to reconcile key information or the unavailability or inconsistency of data);

iii. the Auditor could not confirm or corroborate the standard Finding number ... because

Remarks

We would like to add the following remarks relevant for the proper understanding of the Methodology applied by the [Beneficiary] [Linked Third Party] or the results reported:

Example (to be removed from the Report):

Regarding the methodology applied to calculate hourly rates ...

Regarding standard Finding 15 it has to be noted that ...

The [Beneficiary] [Linked Third Party] explained the deviation from the benchmark statement XXIV concerning time recording for personnel with no exclusive dedication to the action in the following manner:

Annexes

Please provide the following documents to the auditor and annex them to the report when submitting this CoMUC to the Commission:

¹ Financial Statement in this context refers solely to Annex 4 of the Agreement by which the Beneficiary declares costs under the Agreement.

- 1. Brief description of the methodology for calculating personnel costs, productive hours and hourly rates;
- 2. Brief description of the time recording system in place;
- 3. An example of the time records used by the [Beneficiary] [Linked Third Party];
- 4. Description of any budgeted or estimated elements applied, together with an explanation as to why they are relevant for calculating the personnel costs and how they are based on objective and verifiable information;
- 5. A summary sheet with the hourly rate for direct personnel declared by the [Beneficiary] [Linked Third Party] and recalculated by the Auditor for each staff member included in the sample (the names do not need to be reported);
- 6. A comparative table summarising for each person selected in the sample a) the time claimed by the [Beneficiary] [Linked Third Party] in the Financial Statement(s) and b) the time according to the time record verified by the Auditor;
- 7. A copy of the letter of representation provided to the Auditor.

Use of this Report

This Report has been drawn up solely for the purpose given under Point 1.1 Reasons for the engagement.

The Report:

- is confidential and is intended to be submitted to the Commission by the [Beneficiary] [Linked *Third Party*] in connection with Article 18.1.2 of the Agreement;
- may not be used by the [Beneficiary] [Linked Third Party] or by the Commission for any other purpose, nor distributed to any other parties;
- may be disclosed by the Commission only to authorised parties, in particular the European Anti-Fraud Office (OLAF) and the European Court of Auditors.
- relates only to the usual cost accounting practices specified above and does not constitute a report on the Financial Statements of the [Beneficiary] [Linked Third Party].

No conflict of interest ² exists betwee	on the Auditor and the Beneficiary [and the Linked Third Party]
that could have a bearing on the Repo	ort. The total fee paid to the Auditor for producing the Report was
EUR (including EUR	of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance which may be required.

Yours sincerely

[legal name of the Auditor] name and title of the authorised representative [dd Month yyyy] Signature of the Auditor

A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

was involved in the preparation of the Financial Statements;

stands to benefit directly should the certificate be accepted;

⁻ has a close relationship with any person representing the beneficiary;

is a director, trustee or partner of the beneficiary; or

is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Statements to be made by the Beneficiary/Linked Third Party ('the Statements') and Procedures to be carried out by the Auditor ('the Procedures') and standard factual findings ('the Findings') to be confirmed by the Auditor

The Commission reserves the right to provide the auditor with guidance regarding the Statements to be made, the Procedures to be carried out or the Findings to be ascertained and the way in which to present them. The Commission reserves the right to vary the Statements, Procedures or Findings by written notification to the Beneficiary/Linked Third Party to adapt the procedures to changes in the grant agreement(s) or to any other circumstances.

