Horizon 2020

Call: H2020-BG-2016-2017

(Blue Growth - Demonstrating an ocean of opportunities)

Topic: BG-09-2016

Type of action: RIA

(Research and Innovation action)

Proposal number: 727890

Proposal acronym: INTAROS

Deadline Id: H2020-BG-2016-1

Table of contents

How to fill in the forms

The administrative forms must be filled in for each proposal using the templates available in the submission system. Some data fields in the administrative forms are pre-filled based on the previous steps in the submission wizard.

1 - General information

Topic	BG-09-2016
Call Identifier	H2020-BG-2016-2017
Type of Action	RIA
Deadline Id	H2020-BG-2016-1

Acronym	INTAROS
Proposal title*	Integrated Arctic observation system

Note that for technical reasons, the following characters are not accepted in the Proposal Title and will be removed: < > " &

Duration in months	*60*
Fixed keyword 1	*Geo-information and spatial data analysis* (Add)
Free keywords	*Observation system, in situ, Arctic, integrated, ocean, atmosphere, ice, terrestrial, ecosystems, communities.*

Abstract

The overall objective of INTAROS is to develop an integrated Arctic Observation System (iAOS) by extending, improving and unifying existing systems in the different regions of the Arctic. INTAROS will have a strong multidisciplinary focus, with tools for integration of data from atmosphere, ocean, cryosphere and terrestrial sciences, provided by institutions in Europe, North America and Asia. Satellite earth observation data plays an increasingly important role in such observing systems, because the amount of EO data for observing the global climate and environment grows year by year. In situ observing systems are much more limited due to logistical constraints and cost limitations. The sparseness of in situ data is therefore the largest gap in the overall observing system. INTAROS will assess strengths and weaknesses of existing observing systems and contribute with innovative solutions to fill some of the critical gaps in the in situ observing network. INTAROS will develop a platform, iAOS, to search for and access data from distributed databases. The evolution into a sustainable Arctic observing system requires coordination, mobilization and cooperation between the existing European and international infrastructures (in-situ and remote including space-based), the modeling communities and relevant stakeholder groups. INTAROS will include development of community-based observing systems, where local knowledge is merged with scientific data. An integrated Arctic Observation System will enable better-informed decisions and better-documented processes within key sectors (e.g. local communities, shipping, tourism, fisheries), in order to strengthen the societal and economic role of the Arctic region and support the EU strategy for the Arctic and related maritime and environmental policies.

Remaining characters 180

Has this proposal (or a very similar one) been submitted in the past 2 years in response to a call for proposals under the 7th Framework Programme, Horizon 2020 or any other EU programme(s)? ○ Yes ◉ No

Proposal ID **727890** *Acronym* **INTAROS**

Declarations

1) The coordinator declares to have the explicit consent of all applicants on their participation and on the content of this proposal.	☒
2) The information contained in this proposal is correct and complete.	☒
3) This proposal complies with ethical principles (including the highest standards of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity — and including, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct).	☒

4) The coordinator confirms:

- to have carried out the self-check of the financial capacity of the organisation on http://ec.europa.eu/research/participants/portal/desktop/en/organisations/lfv.html or to be covered by a financial viability check in an EU project for the last closed financial year. Where the result was "weak" or "insufficient", the coordinator confirms being aware of the measures that may be imposed in accordance with the H2020 Grants Manual (Chapter on Financial capacity check); or	◉
- is exempt from the financial capacity check being a public body including international organisations, higher or secondary education establishment or a legal entity, whose viability is guaranteed by a Member State or associated country, as defined in the H2020 Grants Manual (Chapter on Financial capacity check); or	○
- as sole participant in the proposal is exempt from the financial capacity check.	○

5) The coordinator hereby declares that each applicant has confirmed:

- they are fully eligible in accordance with the criteria set out in the specific call for proposals; and	☒
- they have the financial and operational capacity to carry out the proposed action.	☒

The coordinator is only responsible for the correctness of the information relating to his/her own organisation. Each applicant remains responsible for the correctness of the information related to him/her and declared above. Where the proposal to be retained for EU funding, the coordinator and each beneficiary applicant will be required to present a formal declaration in this respect.

According to Article 131 of the Financial Regulation of 25 October 2012 on the financial rules applicable to the general budget of the Union (Official Journal L 298 of 26.10.2012, p. 1) and Article 145 of its Rules of Application (Official Journal L 362, 31.12.2012, p.1) applicants found guilty of misrepresentation may be subject to administrative and financial penalties under certain conditions.

Personal data protection

Your reply to the grant application will involve the recording and processing of personal data (such as your name, address and CV), which will be processed pursuant to Regulation (EC) No 45/2001 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. Unless indicated otherwise, your replies to the questions in this form and any personal data requested are required to assess your grant application in accordance with the specifications of the call for proposals and will be processed solely for that purpose. Details concerning the processing of your personal data are available on the privacy statement. Applicants may lodge a complaint about the processing of their personal data with the European Data Protection Supervisor at any time.

Your personal data may be registered in the Early Warning System (EWS) only or both in the EWS and Central Exclusion Database (CED) by the Accounting Officer of the Commission, should you be in one of the situations mentioned in:
-the Commission Decision 2008/969 of 16.12.2008 on the Early Warning System (for more information see the Privacy Statement), or
-the Commission Regulation 2008/1302 of 17.12.2008 on the Central Exclusion Database (for more information see the Privacy Statement) .

Proposal ID **727890** *Acronym* **INTAROS**

List of participants

#	Participant Legal Name	Country
1	STIFTELSEN NANSEN SENTER FOR MILJOOG FJERNMALING	Norway
2	UNIVERSITETET I BERGEN	Norway
3	HAVFORSKNINGSINSTITUTTET	Norway
4	STOCKHOLMS UNIVERSITET	Sweden
5	ALFRED-WEGENER-INSTITUT HELMHOLTZ- ZENTRUM FUER POLAR- UND MEERESFORSCHUNG	Germany
6	INSTYTUT OCEANOLOGII POLSKIEJ AKADEMII NAUK	Poland
7	DANMARKS TEKNISKE UNIVERSITET	Denmark
8	AARHUS UNIVERSITET	Denmark
9	Geological Survey of Denmark and Greenland	Denmark
10	ILMATIETEEN LAITOS	Finland
11	University Centre in Svalbard	Norway
12	NORDISK FOND FOR MILJØ OG UDVIKLING	Denmark
13	SVERIGES METEOROLOGISKA OCH HYDROLOGISKA INSTITUT	Sweden
14	THE UNIVERSITY OF SHEFFIELD	United Kingdom
15	NATIONAL UNIVERSITY OF IRELAND MAYNOOTH	Ireland
16	INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	France
17	MAX PLANCK GESELLSCHAFT ZUR FOERDERUNG DER WISSENSCHAFTEN E.V.	Germany
18	EUROGOOS AISBL	Belgium
19	FUNDACAO EUROCEAN	Portugal
20	UNIVERSIDAD POLITECNICA DE MADRID	Spain
21	UNIVERSITAET BREMEN	Germany

Proposal ID **727890** *Acronym* **INTAROS**

#	Participant Legal Name	Country
22	UNIVERSITAET HAMBURG	Germany
23	NORTHERN RESEARCH INSTITUTE TROMSO AS	Norway
24	TERRADUE SRL	Italy
25	GRONLANDS NATURINSTITUT	Greenland
26	THE OPEN UNIVERSITY	United Kingdom
27	NORSK INSTITUTT FOR VANNFORSKNING	Norway
28	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	France
29	HELSINGIN YLIOPISTO	Finland
30	HELMHOLTZ ZENTRUM POTSDAM DEUTSCHES GEOFORSCHUNGSZENTRUM	Germany
31	ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT DES METHODES ET PROCESSUS INDUSTRIELS	France
32	Instytut Geofizyki Polskiej Akademii Nauk	Poland
33	UNIWERSYTET SLASKI	Poland
34	BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION	Spain
35	DNV GL AS	Norway
36	SEASCAPE CONSULTANTS LTD	United Kingdom
37	Scientific foundation Nansen International Environmental and Remote Sensing Centre	Russian Federation
38	WOODS HOLE OCEANOGRAPHIC INSTITUTION	United States
39	University of California, San Diego	United States
40	University of Alaska	United States
41	Jet Propulsion Laboratory, California Institute of Technology	United States
42	UNIVERSITE LAVAL	Canada
43	UNIVERSITY OF VICTORIA	Canada
44	National Marine Environmental Forecasting Center	China (People's Republic of)

45	Polar Research Institute of China	China (People's Republic of)
46	INSTITUTE OF REMOTE SENSING AND DIGITAL EARTH - CHINESE ACADEMY OF SCIENCE	China (People's Republic of)
47	National Institute of Polar Research	Japan
48	KOREA OCEAN RESEARCH AND DEVELOPMENT INSTITUTE	Korea (Republic of)

2 - Administrative data of participating organisations

PIC	***Legal name***
999477913	*STIFTELSEN NANSEN SENTER FOR MILJOOG FJERNMALING*

Short name: NERSC

Address of the organisation

Street THORMOHLENSGATE 47

Town BERGEN

Postcode 5006

Country Norway

Webpage www.nersc.no

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Legal person .... yes

Non-profit .... yes

International organisation .... unknown

International organisation of European interest ...... unknown

Secondary or Higher education establishment .... no

Research organisation .... yes

Enterprise Data

SME self-declared status................................. 2007 - yes

SME self-assessment .... unknown

SME validation sme....................................... 2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NERSC**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Kjetil**

Last name: **LYGRE**

E-Mail: **kjetil.lygre@nersc.no**

Position in org.: Scientist

Department: STIFTELSEN NANSEN SENTER FOR MILJOOG FJERNMALING

☒ Same as organisation

☒ Same as organisation address

Street: THORMOHLENSGATE 47

Town: BERGEN

Post code: 5006

Country: Norway

Website: www.nersc.no

Phone 1: +47 55 20 58 00

Phone 2: +47 45225135

Fax: +XXX XXXXXXXXX

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Hanne Sagen	Hanne	hanne.sagen@nersc.no	+47 453 93 201
Knut	Holba	knut.holba@nersc.no	+47 907 34 815
Stein	Sandven	stein.sandven@nersc.no	+47 993 68 440
Anders	Nesse	anders.nesse@nersc.no	

PIC	***Legal name***
999974456	*UNIVERSITETET I BERGEN*

Short name: UiB

Address of the organisation

Street Museplassen 1

Town BERGEN

Postcode 5007

Country Norway

Webpage www.uib.no

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... no

International organisation of European interest .... no

Secondary or Higher education establishment .... yes

Research organisation .... no

Enterprise Data

SME self-declared status.. unknown

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name	Department of Earth Science
	☐ not applicable
	☐ Same as organisation address
Street	Allégt 41, PO Box 7803
Town	Bergen
Postcode	5020
Country	Norway

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **UiB**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr. Sex: ○ Male ◉ Female

First name: **Mathilde B.** Last name: **Sørensen**

E-Mail: **mathilde.sorensen@uib.no**

Position in org.: Associate Professor

Department: Department of Earth Science ☐ Same as organisation

☐ Same as organisation address

Street: Allegt. 41, PO Box 7803

Town: Bergen Post code: 5020

Country: Norway

Website: http://www.uib.no/en/persons/Mathilde.B..S%C3%B8rensen#

Phone 1: +47 55 58 34 26 Phone 2: +XXX XXXXXXXXX Fax: +XXX XXXXXXXXX

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Friederike	Urbassek Hoffmann	friederike.hoffmann@gfi.uib.no	+4755588795
Liv-Grethe	Gudmundsen	post@fa.uib.no	+4755584965
Truls	Johannessen	truls.johannessen@uib.no	+47 55 58 43 27

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **IMR**

PIC	***Legal name***
999548432	*HAVFORSKNINGSINSTITUTTET*

Short name: IMR

Address of the organisation

Street NORDNESGATEN 50

Town BERGEN

Postcode 5817

Country Norway

Webpage www.imr.no

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Enterprise Data

SME self-declared status.................................2013 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

Department 1

Department name: Research Group; Oceanography and climate ☐ not applicable

☒ Same as organisation address

Street: NORDNESGATEN 50

Town: BERGEN

Postcode: 5817

Country: Norway

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **IMR**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Jan Erik**

Last name: **Stiansen**

E-Mail: **jan.erik.stiansen@imr.no**

Position in org.: Research group leader (Senior Scientist)

Department: Research Group; Oceanography and climate

☐ Same as organisation

☒ Same as organisation address

Street: NORDNESGATEN 50

Town: BERGEN

Post code: 5817

Country: Norway

Website: www.imr.no

Phone 1: +4795293712

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Geir	Ottersen	geir.ottersen@imr.no	+4741047374
Turid S.	Loddengaard	turid.loddengaard@imr.no	+4794410669
Anita	Jacobsen	anita.jacobsen@imr.no	+4797953774

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **MISU**

PIC	***Legal name***
999885022	*STOCKHOLMS UNIVERSITET*

Short name: MISU

Address of the organisation

Street Universitetsvaegen 10

Town STOCKHOLM

Postcode 10691

Country Sweden

Webpage www.su.se

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....unknown

International organisation of European interest ......unknown

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

Department 1

Department name: Department of Meteorology

☐ not applicable

☐ Same as organisation address

Street: Svante Arrhenius väg 16C

Town: Stockholm

Postcode: 10691

Country: Sweden

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Michael** Last name: **Tjernström**

E-Mail: **michaelt@misu.su.se**

Position in org.: Professor

Department: Department of Meteorology ☐ Same as organisation

☐ Same as organisation address

Street: Svante Arrhenius väg 16C

Town: Stockholm Post code: 10691

Country: Sweden

Website: www.misu.su.se

Phone 1: +468163110 Phone 2: +46702056631 Fax: +468157185

PIC	***Legal name***
999497507	*ALFRED-WEGENER-INSTITUT HELMHOLTZ- ZENTRUM FUER POLAR- UND MEERESFORSCHUN*

Short name: AWI

Address of the organisation

Street AM HANDELSHAFEN 12

Town BREMERHAVEN

Postcode 27570

Country Germany

Webpage www.awi.de

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... no

International organisation of European interest .... no

Secondary or Higher education establishment .... no

Research organisation .... yes

Enterprise Data

SME self-declared status....... 2013 - no

SME self-assessment .... unknown

SME validation sme....... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name: HGF-MPG Joint Research Group for Deep-Sea Ecology and Technology

☐ not applicable

☒ Same as organisation address

Street: AM HANDELSHAFEN 12

Town: BREMERHAVEN

Postcode: 27570

Country: Germany

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (●) Male ( ) Female

First name: **Thomas**

Last name: **Soltwedel**

E-Mail: **thomas.soltwedel@awi.de**

Position in org.: Senior Scientist

Department: HGF-MPG Joint Research Group for Deep-Sea Ecology and Technology

☐ Same as organisation

☒ Same as organisation address

Street: AM HANDELSHAFEN 12

Town: BREMERHAVEN

Post code: 27570

Country: Germany

Website: http://www.awi.de/en/about-us/organisation/staff/thomas-soltwedel

Phone 1: +49 471 4831-1775

Phone 2: +xxx xxxxxxxxx

Fax: +49 471 4831-1776

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Maria	Eden	maria.eden@awi.de	+494714831-2412
Ingo	Schewe	ingo.schewe@awi.de	+494714831-1737

PIC	***Legal name***
999488971	*INSTYTUT OCEANOLOGII POLSKIEJ AKADEMII NAUK*

Short name: IO PAN

Address of the organisation

Street UL. POWSTANCOW WARSZAWY 55

Town SOPOT

Postcode 81 712

Country Poland

Webpage www.iopan.gda.pl

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Enterprise Data

SME self-declared status.................................2013 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name: Physical Oceanography Department ☐ not applicable

☒ Same as organisation address

Street: UL. POWSTANCOW WARSZAWY 55

Town: SOPOT

Postcode: 81 712

Country: Poland

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **IO PAN**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr. Sex: ◯ Male ◉ Female

First name: **Agnieszka** Last name: **Beszczynska-Moeller**

E-Mail: **abesz@iopan.gda.pl**

Position in org.: Research group leader

Department: Physical Oceanography Department ☐ Same as organisation

☒ Same as organisation address

Street: UL. POWSTANCOW WARSZAWY 55

Town: SOPOT Post code: 81 712

Country: Poland

Website: www.iopan.gda.pl

Phone 1: +48 58 7311914 Phone 2: +48 501828787 Fax: +48 58 5512130

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Waldemar	Walczowski	walczows@iopan.gda.pl	+48587311904

PIC	***Legal name***
999990655	*DANMARKS TEKNISKE UNIVERSITET*

Short name: DTU

Address of the organisation

Street Anker Engelundsvej 1, Bygning 101

Town KONGENS LYNGBY

Postcode 2800

Country Denmark

Webpage www.dtu.dk

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... no

International organisation of European interest ...... no

Secondary or Higher education establishment .... yes

Research organisation .... yes

Enterprise Data

SME self-declared status................................. 2013 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

Department 1

Department name: Space ☐ not applicable

☐ Same as organisation address

Street: Elektrovej, building 327+328

Town: Kongens Lyngby

Postcode: 2800

Country: Denmark

Department 2

Department name: Aqua ☐ not applicable

☐ Same as organisation address

Street: Jægersborg Allé 1

Town: Charlottenlund

Postcode: 2920

Country: Denmark

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **DTU**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr. Sex: (•) Male ( ) Female

First name: **Asbjørn** Last name: **Christensen**

E-Mail: **asc@aqua.dtu.dk**

Position in org.: senior scientist

Department: Aqua ☐ Same as organisation

☐ Same as organisation address

Street: Jægersborg Allé 1

Town: Charlottenlund Post code: 2920

Country: Denmark

Website: http://www.aqua.dtu.dk/

Phone 1: +45 3588 3373 Phone 2: +xxx xxxxxxxxx Fax: +45 3588 3333

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Per	Knudsen	pk@space.dtu.dk	
Kirsten	Thomsen	kth@aqua.dtu.dk	+4535883379
Ole Henrik	Haslund	ohha@aqua.dtu.dk	

PIC	***Legal name***
999997736	*AARHUS UNIVERSITET*

Short name: AU

Address of the organisation

Street NORDRE RINGGADE 1

Town AARHUS C

Postcode 8000

Country Denmark

Webpage www.au.dk

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status..................................2013 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

Department 1

Department name: Arctic Research Centre ☐ not applicable

☐ Same as organisation address

Street: Ny Munkegade, bldg 1540

Town: Aarhus

Postcode: 8000

Country: Denmark

Department 2

Department name: Bioscience ☐ not applicable

☐ Same as organisation address

Street: Frederiksborgvej 399

Town: Roskilde

Postcode: 4000

Country: Denmark

Dependencies with other proposal participants

Character of dependence	*Participant*	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **AU**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: (•) Male ( ) Female

First name: **Mikael Kristian** Last name: **Sejr**

E-Mail: **mse@bios.au.dk**

Position in org.: senior scientist

Department: Arctic Research Centre ☐ Same as organisation

☐ Same as organisation address

Street: Ny Munkegade, bldg 1540

Town: Aarhus Post code: 8000

Country: Denmark

Website:

Phone 1: +45 30454314 Phone 2: +xxx xxxxxxxxx Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Marie	Maar	mam@bios.au.dk	+4587158572
Anya Bjørn	Vinstrup	abv@au.dk	+4524441347

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **GEUS**

PIC	***Legal name***
999459677	*Geological Survey of Denmark and Greenland*

Short name: GEUS

Address of the organisation

Street OSTER VOLDGADE 10

Town KOBENHAVN K

Postcode 1350

Country Denmark

Webpage www.geus.dk

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... unknown

International organisation of European interest .... unknown

Secondary or Higher education establishment .... unknown

Research organisation .... yes

Enterprise Data

SME self-declared status .... unknown

SME self-assessment .... unknown

SME validation sme .... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name	Glaciology and Climate	☐ not applicable
	☒ Same as organisation address	
Street	OSTER VOLDGADE 10	
Town	KOBENHAVN K	
Postcode	1350	
Country	Denmark	

Department 2

Department name	Geophysics	☐ not applicable
	☒ Same as organisation address	
Street	OSTER VOLDGADE 10	
Town	KOBENHAVN K	
Postcode	1350	
Country	Denmark	

Department 3

Department name: Geological Data Centre ☐ not applicable

☒ Same as organisation address

Street: OSTER VOLDGADE 10

Town: KOBENHAVN K

Postcode: 1350

Country: Denmark

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **GEUS**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Andreas**

Last name: **Ahlstrøm**

E-Mail: **apa@geus.dk**

Position in org.: Senior Scientist

Department: Glaciology and Climate

☐ Same as organisation

☒ Same as organisation address

Street: OSTER VOLDGADE 10

Town: KOBENHAVN K

Post code: 1350

Country: Denmark

Website:

Phone 1: +4591333810

Phone 2: +4538142000

Fax: +4538142050

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Peter	Voss	pv@geus.dk	+4540216288

PIC	***Legal name***
999591306	*ILMATIETEEN LAITOS*

Short name: FMI

Address of the organisation

Street Erik Palmenin aukio 1

Town HELSINKI

Postcode 00560

Country Finland

Webpage www.fmi.fi

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... unknown

International organisation of European interest ...... unknown

Secondary or Higher education establishment .... unknown

Research organisation .... yes

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name: Research and Development ☐ not applicable

☒ Same as organisation address

Street: Erik Palmenin aukio 1

Town: HELSINKI

Postcode: 00560

Country: Finland

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **FMI**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: ◯ Male ◉ Female

First name: **Roberta**

Last name: **Pirazzini**

E-Mail: **roberta.pirazzini@fmi.fi**

Position in org.: Scientist

Department: Research and Development

☐ Same as organisation

☒ Same as organisation address

Street: Erik Palmenin aukio 1

Town: HELSINKI

Post code: 00560

Country: Finland

Website:

Phone 1: +358 503802653

Phone 2: +358 505266784

Fax: +358 0295394103

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Bin	Cheng	bin.cheng@fmi.fi	+358505696532
Hanna	Manninen	hanna.manninen@fmi.fi	+358505413511

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **UNIS**

PIC	***Legal name***
998225449	*University Centre in Svalbard*

Short name: UNIS

Address of the organisation

Street Sjoskrenten 1

Town Longyearbyen

Postcode 9171

Country Norway

Webpage www.unis.no

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Legal person .... yes

Non-profit .... no

International organisation .... unknown

International organisation of European interest ...... unknown

Secondary or Higher education establishment .... yes

Research organisation .... no

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

No departement involved

Department name [ ] ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **UNIS**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: (•) Male ( ) Female

First name: **Frank** Last name: **Nilsen**

E-Mail: **frank.nilsen@unis.no**

Position in org.: Acting Managing Director

Department: University Centre in Svalbard ☒ Same as organisation

☒ Same as organisation address

Street: Sjoskrenten 1

Town: Longyearbyen Post code: 9171

Country: Norway

Website:

Phone 1: +47 79 02 33 05 Phone 2: +47 79 02 33 00 Fax: +47 79 02 33 01

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Ole Jørgen	Lønne	ole.jorgen.lonne@unis.no	+47 79 02 33 58

PIC	***Legal name***
986361476	*NORDISK FOND FOR MILJØ OG UDVIKLING*

Short name: NORDECO

Address of the organisation

Street SKINDERGADE 23

Town KOBENHAVN

Postcode 1159

Country Denmark

Webpage www.nordeco.dk

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Non-profit .... yes

International organisation .... no

International organisation of European interest ...... no

Secondary or Higher education establishment .... no

Research organisation .... no

Legal person .... yes

Enterprise Data

SME self-declared status.................................2008 - yes

SME self-assessment .... unknown

SME validation sme.......................................2008 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Finn** Last name: **Danielsen**

E-Mail: **fd@nordeco.dk**

Position in org.: Senior Ecologist

Department: NORDISK FOND FOR MILJØ OG UDVIKLING ☒ Same as organisation

☒ Same as organisation address

Street: SKINDERGADE 23

Town: KOBENHAVN Post code: 1159

Country: Denmark

Website: www.nordeco.dk

Phone 1: +4527116475 Phone 2: +xxx xxxxxxxxx Fax: +xxx xxxxxxxxx

PIC	***Legal name***
999507983	*SVERIGES METEOROLOGISKA OCH HYDROLOGISKA INSTITUT*

Short name: SMHI

Address of the organisation

Street Folkborgsvaegen 1

Town NORRKOEPING

Postcode 601 76

Country Sweden

Webpage www.smhi.se

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....no

Enterprise Data

SME self-declared status.................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: L - Real estate activities

Department(s) carrying out the proposed work

Department 1

Department name	Research Department, Hydrology Research	☐ not applicable
	☒ Same as organisation address	
Street	Folkborgsvaegen 1	
Town	NORRKOEPING	
Postcode	601 76	
Country	Sweden	