If this methodology certificate relates to the Linked Third Party's usual accounting practices for calculating and claiming direct personnel costs declared as unit costs any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

Please ex	Please explain any discrepancies in the body of the Report.		
Statements to be made by Beneficiary		Procedures to be carried out and Findings to be confirmed by the Auditor	
A. Use of	f the Methodology	Procedure:	
	The cost accounting practice described below has been in use since [dd Month yyyy].	✓ The Auditor checked these dates against the documentation the Beneficiary has provided.	
	The next planned alteration to the methodology used by the Beneficiary	Factual finding:	
V	will be from [dd Month yyyy].	1. The dates provided by the Beneficiary were consistent with the documentation.	
B. Descr	ription of the Methodology	Procedure:	
	The methodology to calculate unit costs is being used in a consistent manner and is reflected in the relevant procedures.	✓ The Auditor reviewed the description, the relevant manuals and/or internal guidance documents describing the methodology.	
_	describe the methodology your entity uses to calculate <u>personnel</u> costs,	Factual finding:	
1 -	ve hours and hourly rates, present your description to the Auditor and to this certificate]	2. The brief description was consistent with the relevant manuals, internal guidance and/or other documentary evidence the Auditor has reviewed.	
endorsed	tatement of section "B. Description of the methodology" cannot be by the Beneficiary or there is no written methodology to calculate unit should be listed here below and reported as exception by the Auditor in the	3. The methodology was generally applied by the Beneficiary as part of its usual costs accounting practices.	
main Repo -	oort of Factual Findings:]		

Please explain any discrepancies in the body of the Report.

Statements to be made by Beneficiary

C. Personnel costs

General

- IV. The unit costs (hourly rates) are limited to salaries including during parental leave, social security contributions, taxes and other costs included in the remuneration required under national law and the employment contract or equivalent appointing act;
- V. Employees are hired directly by the Beneficiary in accordance with national law, and work under its sole supervision and responsibility;
- VI. The Beneficiary remunerates its employees in accordance with its usual practices. This means that personnel costs are charged in line with the Beneficiary's usual payroll policy (e.g. salary policy, overtime policy, variable pay) and no special conditions exist for employees assigned to tasks relating to the European Union or Euratom, unless explicitly provided for in the grant agreement(s);
- VII. The Beneficiary allocates its employees to the relevant group/category/cost centre for the purpose of the unit cost calculation in line with the usual cost accounting practice;
- VIII. Personnel costs are based on the payroll system and accounting system.
- IX. Any exceptional adjustments of actual personnel costs resulted from relevant budgeted or estimated elements and were based on objective and verifiable information. [Please describe the 'budgeted or estimated elements' and their relevance to personnel costs, and explain how they were reasonable and based on objective and verifiable information, present your explanation to the Auditor and annex it to this certificate].
- X. Personnel costs claimed do not contain any of the following ineligible costs: costs related to return on capital; debt and debt service charges; provisions for future losses or debts; interest owed; doubtful debts; currency exchange losses; bank costs charged by the Beneficiary's bank for transfers from the Commission/Agency; excessive or reckless expenditure; deductible VAT or costs incurred during suspension of the implementation of the action.
- XI. Personnel costs were not declared under another EU or Euratom grant

Procedures to be carried out and Findings to be confirmed by the Auditor

Procedure:

The Auditor draws a sample of employees to carry out the procedures indicated in this section C and the following sections D to F.

[The Auditor has drawn a random sample of 10 employees assigned to Horizon 2020 action(s). If fewer than 10 employees are assigned to the Horizon 2020 action(s), the Auditor has selected all employees assigned to the Horizon 2020 action(s) complemented by other employees irrespective of their assignments until he has reached 10 employees.]. For this sample:

- ✓ the Auditor reviewed all documents relating to personnel costs such as employment contracts, payslips, payroll policy (e.g. salary policy, overtime policy, variable pay policy), accounting and payroll records, applicable national tax, labour and social security law and any other documents corroborating the personnel costs claimed;
- ✓ in particular, the Auditor reviewed the employment contracts of the employees in the sample to verify that:
 - i. they were employed directly by the Beneficiary in accordance with applicable national legislation;
 - ii. they were working under the sole technical supervision and responsibility of the latter;
 - iii. they were remunerated in accordance with the Beneficiary's usual practices:
 - iv. they were allocated to the correct group/category/cost centre for the purposes of calculating the unit cost in line with the Beneficiary's usual cost accounting practices;
- the Auditor verified that any ineligible items or any costs claimed under other costs categories or costs covered by other types of grant or by other grants financed from the European Union budget have not been taken into account when calculating the personnel costs;
- the Auditor numerically reconciled the total amount of personnel costs used to calculate the unit cost with the total amount of personnel costs recorded in the statutory accounts and the payroll system.