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **SMHI**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: (•) Male ( ) Female

First name: **Gustafsson** Last name: **David**

E-Mail: **david.gustafsson@smhi.se**

Position in org.: Senior Scientist

Department: Research Department, Hydrology Research ☐ Same as organisation

☒ Same as organisation address

Street: Folkborgsvaegen 1

Town: NORRKOEPING Post code: 601 76

Country: Sweden

Website: www.smhi.se

Phone 1: +4611 4958647 Phone 2: +XXX XXXXXXXXX Fax: +4611 4958001

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Benderyd	Madeleine	madeleine.benderyd@smhi.se	+46114958640
Ralf	Döscher	ralf.doescher@smhi.se	+46114958583
Abhay	Devasthale	abhay.devasthale@smhi.se	+46114958043

PIC	***Legal name***
999976881	*THE UNIVERSITY OF SHEFFIELD*

Short name: USFD

Address of the organisation

Street FIRTH COURT WESTERN BANK

Town SHEFFIELD

Postcode S10 2TN

Country United Kingdom

Webpage www.shef.ac.uk

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....no

Enterprise Data

SME self-declared status..................................2007 - no

SME self-assessment .... unknown

SME validation sme..2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

Department 1

Department name: Animal and Planet Sciences ☐ not applicable

☐ Same as organisation address

Street: Alfred Denny Building

Town: Sheffield

Postcode: S10 2TN

Country: United Kingdom

Department 2

Department name: School of Mathematics and Statistics ☐ not applicable

☐ Same as organisation address

Street: Hicks Building, Hounsfield Road

Town: Sheffield

Postcode: S3 7RH

Country: United Kingdom

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **USFD**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: ◯ Male ◉ Female

First name: **Donatella**
Last name: **Donatella Zona**

E-Mail: **d.zona@sheffield.ac.uk**

Position in org.: Lecturer

Department: Animal and Plant Sciences
☐ Same as organisation

☐ Same as organisation address

Street: Alfred Denny Building

Town: Sheffield
Post code: S10 2TN

Country: United Kingdom

Website: www.shef.ac.uk/aps

Phone 1: +44 (0)114 222 0122
Phone 2: +XXX XXXXXXXXX
Fax: +44 (0)114 222 0002

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Shaun	Quegan	s.quegan@sheffield.ac.uk	+44(0)1142223778
Nick	Cupit	research.eds@sheffield.ac.uk	
Andrew	Flint	a.flint@sheffield.ac.uk	
John	Beresford	j.k.beresford@sheffield.ac.uk	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NUIM**

PIC	***Legal name***
999901415	*NATIONAL UNIVERSITY OF IRELAND MAYNOOTH*

Short name: NUIM

Address of the organisation

Street CO KILDARE

Town MAYNOOTH

Postcode

Country Ireland

Webpage www.nuim.ie

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status.................................2011 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name: ICARUS ☐ not applicable

☒ Same as organisation address

Street: CO KILDARE

Town: MAYNOOTH

Postcode:

Country: Ireland

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NUIM**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (●) Male ( ) Female

First name: **Peter**

Last name: **Thorne**

E-Mail: **peter.thorne@nuim.ie**

Position in org.: Centre Director

Department: ICARUS

☐ Same as organisation

☒ Same as organisation address

Street: CO KILDARE

Town: MAYNOOTH

Post code:

Country: Ireland

Website: www.maynoothuniversity.ie

Phone 1: +353 1 7086469

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Christine	Shortt	christine.shortt@nuim.ie	+35314747227
Maynooth research	development office	eu.research@nuim.ie	+35314747227

PIC	***Legal name***
999630300	*INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER*

Short name: IFREMER

Address of the organisation

Street 155 rue Jean Jacques Rousseau

Town ISSY-LES-MOULINEAUX

Postcode 92138

Country France

Webpage http://www.ifremer.fr

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... unknown

International organisation of European interest .... unknown

Secondary or Higher education establishment .... unknown

Research organisation .... yes

Enterprise Data

SME self-declared status.. unknown

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

Department 1

Department name: Laboratoire d'Oceanographie Spatiale

☐ not applicable

☐ Same as organisation address

Street: ZI de la Pointe du Diable - CS10070

Town: Plouzane

Postcode: 29280

Country: France

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **IFREMER**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Bertrand** Last name: **Chapron**

E-Mail: **bertrand.chapron@ifremer.fr**

Position in org.: Head of Laboratory

Department: Laboratoire d'Oceanographie Spatiale ☐ Same as organisation

☐ Same as organisation address

Street: ZI de la Pointe du Diable - CS 10070

Town: Plouzane Post code: 29280

Country: France

Website: www.ifremer.fr

Phone 1: +33298224312 Phone 2: +xxx xxxxxxxxx Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Caroline	Gernez	caroline.gernez@ifremer.fr	+3398224287
Janick	Janick Vourch	janick.vourch@ifremer.fr	+33298224315
Fanny	Ardhuin	fanny.ardhuin@ifremer.fr	+33298224315

PIC	***Legal name***
999990267	*MAX PLANCK GESELLSCHAFT ZUR FOERDERUNG DER WISSENSCHAFTEN E.V.*

Short name: MPG

Address of the organisation

Street Hofgartenstrasse 8

Town MUENCHEN

Postcode 80539

Country Germany

Webpage www.mpg.de

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Legal person .... yes

Non-profit .... yes

International organisation .... no

International organisation of European interest .... no

Secondary or Higher education establishment .... no

Research organisation .... yes

Enterprise Data

SME self-declared status.. 2015 - no

SME self-assessment .... unknown

SME validation sme.. 2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **MPG**

Department(s) carrying out the proposed work

Department 1

Department name: Max Planck Institute for Biogeochemistry, Biogeochemical Systems ☐ not applicable

☐ Same as organisation address

Street: Hans-Knöll-Str. 10

Town: Jena

Postcode: 07745

Country: Germany

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **MPG**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: ◉ Male ○ Female

First name: **Mathias**
Last name: **Goeckede**

E-Mail: **mathias.goeckede@bgc-jena.mpg.de**

Position in org.: Research Scientist, Leader of the Research Group IPAS

Department: Max Planck Institut for Biogeochemistry, Biogeochemical Systems
☐ Same as organisation

☐ Same as organisation address

Street: Hans-Knöll-Str. 10

Town: Jena
Post code: 07745

Country: Germany

Website: https://www.bgc-jena.mpg.de/bgc-systems/index.shtml

Phone 1: +493641576309
Phone 2: +4915151106657
Fax: +493641577300

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Martin	Heimann	martin.heimann@bgc-jena.mpg.de	+493641576350
Corinne	Sacher	csacher@bgc-jena.mpg.de	+493641576202

PIC	***Legal name***
950397271	*EUROGOOS AISBL*

Short name: EUROGOOS

Address of the organisation

Street AVENUE LOUISE 231

Town BRUXELLES

Postcode 1050

Country Belgium

Webpage http://eurogoos.eu

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Non-profit .... yes

International organisation .... no

International organisation of European interest ...... no

Secondary or Higher education establishment .... no

Research organisation .... no

Legal person .... yes

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: ◉ Male ◯ Female

First name: **Erik**

Last name: **Erik Buch**

E-Mail: **erik.buch@eurogoos.eu**

Position in org.: Chair

Department: EUROGOOS AISBL

☒ Same as organisation

☒ Same as organisation address

Street: AVENUE LOUISE 231

Town: BRUXELLES

Post code: 1050

Country: Belgium

Website: www.eurogoos.eu

Phone 1: +4525249464

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Glenn	Nolan	glenn.nolan@eurogoos.eu	+32 (0) 22 383 790

PIC	***Legal name***
998669806	*FUNDACAO EUROCEAN*

Short name: EUROCEAN

Address of the organisation

Street AVENIDA DOM CARLOS I 126-2

Town LISBOA

Postcode 1249 074

Country Portugal

Webpage www.eurocean.org

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Non-profit ....yes

International organisation ....unknown

International organisation of European interest ......unknown

Secondary or Higher education establishment ....no

Research organisation ....unknown

Legal person .... yes

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Ned** Last name: **Dwyer**

E-Mail: **ned.dwyer@eurocean.org**

Position in org.: Executive-Director

Department: FUNDACAO EUROCEAN ☒ Same as organisation

☒ Same as organisation address

Street: AVENIDA DOM CARLOS I 126-2

Town: LISBOA Post code: 1249 074

Country: Portugal

Website: http://www.eurocean.org

Phone 1: +351 213 924 486 Phone 2: *+xxx xxxxxxxxx* Fax: +351 21 3 956 519

PIC	***Legal name***
999974844	*UNIVERSIDAD POLITECNICA DE MADRID*

Short name: UPM

Address of the organisation

Street CALLE RAMIRO DE MAEZTU 7 EDIFICIO REC

Town MADRID

Postcode 28040

Country Spain

Webpage www.upm.es

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... no

International organisation of European interest .... no

Secondary or Higher education establishment .... yes

Research organisation .... yes

Enterprise Data

SME self-declared status........ 2007 - no

SME self-assessment .... unknown

SME validation sme........ 2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name: Departamento de Matemática Aplicada a las TICs ☐ not applicable

☐ Same as organisation address

Street: ETSI Telecomunicación, Av Complutense 30

Town: Madrid

Postcode: 28040

Country: Spain

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **UPM**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Francisco** Last name: **Navarro**

E-Mail: **francisco.navarro@upm.es**

Position in org.: Profesor Titular

Department: Departamento de Matemática Aplicada a las TICs ☐ Same as organisation

☐ Same as organisation address

Street: ETSI Telecomunicación, Av Complutense 30

Town: Madrid Post code: 28040

Country: Spain

Website: http://www.mat.upm.es/

Phone 1: +34 914533565 Phone 2: +34 618444392 Fax: +34 913367289

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Javier Jesus	Lapazaran	javier.lapazaran@upm.es	+34915495700-2215
Jaime	Otero	jaime.otero@upm.es	+34915495700-2225

PIC	***Legal name***
999987454	*UNIVERSITAET BREMEN*

Short name: UB

Address of the organisation

Street Bibliothekstrasse 1

Town BREMEN

Postcode 28359

Country Germany

Webpage www.uni-bremen.de

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status..................................2007 - no

SME self-assessment .... unknown

SME validation sme..2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

Department 1

Department name	Institute of Environmental Physics
	☐ not applicable
	☐ Same as organisation address
Street	Otto Hahn Allee
Town	Bremen
Postcode	28334
Country	Germany

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **UB**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Georg**

Last name: **Heygster**

E-Mail: **heygster@uni-bremen.de**

Position in org.: Academic Director

Department: Institute of Environmental Physics

☐ Same as organisation

☐ Same as organisation address

Street: Otto Hahn-Allee

Town: Bremen

Post code: 28334

Country: Germany

Website: www.iup.uni-bremen.de

Phone 1: +49 421 218 62180

Phone 2: +xxx xxxxxxxxx

Fax: +49 421 218 98 62180

PIC	***Legal name***
999905101	*UNIVERSITAET HAMBURG*

Short name: UHAM

Address of the organisation

Street EDMUND-SIEMERS-ALLEE 1

Town HAMBURG

Postcode 20146

Country Germany

Webpage http://www.uni-hamburg.de/

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status..................................2012 - no

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name: Center für Erdsystemforschung und Nachhaltigkeit - CEN

☐ not applicable

☐ Same as organisation address

Street: Bundesstrasse 53-55

Town: Hamburg

Postcode: 20146

Country: Germany

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **UHAM**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.
Sex: (•) Male ( ) Female

First name: **Detlef**
Last name: **Stammer**

E-Mail: **detlef.stammer@uni-hamburg.de**

Position in org.: Professor and Director of CEN

Department: Institute of Oceanography | CEN
☐ Same as organisation

☐ Same as organisation address

Street: Bundesstrasse 53 - 55

Town: Hamburg
Post code: 20146

Country: Germany

Website: http://www.cen.uni-hamburg.de

Phone 1: +49 40 42838 5052
Phone 2: +49 40 42838 5449
Fax: +49 40 42838 7063

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Chenbo	Guo	chenbo.guo@uni-hamburg.de	+4940248387478
Sabine	Baars	sabine.baars@verw.uni-hamburg.de	+4940428389477

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NORUT**

PIC	***Legal name***
999621570	*NORTHERN RESEARCH INSTITUTE TROMSO AS*

Short name: NORUT

Address of the organisation

Street SYKEHUSVEIEN 21 FORSKNINGSPARKEN I T

Town TROMSO

Postcode 9294

Country Norway

Webpage

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Legal person .... yes

Non-profit ....yes

International organisation ....unknown

International organisation of European interest ......unknown

Secondary or Higher education establishment ....unknown

Research organisation ....yes

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: -

Department(s) carrying out the proposed work

Department 1

Department name: Earth Observation

☐ not applicable

☒ Same as organisation address

Street: SYKEHUSVEIEN 21 FORSKNINGSPARKEN I TROMS

Town: TROMSO

Postcode: 9294

Country: Norway

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NORUT**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: (•) Male ( ) Female

First name: **Agnar** Last name: **Sivertsen**

E-Mail: **agnar.sivertsen@norut.no**

Position in org.: Senior Scientist

Department: Earth Observation ☐ Same as organisation

☒ Same as organisation address

Street: SYKEHUSVEIEN 21 FORSKNINGSPARKEN I TROMSO

Town: TROMSO Post code: 9294

Country: Norway

Website: http://norut.no/en/user/791

Phone 1: +47 91838463 Phone 2: +xxx xxxxxxxxx Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Stian Andre	Solbø	stian.andre.solbo@norut.no	+4797586835
Camilla	Hegrand	camilla.hegrand@norut.no	+47 91626445
Rune	Storvold	rune.storvold@norut.no	+47 93416169

PIC	***Legal name***
999732829	*TERRADUE SRL*

Short name: TDUE

Address of the organisation

Street VIA G. LUNATI 10

Town FRASCATI

Postcode 00044

Country Italy

Webpage

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Non-profit .... no

International organisation .... no

International organisation of European interest .... no

Secondary or Higher education establishment .... no

Research organisation .... no

Legal person .... yes

Enterprise Data

SME self-declared status........ 2009 - yes

SME self-assessment .... unknown

SME validation sme........ 2008 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **TDUE**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Pedro**

Last name: **Goncalves**

E-Mail: **pedro.goncalves@terradue.com**

Position in org.: Director

Department: TERRADUE SRL

☒ Same as organisation

☐ Same as organisation address

Street: Via Giovanni Amendola 46

Town: Roma

Post code: 00185

Country: Italy

Website: http://www.terradue.com

Phone 1: +393406767340

Phone 2: *+xxx xxxxxxxxx*

Fax: *+xxx xxxxxxxxx*

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Fabrice	Brito	fabrice.brito@terradue.com	+393406767340

PIC	***Legal name***
998297908	*GRONLANDS NATURINSTITUT*

Short name: GINR

Address of the organisation

Street Kivioq 2

Town NUUK

Postcode 3900

Country Greenland

Webpage

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... unknown

International organisation of European interest ...... unknown

Secondary or Higher education establishment .... no

Research organisation .... yes

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: -

Department(s) carrying out the proposed work

Department 1

Department name	Greenland Climate Research Centre	☐ not applicable
	☒ Same as organisation address	
Street	Kivioq 2	
Town	NUUK	
Postcode	3900	
Country	Greenland	

Department 2

Department name	Department of Fish and Shellfish	☐ not applicable
	☒ Same as organisation address	
Street	Kivioq 2	
Town	NUUK	
Postcode	3900	
Country	Greenland	

Dependencies with other proposal participants

Character of dependence	*Participant*	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **GINR**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Thomas**

Last name: **Juul Pedersen**

E-Mail: **thpe@natur.gl**

Position in org.: Scientist & Education Coordinator

Department: Greenland Climate Research Centre

☐ Same as organisation

☐ Same as organisation address

Street: Kivioq 2; PO Box 570

Town: Nuuk

Post code: 3900

Country: Greenland

Website: www.natur.gl

Phone 1: +299 361200

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Malene J.	Simon	masi@natur.gl	+299361200

PIC	***Legal name***
999923337	*THE OPEN UNIVERSITY*

Short name: OU

Address of the organisation

Street WALTON HALL

Town MILTON KEYNES

Postcode MK7 6AA

Country United Kingdom

Webpage www.open.ac.uk

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status..................................2011 - no

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name	Environment, Earth and Ecosystems	☐ not applicable
	☒ Same as organisation address	
Street	WALTON HALL	
Town	MILTON KEYNES	
Postcode	MK7 6AA	
Country	United Kingdom	

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **OU**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Walter**

Last name: **Oechel**

E-Mail: **walter.oechel@open.ac.uk**

Position in org.: Professor of Biosphere Atmosphere Exchange

Department: Environment, Earth and Ecosystems

☐ Same as organisation

☒ Same as organisation address

Street: WALTON HALL

Town: MILTON KEYNES

Post code: MK7 6AA

Country: United Kingdom

Website: http://www.open.ac.uk/people/wco5

Phone 1: +441908332381

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Louise	Thomas	louise.thomas@open.ac.uk	+441908858509
Gemma	Maldar	gemma.maldar@open.ac.uk	+441908659521

PIC	***Legal name***
997826585	*NORSK INSTITUTT FOR VANNFORSKNING*

Short name: NIVA

Address of the organisation

Street GAUSTADALLEEN 21

Town OSLO

Postcode 0349

Country Norway

Webpage

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Non-profit ....yes

International organisation ....no

International organisation of European interest ....no

Secondary or Higher education establishment ....no

Research organisation ....yes

Legal person .... yes

Enterprise Data

SME self-declared status..........2013 - no

SME self-assessment .... unknown

SME validation sme.......... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name: Marine Biogeochemistry and Oceanography ☐ not applicable

☒ Same as organisation address

Street: GAUSTADALLEEN 21

Town: OSLO

Postcode: 0349

Country: Norway

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NIVA**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Andrew** Last name: **King**

E-Mail: **andrew.king@niva.no**

Position in org.: Research Scientist

Department: Marine Biogeochemistry and Oceanography ☐ Same as organisation

☒ Same as organisation address

Street: GAUSTADALLEEN 21

Town: OSLO Post code: 0349

Country: Norway

Website:

Phone 1: +47 98227725 Phone 2: +XXX XXXXXXXXX Fax: +XXX XXXXXXXXX

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Kai	Sørensen	kai.sorensen@niva.no	+47 90732129
Ståle	Mygland	stale.mygland@niva.no	+47 47015757
Kristoffer	Naes	kristoffer.naes@niva.no	+47 91337586

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **CNRS**

PIC	***Legal name***
999997930	*CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE*

Short name: CNRS

Address of the organisation

Street Rue Michel -Ange 3

Town PARIS

Postcode 75794

Country France

Webpage www.cnrs.fr

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... no

International organisation of European interest .... no

Secondary or Higher education establishment .... no

Research organisation .... yes

Enterprise Data

SME self-declared status.. 2013 - no

SME self-assessment .... unknown

SME validation sme.. 2013 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name: Laboratoire d'Oceanographie et du Climat (LOCEAN) ☐ not applicable

☐ Same as organisation address

Street: UPMC, Case 100, 4 place Jussieu

Town: Paris Cedex 05

Postcode: 75252

Country: France

Department 2

Department name: Institut Universitaire Européen de la Mer (IUEM) ☐ not applicable

☐ Same as organisation address

Street: Technopole Brest-Iroise

Town: Plouzané

Postcode: 29280

Country: France

Department 3

Department name: Laboratoire d"Océanographie de Villefranche-sur-Mer (LOV)

☐ not applicable

☐ Same as organisation address

Street: 181 Chemin du Lazaret

Town: Villefranche-sur-Mer Cedex

Postcode: 06230

Country: France

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **CNRS**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: ◯ Male ◉ Female

First name: **Marie-Noëlle**
Last name: **HOUSSAIS**

E-Mail: **mnh@locean-ipsl.upmc.fr**

Position in org.: Directrice de Recherches

Department: Laboratoire d'Oceanographie et du Climat (LOCEAN)
☐ Same as organisation

☐ Same as organisation address

Street: UPMC, Case 100, 4 place Jussieu

Town: Paris Cedex 05
Post code: 75252

Country: France

Website: https://www.locean-ipsl.upmc.fr/

Phone 1: 33 1 44 27 61 02
Phone 2: +xxx xxxxxxxxx
Fax: +xxx xxxxxxxxx

Other contact persons

First Name	*Last Name*	*E-mail*	*Phone*
Julie	Zittel	spv@dr2.cnrs.fr	
Jenna	Couffin	jenna.couffin@dr2.cnrs.fr	

PIC	***Legal name***
999994535	*HELSINGIN YLIOPISTO*

Short name: U Helsinki

Address of the organisation

Street YLIOPISTONKATU 4

Town HELSINGIN YLIOPISTO

Postcode 00014

Country Finland

Webpage www.helsinki.fi

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status.................................2007 - yes

SME self-assessment .... unknown

SME validation sme.......................................2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name: Department of Physics ☐ not applicable

☐ Same as organisation address

Street: Gustaf Hällströmin katu 2a

Town: Helsinki

Postcode: FI-00560

Country: Finland

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **U Helsinki**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: ○ Male ◉ Female

First name: **Hanna K**

Last name: **Lappalainen**

E-Mail: **hanna.k.lappalainen@helsinki.fi**

Position in org.: Research Coordinator

Department: Department of Physics

☐ Same as organisation

☐ Same as organisation address

Street: Gustaf Hällströmin katu 2a

Town: Helsinki

Post code: FI-00014

Country: Finland

Website: http://www.physics.helsinki.fi/tutkimus/atm/english/

Phone 1: +358504341710

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

PIC	***Legal name***
999994341	*HELMHOLTZ ZENTRUM POTSDAM DEUTSCHES GEOFORSCHUNGSZENTRUM*

Short name: GFZ

Address of the organisation

Street TELEGRAFENBERG 17

Town POTSDAM

Postcode 14473

Country Germany

Webpage www.gfz-potsdam.de

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....unknown

International organisation of European interest ......unknown

Secondary or Higher education establishment ....unknown

Research organisation ....yes

Enterprise Data

SME self-declared status.................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 7210 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name: Dept. 1: Geodesy, Section:1.4 Remote Sensing

☐ not applicable

☒ Same as organisation address

Street: TELEGRAFENBERG 17

Town: POTSDAM

Postcode: 14473

Country: Germany

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **GFZ**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (●) Male ( ) Female

First name: **Torsten**

Last name: **Sachs**

E-Mail: **torsten.sachs@gfz-potsdam.de**

Position in org.: Senior Scientist

Department: Dept. 1: Geodesy, Section:1.4 Remote Sensing

☐ Same as organisation

☒ Same as organisation address

Street: TELEGRAFENBERG 17

Town: POTSDAM

Post code: 14473

Country: Germany

Website:

Phone 1: +49 331 288-1423

Phone 2: +xxx xxxxxxxxx

Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Andreas	Küppers	epo@gfz-potsdam.de	+49 331 288-1030

PIC	***Legal name***
999981246	*ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT DES METHODES ET PROCESS*

Short name: ARMINES

Address of the organisation

Street BOULEVARD SAINT MICHEL 60

Town PARIS

Postcode 75272

Country France

Webpage www.armines.net

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Legal person .... yes

Non-profit .... yes

International organisation .... unknown

International organisation of European interest .... unknown

Secondary or Higher education establishment .... unknown

Research organisation .... yes

Enterprise Data

SME self-declared status .... 2007 - no

SME self-assessment .... unknown

SME validation sme .... 2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name	ARMINES Centre de Géosciences	☐ not applicable
	☐ Same as organisation address	
Street	35, rue Saint-Honoré	
Town	Fontainebleau	
Postcode	77300	
Country	France	

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **ARMINES**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.   Sex: (•) Male ( ) Female

First name: **Hans**   Last name: **Wackernagel**

E-Mail: **hans.wackernagel@mines-paristech.fr**

Position in org.: Researcher

Department: Centre de Géosciences   ☐ Same as organisation

☐ Same as organisation address

Street: 35, rue Saint-Honoré

Town: Fontainebleau   Post code: 77300

Country: France

Website: http://www.geosciences.mines-paristech.fr/fr

Phone 1: +33164694760   Phone 2: +xxx xxxxxxxxx   Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Louise	Théodon	louise.theodon@mines-paristech.fr	+33140519307
François	Job	francois.job@mines-paristech.fr	

PIC	***Legal name***
996625337	*Instytut Geofizyki Polskiej Akademii Nauk*

Short name: IGPAN

Address of the organisation

Street Ksiecia Janusza 64

Town Warsaw

Postcode 01-452

Country Poland

Webpage www.igf.edu.pl

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Enterprise Data

SME self-declared status.................................2010 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name: Polar and Marine Research Department

☐ not applicable

☒ Same as organisation address

Street: Ksiecia Janusza 64

Town: Warsaw

Postcode: 01-452

Country: Poland

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **IGPAN**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.
Sex: (•) Male ( ) Female

First name **Piotr** Last name **Glowacki**

E-Mail **glowacki@igf.edu.pl**

Position in org.: Head of Department

Department: Instytut Geofizyki Polskiej Akademii Nauk ☒ Same as organisation

☒ Same as organisation address

Street: Ksiecia Janusza 64

Town: Warsaw Post code: 01-452

Country: Poland

Website: www.igf.edu.pl

Phone 1: +48-22-6915890 Phone 2: +48-605-314338 Fax: +48-22-8776721

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Wlodzimierz	Sielski	sielski@igf.edu.pl	+48-22-6915979

PIC	***Legal name***
999917614	*UNIWERSYTET SLASKI*

Short name: U Slaski

Address of the organisation

Street Bankowa 12

Town KATOWICE

Postcode 40-007

Country Poland

Webpage www.us.edu.pl

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....unknown

International organisation of European interest ......unknown

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status...................................2007 - no

SME self-assessment .... unknown

SME validation sme...2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name	Faculty of Earth Sciences, Centre for Polar Studies
	☐ not applicable
	☐ Same as organisation address
Street	Bedzinska 60
Town	Sosnowiec
Postcode	41-200
Country	Poland

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **U Slaski**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title Dr. Sex (•) Male ( ) Female

First name **Mariusz** Last name **Grabiec**

E-Mail **gramariusz@gmail.com**

Position in org. Researcher

Department Faculty of Earth Sciences, Centre for Polar Studies ☐ Same as organisation

☐ Same as organisation address

Street Bedzinska 60

Town Sosnowiec Post code 41-200

Country Poland

Website www.wnoz.us.edu.pl, www.polarknow.us.edu.pl/en/csp-2/

Phone 1 +48323689589 Phone 2 +xxx xxxxxxxxx Fax +48322915865

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Jacek	Jania	jam.jania@gmail.com	+48323689397
Ewelina	Doluk	ewelina.doluk@us.edu.pl	+48323592265

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **BSC**

PIC	***Legal name***
999655520	*BARCELONA SUPERCOMPUTING CENTER - CENTRO NACIONAL DE SUPERCOMPUTACION*

Short name: BSC

Address of the organisation

Street Calle Jordi Girona 31

Town BARCELONA

Postcode 08034

Country Spain

Webpage www.bsc.es

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Enterprise Data

SME self-declared status.................................2011 - no

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 72 - Scientific research and development

Department(s) carrying out the proposed work

Department 1

Department name	Earth Science
☐ not applicable	
☐ Same as organisation address	
Street	Jordi Girona Street, 29
Town	Barcelona
Postcode	08034
Country	Spain

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **BSC**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: ○ Male ◉ Female

First name: **Virginie**
Last name: **Guemas**

E-Mail: **virginie.guemas@bsc.es**

Position in org.: CLIMATE PREDICTION GROUP MANAGER

Department: Earth Science
☐ Same as organisation

☐ Same as organisation address

Street: Jordi Girona Street, 29

Town: Barcelona
Post code: 08034

Country: Spain

Website: www.bsc.es

Phone 1: +34934137679
Phone 2: +xxx xxxxxxxxx
Fax: +xxx xxxxxxxxx

Other contact persons

First Name	Last Name	E-mail	Phone
Marina	Azor	marina.azor@bsc.es	+34934134082

PIC	***Legal name***
999929060	*DNV GL AS*

Short name: DNV GL

Address of the organisation

Street VERITASVEIEN 1

Town HOVIK

Postcode 1363

Country Norway

Webpage www.dnv.com

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Legal person .... yes

Non-profit ....no

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....no

Enterprise Data

SME self-declared status.................................2012 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 93 - Sports activities and amusement and recreation activities

Department(s) carrying out the proposed work

Department 1

Department name: OENNO615 Environmental Monitoring ☐ not applicable

☒ Same as organisation address

Street: VERITASVEIEN 1

Town: HOVIK

Postcode: 1363

Country: Norway

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **DNV GL**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Mr.
Sex: (•) Male ( ) Female

First name: **Pål**
Last name: **Rylandsholm**

E-Mail: **pal.rylandsholm@dnvgl.com**

Position in org.: Head Of Section

Department: OENNO615 Environmental Monitoring
[ ] Same as organisation

[x] Same as organisation address

Street: VERITASVEIEN 1

Town: HOVIK
Post code: 1363

Country: Norway

Website: www.dnvgl.com

Phone 1: +47 976 73 822
Phone 2: +47 67 57 99 00
Fax: +XXX XXXXXXXXX

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Per Olav	Moslet	per.olav.moslet@dnvgl.com	+4767 57 99 00
Øyvind	Endresen	oyvind.endresen@dnvgl.com	+4767 57 99 00

PIC	***Legal name***
952856803	*SEASCAPE CONSULTANTS LTD*

Short name: Seascape

Address of the organisation

Street BELBINS VALLEY BELBINS

Town ROMSEY HAMPSHIRE

Postcode SO51 0PE

Country United Kingdom

Webpage www.seascapeconsultants.co.uk

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Legal person .... yes

Non-profit ....no

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....no

Enterprise Data

SME self-declared status.................................2012 - yes

SME self-assessment .... unknown

SME validation sme.......................................2012 - yes

Based on the above details of the Beneficiary Registry the organisation is an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	*Participant*	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **Seascape**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: ○ Male ◉ Female

First name: **Vikki**

Last name: **Gunn**

E-Mail: **vikki.gunn@seascapeconsultants.co.uk**

Position in org.: Director

Department: SEASCAPE CONSULTANTS LTD

☒ Same as organisation

☒ Same as organisation address

Street: BELBINS VALLEY BELBINS

Town: ROMSEY HAMPSHIRE

Post code: SO51 0PE

Country: United Kingdom

Website: www.seascapeconsultants.co.uk

Phone 1: 00441794367797

Phone 2: *+XXX XXXXXXXXX*

Fax: *+XXX XXXXXXXXX*

PIC	***Legal name***
998049685	*Scientific foundation Nansen International Environmental and Remote Sensing Centre*

Short name: NIERSC

Address of the organisation

Street 14th Line Street 7A

Town St. Petersburg

Postcode 199034

Country Russian Federation

Webpage http://www.niersc.spb.ru

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Legal person .... yes

Enterprise Data

SME self-declared status.................................2007 - no

SME self-assessment .... unknown

SME validation sme.......................................2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

No departement involved

Department name [ ] ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: ◉ Male ○ Female

First name: **Leonid**
Last name: **Bobylev**

E-Mail: **leonid.bobylev@niersc.spb.ru**

Position in org.: Managing Director

Department: Scientific foundation Nansen International Environmental and Remo
☒ Same as organisation

☒ Same as organisation address

Street: 14th Line Street 7A

Town: St. Petersburg
Post code: 199034

Country: Russian Federation

Website: http://www.niersc.spb.ru

Phone 1: +7 (812) 324 51 03
Phone 2: +XXX XXXXXXXXX
Fax: +7 (812) 324 51 02

PIC	***Legal name***
998794063	*WOODS HOLE OCEANOGRAPHIC INSTITUTION*

Short name: WHOI

Address of the organisation

Street WOODS HOLE ROAD 573

Town WOODS HOLE

Postcode 02543

Country United States

Webpage www.whoi.edu

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... no

Legal person .... yes

Non-profit .... yes

International organisation .... unknown

International organisation of European interest .... unknown

Secondary or Higher education establishment .... yes

Research organisation .... yes

Enterprise Data

SME self-declared status.. 2007 - yes

SME self-assessment .... unknown

SME validation sme.. 2007 - no

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: -

Department(s) carrying out the proposed work

No departement involved

Department name [ ] ☒ not applicable

☐ Same as organisation address

Street: *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **WHOI**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: (•) Male ( ) Female

First name **John** Last name **Toole**

E-Mail **jtoole@whoi.edu**

Position in org.: Senior Scientist

Department: Physical Oceanography
☐ Same as organisation

☒ Same as organisation address

Street: WOODS HOLE ROAD 573

Town: WOODS HOLE Post code: 02543

Country: United States

Website: https://www.whoi.edu/more.go?username=jtoole

Phone 1: +1 508 289 2531 Phone 2: +xxx xxxxxxxxx Fax: +1 508 457 2181

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **SIO**

PIC	***Legal name***
922320136	*University of California, San Diego*

Short name: SIO

Address of the organisation

Street 9500 Gilman Drive

Town La Jolla

Postcode

Country United States

Webpage

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... unknown
Legal person .... yes
Non-profit .... unknown
International organisation .... unknown
International organisation of European interest .... unknown
Secondary or Higher education establishment .... unknown
Research organisation .... unknown

Enterprise Data

SME self-declared status .... unknown
SME self-assessment .... unknown
SME validation sme .... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: P - Education

Department(s) carrying out the proposed work

Department 1

Department name: Scripps Institution of Oceanography, UC San Diego

☐ not applicable

☐ Same as organisation address

Street: 9500 Gilman Drive, 0225

Town: La Jolla, CA 92093

Postcode: 0225

Country: United States

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **SIO**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Peter** Last name: **Worchester**

E-Mail: **pworcester@ucsd.edu**

Position in org.: Research Oceanographer

Department: Scripps Institute of Oceanography ☐ Same as organisation

☐ Same as organisation address

Street: 9500 Gilman Drive, 0225

Town: La Jolla, CA 92093 Post code: 0225

Country: United States

Website: https://scripps.ucsd.edu

Phone 1: +1 (858)534-4688 Phone 2: +1 858-534-3624 Fax: +XXX XXXXXXXXX

PIC	***Legal name***
987205958	*University of Alaska*

Short name: UAF

Address of the organisation

Street North Koyukuk Drive 902

Town Fairbanks

Postcode 99775

Country United States

Webpage www.iab.uaf.edu

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status................................. unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 721 - Research and experimental development on natural sciences and engineering

Department(s) carrying out the proposed work

Department 1

Department name	International Arctic Research Center
	☐ not applicable
	☐ Same as organisation address
Street	930 Koyukuk Dr.
Town	Fairbanks
Postcode	99775
Country	United States

Dependencies with other proposal participants

Character of dependence	*Participant*	

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.
Sex: (●) Male ( ) Female

First name: **Hajo**
Last name: **Eicken**

E-Mail: **heicken@alaska.edu**

Position in org.: Director

Department: International Arctic Research Center
☐ Same as organisation

☐ Same as organisation address

Street: 930 Koyukuk Dr.

Town: Fairbanks
Post code: 99775

Country: United States

Website: iarc.uaf.edu

Phone 1: +001 9074747280
Phone 2: *+xxx xxxxxxxxx*
Fax: *+xxx xxxxxxxxx*

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **JPL**

PIC	***Legal name***
925539566	*Jet Propulsion Laboratory, California Institute of Technology*

Short name: JPL

Address of the organisation

Street 4800 Oak Grove Drive

Town Pasadena, CA

Postcode 91109

Country United States

Webpage www.jpl.nasa.gov/

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Enterprise Data

SME self-declared status..................................2015 - no

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: -

Department(s) carrying out the proposed work

No departement involved

Department name: ☒ not applicable

☐ Same as organisation address

Street: *Please enter street name and number.*

Town:

Postcode:

Country:

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **JPL**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: ◉ Male ○ Female

First name: **Ronald** Last name: **Kwok**

E-Mail: **ronald.kwok@jpl.nasa.gov**

Position in org.: Senior Research Scientist

Department: Jet Propulsion Laboratory, California Institute of Technology ☒ Same as organisation

☒ Same as organisation address

Street: 4800 Oak Grove Drive

Town: Pasadena, CA Post code: 91109

Country: United States

Website: http://www.jpl.nasa.gov

Phone 1: +1 818 354 5614 Phone 2: +xxx xxxxxxxxx Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Benjamin	Holt	benjamin.m.holt@jpl.nasa.gov	+1 8183545473

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **U Laval**

PIC	***Legal name***
998082180	*UNIVERSITE LAVAL*

Short name: U Laval

Address of the organisation

Street ALLEE DES BIBLIOTHEQUES 2345

Town QUEBEC

Postcode G1V 0A6

Country Canada

Webpage http://www.ulaval.ca

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....yes

Enterprise Data

SME self-declared status.................................2010 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

Department 1

Department name: Département de biologie

☐ not applicable

☐ Same as organisation address

Street: 1045, avenue de la Médecine

Town: Québec, QC

Postcode: G1V 0A6

Country: Canada

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **U Laval**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.
Sex: (•) Male ( ) Female

First name: **Louis**
Last name: **Fortier**

E-Mail: **louis.fortier@bio.ulaval.ca**

Position in org.: Professor
Department: Biology
☐ Same as organisation

☐ Same as organisation address

Street: 1045, avenue de la Médecine
Town: Québec, QC
Post code: G1V 0A6
Country: Canada
Website: http://www.arcticnet.ulaval.ca

Phone 1: +1-418-656-5646
Phone 2: +xxx xxxxxxxxx
Fax: +1-418-656-2339

PIC	***Legal name***
986196188	*UNIVERSITY OF VICTORIA*

Short name: UVIC

Address of the organisation

Street FINNERTY ROAD 3800

Town VICTORIA

Postcode V8P 5C2

Country Canada

Webpage www.uvic.ca

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....yes

Research organisation ....no

Legal person .... yes

Enterprise Data

SME self-declared status.................................2010 - no

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 853 - Higher education

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **UVIC**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: ◯ Male ◉ Female

First name: **Kate**
Last name: **Moran**

E-Mail: **kmoran@uvic.ca**

Position in org.: President and Chief Executive Officer, Ocean Networks Canada

Department: UNIVERSITY OF VICTORIA ☒ Same as organisation

☒ Same as organisation address

Street: FINNERTY ROAD 3800

Town: VICTORIA Post code: V8P 5C2

Country: Canada

Website: http://www.oceannetworks.ca

Phone 1: +1 2504725350 Phone 2: +xxx xxxxxxxxx Fax: +xxx xxxxxxxxx

PIC	***Legal name***
928394858	*National Marine Environmental Forecasting Center*

Short name: NMEFC

Address of the organisation

Street No.8 Dahuisi Road, haidian district

Town Beijing

Postcode 100081

Country China (People's Republic of)

Webpage http://www.nmefc.gov.cn/

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... unknown

Legal person .... yes

Non-profit .... unknown

International organisation .... unknown

International organisation of European interest .... unknown

Secondary or Higher education establishment .... unknown

Research organisation .... unknown

Enterprise Data

SME self-declared status.. unknown

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: 72 - Scientific research and development

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NMEFC**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Yang** Last name: **Qinghua**

E-Mail: **yqh@nmefc.gov.cn**

Position in org.: Professor / Deputy Department Leader

Department: National Marine Environmental Forecasting Center ☒ Same as organisation

☒ Same as organisation address

Street: No.8 Dahuisi Road, haidian district

Town: Beijing Post code: 100081

Country: China (People's Republic of)

Website: http://english.nmefc.gov.cn/

Phone 1: Phone 2: *+XXX XXXXXXXXX* Fax: *+XXX XXXXXXXXX*

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **PRIC**

PIC	***Legal name***
991505968	*Polar Research Institute of China*

Short name: PRIC

Address of the organisation

Street Jinqiao Road 451

Town Shanghai

Postcode 200136

Country China (People's Republic of)

Webpage

Legal Status of your organisation

Research and Innovation legal statuses

Public body .... yes

Legal person .... yes

Non-profit .... yes

International organisation .... no

International organisation of European interest .... no

Secondary or Higher education establishment .... no

Research organisation .... yes

Enterprise Data

SME self-declared status .... unknown

SME self-assessment .... unknown

SME validation sme .... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

No departement involved

Department name ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **PRIC**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.

Sex: (•) Male ( ) Female

First name: **Sun** Last name: **Bo**

E-Mail: **sunbo@pric.gov.cn**

Position in org.: Deputy Director

Department: Polar Research Institute of China ☒ Same as organisation

☒ Same as organisation address

Street: Jinqiao Road 451

Town: Shanghai Post code: 200136

Country: China (People's Republic of)

Website:

Phone 1: Phone 2: +xxx xxxxxxxxx Fax: +xxx xxxxxxxxx

Other contact persons

First Name	***Last Name***	***E-mail***	***Phone***
Lei	Ruibo	leiruibo@pric.gov.cn	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **RADI**

PIC	***Legal name***
999889387	*INSTITUTE OF REMOTE SENSING AND DIGITAL EARTH - CHINESE ACADEMY OF SCIENCE*

Short name: RADI

Address of the organisation

Street North no JIA-20, Datun Road, An Ding Men Wa

Town BEIJING

Postcode 100101

Country China (People's Republic of)

Webpage

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....yes

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Enterprise Data

SME self-declared status..................................2013 - no

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: - - Not applicable

Department(s) carrying out the proposed work

No departement involved

Department name [ ] ☒ not applicable

☐ Same as organisation address

Street *Please enter street name and number.*

Town

Postcode

Country

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **RADI**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title	Dr.	Sex	(●) Male ( ) Female
First name	**Yubao**	Last name	**Qiu**
E-Mail	**qiuyb@radi.ac.cn**		
Position in org.	Associate Professor		
Department	Institute of Remote Sensing and Digital Earth, CAS	☐ Same as organisation	
	☐ Same as organisation address		
Street	No.9 Dengzhuang South Road, Haidian District		
Town	Beijing	Post code	100094
Country	China (People's Republic of)		
Website	http://www.radi.ac.cn/		
Phone 1	+86 10 8217 8101	Phone 2	*+xxx xxxxxxxxx*
Fax	*+xxx xxxxxxxxx*		

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NIPR**

PIC	***Legal name***
922426642	*National Institute of Polar Research*

Short name: NIPR

Address of the organisation

Street 10-3 Midori-cho

Town Tachikawa

Postcode 190-8518

Country Japan

Webpage http://www.nipr.ac.jp/english/

Legal Status of your organisation

Research and Innovation legal statuses

Public body	unknown	Legal person	yes
Non-profit	unknown		
International organisation	unknown		
International organisation of European interest	unknown		
Secondary or Higher education establishment	unknown		
Research organisation	unknown		

Enterprise Data

SME self-declared status .... unknown

SME self-assessment .... unknown

SME validation sme....................................... unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: -

Department(s) carrying out the proposed work

Department 1

Department name	Arctic Environment Research Center	☐ not applicable
	☒ Same as organisation address	
Street	10-3 Midori-cho	
Town	Tachikawa	
Postcode	190-8518	
Country	Japan	

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **NIPR**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Prof.

Sex: (•) Male ( ) Female

First name: **Hiroshi** Last name: **Miyaoka**

E-Mail: **miyaoka@nipr.ac.jp**

Position in org.: Vice director of Arctic Environment Research Center

Department: Arctic Environment Research Center ☐ Same as organisation

☒ Same as organisation address

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Phone 1: +81 425120662 Phone 2: *+xxx xxxxxxxxx* Fax: *+xxx xxxxxxxxx*

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **KOPRI**

PIC	***Legal name***
998097021	*KOREA OCEAN RESEARCH AND DEVELOPMENT INSTITUTE*

Short name: KOPRI

Address of the organisation

Street SADONG,SANGROK 1270

Town ANSAN

Postcode 426-744

Country Korea (Republic of)

Webpage www.kordi.re.kr

Legal Status of your organisation

Research and Innovation legal statuses

Public body ....no

Legal person .... yes

Non-profit ....yes

International organisation ....no

International organisation of European interest ......no

Secondary or Higher education establishment ....no

Research organisation ....yes

Enterprise Data

SME self-declared status.................................. unknown

SME self-assessment .... unknown

SME validation sme.. unknown

Based on the above details of the Beneficiary Registry the organisation is not an SME (small- and medium-sized enterprise) for the call.

NACE Code: -

Department(s) carrying out the proposed work

Department 1

Department name	Korea Polar Research Institute
	☐ not applicable
	☐ Same as organisation address
Street	26 Songdomirae-ro
Town	Yeonsu-gu, Incheon
Postcode	21990
Country	Korea (Republic of)

Dependencies with other proposal participants

Character of dependence	***Participant***	

Proposal ID **727890** *Acronym* **INTAROS** *Short name* **KOPRI**

Person in charge of the proposal

The name and e-mail of contact persons are read-only in the administrative form, only additional details can be edited here. To give access rights and basic contact details of contact persons, please go back to Step 4 of the submission wizard and save the changes.

Title: Dr.
Sex: (•) Male ( ) Female

First name: **Yea-Dong**
Last name: **Kim**

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Department: Korea Polar Research Institute
☐ Same as organisation

☐ Same as organisation address

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JeongWon	Park	jeongwonpark@kopri.re.kr	

Proposal ID **727890** *Acronym* **INTAROS**

3 - Budget for the proposal

No	Participant	Country	(A) Direct personnel costs/€	(B) Other direct costs/€	(C) Direct costs of sub-contracting/€	(D) Direct costs of providing financial support to third parties/€	(E) Costs of inkind contributions not used on the beneficiary's premises/€	(F) Indirect Costs / € (=0.25(A+B-E))	(G) Special unit costs covering direct & indirect costs / €	(H) Total estimated eligible costs / € (=A+B+C+D+F +G)	(I) Reimburse-ment rate (%)	(J) Max.EU Contribution / € (=H*I)	(K) Requested EU Contribution/ €
1	Nersc	NO	1096453	300000	0	0	0	349113,25	0	1745566,25	100	1745566,25	1745566,25
2	Uib	NO	515565	442500	22200	0	0	239516,25	0	1219781,25	100	1219781,25	1219781,25
3	Imr	NO	652005	122500	0	0	0	193626,25	0	968131,25	100	968131,25	968131,25
4	Misu	SE	172600	40000	0	0	0	53150,00	0	265750,00	100	265750,00	265750,00
5	Awi	DE	290249	354500	0	0	0	161187,25	0	805936,25	100	805936,25	805936,25
6	Io Pan	PL	181000	692500	0	0	0	218375,00	0	1091875,00	100	1091875,00	1091875,00
7	Dtu	DK	406934	14500	0	0	0	105358,50	0	526792,50	100	526792,50	526792,50
8	Au	DK	422775	151000	30240	0	0	143443,75	0	747458,75	100	747458,75	747458,75
9	Geus	DK	484938	268500	0	0	0	188359,50	0	941797,50	100	941797,50	941797,50
10	Fmi	FI	496900	103500	0	0	0	150100,00	0	750500,00	100	750500,00	750500,00

Proposal ID **727890** *Acronym* **INTAROS**

11	Unis	NO	0	75000	0	0	0	18750,00	0	93750,00	100	93750,00	93750,00
12	Nordeco	DK	256310	292941	51000	0	0	137312,75	0	737563,75	100	737563,75	737563,75
13	Smhi	SE	215500	10000	0	0	0	56375,00	0	281875,00	100	281875,00	281875,00
14	Usfd	UK	154652	24500	0	0	0	44788,00	0	223940,00	100	223940,00	223940,00
15	Nuim	IE	62671	8000	0	0	0	17667,75	0	88338,75	100	88338,75	88338,75
16	Ifremer	FR	127618	26500	0	0	0	38529,50	0	192647,50	100	192647,50	192647,50
17	Mpg	DE	309900	226000	0	0	0	133975,00	0	669875,00	100	669875,00	669875,00
18	Eurogoos	BE	124500	10000	0	0	0	33625,00	0	168125,00	100	168125,00	168125,00
19	Eurocean	PT	53627	64450	0	0	0	29519,25	0	147596,25	100	147596,25	147596,25
20	Upm	ES	130272	22000	0	0	0	38068,00	0	190340,00	100	190340,00	190340,00
21	Ub	DE	145000	5000	0	0	0	37500,00	0	187500,00	100	187500,00	187500,00
22	Uham	DE	187500	42000	0	0	0	57375,00	0	286875,00	100	286875,00	286875,00
23	Norut	NO	23611	7000	0	0	0	7652,75	0	38263,75	100	38263,75	38263,75
24	Tdue	IT	338250	45250	0	0	0	95875,00	0	479375,00	100	479375,00	479375,00
25	Ginr	GL	33470	10000	0	0	0	10867,50	0	54337,50	100	54337,50	54337,50