Please explain any discrepancies in the body of the Report.

Statements to be made by Beneficiary

(including grants awarded by a Member State and financed by the EU budget and grants awarded by bodies other than the Commission/Agency for the purpose of implementing the EU or Euratom budget in the same period, unless the Beneficiary can demonstrate that the operating grant does not cover any costs of the action).

If additional remuneration as referred to in the grant agreement(s) is paid

- XII. The Beneficiary is a non-profit legal entity;
- XIII. The additional remuneration is part of the beneficiary's usual remuneration practices and paid consistently whenever the relevant work or expertise is required;
- XIV. The criteria used to calculate the additional remuneration are objective and generally applied regardless of the source of funding;
- XV. The additional remuneration included in the personnel costs used to calculate the hourly rates for the grant agreement(s) is capped at EUR 8 000 per full-time equivalent (reduced proportionately if the employee is not assigned exclusively to the action).

[If certain statement(s) of section "C. Personnel costs" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor in the main Report of Factual Findings:

...]

Procedures to be carried out and Findings to be confirmed by the Auditor

- ✓ to the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, the Auditor carefully examined those elements and checked the information source to confirm that they correspond to objective and verifiable information;
- ✓ if additional remuneration has been claimed, the Auditor verified that the Beneficiary was a non-profit legal entity, that the amount was capped at EUR 8000 per full-time equivalent and that it was reduced proportionately for employees not assigned exclusively to the action(s).
- ✓ the Auditor recalculated the personnel costs for the employees in the sample.

Factual finding:

- 4. All the components of the remuneration that have been claimed as personnel costs are supported by underlying documentation.
- 5. The employees in the sample were employed directly by the Beneficiary in accordance with applicable national law and were working under its sole supervision and responsibility.
- 6. Their employment contracts were in line with the Beneficiary's usual policy;
- 7. Personnel costs were duly documented and consisted solely of salaries, social security contributions (pension contributions, health insurance, unemployment fund contributions, etc.), taxes and other statutory costs included in the remuneration (holiday pay, thirteenth month's pay, etc.);
- 8. The totals used to calculate the personnel unit costs are consistent with those registered in the payroll and accounting records;
- 9. To the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, those elements were relevant for calculating the personnel costs and correspond to objective and verifiable information. The budgeted or estimated elements used are: (indicate the elements and their values).
- 10. Personnel costs contained no ineligible elements;
- 11. Specific conditions for eligibility were fulfilled when additional

Please explain any discrepancies in the body of the Report.		
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor	
	remuneration was paid: a) the Beneficiary is registered in the grant agreements as a non-profit legal entity; b) it was paid according to objective criteria generally applied regardless of the source of funding used and c) remuneration was capped at EUR 8000 per full-time equivalent (or up to up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).	
D. Productive hours	Procedure (same sample basis as for Section C: Personnel costs):	
XVI. The number of productive hours per full-time employee applied is [deleas as appropriate]:	The Auditor verified that the number of productive hours applied is in accordance with method A, B or C.	
A. 1720 productive hours per year for a person working full-tir (corresponding pro-rata for persons not working full time).	The Auditor checked that the number of productive hours per full-time employee is correct.	
B. the total number of hours worked in the year by a person for t BeneficiaryC. the standard number of annual hours generally applied by t beneficiary for its personnel in accordance with its usual companies.	number of hours worked was done and ii) that the contract specified the annual workable hours by inspecting all the relevant documents, national	
accounting practices. This number must be at least 90% of t standard annual workable hours. If method B is applied	He ✓ If method C is applied the Auditor reviewed the manner in which the standard number of working hours per year has been calculated by inspecting all the relevant documents, national legislation, labour agreements and contracts and verified that the number of productive hours	
XVII. The calculation of the total number of hours worked was done follows: annual workable hours of the person according to t employment contract, applicable labour agreement or national law pl overtime worked minus absences (such as sick leave and special leave	of working hours per year. Factual finding:	
XVIII. 'Annual workable hours' are hours during which the personnel must working, at the employer's disposal and carrying out his/her activity duties under the employment contract, applicable collective laboragreement or national working time legislation.	12. The Beneficiary applied a number of productive hours consistent with method A, B or C detailed in the left-hand column. 13. The number of productive hours per year per full-time employee was	
XIX. The contract (applicable collective labour agreement or nation working time legislation) do specify the working time enabling calculate the annual workable hours.		