Proposal ID **727890** *Acronym* **INTAROS**

26	Ou	UK	251552	171450	0	0	0	105750,50	0	528752,50	100	528752,50	528752,50
27	Niva	NO	212125	143000	0	0	0	88781,25	0	443906,25	100	443906,25	443906,25
28	Cnrs	FR	152100	490000	67000	0	0	160525,00	0	869625,00	100	869625,00	869625,00
29	U Helsinki	FI	55530	7000	0	0	0	15632,50	0	78162,50	100	78162,50	78162,50
30	Gfz	DE	189637	10000	0	0	0	49909,25	0	249546,25	100	249546,25	249546,25
31	Armines	FR	101800	7000	0	0	0	27200,00	0	136000,00	100	136000,00	136000,00
32	Igpan	PL	10000	10000	0	0	0	5000,00	0	25000,00	100	25000,00	25000,00
33	U Slaski	PL	5000	9000	0	0	0	3500,00	0	17500,00	100	17500,00	17500,00
34	Bsc	ES	45000	5000	0	0	0	12500,00	0	62500,00	100	62500,00	62500,00
35	Dnv Gl	NO	130126	10000	0	0	0	35031,50	0	175157,50	100	175157,50	175157,50
36	Seascape	UK	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
37	Niersc	RU	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
38	Whoi	US	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
39	Sio	US	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
40	Uaf	US	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00

Proposal ID **727890** *Acronym* **INTAROS**

41	Jpl	US	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
42	U Laval	CA	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
43	Uvic	CA	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
44	Nmefc	CN	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
45	Pric	CN	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
46	Radi	CN	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
47	Nipr	JP	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
48	Kopri	KR	0	0	0	0	0	0,00	0	0,00	100	0,00	0,00
	Total		8035170	4220591	170440	0	0	3063940,25	0	15490141,25		15490141,25	15490141,25

4 - Ethics issues table

1. HUMAN EMBRYOS/FOETUSES		Page
Does your research involve Human Embryonic Stem Cells (hESCs)?	○Yes ◉No	
Does your research involve the use of human embryos?	○Yes ◉No	
Does your research involve the use of human foetal tissues / cells?	○Yes ◉No	
2. HUMANS		**Page**
Does your research involve human participants?	○Yes ◉No	
Does your research involve physical interventions on the study participants?	○Yes ◉No	
3. HUMAN CELLS / TISSUES		**Page**
Does your research involve human cells or tissues (other than from Human Embryos/ Foetuses, i.e. section 1)?	○Yes ◉No	
4. PERSONAL DATA		**Page**
Does your research involve personal data collection and/or processing?	○Yes ◉No	
Does your research involve further processing of previously collected personal data (secondary use)?	○Yes ◉No	
5. ANIMALS		**Page**
Does your research involve animals?	○Yes ◉No	
6. THIRD COUNTRIES		**Page**
In case non-EU countries are involved, do the research related activities undertaken in these countries raise potential ethics issues?	○Yes ◉No	
Do you plan to use local resources (e.g. animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?	○Yes ◉No	
Do you plan to import any material - including personal data - from non-EU countries into the EU? *For data imports, please fill in also section 4.* *For imports concerning human cells or tissues, fill in also section 3.*	○Yes ◉No	
Do you plan to export any material - including personal data - from the EU to non-EU countries? *For data exports, please fill in also section 4.* *For exports concerning human cells or tissues, fill in also section 3.*	○Yes ◉No	

If your research involves low and/or lower middle income countries, are benefits-sharing actions planned?	○ Yes ◉ No	
Could the situation in the country put the individuals taking part in the research at risk?	○ Yes ◉ No	
7. ENVIRONMENT & HEALTH and SAFETY		Page
Does your research involve the use of elements that may cause harm to the environment, to animals or plants? *For research involving animal experiments, please fill in also section 5.*	○ Yes ◉ No	
Does your research deal with endangered fauna and/or flora and/or protected areas?	○ Yes ◉ No	
Does your research involve the use of elements that may cause harm to humans, including research staff? *For research involving human participants, please fill in also section 2.*	○ Yes ◉ No	
8. DUAL USE		Page
Does your research have the potential for military applications?	○ Yes ◉ No	
9. MISUSE		Page
Does your research have the potential for malevolent/criminal/terrorist abuse?	○ Yes ◉ No	
10. OTHER ETHICS ISSUES		Page
Are there any other ethics issues that should be taken into consideration? Please specify	○ Yes ◉ No	

I confirm that I have taken into account all ethics issues described above and that, if any ethics issues apply, I will complete the ethics self-assessment and attach the required documents. ☒

How to Complete your Ethics Self-Assessment

5 - Call specific questions

Open Research Data Pilot in Horizon 2020

If selected, all applicants will participate in the Pilot on Open Research Data in Horizon 2020[1] , which aims to improve and maximise access to and re-use of research data generated by actions. Participating in the Pilot does not necessarily mean opening up all research data. Actions participating in the Pilot will be invited to formulate a Data Management Plan in which they will determine and explain which of the research data they generate will be made open.

Applicants have the possibility to opt out of this Pilot and must indicate a reason for this choice.

Participation in this Pilot does not constitute part of the evaluation process. Proposals will not be evaluated favourably because they are part of the Pilot and will not be penalised for opting out of the Pilot.

We wish to opt out of the Pilot on Open Research Data in Horizon 2020.	○ Yes	◉ No

[1] According to article 43.2 of 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)" and repealing Regulation (EC) No 1906/2006.

Data management activities

The use of a Data Management Plan (DMP) is required for projects participating in the Open Research Data Pilot in Horizon 2020, in the form of a deliverable in the first 6 months of the project.

All other projects may deliver a DMP on a voluntary basis, if relevant for their research.

Are data management activities relevant for your proposed project?	◉ Yes	○ No

A Data Management Plan will be delivered (Please note: Projects participating in the Open Research Data Pilot **must** include a Data Management Plan as a deliverable in the first 6 months of the project).	☒
Data Management is part of a Work Package.	☒
Data Management will be integrated in another way.	☐

Title: **INT**egrated **ARct**ic **O**bservation **S**ystem

Proposal acronym: **INTAROS**

Type of action: Research and Innovation Action

Call identifier: H2020-BG-09-2016 An integrated Arctic observation system

No	Acronym	Participant Legal Name Country	Country
1	NERSC	STIFTELSEN NANSEN SENTER FOR MILJOOG FJERNMALING	NO
2	UiB	UNIVERSITETET I BERGEN	NO
3	IMR	HAVFORSKNINGSINSTITUTTET	NO
4	MISU	STOCKHOLMS UNIVERSITET	SE
5	AWI	ALFRED-WEGENER-INSTITUT	DE
6	IOPAN	INSTYTUT OCEANOLOGII POLSKIEJ AKADEMII NAUK	PL
7	DTU	DANMARKS TEKNISKE UNIVERSITET	DK
8	AU	AARHUS UNIVERSITET	DK
9	GEUS	GEOLOGICAL SURVEY OF DENMARK AND GREELAND	DK
10	FMI	ILMATIETEEN LAITOS	FI
11	UNIS	UNI VERSITY CENTRE IN SVALBARD	NO
12	NORDECO	NORDISK FOND FOR MILJØ OG UDVIKLING	DK
13	SMHI	SVERIGES METEOROLOGISKA OCH HYDROLOGISKA INSTITUT	SE
14	USFD	THE UNIVERSITY OF SHEFFIELD	UK
15	NUIM	NATIONAL UNIVERSITY OF IRELAND MAYNOOTH	IE
16	IFREMER	INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER	FR
17	MPG	MAX PLANCK GESELLSCHAFT ZUR FOERDERUNG DER WISSENSCHAFTEN E.V.	DE
18	EUROGOOS	EUROGOOS AISBL	BE
19	EUROCEAN	FUNDACAO EUROCEAN	PT
20	UPM	UNIVERSIDAD POLITECNICA DE MADRID	ES
21	UB	UNIVERSITAET BREMEN	DE
22	UHAM	UNIVERSITAET HAMBURG	DE
23	NORUT	NORTHERN RESEARCH INSTITUTE TROMSO AS	NO
24	Terradue	TERRADUE	IT
25	GINR	GRØNLANDS NATURINSTITUT	GL
26	OU	OPEN UNIVERSITY	UK
27	NIVA	NORSK INSTITUTT FOR VANNFORSKING	NO
28	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	FR
29	U Helsinki	UNIVERSITY of HELSINKI	FI
30	GFZ	HELMHOLZ ZENTRUM POTSDAM GFZ	DE
31	ARMINE	ASSOCIATION POUR LA RECHERCHE ET LE DEVELOPPEMENT ……	FR
32	IGPAN	INSTYTUT GEOFIZYKI POLSKIEJ AKADEMII NAUK	PL
33	U SLASKI	UNIWERSYTET SLASKI	PL
34	BSC	Barcelona Supercomputing Center	ES
35	DNV GL	Det Norske Veritas GL AS	NO
36	Seascape	Seascape Consultants Ltd (secretariat for EMODnet)	UK
37	NIERSC	Scientific Foundation Nansen International Environmental and Remote Sensing Center	RU
38	WHOI	Woods Hole Oceanographic Institution	US
39	SIO	Scripps Institution of Oceanography, University of California	US
40	UAF	University of Alaska	US
41	JPL	Jet Propulsion Laboratory, California Institute of Technology	US
42	U Laval	Université Laval	CA
43	UVIC	University of Victoria	CA
44	NMEFC	National Marine Environmental Forecasting Center	CN
45	PRIC	Polar Research Institute of China	CN
46	RADI	Institute of Remote Sensing and Digital Earth – Chinese Academy of Science	CN
47	NIPR	National Institute of Polar Research	JP
48	KOPRI	Korea Ocean Research and Development Institute	KR

1. Excellence

1.1 Objectives

The Arctic is undergoing the most rapid changes in the climate system worldwide. This is clearly demonstrated by the thinning and reduction of sea ice, the melting of ice sheets and glaciers, thawing permafrost, and the potential for more extreme weather events. These changes are closely connected to the warming of the atmosphere and ocean due to increased greenhouse gas concentration in the atmosphere. While the role of these Arctic changes in increasing risks of extreme events remains a critical but hotly debated question, it is clear that these interlinked processes are expected to increase the risk from natural hazards such as increased erosion and increased icebergs. Climate change may also induce increased probability for landslides, earthquakes and tsunamis. Thawing of permafrost will release greenhouse gases that will further enhance the warming of the atmosphere and ocean. This will have wide implications for the Arctic environment, its ecosystems, and its communities as well as on the global scale, and knowledge-based planning of the *future is required to support international assessments of global challenges such as climate change, scarcity of natural resources, and global-scale hazards*.

On the other hand, the warming of the Arctic will improve access to the Arctic and its resources, offering new opportunities for communities and for economic development related to exploration of natural resources, transport, and other industries. This presents extraordinary requirements for planning and decision-making based on scientific and economic assessments and predictions. Against this background, the EU is developing a strategy for sustainable development of the Arctic (EC, 2012; Stepien et al., 2014[1] http://www.arcticinfo.eu/en).

To meet these challenges we need improved and precise systems to *enable better-informed decisions and better-documented processes within key sectors (e.g. local communities, shipping, tourism, fishing)*, in order to *strengthen the societal and economic role of the Arctic region and support the EU strategy for the Arctic and related maritime and environmental policies. To this end, it is of paramount importance to establish an* integrated Arctic Observing System.

The overall objective is to build an efficient integrated Arctic Observation System (iAOS) by extending, improving and unifying existing systems in the different regions of the Arctic.

Many efforts have been initiated to build components of an Arctic Observing System, addressing specific thematic areas or regions. The US SEARCH Program has proposed a way forward to design and coordinate long-term observing networks in the Arctic, where many actors have different interest and priorities (Lee et al., 2015). The Arctic Council with its eight member countries, established in 1996, has initiated and run environmental monitoring programmes for 20 years. Global programmes such GCOS and GEOSS provide a framework for implementing observing systems to serve a wide range of societal benefit areas (GCOS, 2011, 2015; GEO-CRI, 2016). Satellite Earth Observation (EO) has become an essential component of a sustainable iAOS as space agencies invest in long-term EO programmes for global change monitoring. In situ data are much more scarce in the Arctic both in time and space, but are essential to fill the gaps that satellite data cannot cover. Furthermore, in situ data are also important for calibration and validation of the satellite data, this is addressed in several project e.g. H2020 GAIA-CLIM.

The EU's strategies for the Arctic emphasize the need to implement monitoring programmes to underpin sustainable development in the region. To build and sustain an integrated system of many discipline-specific observing systems requires agreement among the major players from Europe, North America and Asia who can contribute to this system. Many countries related to the Arctic have invested in infrastructure and logistical services to support various observing systems with a long-term perspective, which is an important condition for sustainable observing programmes.

Based on the above rationale the INTAROS will be implemented according to the following *specific objectives:*

Specific objective 1: Establish a Pan-Arctic forum to support formulation of agreements and collaboration between organization involved in developing Arctic observing systems across EU member states, non-EU countries and transnational organizations. A Pan-Arctic Observing Forum will be formalized in

[1] References and acronyms are listed in Appendix after Section 5

collaboration with established transnational networks and organizations. Members of the Forum will be stakeholders from different communities including science and private sector. This is addressed in WP1.

Specific objective 2: Develop a Roadmap for future implementation of a Sustainable Arctic Observing System (SAOS). The Roadmap will be based on the synthesis of results obtained from the entire INTAROS project assimilating recommendations from organizations and programs involved in the Forum (WP1).

Specific objective 3: Exploit existing observing systems and databases of atmosphere, ocean, cryosphere, geosphere and terrestrial data as the backbone of an integrated Arctic Observing System (iAOS) platform. It is essential for iAOS to build on present observing systems developed over several years and operated with funding from countries and international agencies to ensure that the iAOS is maintained as a platform for SAOS. This is addressed in WP 1 and WP2.

Specific objective 4: Contribute to fill gaps of the in situ observing system by use of robust technologies suitable for the Arctic. There will be an emphasis on using multidisciplinary autonomous systems, building on observing technology suitable for the Arctic, which can be operated year-round with a minimum of human involvement. This is addressed in WP3.

Specific objective 5: Add value to observations through assimilation into models. Generation of 3D gridded datasets, incorporating observations while constrained by the dynamics of the model, adds value across key regions where observations are sparse in the ice-ocean, atmosphere, and ecosystems. This work is addressed in WP6.

Specific objective 6: Enhance community-based observing programmes by building capacity of scientists and community members to participate in community based research. A model of how Arctic community-based observing programmes can connect and cross-fertilize with an iAOS will be developed. The model will be used to incorporate community-based observations from selected communities into existing databases. This work is addressed in WP4.

Specific objective 7: Develop and implement the iAOS platform for integration and analysis of multidisciplinary with distributed data repositories. The iAOS platform will be user driven and will include tools for data discovery, aggregation, analysis and visualization. The iAOS will be developed in agreement with international standards for interoperable services, ensuring compatibility with similar data management systems. This work is addressed in WP5, with input from WP2, WP3 and WP4.

Specific objective 8: Demonstrate benefit of the iAOS functionality to selected stakeholders. Prove the value of the iAOS towards selected stakeholders in eight tailored applications: (1) Climate model studies, (2) Improved ecosystem understanding and management, (3) Ice-ocean statistics for risk management, (4) Natural hazards in the Arctic, (5) Improve understanding of greenhouse gas cycle, (6) Cross-fertilizing community based observing systems with science-driven observations, (7) Support for marine and maritime industries, and (8) Support for fisheries and environmental management agencies. This work is addressed in WP6.

Specific objective 9: Develop professional skills in using the iAOS platform and new data products within industry, education and science. Expertise and competence for those working within this subject area, including major stakeholders, will be developed through summer schools, training programs, scientist exchange programs, and publications in science and popular science. This work is addressed in WP7.

1.2 Relation to the work programme

The work programme topics are addressed in the different work packages, as described below. An integrated Arctic observation system should:

(1) *"close critical gaps with innovative solutions"* This will be achieved through greater use of new data products from EO data (WP2), combined with increased in situ data (WP3). Values will be added to the data by use of geo-statistics, modelling, and data assimilation (WP5, WP6). Enhanced use of community-based monitoring (CBM) will be innovative solutions in selected communities (WP4).

(2) *"improve the integration and inter-operability of existing observation systems"* Integration of data from distributed databases will be done through the iAOS platform which will provide interoperability between repositories used by existing observing systems (WP2, WP5), see Fig. 1. New data collected in INTAROS (WP 3, WP4) will be ingested into existing data repositories. The iAOS platform will also provide tools for combining data from different observing platforms.

(3) *"improve the integration and inter-operability … in view of data assimilation into models"* Assimilation of data from iAOS will be undertaken for coupled climate models, ecosystem models, ice-ocean forecasting models, and atmospheric inverse models of GHG. Application studies will be performed in collaboration with other projects e.g. BG10 project and Copernicus (WP6).

(4) *"co-operation between the existing European and international infrastructures (in-situ and remote/ space-based) and the modelling communities"* Collaboration will be established between European and international EO and in situ infrastructures in the USA, Canada, Japan, China and Korea. These countries have established data centres where databases are built up and made available for external users (WP1, WP2). INTAROS will work closely with modelling groups in Copernicus Marine Environmental Monitoring Services and climate modelling communities both in Europe and the USA (WP6).

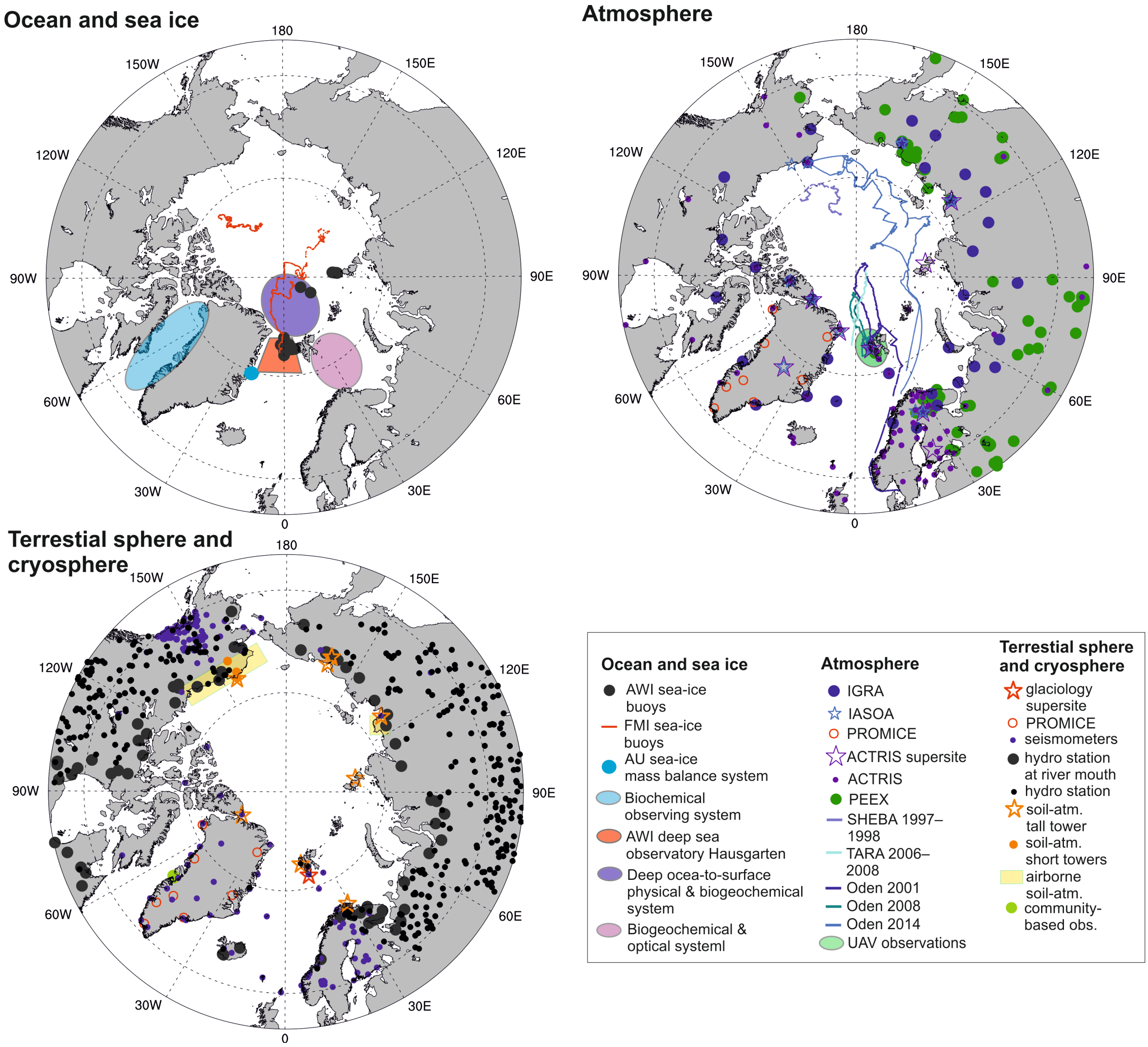

Figure 1. Example of existing observing systems in the Arctic (courtesy FMI).

(5) *"active participation of relevant stakeholder groups"*. INTAROS will have key stakeholders involved as partners and in stakeholder advisory group (WP1). Stakeholders from selected sectors will be involved in development and demonstration of iAOS (WP6) CBM will work directly with stakeholders in WP4 and WP6.

(6) *"implementing the Transatlantic Ocean Research Alliance, the Sustaining Arctic Observation Networks (SAON) and the Cold Region Initiative of the Group on Earth Observation (GEO)"*. INTAROS will cooperate directly with UAF, WHOI, SIO, JPL, U Laval and UVIC. The collaboration will involve activities to improve: data sharing and inter-operability, coordination, planning, and implementation of observing components of iAOS (WP1, WP2, WP3, WP4, WP6). Dissemination and Outreach (WP7); and the development of the Roadmap (WP1) will involve collaboration with the partners from USA and Canada. GEO-CRI has provided a letter of support (see Appendix), inviting INTAROS to collaborate with GEOSS. GEO-CRI will be a member of the Stakeholder group. SAON will be a member of the Science Advisory Panel.

(7) *"have links to the relevant Copernicus and European Space Agency (ESA) programmes"*. ESA CCI, Sentinel, Earth Explore and STSE programmes will contribute with EO data to iAOS. The Copernicus Marine Environmental Monitoring Services for the Arctic is led by NERSC and will work closely with INTAROS (WP2, WP5, WP6).

(8) *"maximise the synergies other European efforts … strong coordination with the on-going Horizon 2020 projects which aim to develop an Integrated Atlantic Ocean Observing System … with the relevant ESFRI"*. INTAROS will collaborate with European infrastructure projects that have Arctic components, in particular EPOS, ICOS, SIOS KC, IASOA, and ENVRIplus. Furthermore, INTAROS will coordinate work with AtlantOS, EU PolarNet, GAIA-CLIM, and the BG10 project under H2020 (WP1, WP2, WP3 and WP6).

(9) *"support and promote the integrated use of Arctic land, ocean, ice and atmosphere in-situ and space-based observations from Europe, the USA, Canada and other international partners"*. iAOS will be developed to use and promote existing multidisciplinary observing systems and data repositories in collaboration with international partners in North America and Asia. The work will be carried out in collaboration with the Arctic Observing Network (AON)[2], the Ocean Network Canada[3] and the Arctic Data Archiving System (ADS, Japan[4]) that are developing similar systems (WP1, WP2, WP5, WP6).

(10) *"Community-based observation programmes that draw on indigenous and local knowledge should be included … basis for participatory research and capacity-building within Arctic communities"*. Development of community-based programmes is a dedicated activity in WP4, and will be followed by a demonstration study in WP6 and through various capacity-building activities in WP7.

(11) *"ensure data interoperability through internationally recognised standardisation and quality assurance/quality control (QA/QC) processes"*. The iAOS platform will be the central node in a network of interoperable databases, enabling search and access to multidisciplinary data (WP2, WP5).

(12) *"promote database integration and allow free and open access to all data and data products, following the GEO data sharing principles"*. The iAOS platform and its distributed databases will follow the free and open data policy in agreement with the GEO data sharing principles (WP2, WP 3, WP 4, WP5).

(13) *"make best use of reference sites (supersites) and should contribute to filling in-situ observational gaps through novel technology development"*. Gap filling of the in situ observing network will be connected to established multidisciplinary research stations (supersites) in Svalbard, Greenland, Canada, Alaska and Siberia (WP3) where deployment of sensors and platforms will be done as an extension of the existing systems.

(14) *"particular attention to the gaps that may help improve the accuracy of predictive models"*. There is a big gap in ocean observations below the Arctic sea ice cover, and heat transfer between the ocean and atmosphere. We will fill the gap in ice-ocean in-situ data in the interior Arctic by deploying an array of ITPS (atmosphere, ice and ocean) and supplementing them with ice mass balance buoys. In addition there will be deployment of platforms and instruments in several locations around the Arctic Ocean to fill selected gaps in atmospheric, ocean, cryosphere and terrestrial observing systems. Application studies for stakeholders will be performed using climate models, atmospheric models, ecosystem models, ice-ocean and CMEMS prediction models (WP6). Links will also be established to the modelling work in the project in BG-10.

1.3 Concept and methodology

1.3.1 Overall concept

The vision of INTAROS is to contribute a sustainable integrated Arctic Observing System. This will be achieved by mobilizing and increasing cooperation between entities operating existing European and international observing systems and infrastructures (in-situ and remote data, including space-based). In this process, it is crucial to engage all relevant stakeholder groups, including the climate and forecasting modelling community, environmental agencies, industry, decision makers and local communities.

In line with the vision, the overall concept of INTAROS is to develop an integrated Arctic Observation System (iAOS) using an Earth System Science approach, where data from ocean, atmosphere, ice and land are used in an integrative way. Therefore, the proposal is composed of a set of multidisciplinary workpackages covering the main spheres of the Arctic environment. The concept is to build on existing

[2] https://www.arcus.org/search-program/aon/products
[3] http://www.oceannetworks.ca/
[4] http://https://ads.nipr.ac.jp

observing systems, including remote sensing and in situ, and to fill gaps in selected regions (Fig.1) by means of innovative combinations of proven and new technologies. Furthermore, we will leverage on existing data repositories for storage and curation of new data collected during INTAROS. A main goal is to provide seamless access to distributed data repositories, through a common ICT platform with embedded processing and analysis tools. This will facilitate development of new products and integration of new observations from INTAROS with historical data, as well as new data from other Arctic observation activities.

Positioning of the project (Technology Readiness Levels). To build up an integrated Arctic Observation System there are three major categories of challenges: (1) produce sensors and platforms that are adapted to and can operate in a harsh Arctic environment, (2) implement year-round data collection with near real time (NRT) transmission to data centres, and (3) provide seamless multidisciplinary data access and integration from distributed data repositories. INTAROS will address all these challenges with the goal to obtain significant progress beyond state-of-the-art. The readiness level of the components to be used in INTAROS have been evaluated according to General Annex G in the work programme, as described in the following paragraphs.

Most instrumentation used in INTAROS is well proven for the Arctic environment, such as standard oceanographic instruments on moorings and ITPs (TRL 9). INTAROS will also use new or improved technologies and sensors development currently at TRL 4-6. These include proven prototypes for nutrients (TRL 5-6), the development of pCO2 optodes (TRL 4), pH sensors (TRL 6), dissolved inorganic carbon and total alkalinity sensors (TRL 4) and improved oxygen sensors (TRL 6). A new carbonate sensor will be developed from TRL 2 to TRL 7, and a spectral absorption sensor will be brought up from TRL 5 to TRL 8. INTAROS aims to accelerate the TRL of these systems such that prototypes will be demonstrated on platforms (fixed moorings and mobile platforms) used in the harsh Arctic environment. Among them, pCO2 sensors have not yet been used under such harsh conditions, and we expect to increase the level tof these sensors to TRL 7 during the project. The FOCE (Free-Ocean CO2 Enrichment) systems are designed to assess the impact of ocean acidification on biological communities *in situ*, but have never been used in the Arctic (TLR 5-6). In INTAROS these systems will be advanced to TLR 7-8 for the polar environment. Furthermore, contaminant sensors for detection and classification of micro plastic will be advanced from TRL 5 to TRL 8. Gliders are widely used around the world (TLR 9) but in the Arctic environment only very limited glider activities have been tested (TLR 7).

Year-round data collection in the Arctic with NRT data transmission is limited to platforms providing satellite communication, such as stations on land and ice tethered platforms (ITPs). We consider their TRL to be 9, although the capacity to transfer data via satellites is limited. Instruments in moorings can in general only provide data in delayed mode, after the moorings have neen recovered by a vessel. While acoustic modems have been used to download data from underwater platforms, the limited bandwidth available causes slow and unstable transfer of data. Acoustic modems are not yet robust technology for the Arctic, and therefore not used in this project.

The Terradue Cloud Platform has been used in multiple RTD projects, e.g., the GeoHazards TEP (https://geohazards-tep.eo.esa.int/) and is considered to be TRL-7. During the INTAROS project the resulting platform is expected to be at TRL-8 at the end of the project. Sea ice services from remote sensing data are considered to be at TRL 7-9, as algorithms exist and are used in CMEMS and other services. The open source software for geo-statistics, RGeostats, is considered at TRL 5-6 in the beginning of the project and expected to be at TRL-8 by the end of the project. The system that DNV-GL uses for risk management for offshore and maritime activities is considered to be at TRL-5 during INTAROS, the level is expected to increase to TRL-7.

Linkages to national and international research and innovation activities. The INTAROS consortium has several members with direct linkages to transnational organizations: Dr. Alf Håkon Hoel (IMR) is presently special advisor and Norwegian governmental representative in the *Arctic council*. Drs R. Bellerby (NIVA) and A.P. Ahlstrøm (GEUS) have a direct link to *AMAP*. AMAP has provided a letter of support (see Appendix). Scientific officer in *World Climate Research Programme (WCRP)*, Michel Rixen, will be member of the stakeholder panel in INTAROS. Dr. D. Stammer (UHAM) is co-chair of WCRPs core project CLIVAR on the ocean-atmosphere system and leads the WCRP grand challenge on regional sea level change and coastal impacts. Dr. A. B. Möller is the Polish representative in *SAON*.

Study of Environmental Arctic Change (SEARCH) is a collaborative multidisciplinary program in USA with focus on data sharing and access through Arctic Observing Network (AON). It has a long-term perspective and engages the research community, government agencies and other Arctic stakeholders. Since DAMOCLES IP there has not been a European counterpart to SEARCH. INTAROS aims to revitalize the

European collaboration with SEARCH through the establishment of the Pan-Arctic Observing System Forum (WP1). The Forum will primarily interact with SEARCH through AON, SAON and AOS.

The consortium members are linked to many national and international projects and programmes related to Arctic observing systems as shown in the WP descriptions and the partner description in Section 4. In this section the links to major on-going projects/programmes, large infrastructure programmes, and transnational high-level organizations are described.

AtlantOS (2015-2019) is funded under the H2020 call BG-8-2014: *Developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of the maritime resources.* The project involves 62 partners and is coordinated by GEOMAR Helmholtz Centre for Ocean Research Kiel. AtlantOS is a research and innovation project for integration of ocean observing across all disciplines for the Atlantic (bordering up to the Fram Strait in the north) to establish a sustainable, Integrated Atlantic Ocean Observing System (IAOOS). The IAOOS is to form the ocean in-situ observing backbone of the Copernicus Marine Monitoring system. INTAROS will be closely linked to AtlantOS through several partners (EuroGOOS, AWI, UiB) and IMR, where K. Drinkwater is WP leader in AtlantOS. INTAROS will establish formal agreement with AtlantOS.

Copernicus is a major European effort to provide monitoring and forecasting services to the benefit of society: Earth observation satellites (ESA, EUMETSAT) play a key role in the observing system, supported by *in situ* data. The Copernicus Arctic MFC (Marine forecasting center), the Arctic component of CMEMS, is lead by NERSC in close collaboration with MET Norway and the Institute of Marine Research. INTAROS will have strong links to CMEMS, mainly as provider of in situ and EO data for validation of the forecasting models.

PolarNET (2015-2020) is a consortium of 22 partners from 17 countries with interdisciplinary expertise and infrastructure for polar research. The project is coordinated by AWI. The project aims to develop and deliver a strategic framework and mechanisms to priorities science, optimize the use of polar infrastructure, and facilitate for network building to create new projects. EU-PolarNet will provide input to *European Polar Board (EPB)*. The link between INTAROS and PolarNET will mainly be through AWI, Norwegian Research Council, CNRS and other INTAROS partners.

Year of Polar Prediction (YOPP) is established by WMO and aims to improve the environmental prediction capabilities for the polar regions and beyond, by coordinating a period of intensive observing, modeling, verification, user-engagement and education activities. INTAROS will establish formal collaboration with YOPP through Gunilla Svensson (MISU) who is in the YOPP Steering Group. The YOPP international coordination office is at AWI. YOPP field work will take place from mid-2017 to mid-2019 with a consolidation phase (2019-2022). INTAROS and YOPP will coincide in time and their goals for an Arctic Ocean Observing System are common. INTAROS and YOPP will collaborate on field experiments in order to provide data for model development.

HAUSGARTEN in the Fram Strait is directly linked to INTAROS through its leader AWI (Thomas Soltwedel). *HAUSGARTEN* is the key site in European Multidisciplinary Seafloor and Water Column Observatory EMSO, and a member of the Long-Term Ecological Research - Network (LTER). HAUSGARTEN contributes to the ESFRI projects SIOS (Svalbard Integrated Arctic Earth Observing System) and ICOS (Integrated Carbon Observation System). INTAROS will add new monitoring capability to HAUSGARTEN, and benefit from full integration with data from HAUSGARTEN.

The *FRAM Ocean Observing System* is an infrastructure funded by German Helmholtz Association (HGF) to provide data on Earth system dynamics, climate variability and ecosystem change. As part of the Fixed-point Open Ocean Observatory network FixO3 (FP7), the FRAM infrastructure provides free-of-charge access to external users under the objective of Transnational Access (TNA). Link to INTAROS is through AWI (Ingo Schewe. Leader of the Data management Task of FRAM). INTAROS will complement 'FRAM' with new data, and benefit from full integration with data from FRAM.

Th*e Integrated Carbon Observing System (ICOS RI)* integrates national networks consisting of atmospheric and ecosystem stations (>90 stations) across Europe and marine stations covering North Atlantic and European marginal seas. Truls Johannessen (UiB) is the director for ICOS Ocean Thematic Centre and coordinator of ICOS Norway (EU ERIC land mark project). Scientists in INTAROS are directly involved in ICOS and will provide new data to ICOS from the Arctic, and INTAROS will benefit from full integration with ICOS RI. Letter of support from ICOS is enclosed in Appendix.

The European Plate Observing System (EPOS, www.epos-eu.org/) aims to integrate existing infrastructures in solid Earth sciences into a single infrastructure enabling Earth scientists across Europe.. Prof. Kuvvet Atakan at UiB is the coordinator of the national EPOS-Norway project. Partners in INTAROS (P. Voss, GEUS and M. Sørensen, UIB) are directly involved in EPOS and will provide new data to EPOS from the Arctic. Letter of support from EPOS is enclosed in Appendix.

Svalbard has become a hotspot for Arctic research due to its strategic location and well-developed infrastructure. A large number of institutions from many nations have established permanent research stations in Svalbard. The *Svalbard Integrated Earth observing system (SIOS)* has been proposed to be a regional coordination instrument of observational system for long-term measurements in and around Svalbard. After an ESFRI preparatory study the Norwegian Research Council have funded a SIOS Knowledge Centre to coordinate research and data dissemination. SIOS KC is hosted by UNIS and there for directly involved as partner via UNIS. INTAROS will collaborate directly with SIOA KC with respect to data dissemination and outreach. SIOS KC has provided letter of support (see Appendix).

1.3.2 Methodology

An efficient and sustainable integrated Arctic Observation System (iAOS) can only be built through interaction and coordination with transnational organizations, European and national projects, programmes, and infrastructures. INTAROS will tie in with global programmes such as GCOS, Global Cryosphere Watch, GEO/GEOSS, and Arctic initiatives such as SAON. INTAROS will be connected to observing systems and infrastructures that are on going or under development in Europe, USA, Canada, Japan and other countries collecting data in the Arctic. Sustainability of the iAOS depends on long-term funding, which again depends on usefulness and engagement for a broad spectre of stakeholder. It is therefore imperative for INTAROS to engage and involve important stakeholder groups including research communities, decision makers and private sector. This will be done in WP1 through establishment of *Pan Arctic Observing Forum*. A 'Stakeholder and innovation panel' will be established to facilitate for innovative processes in the project.

Existing observing systems, data repositories and infrastructure available from partners and collaborators will be the building blocks of iAOS. In WP2 these systems will be assessed with respect to technological readiness (sensors, platforms), data delivery chain and data accessibility. Gap analysis includes reviews of previous work use by other projects and programs, OSSE's for selected regions and parameters, and the maturity of systems in will be evaluated using the Maturity Matrix Approach (GAIA-CLIM). The assessments will be used to define how to fill selected gaps in space and time in the future iAOS. New products derived from existing EO and in situ data will be developed and made openly available through existing repositories following the standard search and access protocols.

INTAROS will use innovative combination of mature and new instruments in integration with existing observatories to increase temporal and geographic coverage of *in situ* data (WP3). INTAROS will collect data using platforms such as aircraft, stations on land, ice-tethered platform (ITPs), gliders and fixed moorings. INTAROS plans to fill selected gaps in the following regions: (1) Coastal Greenland, (2) North of Svalbard, (3) Fram Strait, (4) Eurasian Basin, and (5) sites in Siberia, Canada and Alaska for terrestrial and atmospheric measurements. A particular focus is on integration of seismometers and biogeochemical sensors into the existing monitoring programs/infrastructure adding an Arctic component to EPOS and ICOS infrastructures.

Community-based observing systems (WP 4) will be studied in two Arctic communities, Longyearbyen, Svalbard, and Disko Bay, Greenland. These two communities are selected because (i) they are high-risk regions for climate change impacts as well as loss of biological diversity, (ii) they can potentially benefit significantly from community-based observing programs in terms of resilience and adaptation to climate change through improved governance, and (iii) they are characterized by economies in which institutional set-ups and available funding would benefit from efficient and low-cost observing programs at local levels.

INTAROS will build a platform (iAOS) to integrate distributed databases holding ocean, atmosphere, cryosphere, terrestrial, and community based data (WP 5). The platform will provide a common entry point to data originating from a wide range of existing observation networks/repositories (remote sensing and *in situ*) as well as new data obtained during the project. The iAOS platform will be built using state of the art cloud computing technologies to facilitate seamless access to multidisciplinary data, scalable allocation of data storage and computer power for BIG data processing including geo-statistical methods (see WP 5) and assimilation into models (WP 6). The usefulness and functionality of the platform will be demonstrated for selected stakeholders, scientists, decision makers, communities, and the private sector, in WP 6.

The experience gained from building and demonstrating the iAOS platform will be used in WP1 to prepare a Roadmap for further development of a sustainable integrated Arctic Observing System. The project will disseminate multidisciplinary results and promote future use of iAOS towards decision-makers in European agencies and businesses, Arctic, international bodies, local communities and general public. Legacy of iAOS is further enhanced through capacity building and training for early-career scientists in WP7.

How sex and/or gender analysis is taken into account in the project's content

The gender dimension plays a role in how INTAROS approach communities, decision and policymakers, and private sector. We will involve both genders in selection of information topics and how we address the topics. For instance the project will provide information about risk and warning systems for natural hazards, knowledge based planning of community development (business, infrastructure, environment). This will impact the lives of both genders. The project will follow the guidelines established for EU project see http://ec.europa.eu/research/swafs/gendered-innovations/index_en.cfm?pg=home

Gender balance was a criterion when the INTAROS consortium was established. In the leader team the deputy coordinator, 3 of 7 work package leaders are females. The Consortium agrees to promote and ensure gender equality throughout the project. The Consortium is aware of the importance of attracting more female researchers into spheres of polar research and innovation. Additionally, the Consortium is ready to contribute to surveys and investigations conducted by the European Commission. The project will act upon the EC recommendations listed in the "Gendered Innovation" to stimulate and promote career development for women in science, innovation, and technology. The Consortium will support equal participation between men and women in the project and will aim to improve a gender balance at all levels of personnel assigned to the project, including at supervisory and managerial levels (ref. Art. 33 of the Grant Agreement). The promotion and monitoring of gender equality throughout the project will be the responsibility of the coordination team (WP8) and reported to the steering committee.

1.4 Ambition

1.4.1 Advancement beyond state-of-the-art

The main ambition of the proposal is to develop an effective and efficient Pan-Arctic integrated Arctic Observing System (iAOS), which consists of the following main components: (1) Coordination and collaboration; (2) Databases with dissemination systems and networks; (3) The observing platforms and sensors; (4) Data sampling, data transmission, calibration and processing.

The first two components are cross-disciplinary, and will be addressed as such in this section with respect to state of the art, challenges and progress expected in the project. The third and the fourth are more theme specific, although platforms are often designed for multidisciplinary observations. In INTAROS the ambition is to improve observing systems within the following themes: 1) Atmosphere, 2) Ocean, 3) Sea ice, 4) Marine Ecosystem, 5) Terrestrial, 6) Glaciology, 7) Natural hazards, and 8) Community-based monitoring.

Coordination and Collaboration

State-of-the-art and challenges: The Arctic Council has conducted monitoring for about 20 years through its working groups such as AMAP. It initiated the transnational process "Sustaining Arctic Observing Networks" (SAON), which has been active for the last decade. The purpose of SAON is to support and strengthen the development of multinational engagement for sustained and coordinated pan-Arctic observing and data sharing systems that serve societal needs, particularly related to environmental, social, economic and cultural issues (www.arcticobserving.org). SAON also is committed to facilitating the inclusion of Arctic indigenous people in observing activities, in particular by promoting community-based monitoring (CBM) efforts. As a contribution to SAON, the International Study of Arctic Change Science (ISAC) has initiated and led the high level biennial Arctic Observing Summit since 2013. AOS has evolved into a driver for the development of an Arctic Observing System. The state-of-the-art in the planning and implementation of an integrated Arctic Observing System is described in a series of papers from the 2013 conference, published in ARCTIC, Vol 68, Suppl.1 (2015). See http://www.arcticobservingsummit.org/.

On European level, collaboration and coordination of Arctic Observing have first of all been implemented through regional and thematic programs and projects (e.g. DAMOCLES, ACOBAR, INTERACT, ICE-ARC, SEN3APP, ACCESS, COOPEUS, SWARP, NACLIM). During the International Polar Year (2007-2009) a number of new observing methods and technologies were demonstrated enhancing data collection in the Arctic significantly (www.ipy.org). In 2014 the EU funded the PolarNET with the goal to improve the coordination of polar research in Europe. In addition, European legal entities have been established to coordinate the implementation of ocean observing systems in particular EuroGOOS and EuroArgo. Several infrastructure projects with long-term funding such as ICOS, GRUAN, EPOS, and ENVRI PLUS have also been established. Recently, Knowledge Centres, such as the Svalbard Integrated Observing System Knowledge Centre (SIOS-KC) and the European Arctic Information Centre (EUAIC) have been established.

The major challenge is to coordinate and integrate the vast array of on-going and planned initiatives and programmes that can contribute to an Arctic Observing Systems. The most urgent issue is to establish efficient flow of information about all monitoring activities, and to establish agreements between data providers and data users, which can be policy-driven (top-down) or science-driven (bottom-up).

Expected progress beyond state-of-the-art:

- A multidisciplinary **Pan-Arctic Observing Forum** will be established with participation from high-level policy makers, funding agencies, stakeholders and research communities. The forum will coordinate European initiatives working toward a Sustained Arctic Observing System in agreement with EU's Arctic policy development. The Forum will work together with AON and AOS.
- A Roadmap for implementation of a future Sustainable Arctic Observing System (SAOS) will be developed based on the synthesis of results obtained from the entire INTAROS project.

Management and integration of Arctic data

State-of-the-art and challenges: In 2014, SAON established the Arctic Data Committee (ADC) to map Arctic data management projects and services with their locations and relationships, to identify and promote common metadata elements, to provide a guide on data publication and citation, and to conduct interoperability experiments for selected regions and SBAs (Social Benefit Areas). They also established the Committee on Observations and Networks (CON), to advise the SAON Board on funding, coordinating and extending existing observation systems, and planning for their sustainability. Several Spatial Data Infrastructures (SDIs) and data repositories hold data for either the whole, or part of, the Arctic. These SDIs are operated by different organisations and communities world-wide, making it a challenge to reach agreement on common metadata and data standards, data policies and governance frameworks.

A further challenge is to reach a higher level of interoperability between the different SDIs that hold relevant data for Arctic regions. This concerns both technical interoperability (i.e. the capability of systems to exchange metadata and data via predefined standard protocols and formats without human intervention), as well as semantic interoperability (i.e. the capability of systems to interpret the meaning of the metadata and data exchanged, by means of automated systems).

Expected progress beyond state-of-the-art:

- Develop a joint data governance framework for a Pan-Arctic Observation System.
- Integrate distributed data repositories into an integrated Arctic Observing System platform.
- Improve technical interoperability between the Arctic SDIs and data repositories.
- Incorporate best practices on documenting the semantic meaning of a dataset.

Atmospheric Theme

State-of-the-art and challenges: Atmospheric data are well organized under the auspices of the WMO's global World Weather Watch and are available through national meteorological services. The challenge is to obtain regular and reliable data from unmanned platforms/stations. In the Arctic instruments ice-up within a matter of hours and in many cases it is impossible to determine a faulty sensor from a functional one by analysing the observations. Therefore, the operational network of atmospheric in situ observations to date is very sparse, over Arctic land and non-existing over the Arctic Ocean (ACIA, 2004; see also Figure 1). It is therefore challenge to develop autonomous instruments or measurement strategies that work in the harsh Arctic environment with a minimum of power requirements. Semi-autonomous instruments deployed on ships of opportunity are promising for obtaining more data from the Arctic.

With data so scarce, it is vital that all data be utilised where possible, and we see it as an important task to identify field experiment data that is not available to everyone. Sparseness of atmospheric in situ data influence processes studies and the weather prediction capability in the Arctic.

Polar orbiting satellites provide frequent and regular data coverage in the Arctic. Passive sensors have problems during the polar night when solar radiation is unavailable. This makes retrieval of atmospheric information very difficult and uncertain.

Expected progress beyond state-of-the-art:

- More in-situ data will be made available from atmospheric observatories and scientific field experiments.
- Improved and better-documented information about atmospheric vertical structure and clouds from passive satellite sensors will be made available to society and scientific community.
- Strategies and best practices for semi-autonomous ship-borne observations will be developed for use on research vessels and ships of opportunity.

- Provide integrated water vapor fields over sea ice and over open water in a consistent data set suitable for assimilation in atmospheric circulation models.

Sea Ice Theme

State-of-the-art and challenges: Sea ice monitoring is important for documenting climate change and validating models. Sea ice concentration and extent is perhaps the best-observed climate variable in the Arctic with four decades of systematic monitoring (Breivik et al., 2009, Ivanova et al, 2015). However, there is a significant uncertainty in retrieval of quantitative data on sea ice concentration from microwave satellite data due to melt-ponds. The challenge is to improve and validate the ice concentration retrieval algorithms in the summer season. Satellite radar altimeter data (e.g. CryoSat2) has delivered promising results to measure changes in Arctic sea ice thickness since 2010 (Laxon, 2013, Kwok, 2015). Ice thickness data are also obtained from several in situ and airborne observing systems (Lindsay and Schweiger, 2015). Retrieval of sea-ice thickness from freeboard data observed with radar altimeter is a challenge due to uncertainties caused by penetration depth of the radar signal, as well as the varying snow cover and snow-ice density. Ice drift and discrimination between first-year ice and multiyear ice are derived products from satellite data used operationally.

In the ESA CCI programme, algorithms for sea-ice concentration, thickness, and drift are studied and validated in order to produce time series data for climate research. The Sentinels will increase the amount of sea ice data significantly in the coming years and new derived products such as ice drift and ice classification will be produced and made available for users. The main challenge is to collect relevant insitu measurements for validation of the satellite product.

Expected progress beyond state-of-the-art:

- Improved satellite-based ice concentration, ice thickness and ice drift products using new Sentinel data, passive microwave and optical data.
- Obtain year round in situ measurements from ITP and ice mass balance buoys of snow and ice thickness, and ice drift for validation of satellite products and models.
- Provide access to sea-ice data products developed and disseminated from various European and international programmes.

Ocean Theme

State-of-the-art and challenges: The knowledge of physical and biological processes in the Arctic Ocean is limited, because the ice cover severely hampers observations, both in the upper layers and deep waters. There is a severe lack of *in situ* multidisciplinary, in particular biogeochemical data for the Arctic Ocean and significant patterns of the Arctic ecosystem are not currently well monitored (see Figure 1). It is a pronounced technological and logistical challenge to improve the ocean component of iAOS.

Multidisciplinary *in situ* data in the Arctic Ocean are still collected mainly during icebreakers expeditions, aircraft surveys, or from manned drifting platforms. However, these activities are irregular in time, very expensive, biased to the summer season, and hence poorly suited for providing regular long-term monitoring data. Moorings have been deployed at key locations in the gateways and rims of the Arctic Ocean (Beszczynska-Möller et al., 2011; NABOS, http://research.iarc.uaf.edu/NABOS2/), but they mainly deliver physical parameters from fixed depths in delayed mode. Biogeochemical and profiling sensors for moored applications are still very limited, resulting in insufficient multi-disciplinary data. Only in the Fram Strait, the key region for Arctic-Atlantic exchanges, the multi-disciplinary observatory (Hausgarten/FRAM) has been implemented for long-term ecosystem monitoring (Soltwedel et al., 2005).