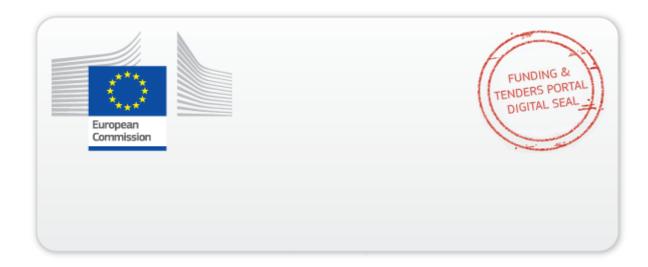
Please explain any discrepancies in the body of the Report.		
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor	
If method C is applied	verifiable based on the documents provided by the Beneficiary and the calculation of the total number of hours worked was accurate.	
XX. The standard number of productive hours per year is that of a full-time equivalent.	15. The contract specified the working time enabling to calculate the annual workable hours.	
XXI. The number of productive hours per year on which the hourly rate is based i) corresponds to the Beneficiary's usual accounting practices; ii) is at least	If method C is applied	
90% of the standard number of workable (working) hours per year. XXII. Standard workable (working) hours are hours during which personnel are at	16. The calculation of the number of productive hours per year corresponded to the usual costs accounting practice of the Beneficiary.	
the Beneficiary's disposal preforming the duties described in the relevant employment contract, collective labour agreement or national labour	17. The calculation of the standard number of workable (working) hours per year was corroborated by the documents presented by the Beneficiary.	
legislation. The number of standard annual workable (working) hours that the Beneficiary claims is supported by labour contracts, national legislation and other documentary evidence.	18. The number of productive hours per year used for the calculation of the hourly rate was at least 90% of the number of workable (working) hours per year.	
[If certain statement(s) of section "D. Productive hours" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:]	year.	
E. Hourly rates	Procedure	
The hourly rates are correct because:	✓ The Auditor has obtained a list of all personnel rates calculated by the Beneficiary in accordance with the methodology used.	
XXIII. Hourly rates are correctly calculated since they result from dividing annual personnel costs by the productive hours of a given year and group (e.g. staff category or department or cost centre depending on the methodology	✓ The Auditor has obtained a list of all the relevant employees, based on which the personnel rate(s) are calculated.	
applied) and they are in line with the statements made in section C. and D. above.	For 10 employees selected at random (same sample basis as Section C: Personnel costs):	
	✓ The Auditor recalculated the hourly rates.	
[If the statement of section 'E. Hourly rates' cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:	✓ The Auditor verified that the methodology applied corresponds to the usual accounting practices of the organisation and is applied consistently for all activities of the organisation on the basis of objective criteria irrespective of the source of funding.	
J	Factual finding:	