In the last decade, the Ice-Tethered Profilers (ITPs) significantly increased the number of high-quality upper-ocean observations available from the central Arctic (Toole et al., 2011). ITPs offer a platform that can carry a cluster of instruments with real time capability and recently the prototype bio-optical sensor suite was developed for ITPs for ecosystem monitoring (Laney et al., 2015). However, the ITP network is still sparse and covers only a limited ice-covered part of the Arctic Ocean. The Argo programme of oceanographic floats is the main ocean observing system for the global ocean (Riser et al., 2016) but Argo floats relay on surface access, therefore are not suitable for ice-covered Arctic regions. Only recently have the ice-capable RAFOS floats have been implemented (Klatt et al., 2007). Gliders have proven to be efficient for the upper ocean measurements in many parts of the world but as ARGO floats they need open water for data offload and positioning. Gliders and floats operating in ice-covered regions have to rely on underwater geo-positioning systems (GPS). Regional acoustic networks for acoustic thermometry, underwater GPS, and passive acoustic (Mikhalevsky et al. 2015) have been used in Fram Strait (UNDER-ICE project, H. Sagen), and in the Beaufort Sea (CANAPE project, P. Worcester). Gliders have been successfully operated under sea-ice in the

Davis Strait (Lee et al., 2013) and were tested in Fram Strait (EU ACOBAR project). However, the under-ice navigation of gliders is still in the development stage and European gliders have not yet been proved in the Arctic environment.

Expected progress beyond state-of-the-art:

- Develop (or adapt to Arctic conditions) biogeochemical sensors and systems for measurements on moorings, bottom-installed systems and Ferryboxes.
- Implement multidisciplinary moored observatories with a full suite of biogeochemical measurements in the Arctic boundary current and across the shelf-deep ocean gradient to extent the existing network of moored arrays around the Arctic Ocean (NABOS in the Eurasian and Makarov Basin, ArcticNet in the Western Arctic).
- Upgrade the coastal ecosystem monitoring in the Baffin Bay, Disko Bay and Young Sound regions to a multi-disciplinary approach.
- Extend the ITP network in the Eurasian sector of the Arctic Ocean in collaboration with US, Chinese, Korean and Japanese programmes.
- Extend the global network of glider endurance lines with regularly repeated glider surveys in the ice-free areas in Fram Strait and the Nansen Basin.
- Provide baseline characteristics of the sound scape in the Arctic for future environmental assessments by passive acoustic data. Provide acoustic thermometry data to validate and constrain ice-ocean models.

Marine Ecosystem Theme

State-of-the-art: The knowledge of the ecosystems of the more southerly parts of the Arctic, especially the Barents Sea (Sakshaug et al. 2009, Jakobsen and Ozhigin 2011), is at least the same level as for most temperate seas. In the Barents Sea there has been coordinated (Soviet) Russian and Norwegian biological research surveys for decades, some time series go back more than 100 years. The surveys have traditionally targeted fish species of high commercial value (cod, herring, capelin), but over the last decade one has developed also far broader cruises targeting ecosystem understanding. Advanced ecological and environmental reporting and management system is used for the Barents Sea to support sustainable exploitation of marine resources.

Most of the biological sampling, especially sub-surface, is still done from research vessels, the long distance from ports to the high Arctic adds to the costs and feasibility. Even baseline information regarding physical, chemical and biological conditions is generally lacking in the Arctic Ocean (Anon., 2011). Similar to physical observations, the main restriction to developing good Arctic biological observation systems is the ice cover. Consequently, there are large knowledge gaps concerning the presence, abundance and distribution of planktonic organisms, fish species, marine mammals and benthic organisms in the Arctic. Furthermore, very little is known about the production capacity at species level, hence also in an ecosystem context (Anon, 2011). The lack of understanding of how the ecosystem responds to the changes in the Arctic physical environment is a challenge (e.g. Wassmann, 2011).

Expected progress beyond state of the art:

- Advance ecological and environmental understanding by merging and synthesizing iAOS data through ecosystem modelling at the regional (Barents Sea) and local (areas off Greenland) scales
- Collect and make available biological and physical data from different platforms and databases.
- Validate the ecosystem models by means of physical and biological observations from the iAOS
- Generate higher-level, ecosystem specific model products towards targeting management and harvesting of living marine resources while protection of the Arctic environment (Arctic Council 2015)
- Adapt existing ecological and environmental reporting and management systems for use in the Arctic
- Demonstrate the usefulness of data integration through a sustained and optimized observing system to Norwegian and Greenland fisheries and env ironmental authorities.

Terrestrial Theme

State-of-the-art and challenges: The Arctic and boreal land surface is home to a wide range of coupled processes with major feedbacks on the Earth System and/or which have significant societal effects on the vulnerable economies of northern latitudes and Europe's welfare. A major challenge is to estimate the Arctic GHG budget. The *in situ* observing network, established in Siberia and western Russia, Canada, Alaska and Eastern Siberia, is focussed on the two major carbon species CO_2 and CH_4. However, the network is still too sparse and most records are too short for differentiating inter-annual variability from long-term trends in GHG exchange processes. Due to this, an upscaling of fluxes to e.g. regional domains (1000km) and longer-term averages (decadal means), needed to assess spatial and temporal variability in pan-Arctic GHG patterns, remains highly challenging. Upgrades are particularly important for the network of flux sites, where lacking infrastructure (power supply) and instrumentation problems (e.g. de-icing) is still a challenge.

Changes in the Arctic hydrological regime and river discharge are key components for understanding the Arctic Ocean freshwater balance. About 50% of the freshwater inflow to the Arctic Ocean is river discharge from the surrounding landmasses in Eurasia and North America. The Global Runoff Data Center (GRDC) has collected data from about 2400 stations within the Arctic Ocean drainage basin in a subset called Arctic Runoff Database. Changes in surface properties arise from changes in the spatial distribution and properties of vegetation, surface water (e.g. in seasonal lakes) and ice and snow; though mainly measured from satellite data, in situ data are crucial for calibration and to measure properties inaccessible from space.

For changes in the hydrological regime and river discharge to the Arctic ocean, the key need is to address inadequacies in the current network of in situ river discharge observations. About 30% of the drainage basin is ungauged, so we must exploit the existing data to estimate discharge from such areas through modelling or spatio-temporal interpolation methods. It is also crucial to address the loss of existing stations, failure to report regularly to open databases, and unknown quality control status. More generally, in situ measurements are important to estimate parameters for land surface models, which are critical for integrating the diverse measurements provided by an iAOS.

Expected progress beyond state of the art:

- The Alaskan transect of 5 eddy covariance towers measuring CO_2, H_2O, CH_4 and energy fluxes will be enhanced to provide continuous, year-round data on GHG concentrations and fluxes, as well as active layer depth, water table depth and snow depth.
- These measurements will be closely linked to airborne meteorology and eddy covariance measurements of sensible and latent heat, CO_2 and CH_4 flux in the Alaskan and NW Canadian Arctic
- A new flask sampling instrument will be installed at a key location in Northeast Siberia to extended data streams (e.g. isotopes) to identify processes related to Arctic GHG exchange. The representativeness of the currently existing network of tall towers around the Arctic will be assessed for constraining GHG exchange processes in different Arctic regions.
- The unique infrastructure for long-term multi-disciplinary measurements of soil, ecosystem, cryosphere and atmosphere at the FMI Sodankylä-Pallas research station (a cal/val site for the SMAP and SMOS missions) will be enhanced to create new satellite retrieval methods for snow and atmospheric properties.
- The network of 9 monitoring stations in the Eastern Canadian Arctic will be enhanced by use of a new airborne LIDAR to map snow depth, to investigate the rapid modifications of snow depth caused by vegetation growth and the coupled evolution of vegetation, snow depth and permafrost temperature.
- SMHI will develop: (a) methods to fill spatial and temporal gaps in river discharge observations and predict freshwater flow into the Arctic Ocean from ungauged basins, and (b) strategies to improve data delivery chains and data accessibility for iAOS. River discharge and satellite data will be assimilated into the pan-arctic hydrological model Arctic-HYPE to predict freshwater flow to the Arctic Ocean**.**

Glaciology theme

State-of-the-art and challenges:. Recent decades have seen the first dedicated satellite Earth observation missions with specific objectives related to ice sheets and glaciers, such as ICESat and CryoSat-II providing ice elevation changes and GRACE providing total ice mass changes. Other satellite EO missions as e.g. RADARSAT, ERS and ENVISAT have provided ice velocity maps enabling studies of ice-dynamics. The new Copernicus programme (European Commission/European Space Agency) will vastly improve our capability for monitoring the environment in the Arctic. *In situ* observational networks are comparatively sparse in the Arctic and play an important role in providing ground-truth for the satellite products (see Figure 1). Two networks of automatic weather stations are in operation on the Greenland ice sheet; the US Greenland Climate Network (GC-Net) and the Danish Programme for Monitoring of the Greenland Ice Sheet (PROMICE), whereas the GNET installation of differential GPSs measure crustal movement due to load changes along the perimeter of the Greenland ice sheet and GLISN acquires seismological measurements. The NASA projects Operation IceBridge (OIB) and Oceans Melting Greenland (OMG) are currently leading the airborne monitoring of the Arctic ice masses and neighbouring waters, supplemented by European missions such as CryoVex and PROMICE.

A major challenge regarding the Arctic icesheets and glaciers is the difficulty of obtaining high quality in-situ observations in the extremely harsh environment. Logistical difficulties often mean that it is not possible to revisit instruments more than once every few years, ensuring that robustness takes precedence over other factors. Lack of links and integration between the current monitoring efforts, which will be required for producing new and enhanced climate services needed for the increasingly accessible Arctic region.

Progress beyond state of the art

- Integrate ESA Sentinel/Copernicus data with in situ observations and climate modelling to deduce sub-annual mass loss estimates from the Greenland ice sheet at sub-basin scale.
- Develop guidelines and tools for using GNET GPS data for monitoring mass changes in the coming years. Combine with methods for using GRACE data and compare results of both methods.
- Upgrade positioning of ice sheet weather stations to WMO-standard data to enable use in weather forecasting and for validation of ice velocity maps from the ESA Sentinel-1 mission.
- Introduce observation of snow water equivalent (SWE) at ice sheet weather stations to improve performance of ice sheet meltwater runoff models and regional climate models.
- Improve methods for ice volume estimation and calculation of the ice discharge of Arctic ice masses.
- Upgrade albedo measurements from weather stations on snow/ice to allow calibration of satellite albedo products and regional climate models.

Natural Hazards

State-of-the-art and challenges: Observation of natural hazards needs to consider two different aspects, namely the direct observation of the hazardous event, for example as seismometer recordings of earthquake ground motion or tide gauge recording of a tsunami wave, and the observation of parameters needed for assessing the likelihood of future hazardous events. Assessing the likelihood of a future natural hazard event usually requires interdisciplinary data. For example, snow avalanche potential will be affected by precipitation, temperature and the current snow conditions, and the evaluation of global sea level rise potential require input and integration of e.g. ice sheet mass loss estimates, *in situ* observations, remote sensing, meteorological and oceanographic modelling. Many datasets are available through national or international monitoring networks or data repositories, but much data still remain unavailable to the scientific community, and there has been little effort to integrate interdisciplinary data. The European Plate Observing System (EPOS), a pan-European ESFRI project that aims to integrate the European research infrastructures for solid earth science through an interdisciplinary approach. EPOS will help understanding natural hazards related to ground deformation (from e.g. earthquakes), but there is a large observational gap offshore and especially in ice covered areas. Technologies exist, for example for climate observatories on the Greenland ice sheet or for ocean bottom seismometer (OBS) observations, but installations are expensive and logistically challenging, especially in ice covered areas where the sea bottom cannot be accessed. This leads to a large monitoring gap in the Arctic region and especially in the Arctic Ocean and thus limited understanding of the processes controlling natural hazards and the potential warning of future events.

Expected progress beyond state-of-the-art:

- Provide input to climate change impact assessments on the contribution of the Greenland ice sheet to global sea level rise.
- Utilize in situ snow and meteorological data to develop a post-processing method that will improve the extreme precipitation forecasts and provide better forcing for avalanche forecast models.
- Provide input from ocean bottom seismometer observation to earthquake hazard assessment in the Arctic continental shelf regions.

Community-based observing systems

State-of-the-art and challenges: There are 4 million people living in the Arctic. Indigenous peoples make up about 10% of the population. Arctic community members often have in-depth knowledge of the natural resources. Most efforts to monitor natural resources in the Arctic have focused on scientist-executed methods and ‘externally driven’ approaches (Danielsen *et al*. 2009). In these approaches, professional researchers from outside the area set up, run and analyse the results from a monitoring scheme. Scientist-executed monitoring is often technically and logistically demanding.

Community-based observing is a supplementary approach whereby indigenous and local people are directly involved in data collection and sometimes data interpretation, and in which monitoring is often linked to the decisions of local stakeholders, using methods that are simple, cheap and require few resources (Johnson *et* *al*. 2015). Community-based observing can build relations between local stakeholders and the authorities, thereby stimulating local action and resulting in a dynamic and adaptive resource management.

The remarkable rise of mobile devices and social media opens up the possibility for thousands of community members to participate in scientific processes, and to gather information and obtain results that are both locally and globally relevant. A SAON review analysed a sample of 81 community-based observing programs, including 47 programs in Europe and 34 in North America (Johnson *et al., in press*). Sixty-nine percent of the programs engage 'indigenous knowledge' (Berkes 2012). Community-based observing has considerable potential to involve indigenous and local residents in the Arctic in support of a robust iAOS, but there are some challenges: 1) Scepticism about whether indigenous and local people can produce high quality data must be overcome; 2) Secondly, limited ability or political will, to listen to the 'voice' of indigenous and local people by some decision-makers and government staff must be addressed; 3) At a technical level, there is minimal knowledge of which of the community-based observing programs that potentially can plug gaps and improve available databases for global and regional assessments (such as IPCC); 4) Few mobile devices and digital technologies that enable access to web-based solutions like social media have been tested in the harsh Arctic environment; 5) Expanding the number of sites with observing programs while ensuring a high standard of sampling protocols without precluding programs from being responsive to local circumstances and needs and 6) Sustaining the programs, both financially and institutionally, and to maintain participation of residents, particularly among the youth and the private sector.

Expected progress beyond state-of-the-art:

- Demonstrate 'real world' examples of the benefits of cross-fertilizing indigenous and local observation systems with scientific observation systems to inform decision-makers about solutions to pertinent problems.
- Identify, for the first time, Arctic community-based programs that are possible and suitable to fill key gaps in available databases for global and regional assessments, and for community data to be reformatted, standardized and entered into these databases, for a sub-set of the Essential Climate Variables.
- Enhanced significantly the scientific quality of Arctic community-based observing programs through (i) improved understanding of the capabilities and challenges of the existing programs, (ii) a broadly disseminated library of 'best practice' manuals, and (iii) competence-building of practitioners; all planned and undertaken in close cooperation with indigenous and local civil society organisations.
- Test novel community-based data collection technologies for enhancing understanding of environmental parameters in Svalbard and Greenland, with the findings presented for decision-makers.

1.4.2 Innovation potential

The innovation potential in the development of an integrated Arctic Observing Systems ranges from data transmission to unique combinations of multi-disciplinary data and from new products to use of cloud technology for massive data access. Platforms for iAOS include polar orbiting satellites, aircraft, drones, ships, moorings, and underwater vehicles. In WP 1 we prepare a plan for developing the future sustainable iAOS (The Roadmap) with emphasis on the in situ observing systems. The *in situ* observing system components will require significant innovations within the following topics:

1) Robust platforms and sensors that can operate under Arctic conditions,
2) Real time transfer of data from underwater platforms (gliders, floats, moorings) in ice covered regions,
3) Underwater navigation and geo-positioning of mobile platforms in ice covered regions,
4) Satellite communication and data transfer, which is very limited in the Arctic,
5) Power supplies to operate instruments autonomously year-round underwater, on ice, and in remote areas.

Space-, subsea-, and communication- technologies are examples of highly innovation-driven industries, which are important for in-situ technology innovations. INTAROS will set up a Stakeholder and Innovation Advisory Panel in order to facilitate closer interaction between research and stakeholder communities related to the Arctic to support innovation processes with focus on the challenges in in-situ observations. Industry and research have great potential for joint innovation and technology development in the Arctic, and we will use INTAROS to be a catalyst of such processes.

The needs for safety and rescue systems and exploitation of resources depend on development of better observing systems in the Arctic. INTAROS aims to produce the most advanced and user-friendly integration of multi-disciplinary observation (satellites and in-situ) in the Arctic. This will enable innovative analysis methods and stimulate new products and improved services.

Furthermore, INTAROS will assess and identify community-based observing programs that are suitable to connect with to fill key gaps in available databases for global and regional Arctic assessments. INTAROS will test novel citizen-based technologies in Svalbard and Greenland and use the results to showcase the multiple benefits of cross-fertilizing indigenous and local observation systems with scientific observation systems for improved decision-making from the local to the global level. INTAROS dissemination activity will ensure that the scientific and local communities interact in a bottom-up approach towards protecting arctic resources, promoting tourism, and be part of the debate on sustainable local resource use, social and economic development, and awareness towards limiting impact from pollution in the Arctic.

INTAROS will demonstrate the potential of Cloud Computing to help develop and deploy new services for monitoring and prediction of environmental conditions and resources in the Arctic. Such services must be able to integrate heterogeneous and multidisciplinary data using advanced processing, analysis and visualization, to satisfy the needs of decision- and policy makers, industry, local communities, national and regional authorities and agencies, and science. INTAROS will leverage existing Infrastructure-as-a-Service (IaaS) cloud providers to federate distributed SDIs and offer development and runtime environments for services extracting information from the integrated observations, derived parameters and model results.

The integration of Sentinel/Copernicus data with *in situ* observations and climate modelling will be applied to deduce mass loss estimates from the Greenland ice sheet to provide timely input to climate change impact assessments on the contribution to global sea level rise of the Greenland ice sheet. It will also inform marine ecological models on the freshwater input to the coastal zone of Greenland enhancing the understanding of impact of climate change on marine resources. The integration of data across different Arctic locations and observing systems by means of model assimilation has significant potential for innovation. This includes both improved quality and precision of existing products and a potential to create new forms of information.

INTAROS can provide novel decision support tools for a variety of sectors. For example marine and maritime industry, fishery and environmental management, and governance of local communities can all benefit from this. New ice-ocean statistics will be applied for decision support and risk assessment for offshore and maritime activities. In particular, DNV GL's Arctic Risk Map will be used as the platform for dissemination of project results to relevant stakeholders, especially those with interests in risk analysis in the Arctic region. Improvement of the methods for estimating ice volume and discharge will provide better estimates of Arctic-wide ice mass loss. Upgrading the weather station instrumentation on the ice sheet will improve weather forecasting, regional climate models, and provide new validation and calibration possibilities for satellite-derived climate variables such as albedo and ice sheet velocity.

2. Impact

2.1 Expected impacts

The ways in which INTAROS will contribute to the impacts expected by the call BG-09-2016 are detailed in the following, while referring to the work packages (WPs) in Sec. 3.1:

Increase temporal and geographic coverage and usefulness of observational data in the Arctic with a view to improving the assessment and prediction capacity of Arctic and planetary changes. INTAROS will contribute with improved data access and more data products from satellite remote sensing covering the whole Arctic region (WP2). The current network of *in situ* observing platforms will be expanded by combining existing systems with new deployments, employing innovative multidisciplinary sensors. The new deployments will contribute to fill gaps in the atmospheric, oceanic, cryospheric, and terrestrial observing network across the Pan-Arctic region (WP3). The observing system will also ingest community-based observing systems in selected areas (WP4). Usefulness of the data is improved by the iAOS platform to facilitate searching, downloading, and processing geostatistical analysis of multidisciplinary data (WP5) and its assimilation into models (WP 6). Geostatistical methods will be used to combine heterogeneous data sets. The usefulness of iAOS will be demonstrated in climate modeling and prediction, assessment of greenhouse gasses, ecosystem management, ice-ocean statistics for risk analysis, assessment of geo-hazards, and for support of industrial activities in the Arctic. In particular, communities and decisions makers will be involved in development and use of iAOS in order to ensure it becomes a useful tool for many stakeholders (WP6 and WP1).

Support standardization and calibration/validation activities, and improve the inter-operability of Arctic observational data. The iAOS platform will be developed using established standards for Open Data access, enabling seamless integration of distributed data repositories (WP2, WP5). This will support calibration and validation of satellite data products based on in situ data and model validation using both satellite and in situ data. New datasets and products generated in WP2, WP3 and WP4 will be channeled to selected mature data repositories for geo-scientific data. These repositories will have clearly defined procedures for quality assurance, documentation of calibration and validation conducted, and a commitment to long-term preservation of data. The repositories must comply with international standards for metadata and data formats, and offer standard interfaces for search and access, following recommendations from INSPIRE, GEO, SAON and GCW. This will ensure the availability of quality controlled and standardized datasets for the users, in line with the GEO data sharing principles. Furthermore, iAOS will contribute to making data and data access services interoperable and provide geostatistical tools for combining heterogeneous data (WP2, WP4, WP5). Common procedures for calibration and quality control of new observational data will be established (WP2, WP3, WP5).

Improve the sustained integration of space-based and in-situ Arctic observations into process models and forecast systems showing benefit to the Copernicus monitoring services. Time series of space based data and *in situ* observations will be tested for assimilation into climate models, ecosystem models, process ice-ocean models, and atmospheric models. This will be done in several tasks in WP6 where focus is to demonstrate the impact of new data on the model predictions. Selected products from the Copernicus marine services will be validated using data from WP2 and WP3. The results will be used as recommendations to the Copernicus service providers on how to use the iAOS to improve the services. In WP6 innovative solutions on how to integrate space-based and in situ observations will be explored

Contribute to the long-term improvement of Arctic observation systems and related services. INTAROS will enhance European and international collaboration and coordination of efforts to develop long-term Arctic observing systems. In particular, data providers, stakeholders and policy bodies will work together to plan how develop a sustainable Arctic observing system, SAOS (WP1). Long-term investments in observing systems are mainly done through space programmes (e.g. Copernicus Sentinel), operating research stations in many Arctic sites (e.g. Svalbard), operating icebreakers and aircraft, and through establishment of infrastructure projects (e.g. ICOS, EPOS). INTAROS will build on these long-term investments as basis for a long-term observing system.

Integrate with existing pan-Arctic monitoring networks by building additional capacity and adding monitoring parameters to current programmes. In WP3 the Pan-Arctic network of observing systems will be extended with the multidisciplinary moored observatory North of Svalbard, collecting time series of physical and biogeochemical parameters to monitor the Arctic shelf and Arctic Ocean Boundary Current. This observatory is a part of the network of moorings deployed by US-funded NABOS-2 program in the Eurasian and Makarov Basins and Canadian moorings in the Western Arctic. This network is operated in collaboration with University of Alaska and ArcticNet, and both are partners in INTAROS. This Pan-Arctic network is a central element of an Arctic Ocean Observing system.

The other important component of the ocean observing systems is the network of ice-tethered platforms (ITPS), coordinated by WHOI (http://www.whoi.edu/website/itp/overview). INTAROS will extend this network by deploying additional platforms in the Eurasian Basin, one measuring standard physical and chemical parameters and one super ITP with a suite of biogeochemical sensors for ecosystem and biological monitoring. In addition INTAROS will deploy a network of 10 modern sea ice mass balance buoys (SIMBAs) for monitoring of heat flux through the ice and other snow and ice properties. Also, the Asian partners (PRIC, NIPR ands KOPRI) plans to deploy several new ITPs ice mass balance buoys as a contribution to the network. These ice-based observing platforms will contribute to the International Arctic Buoy Programme (IABP) and fill an important gap in the observing systems in the Eurasian Basin, which is the least observed part of the Arctic Ocean

One of the longest operating deep sea observatories for ecosystem studies is the Hausgarten/FRAM (Frontiers in Arctic Marine Monitoring), which is integrated into EMSO, the Long Term Ecological Research-Network (LTER) and the former ESFRI SIOS. The observatory will be extended by INTAROS to study impacts of ocean acidification on (benthic) marine organisms. The autonomous arcFCOE (Arctic Free Ocean Carbon Enrichment) system will increase the capacity of the Hausgarten/FRAM observatory by enabling novel monitoring of ocean acidification impact. New endurance glider lines will be added in Fram Strait/Greenland Sea area to extend the network of endurance lines of the European glider network EGO (Everybody's Glider Observatory). INTAROS will also contribute to EuroArgo initiative by supporting BioArgo floats in the Baffin Bay Observatory. The EPOS system will be expanded with new seismic measurements with ocean bottom seismometers north of Svalbard.

INTAROS will also add new parameters to the network of atmospheric towers around the Arctic, including among others improved measurements of CO_2 and CH_4 concentrations, fluxes, consumption, and/or production and novel automated flask sampling system capable of capturing additional trace gases (e.g. N_2O, SF_6, CO, O_2/N_2) and isotopes (e.g. ^{13}C-CO_2, ^{13}C-CH_4, ^{2}H-CH_4, ^{18}O). Capacity of atmospheric monitoring in the Arctic region will be increased by development and implementation of a semi-autonomous system that will be installed on the ships of opportunity and routinely provide e.g. surface flux observations, basic meteorology and clouds observations. INTAROS will improve the observing systems for the Greenland Ice Sheet, by including innovative combinations of satellite and in situ data.

Improve the cost-effectiveness of data collection in support of Arctic-related economic and societal activities. INTAROS will extend the multi-disciplinary data collection from platforms at existing reference sites. This is a cost-effective way of increasing the data collection. Secondly, by adding new sensors on ferries and cargo ships to measure pollution and water quality, garage geophone devices to monitor seismic activity other observing sensors in local communities, the integrated observing systems can be extended with a minor additional cost. This will lead to better-informed decisions and better-documented processes within key sectors (e.g. local communities, shipping, tourism, fishing).

Support to local communities. INTAROS will significantly enhance *"community-based observation programs that draw on indigenous and local knowledge"* as *"the basis for participatory research and capacity-building within Arctic communities"*. Moreover, INTAROS will *"improve the professional skills and competences for those working and being trained to work"* within community-based observing in the Arctic. INTAROS will promote cross-fertilization and connection within community-based observing programs as well as between community-based observing programs and scientists-led observing programs. The work of INTAROS in community-based observing helps "strengthen the societal and economic role of the Arctic region and support the EU strategy for the Arctic and related maritime and environmental policies".

Support international assessments of global challenges such as climate change, scarcity of natural resources and global scale hazards. The INTAROS results will have impact on a number of climate and environmental assessments. Climate modelling both in the Arctic and globally will benefit from more data and from the novel integration of data in the Arctic. In particular, the initialization of climate models can be improved and may result in more skilful climate predictions for the global climate (Task 6.1). Better predictions are important for assessment of consequences of climate change on communities on local to global scale to tackle climate changes related to severe changes in e.g. weather pattern (wind, precipitation), sea level rise, land slides, and changes in seismicity, coastal erosion, and permafrost (greenhouse gases).

The marine ecosystem is sensitive to changes in water temperature, decrease in sea ice, acidity, and nutrients distribution. Marine life is also sensitive to changes in the acoustic environment caused by increased human activities in the Arctic e.g. icebreakers, cargo ships, offshore and sea floor installations. With improved environmental observations and tools for integrated analysis, INTAROS will contribute to better assessment and management of marine resources at high latitudes. Improved understand of the Arctic ecosystem and how it reacts to climate change will also improve our understanding at a global scale.

Extreme changes in the Arctic climate system can induce severe environmental changes on a global scale. Dramatic reduction of the Greenland ice sheet will cause the sea level to increase and many areas in Europe and other places will be below sea level. Furthermore reduced ice on Greenland will cause stress in the Earth's crust and this can result in increased number of earthquakes. Subsea earth-quakes can generate tsunamis, which can hit areas far away from its origin. An ice-free Arctic Ocean will expose the ocean to further warming, which will enhance global warming with all its consequences. Improved observing systems will increase the knowledge that serves as a basis for planning and decision-making. Task 6.4 will address how an observing system can contribute to assessment of natural hazards.

Strengthen the societal and economic role of the Arctic region and support the EU strategy for the Arctic and related maritime and environmental policies. A multidisciplinary observing system and knowledge derived from such system is essential for managers and decision makers. This knowledge is also necessary to follow up EU's Arctic policy objectives: (1) "*protecting and preserving the Arctic in unison with its population"* (COM 2008 763). In particular community based programs (WP4) will have an impact. By providing baseline environmental data for decision support, also in view of risk assessment and economic decisions (WP6), INTAROS will contribute to policy objective (2): "*promoting sustainable use of resources"*. By involving various stakeholders from the pan-Arctic region and embedding design of iAOS under the auspice of the Arctic Council, INTAROS will comprise a significant ingredient in policy objective (3): "*contributing to enhanced Arctic multilateral governance*."

INTAROS can implement several of the EU's Arctic contributions as formulated in the JOIN 2012 document. INTAROS will support the goal on "*fighting climate change"* through collaboration with the climate modelling community (WP6). Furthermore, INTAROS will directly contribute to "*research on the Arctic environment*." By building up multi-disciplinary databases for the Arctic, INTAROS will contribute to well-informed decisions and "*investing in sustainable development in the North"*. INTAROS will also improve the data quality and provide seamless access, contributing to "*reducing future uncertainties and monitoring changes in the Arctic region"*. Finally, iAOS can be used to assess the risk of various operations in the Arctic, especially on decisions and policy development related to "*shipping and maritime safety"*.

Contribute to the GEO Cold Region Initiative and to the Transatlantic Ocean Research Alliance (TORA). INTAROS will contribute directly to the GEO Cold Region Initiative as formulated in the support letter (See Appendix). Furthermore, Dr. Yubao Qiu, who is coordinator GEO-CRI, will be represented in the Advisory Panel for INTAROS. Several US and Canadian research institutions are partners in INTAROS and will contribute to the Pan-Arctic observing system, as outlined in objectives for the Transatlantic Ocean Research Alliance: "*study of the interplay of the Atlantic Ocean with the Arctic Ocean, particularly with regards to climate change"*. (The 'Galway Statement on Atlantic Ocean Cooperation'; EC MEMO/13/455). The Pan-Arctic Observation Forum established in WP1 will follow up and maintain strong links with GEO Cold Regions and TORA.

Contribute to the ongoing and possible future OSPAR actions in Arctic waters. The OSPAR Convention *for the Protection of the Marine Environment of the North-East Atlantic* (including Arctic waters, Region I) has been signed by 15 North-East Atlantic countries and the EU. The OSPAR North East Atlantic Environment Strategy addresses the main threats that it has identified concerning issues within its competence, highlighting the need for work in relation to the monitoring and assessment of the status of the marine environment. The dissemination plan (WP7) includes actions to ensure that relevant conventions such as OSPAR is appropriately engaged and informed about INTAROS. In connection to stakeholder engagement workshops (WP1) the plan describes communication actions via traditional media, social media and other communication channels to ensure visibility from the start of the project.

Contribute to the Sustaining Arctic Observation Networks (SAON) process. The INTAROS strategy for the Pan Arctic Observing system (WP1) is directly based on SAON and other international initiatives related to Arctic and European Blue Growth strategy. It will "*support and strengthen the development of multinational engagement for sustained and coordinated pan-Arctic observing and data sharing systems that serve societal needs, particularly related to environmental, social, economic and cultural issues. ... SAON promotes the vision of well-defined observing networks"*. WP4 is dedicated to community-based research in direct alignment with the SAON goal by "*facilitating the inclusion of Arctic indigenous people in observing activities, in particular by promoting community-based monitoring (CBM) efforts"*.

The pan-Arctic exploitation of data (WP2), the new implementation of observing platforms (WP3), the interoperability of distributed data repositories (WP5), and the application studies for stakeholders (WP6) will all contribute to the goals of SAON. The establishing of a multidisciplinary **Pan-Arctic Observing Forum** will be an instrument to ensure the European role in the development of the future sustained multidisciplinary Arctic Observing System. The Forum will interact with SEARCH and SAON and contribute to the development of a Roadmap with the goal is to establish a sustainable observing system as a collaboration between policy makers, funding agencies, stakeholders, and research communities.

Contribute to the WMO Programme Year of Polar Prediction (YOPP). The integrated Arctic Observing System provided by INTAROS will be available for YOPP scientists and other ongoing and future long-term projects that need data from the Arctic. Data products to increase climate prediction skill will be provided by iAOS to YOPP and other modelling groups including the H2020-BG-10-2016 projects ('Impact of Arctic changes on the weather and climate of the Northern Hemisphere'). By involvement of climate modellers in the project, INTAROS supports the goal of YOPP to "*foster relationships with partners, provide common focussed objectives, and be held over a bit more than a one-year period in association with a field campaign providing additional observations"*. Collaboration will be established between INTAROS and the BG-10 project in order to "*coincide with, support, and draw on other related planned activities for polar regions*". Output data from both BG-10 and INTAROS will be openly available for access of a wider community. Members of the INTAROS consortium are involved in existing climate modelling and prediction projects and networks (e.g. EC-Earth, NorESM, SPECS, EUPORIAS).

Improve the professional skills and competences for those working and being trained to work within this subject area. INTAROS will employ several PhD students and post-doctoral researchers in carrying out project specific tasks. In so doing, skills can be gradually built and continued after INTAROS. INTAROS will also undertake capacity building for early-career scientists by arranging two summer schools during the lifetime of the project (WP7), at Svalbard and at Sodankylä, respectively. Teaching material used will be further distributed and utilized as an educational package openly available to schools and universities, interested in observation-based research in the Arctic. Furthermore, short-term scientific exchange and training of 2-6 weeks for PhD students and early-stage researchers will be organized. Based on application studies towards stakeholders (WP6) INTAROS will also contribute to the specialization program on Arctic Affairs, established as collaboration between several of INTAROS EU and North American partners. On skill improvement, INTAROS will raise awareness and attention to Arctic observation by providing teaching packages for e.g. high school students and teachers in Greenland, and linking of high schools with on-going climate monitoring programs and activities and real life data collection (WP7). Further capacity building will be undertaken for local communities and civil society organisations (WP4) by using community-based observing programmes with particular focus on professional and cross-disciplinary skills and competences of the youth to help ensure the sustainability of community-based observing into the future.

Other impacts that could enhance innovation capacity

The innovation capacity is to a large extent driven by the demand from industry to exploit oil and gas resources, develop maritime transport, marine renewable energy, fisheries, aquaculture, tourism, and other businesses. With increasing political and commercial interest in the Arctic, there will be a need to develop observing systems that are tailored to the various user groups. The results of INTAROS therefore have a significant innovation potential. Shipping in the Arctic will for example need improved weather and ice monitoring and forecasting services. This is a market for commercial services, which can exploit satellite data products and ice-ocean models from INTAROS. StormGEO is an example of a successful company that delivers weather and ice service to the offshore industry on global scale as well as in the Arctic (http://www.stormgeo.com/).

The need for exploring the Arctic Ocean will also be a driver for providing innovative logistical solutions. Use of hovercraft to collect data in remote areas of the Arctic has recently been demonstrated (Kristoffersen and Hall, 2014). A hovercraft is a cost-effective vehicle that can work in collaboration with icebreakers and operate large parts of the ice-covered Arctic Ocean. Also UAVs and drones are evolving rapidly as a platform for Arctic observations, and example data from an UAV is presented in WP2. NORUT has recently opened an Arctic Centre for Unmanned Vehicles in Svalbard and will offer services to use these UAVs (http://norut.no/en/news/arctic-centre-unmanned-aircraft-opened).

Cabled observatories are another development of ocean observing systems that is also applicable in the Arctic, e.g. Ocean Network Canada has implemented and run such a system in Cambridge Bay (http://www.oceannetworks.ca/installations/observatories/arctic/cambridge-bay). Cabled observatories can become important in the Arctic in the future. Communication companies will potentially deploy fibre cables in the Arctic as the sea ice retreats and there are business opportunities to do so. For example, Arctic Fibre has a plan to deploy a cable from London to New York and Tokyo via the Arctic. Such fibre cables can also be exploited for ocean observation with real-time transmission of data.

Barriers/obstacles to realizing impact

Lack of an open data policy can be a barrier to realizing some of the impacts of the project, although EU and most countries are advocating free and open access to all data for environmental and climate monitoring. Some data will be of commercial character and may have restrictions, such as high-resolution satellite images, UAV/drone data, topographic and bathymetric data, and pollution data. However, INTAROS will have very limited use for such data. Other barriers can be the lack of effort among data providers to standardize data, or to adapt to international standards and best practices to process and distribute multi-disciplinary observations. This implies that data integration will be hampered and the value of integrated data products will be reduced. Lack of stakeholder engagement can also be a barrier; hence the project will focus on engaging and motivating selected stakeholders from the start of the project. This is done by including stakeholders as partners in the project.

2.2 Measures to maximise impact

For maximizing the impact of the project results, the following dissemination, exploitation and communication plan is set up:

a) Plan for dissemination and exploitation of the project's results

Dissemination

The dissemination of results, tools, and knowledge from the project aims to target a range of stakeholders within services, businesses, science, and society. The dissemination shall also contribute to the development of relevant national, European, and Pan-Arctic policies. The dissemination will also share knowledge about the Arctic with academia and with the public at large. The dissemination and exploitation activities are closely linked with communication and stakeholder engagement, which will be initiated in WP1 where the **Engagement Strategy** will be formulated in the first year of the project. A part of the strategy is to establish a **Pan-Arctic Observing Forum** that will include scientists, funding bodies, policy makers, technology experts, and stakeholders. The Engagement Strategy will identify the user and stakeholder groups to be targeted as well as develop new ideas for usage of data aimed at the target groups. The Engagement Strategy will be prepared in WP1 and also used in capacity building and other dissemination work in WP7.

The target audiences: these include research, public services, commercial operators, investment, insurance, environmental organizations, policy makers, local communities, and educational institutes. INTAROS will develop results-oriented dialogue with key stakeholders groups such as:

Private sector: maritime industry, oil and gas companies, shipping, tourism, fisheries, mining, construction, transport and logistics providers, environment technology, risk assessment, and consultancy companies.

Political decision-makers (Regulatory and Implementing Community): Agencies and organizations responsible for the implementation of legislation, emergency services, environmental protection, and other.

Broader scientific international community: natural science, engineering, social science, economic, legal, etc.

These groups will be brought into the project through stakeholder engagement (WP1) and capacity building and dissemination/outreach in WP7.

Measures: The following activities will be performed:

(A) Web portal & social media will be used for 1) preparing tailored information for different stakeholder groups (policy makers, business stakeholders; etc.), 2) providing information on current and future observing products and services; 3) demonstrate results of case studies for specific stakeholders (WP6); 4) announcing project news and events, products, and services.

(B) Web-based tools: Web-based visualization tools to present data products from the integrated data repositories and data products generated by the INTAROS processing services will be provided (WP5). Results from the application studies (WP6) will be presented in the INTAROS portal, provided the data are available through a standards compliant data repository. As part of WP6, an Arctic Risk Map web application will also be further developed and used to demonstrate project results towards stakeholders with an interest in risk analysis in the Arctic region.

(C) Science-Policy Briefing Papers & documents: The key project results from WPs 2-6 will be compiled and presented to policy-makers for supporting the decision-making. Dissemination material for use towards decision makers and other stakeholders will be prepared in WP7. **Foresight Paper** will be prepared in WP1 where different policy discussions on Arctic Observing Systems are summarized. A **Roadmap** for a future Sustainable Arctic Observing System, SAOS, will be prepared in WP1 as a reference document to national and EU policy makers aiming to place the iAOS on the ESFRI Roadmap.

(D) Strategic events: A few strategic Briefing Events will be organised at events such as the “European Week of Regions and Cities” open days in Brussels and the annual European Maritime Day conference. Presentations will be given at the Arctic Frontier policy sessions and for the Arctic Council secretariat and the working groups and indigenous peoples’ organizations. A side event will be organized by INTAROS at OceanObs 2019.

(E) INTAROS Legacy – after the end of the project

A Roadmap for the further development of iAOS will be done in close collaboration with research infrastructure projects (RIs) in particular ENVRIplus, and with other actors working with observing systems in the Arctic. The Roadmap will be presented as a reference document to national and EU policy makers aiming to place the iAOS on the ESFRI Roadmap.

Dissemination measures *in the closing phase* of the project: The final report of the project will include a plan for the use and dissemination of foreground, to demonstrate the added value and positive impact of the project on the European Union. A final publishable summary of the results will be made available to the Commission for dissemination in the public domain. This will include information on expected results, and their wider societal implications. The text will be drafted in a way to be understandable for a lay audience. A final project booklet collecting all project publications will be produced at the end of the project. The booklet will be made available for download on the website.

Dissemination measures *after the closure* of the project: After the official end of the project, the foreground of the project will be available as a web-based archive for all interested actors. The domain name of the project website will be assigned to the Arctic Portal (the main portal for the Arctic Council and many arctic projects). The website archives all documentation related to the project, including publications, and will be accessible for 5 years after the end of the project.

2.2.1 Exploitation of results

A plan for the knowledge management, protection and for the exploitation of results, the **Exploitation Plan**

(WP8), will be defined for the consortium in the early stage of the project. The plan will be regularly updated during the project and submitted to the EC as an integral part of the Project Periodic Reports. The Exploitation Plan will address:

- *Protection:* procedures for protecting new results and agreeing on dissemination and publishing of information.
- *Ownership:* agreements on access rights for research and commercial use.
- *Implementation of "innovation-related activities":* including validation or take-up activities, definition of strategies relating to the granting of licenses to third parties or to the identification of potential hurdles for the implementation of the project's results (e.g. standards or third parties' patents)
- *Identification and collaboration with potential users:* the strategy will be updated along with the exploitation potential of the results becoming more accurate.

At the end of the project a Strategy for the Intellectual Property exploitation (WP8) will be drafted for providing best practices in capturing and assessing the Intellectual Property and providing measures for exploitation after the end of the project

2.2.2 Data management policy and plan

INTAROS will participate in the Pilot on Open Research Data in Horizon 2020' and EC guidelines for research data management. INTAROS will collect atmosphere, ocean, cryosphere, biogeochemistry, geohazard, and terrestrial data from three reference sites (Costal Greenland, North of Svalbard, and Fram Strait) and two distributed observing systems (for distributed Ocean and Sea ice observations and for distributed Terrestrial and Atmospheric Observations). All collected data will be pre-processed, and quality controlled before being ingested into a reputed data repository, such as PANGAEA or Global Change Metadata Directory (GCMD), or submitted to a community Spatial Data Infrastructure (SDI) such as SeaDataNet and EMODnet.

Other major providers of data for Arctic communities include CMEMS, Copernicus Land Service, ESA CCI portal, EPOS, ICOS, GRUAN, ACTRIS, GTN-P, Polar Data Catalogue (PDC), Ocean Network Canada (ONC), Alaska Ocean Observing System (AOOS) and Arctic Data archive System (ADS). This will ensure all datasets are provided in standard data formats, with metadata structured aligned with best practices and standards for geospatial data, through IAOS. INTAROS will further adapt selected existing databases holding key parameters for the user demonstrations planned in the project. Such adaptations may entail minor modifications of the metadata served by these databases, standardisation of search and access protocols, and (if needed) standardisation of data formats. This will ensure that data from these databases can be integrated seamlessly into iAOS.

All data generated by the project will be made available according to an Open Data policy in line with the recommendations from Horizon 2020. This will enable external parties the right to access and use the digital datasets created by INTAROS, while respecting general terms and conditions as defined in the Grant Agreement and acknowledging that the originating partner retains the ownership of their datasets. External parties must also cite the data owner when datasets are used as basis for a scientific paper, in presentations or combined with other datasets to generate a new datasets (higher order product) or develop a service. The data policy will further define set of guidelines for governance of the datasets generated by INTAROS, taking into account, among others, the needs for documenting data quality, procedures for secure long term storage and curation, as well as a mechanism for data search, retrieval, and use.

A Data Management Plan (DMP) will be defined for all collected and derived datasets according to the template laid out for the Pilot on Open Research Data in Horizon 2020. The DMP will evolve during the as new data products become available, with planned updates in project-month 12, 30, and 54. The DMP will describe how the different datasets can be accessed and used by the scientific and wider user community (including a license and citation statement).

Curation and preservation: As a general rule, the partner collecting a dataset will be responsible for the management and curation of the data, either by preserving the datasets within the partner's own infrastructure or by storing in a reputed data repository. A data owner (partner) can opt out of data preservation and curation provided they submit their datasets to a data centre that takes on the responsibility for their data. Such transfer of responsibility will be specified in the DMP. The responsible data centres shall follow international accepted principles and practices as e.g. ICSU World Data System and using agreed QC. Ensuring long-term preservation of data is a *top priority* of INTAROS and will be implemented through the GEOSS common infrastructure as reference registry, linking to data in different data infrastructures, such as PANGAEA. All data acquired by the autonomous networks, usually in the context of international programmes (e.g. CMEMS, SeaDataNet, EMODNET, INTERACT, CAFF), already have well-defined good practices with respect to data curation and preservation.

2.2.3 Strategy for Knowledge Management and Protection

INTAROS foresees that Intellectual Property generated by the project takes the form of new products from novel sensor assemblages (WP 3), new products from integrating multi-source data (WP2, WP3, WP4, WP6), and software components for iAOS (WP5). In the early stage of the project the **Exploitation Plan (** WP8) will define a strategy for knowledge management, protection of IPR and for exploitation of project results for the partners. It will focus on planning concrete development and exploitation activities to maximize the use of project result, while taking originating partners' interests into due consideration. Access to Background Intellectual Property and protection and exploitation of Foreground IP will follow the recommendations in the Commission's Model Grant Agreement and the DESCA Model Consortium Agreement for Horizon 2020 projects. The management of the IP, generated by the project, will be carefully monitored by the Executive Board, via the project coordinator, to ensure that it complies with the grant agreement with regard to IPR, dissemination and use issues.

Open access to peer-reviewed scientific publications

INTAROS shall participate in the *Pilot on Open Research Data*. Knowledge generated during the project will be shared openly. Any deliverables or technical documents produced will, following appropriate internal-to-project review procedures involving at least an expert and a management based review, be published online and made discoverable. Peer-reviewed publications will by policy be to journals that are either open access or allow the authors to pay for the articles to be made open access (http://www.doaj.org),

Communication activities

Communication in INTAROS is a cross-cutting activity that is strategically planned with a view to the societal impacts we want to bring about. By developing a coherent **communication plan** (WP7) addressing focused activities INTAROS will raise awareness and engagement in issues of Artic observations. We target different stakeholder groups, namely: policy and decision makers; business sectors; service providers; scientists; local communities; high school teachers and students; and the general public. WP1 is dedicated to engage stakeholder representatives in the project. In addition there will be an external open-ended communication with many other stakeholder groups.

Communication activities include creating a branding pack (logos, letterhead and templates – both for documents and presentations); communicating information on the progress and results of the project; facilitating communication between project partners and interested parties; and monitoring the impact of the communication activities, and adapting when deemed necessary.

Tools to be used in support of the communication tasks will include: 1) stakeholder-engaging workshops and meetings to ensure ownership and usefulness of the products and outcomes; 2) electronic communication (e.g. website, eNewsletters, blogs written by scientists and stakeholders, social media, videos); and 3) print media (brochures, factsheets, press releases, policy briefs). WP-leaders and Theme leaders will provide results to be used in dissemination. All the partners will be involved in the dissemination among their own students, staff and employees and beyond, using their own communication tools.

3. Implementation

3.1 Work plan — Work packages, deliverables

INTAROS is a multidisciplinary project covering atmosphere, ocean, cryosphere and terrestrial observing systems by use of remote sensing, *in situ* observation technologies, and modeling. All elements are addressed in an integrative way throughout all work packages. This requires involvement of scientific institutions in each of the themes, international organizations, private sector (SME's and large company) and stakeholders. INTAROS is organized in eight work packages (WPs) shown on Figure 2. Table 1 provides overview of WPs with full title and lead and co-lead. Six out of the 15 leads/co-leads are females.