Please explain any discrepancies in the body of the Report.		
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor	
	19. No differences arose from the recalculation of the hourly rate for the employees included in the sample.	
F. Time recording	Procedure	
XXIV. Time recording is in place for all persons with no exclusive dedication to one Horizon 2020 action. At least all hours worked in connection with the grant agreement(s) are registered on a daily/weekly/monthly basis [delete	✓ The Auditor reviewed the brief description, all relevant manuals and/or internal guidance describing the methodology used to record time.	
as appropriate] using a paper/computer-based system [delete as appropriate];	The Auditor reviewed the time records of the random sample of 10 employees referred to under Section C: Personnel costs, and verified in particular:	
XXV. For persons exclusively assigned to one Horizon 2020 activity the Beneficiary has either signed a declaration to that effect or has put arrangements in place to record their working time;	✓ that time records were available for all persons with not exclusive assignment to the action;	
XXVI.Records of time worked have been signed by the person concerned (on paper or electronically) and approved by the action manager or line manager at least monthly;	that time records were available for persons working exclusively for a Horizon 2020 action, or, alternatively, that a declaration signed by the Beneficiary was available for them certifying that they were working	
XXVII. Measures are in place to prevent staff from:	exclusively for a Horizon 2020 action;	
i. recording the same hours twice,	✓ that time records were signed and approved in due time and that all minimum requirements were fulfilled;	
ii. recording working hours during absence periods (e.g. holidays, sick leave),	✓ that the persons worked for the action in the periods claimed;	
iii. recording more than the number of productive hours per year used to calculate the hourly rates, and	✓ that no more hours were claimed than the productive hours used to calculate the hourly personnel rates;	
iv. recording hours worked outside the action period.	✓ that internal controls were in place to prevent that time is recorded twice, during absences for holidays or sick leave; that more hours are claimed per	
XXVIII. No working time was recorded outside the action period;	person per year for Horizon 2020 actions than the number of productive	
XXIX. No more hours were claimed than the productive hours used to calculate the hourly personnel rates.	hours per year used to calculate the hourly rates; that working time is recorded outside the action period;	
[Please provide a brief description of the time recording system in place together with the measures applied to ensure its reliability to the Auditor and annex it to the	✓ the Auditor cross-checked the information with human-resources records to verify consistency and to ensure that the internal controls have been effective. In addition, the Auditor has verified that no more hours were charged to Horizon 2020 actions per person per year than the number of productive hours per year used to calculate the hourly rates, and verified that	

Please explain any discrepancies in the body of the Report.		
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor	
present certificate ¹].	no time worked outside the action period was charged to the action.	
	Factual finding:	
[If certain statement(s) of section "F. Time recording" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:]	20. The brief description, manuals and/or internal guidance on time recording provided by the Beneficiary were consistent with management reports/records and other documents reviewed and were generally applied by the Beneficiary to produce the financial statements.	
	 For the random sample time was recorded or, in the case of employees working exclusively for the action, either a signed declaration or time records were available; 	
	22. For the random sample the time records were signed by the employee and the action manager/line manager, at least monthly.	
	23. Working time claimed for the action occurred in the periods claimed;	
	24. No more hours were claimed than the number productive hours used to calculate the hourly personnel rates;	
	25. There is proof that the Beneficiary has checked that working time has not been claimed twice, that it is consistent with absence records and the number of productive hours per year, and that no working time has been claimed outside the action period.	
	26. Working time claimed is consistent with that on record at the human-resources department.	

The description of the time recording system must state among others information on the content of the time records, its coverage (full or action time-recording, for all personnel or only for personnel involved in H2020 actions), its degree of detail (whether there is a reference to the particular tasks accomplished), its form, periodicity of the time registration and authorisation (paper or a computer-based system; on a daily, weekly or monthly basis; signed and countersigned by whom), controls applied to prevent double-charging of time or ensure consistency with HR-records such as absences and travels as well as it information flow up to its use for the preparation of the Financial Statements.

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
[official name of the [Beneficiary] [Linked Third Party]]	[official name of the Auditor]
[name and title of authorised representative]	[name and title of authorised representative]
[dd Month yyyy]	[dd Month yyyy]
<pre><signature [beneficiary]="" [linked="" of="" party]="" the="" third=""></signature></pre>	<signature auditor="" of="" the=""></signature>



This document is digitally sealed. The digital sealing mechanism uniquely binds the document to the modules of the Funding & Tenders Portal of the European Commission, to the transaction for which it was generated and ensures its integrity and authenticity.

Any attempt to modify the content will lead to a breach of the electronic seal, which can be verified at any time by clicking on the digital seal validation symbol.