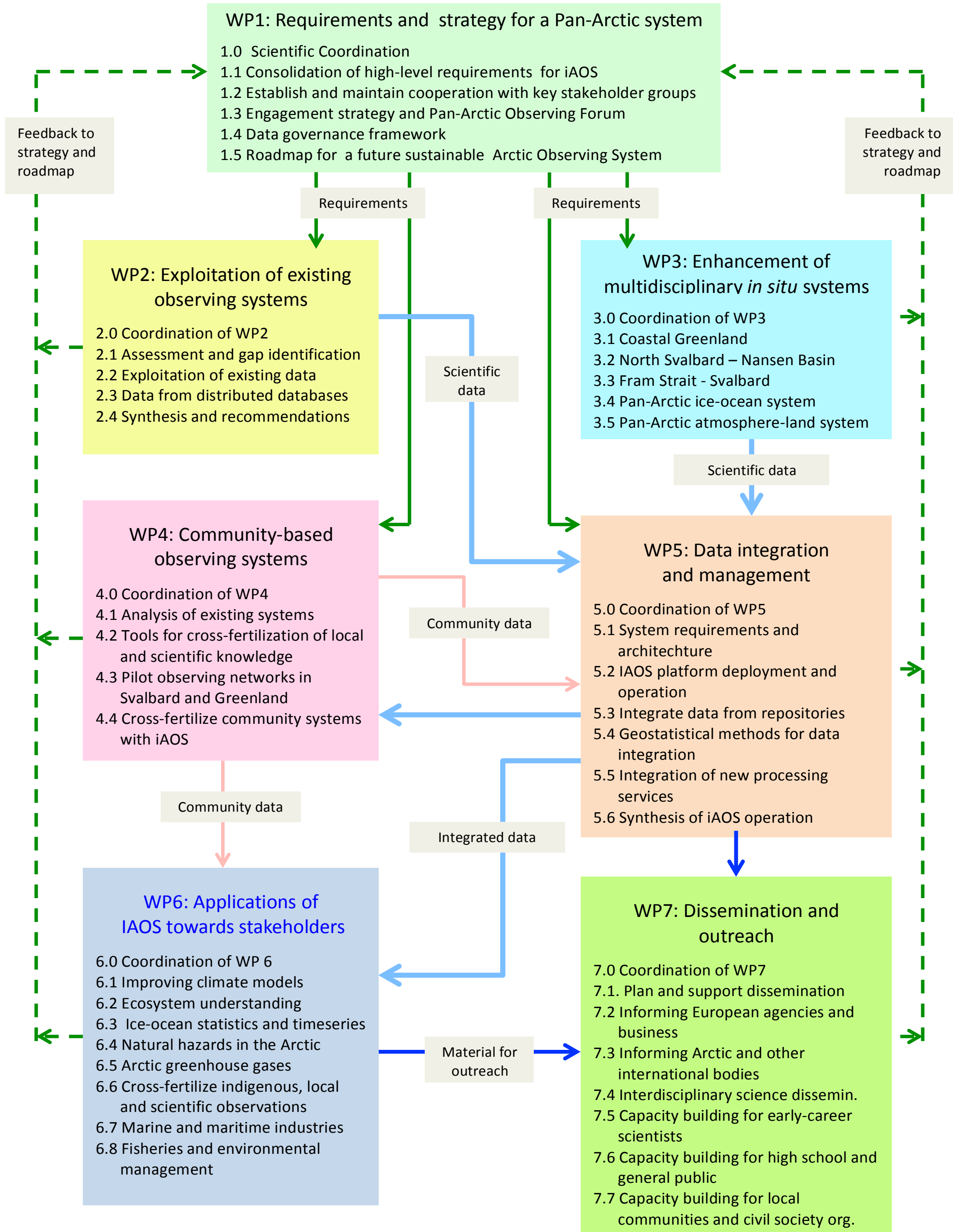

Figure 2. Overall structure of the INTAROS workpackages.

WP1 includes coordination, mobilization, engagement and cooperation between the existing European and international organizations for *in situ* and remote sensing and the modelling communities. **WP1** involves active participation from relevant stakeholder groups. **WP2** will assess existing observing system components and identify gaps as well as prepare for existing repositories for integration into the iAOS platform in **WP5**. **WP3** will increase the temporal and geographic coverage of in situ observation data in selected regions of the Arctic in order to fill selected gaps in the multidisciplinary observing system. The approach in **WP3** is to use innovative combination of mature and new instruments and sensors in integration with existing observatories. **WP4** will address inclusion of community based observing programs into iAOS. A particular focus is on engagement of the local communities to participate in the development of iAOS so that they can take full benefit of such a system. Under **WP5** the new data generated in INTAROS will be ingested into existing data repositories to be accessible from the iAOS platform. The platform will facilitate seamless access to multidisciplinary data, scalable allocation of data storage and computer power for integrative data processing and analysis. **WP6** will demonstrate applications of iAOS to selected stakeholders from governmental institutions, international agencies, industry, local and research communities. Outreach and dissemination will be carried out in **WP7** (in coordination with project management in **WP8**) through meetings, workshops, conferences and summer schools. Finally **WP2-6** will give feedback to **WP1** where the project results will be synthesized and a roadmap for further development of a sustainable integrated Arctic Observing System will be prepared.

Table 3.1: Overview of WPs with leaders/co-leaders.

WP no	WP title	Lead, institution	Co-lead, institution
WP1	Requirements and strategy for a Pan-Arctic system	Stein Sandven, NERSC	Erik Buch, EuroGOOS
WP2	Exploitation of existing observing systems	Roberta Pirazzini, FMI	David Gustafsson, SMHI
WP3	Enhancement of multi-disciplinary *in situ* systems	Agnieszka B. Möller, IOPAN	Per Voss, GEUS
WP4	Community-based observing programs	Finn Danielsen, NORDECO	Lisbeth Iversen, NERSC
WP5	Data integration and management	Pedro Goncalves, TERRADUE	Torill Hamre, NERSC
WP6	Application of iAOS towards stakeholders	Geir Ottersen, IMR	Mikael Sejr, AU
WP7	Dissemination and outreach	Donatella Zona, USFD	Ned Dwyer, EurOcean
WP8	Project management	Stein Sandven, NERSC	Hanne Sagen, NERSC

The Gantt chart below shows the timing of the different work packages and their main components. The project will be implemented over a period of five years allowing for an observational phase of two years overlapping with the YOPP field experiments.

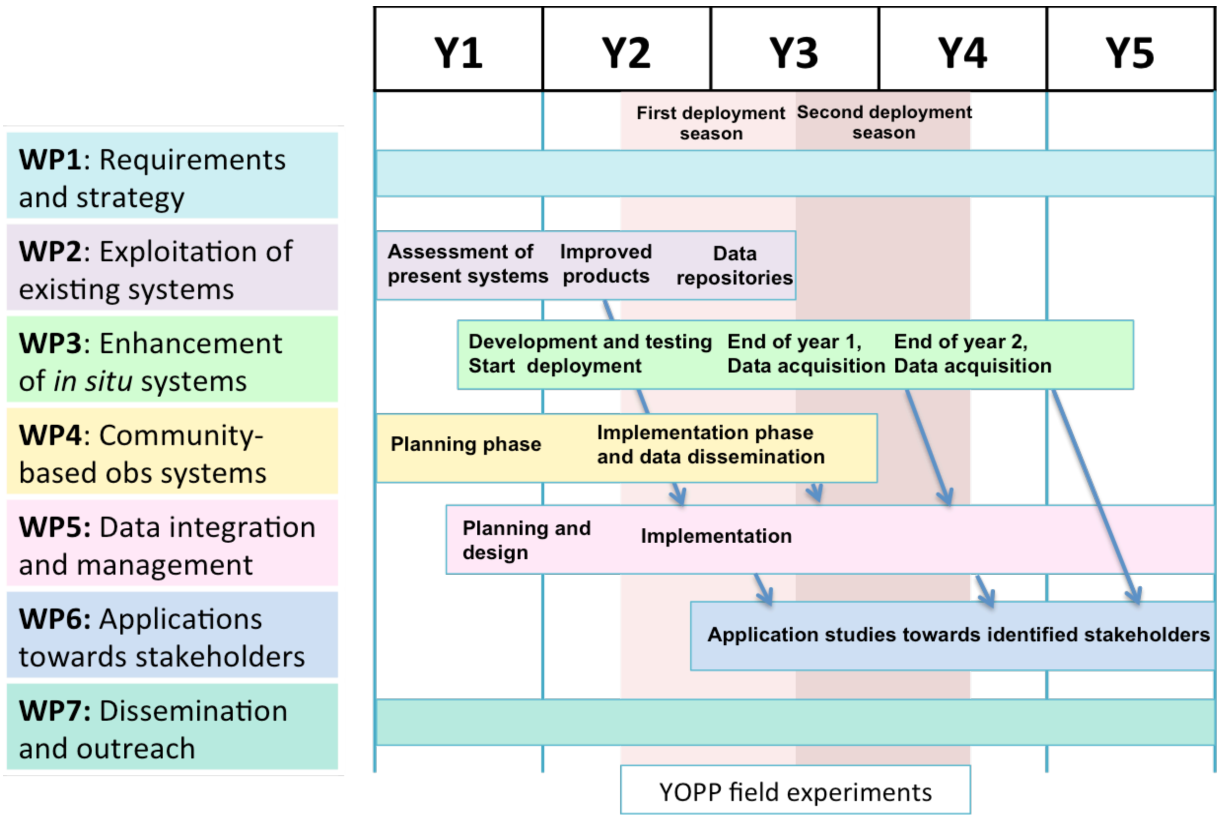

Figure 3. Gantt chart

Table 3.1a: Work package description

Work package number	**1**			**Lead beneficiary**		**NERSC**	
Work package title	**Requirements and strategy for Pan-Arctic Observing System**						
Participant number	**1**	2	3	4	6	7	9
Short name of participant	**NERSC**	UiB	IMR	MISU	IOPAN	DTU	GEUS
Person/months per participant:	17	3	3	2	3	1	2
Participant number	10	12	14	**18**	19	21	27
Short name of participant	FMI	NORDECO	USFD	**EURO GOOS**	EUR OCEAN	UB	NIVA
Person/months per participant:	4	2	0.5	**8**	1.5	2	1
Start month	**Month 1**			**End month**		**Month 55**	

Objectives

Review the high-level requirements and develop the strategy for the Pan Arctic Observing system based on GEO Cold Region Initiative (CRI), SAON and other international initiatives, related to the Arctic and European Blue Growth strategy. Plan the INTAROS activities in agreement with AOS recommendations and Stakeholder groups. Strengthen European participation in Arctic Observing Networks. Specific objectives:

- Formalize collaboration with ATLANTOS, ICOS, EPOS, INTERACT, JERICO-NEXT, Copernicus services, ESA initiatives, ENVRIPLUS, SIOS KC, winners of BG-10 and BG-11 calls, and others.
- Establish and maintain links to various stakeholder groups.
- Formulate an Engagement Strategy and establish a Pan-Arctic Observation Forum to plan and coordinate the work within INTAROS and integrate it within non-INTAROS institutions and organizations.
- Include indigenous perspectives and knowledge in project planning and implementation.
- Prepare data management plan and governance framework.

Description of work

This work package is led by Stein Sandven, NERSC (lead) and Erik Buch, EuroGOOS (deputy lead). The work will focus on consolidation of high-level requirements for iAOS, establishing and maintaining cooperation with key stakeholder groups in Europe and internationally, engagement strategy and establishing of a Pan-Arctic Observing Forum, Data Governance Framework, and Roadmap for a future Sustainable Arctic Observing System. The INTAROS activities will be aligned with recommendations established by the Arctic Observing Summits (AOS2013/2014/2016) and coordinated with ISAC and SAON.

Task 1.0 Scientific Coordination [Lead: **NERSC, Stein Sandven and EuroGOOS, Erik Buch**]

Multidisciplinary scientific coordination of INTAROS work packages will be implemented in agreement with other Arctic projects and international initiatives (GEO, Arctic Council, WMO, IOC). INTAROS will establish formalized collaboration with relevant European projects, programs and infrastructures such as ATLANTOS, ICOS, EPOS, Copernicus services, JERICO-NEXT, ESA initiatives, ENVRIPLUS, SIOS KC, beneficiaries of BG-10 and BG-11 calls. International workshops will be planned and organized with representatives from above projects, non-European partners and stakeholder groups, including indigenous people. Based on science and stakeholder requirements INTAROS will develop a plan for Pan-Arctic Observing System in agreement with the Transatlantic Ocean Research Alliance. The long-term plan will build on Sustained Arctic Observing Networks (SAON) and the Cold Region Initiative of the Group on Earth Observation (GEO) and link up with other relevant programs such as Copernicus and European Space Agency (ESA). In Task 1.0 we will assure that the roadmap to be prepared in Task 1.5 will adhere to plans pursued by nations actively involved in Arctic observing activities, such as US, Canada, Russia, Japan, China and South Korea. The needs of on-going key initiatives such as the Copernicus Services, EMODnet, EU-PolarNet, ENVRIplus, GAIA-CLIM, AtlantOS, BRIDGES, and ACTRIS will be also addressed.

Task 1.1 Consolidation of high-level requirements of iAOS. [Lead: **Stein Sandven, NERSC;** Contributors: EuroGOO, Theme leaders]

The high-level requirements of an integrated Arctic Observing System (iAOS) will be defined based on the societal benefits of GEO (Cold Region Initiative), Marine Strategy Framework Directive (MSFD), and other international initiatives. This task starts with identification of the major societal drivers of a sustained observing system in the Arctic region, driven by issues affecting the entire area and expressed through high-level international agreements (i.e. climate, environment, biodiversity, sustaining ecosystem services, maritime safety, etc.). This will be done in dialogue with SAON and POLARNET, and furthermore coordinated regionally with Arctic coastal countries of Europe, Canada, USA, and Russia. Other countries with significant activities and interests in the Arctic such as China, Japan and South Korea will be involved.

In order to translate these high-level requirements into strategic recommendations for sustained observations of Essential Arctic Variables (EAVs), we will describe the major environmental risks that need to be monitored to support societal goals in the Arctic. Requirements for sustained observations will be expressed in the physical, natural hazards, biogeochemical, and biological EAVs that need to be monitored. These recommendations and requirements will be formulated early in the project from literature studies, projects, programmes and workshops. They will cover an evaluation of feasibility, readiness, and impact to provide guidance on future network design. This deliverable will feed into the work of WP2 and WP3.

In the last phase of the project, we will revisit the requirements and integrate the inputs gathered during the project. The sustained observing requirements and network design will be revised in light of these project outcomes, leaving a legacy of a fully motivated iAOS.

Task 1.2 Establish and maintain cooperation with key stakeholder groups in Europe and internationally. [Lead: **EuroGOOS, Erik Buch**; Contributors: Theme leaders]

The existing Arctic observing network relies primarily on national priorities and funds addressing subjects such as science, monitoring of climate and environment, fishery and fisheries management, safety at sea, energy and mineral exploitation. INTAROS will initiate and maintain an open dialogue with representatives from stakeholder organizations. The key stakeholder groups in the Arctic are the oil and gas industry, insurance companies, shipping organizations, mining companies, tourism, fishing, coast guards, local communities, indigenous people, policy makers, and non-governmental organizations (NGO). Representatives from these groups will be involved in the project to discuss and review their requirements for iAOS to increase the relevance and usefulness of the project. These representatives will attend the annual meetings to follow the implementation of iAOS and provide feedback to the project.

The dialogue with stakeholders will address issues such as:

- Status of the current observing system (goals, objectives, capabilities, challenges and sustainability).
- Usefulness of the Arctic observing system from stakeholders' perspective.
- Improvements in design, implementation, and coordination of long-term observing infrastructure at relevant reference sites.
- Optimal sharing and use of multidisciplinary data from existing and future Arctic observing systems among scientists, governments, community members and the private sector.
- Specific hindrances to the collection or sharing of Arctic observations in the focus areas, e.g. national strategic reasons, industrial interests, or protection of natural resources.
- Use of iAOS to stimulate sustainable development of Arctic communities.

The dialogue will be performed through two dedicated workshops supplemented with virtual communication and circulation of Newsletters (WP7). The first workshop will be organized early in the project and focus on giving input from the Stakeholders to the work in Task 1.1. The aim of the second workshop in M50 is to directly involve stakeholders in the design of the iAOS roadmap in Task 1.5.

Task 1.3 Engagement strategy and establishment of Pan-Arctic Observing Forum. [Lead: **EurOcean, Ned Dwyer**; Contributors: EuroGOOS, Theme leaders]

A comprehensive engagement strategy, containing measures to be implemented both during and after the project, will be conceived and formulated for INTAROS (short: Engagement Strategy) The main aim is to develop a strategy that is shared by all key partners across all relevant WPs both in Europe and across the Arctic. This strategy defines the main INTAROS outputs and precise target audiences. This will support the project in gaining new ideas on how to efficiently engage with stakeholders, attract more users and identify ways to improve data usage and information flow between society and science.

As part of the strategy, a multidisciplinary Pan-Arctic Observing Forum will be established. This Forum will be an instrument to ensure the European role in the development of the future sustained Arctic Observing System. The forum shall have a role as ambassadors for an Arctic observation system, which means that it is important to have members representing political decisions makers, international/intergovernmental organization (with an Arctic focus); research, indigenous people organizations, industry, and other stakeholders. The Forum shall be closely linked to the engagement strategy The Forum will interact with SEARCH, AON and SAON. The Forum will contribute to the development of the roadmap in Task 1.5. The goal is to establish a long-term body involving funding agencies, stakeholders, and research communities.

Task 1.4 Data governance framework. [Lead: **NERSC, T. Hamre**; Contributors: IOPAN, AWI, GEUS, NORDECO, MISU, FMI, EuroGOOS]

The INTAROS *Data Management Plan* (DMP) will provide procedures and methodologies to enable data collected through the project to comply with international standards on quality and metadata, including machine-readable semantic metadata. INTAROS will operate a free and open data policy. The DMP will define how INTAROS data will be made accessible, fully compliant with the INSPIRE directive. The task will also ensure that data and data providers are given maximum visibility, with data and metadata made available through the main European and international data infrastructures, including EMODnet, Copernicus, WMO, EPOS, ICOS, PEEX and INTERACT. The DMP will recommend methods for a free and open data access policy according to the specific data domain. These recommendations will be applied also on WP5 data flows. Digital citation of data will be an important component of data policy.

The INTAROS DMP will define a *data governance framework* to ensure a sustainable data foundation for iAOS. The framework will address the strategy, metadata and data models, standards, policies and procedures, key performance indicators (KPIs) and communication mechanisms for the targeted user and stakeholder communities, that are needed to provide long term preservation and accessibility of the new data and products generated in the project. The iAOS data governance framework will be based on best practices from ESFRI projects and international pan-Arctic initiatives and observation systems. Special attention will be given to addressing principles of intellectual property rights, Free Prior and Informed Consent, respect for knowledge holders, and reciprocity with respect to community-based and citizen science observing, and this will be addressed in collaboration with Task 4.1 of WP4. This task will interact with the key stakeholders to give feedback on the developed framework ensuring it is in line with the frameworks of other infrastructures/data centers before it is submitted to all partners for approval and subsequently implemented.

Task 1.5. Roadmap for a future Sustainable Arctic Observing System. [Lead: **UiB, Truls Johannessen;** Contributors: INTAROS consortium, including non-European partners and Pan-Arctic Forum]

In this Task we will prepare the roadmap for an implementation of a future Sustainable Arctic Observing System (SAOS) based on the synthesis of all results from INTAROS. This WP will synthetize all reports coming from INTRAOS WPs, as well as national plans and European plans (including EuroGOOS plans for an European Ocean Observing System, EOOS), and the Arctic Council strategies and recommendations.

A sustainable iAOS needs to build on existing observing elements and needs to be expanded by new elements aiming to close critical gaps with innovative solutions (technologies and platforms, big data processing, geo-statistical methods). We will assess new in-situ technologies (sensors and platforms) in terms of their readiness (TRL) for use in the Arctic environment based on the results from WP3 and previous experience built up in European and international projects. We will also address their robustness in providing data and delivery mode. The readiness of new data as input to assimilation into prediction and reanalysis systems will be evaluated. Using the AROME NWP model, we will assess the impact of assimilating new in situ and satellite-based atmospheric profiles on the forecast of near surface parameters (pressure, temperature, wind, precipitation) in the Arctic. This will include, in particular, assessment of the feasibility and efficiency of real-time access to key Arctic monitoring data, by taking advantage of existing cabled observatories (e.g. LoVE, Ocean Network of Canada). The overarching data management based on distributed systems at different levels will be also reviewed. Maturity of services and information delivery for defined stakeholders will be examined. The required level of funding to establish a comprehensive future observation system for the Arctic will be estimated in connection with infrastructures that are already supported by countries, EU or international programmes. INTAROS will be in dialogue with space agencies about requirements for future satellite observations in the Arctic, in particular European Space Agency (ESA). We also will approach other major space agencies e.g. NOAA, CSA; ROSCOSMOS; JAXA, CNSA.

We will develop the roadmap for the future integrated Sustained Arctic Observing System (SAOS) in close collaboration with research infrastructure projects (RIs) and other activities in the Arctic, in particular ENVRIplus. The roadmap will be promoted through the Pan-Arctic Observation Forum and presented as a reference document to national and EU policy makers aiming to place the SAOS on the ESFRI roadmap. A future SAOS should be implemented through a co-operation between the existing European and international infrastructures (in-situ and remote / space-based) and the modeling communities and will support and promote the integrated use of Arctic land, ocean, ice and atmosphere *in-situ* and space-based observations from Europe, the USA, Canada and other international partners.

Deliverables

Task 1.0: D1.7 Synthesis report of the project. (Resp. **NERSC**, **M60)**

Task 1.1: D1.1 Initial requirements report: Initial description from ongoing work of the societal imperatives for sustained Arctic observations, EAVs, and contributing observing networks, providing guidance for other WPs. Include stakeholder requirements from the first stakeholder workshop (Resp. **EuroGOOS**, **M6)**

Task 1.2: D1.4 Report on Stakeholder feedback on the designed iAOS, including updated requirements from D1.1. The report reflects the stakeholder evaluation and suggestions to the proposed design of iAOS as based on the second stakeholder workshop. (Resp. **EuroGOOS**, **M54)**

Task 1.3: D1.2 Engagement Strategy. (Resp. **Eurocean**, **M12)**

Task 1.4: D1.3 Data Management Plan and governance framework. (Resp. **NERSC**, **M12)**

Task 1.5: D1.5 Strategic foresight paper on INTAROS. This paper will bring together different policy discussions aimed at the development of Pan Arctic Observing System. (Resp. **EuroGOOS**, **M54)**

Task 1.5: D1.6. Roadmap for sustainable Arctic Observing System. **(**Resp. **NERSC**, **M60)**

Work package number	**2**			**Lead beneficiary**		**FMI**
Work package title	**Exploitation of existing observing systems**					
Participant number	1	2	4	5	6	7	8
Short name of participant	NERSC	UiB	MISU	AWI	IOPAN	DTU	AU
Person/months per participant:	12	7	13	12	4	24	2
Participant number	9	**10**	**13**	14	15	16	17
Short name of participant	GEUS	**FMI**	**SMHI**	USFD	NUIM	IFREMER	MPG
Person/months per participant:	12	**29**	**13**	7	11	9	24
Participant number	18	20	21	22	23	26	27
Short name of participant	EUROGOOS	UPM	UB	UHAM	NORUT	OU	NIVA
Person/months per participant:	2	8	11	12	3	7	5
Participant number	29	30	32	33	35	37	
Short name of participant	UH	GFZ	IGPAN	US	DNV		
Person/months per participant:	6	24	2	2	3		
Start month	**Month 1**			**End month**		**Month 30**	

Objectives

Assess, exploit, and standardize the existing Arctic observing systems to enable established databases to deliver remote sensing and in situ data products to a multidisciplinary, integrated Arctic Observing System (iAOS). Specific objectives are:

- Analyze strengths, weaknesses, gaps in spatial/temporal coverage, and missing monitoring parameters of the existing observation networks and databases in relation to the requirements defined in WP1
- Exploit selected datasets in order to increase the quality and number of data products
- Enhance standardization of data and metadata to ensure that best practices are followed, and to integrate sparse *in situ* data into established networks, preparing their delivery to the iAOS (into WP5 and WP6).

Description of work

In WP2 the existing observing systems will be evaluated with respect to the high-level system requirements defined in WP1, in terms of technological readiness, data delivery chain and data accessibility. The assessment of the observational systems and its gap analysis will be built on new reports from AON, GCOS, GEO, and the WMO-initiated Polar Prediction Project (PPP), and the World Climate Research Program (WCRP). On a European level, the assessment will build on knowledge acquired in previous FP7 projects (e.g. DAMOCLES, MONARCH-A, ACOBAR, INTERACT, ICE-ARC, SEN3APP, ACCESS, COOPEUS, SWARP, NACLIM). The analysis will be made in coordination with parallel activities carried out in the monitoring and infrastructure programmes ICOS, GRUAN, GUAN, NDAAC, EPOS, EUMETNET, GCW, JERICO-NEXT, Euro-Argo, GEOSS, WMO-GAW, SAON, and Arctic-HYCOS, and in established Knowledge Centres, such as the Svalbard Integrated Observing System Knowledge Centre (SIOS-KC), the European Arctic Information Centre (EUAIC), and Polar Knowledge Canada (POLAR).

Data quality and data processing will be improved to meet the highest standards set by the European and international organizations. This will result in the delivery to WP5 of new data products based on the exploitation of single sensors. The integration performed in WP5 will then allow a higher level of data exploitation in WP6, in the form of products based on the combination of several in situ and/or remote sensing data to serve the needs of specific stakeholders.

Task 2.0 Coordination of the Workpackage. [Lead: **FMI, Roberta Pirazzini and SMHI, David Gustafsson**]

This task includes the coordination of WP2, interfacing between tasks in this WP and with other INTAROS WPs. The work package leaders will ensure that the work is carried out according to plan and budget and that the deliverables are produced and milestones are attained on time. WP leaders will ensure establishment of the link with INTAROS project coordination and that the decisions taken at steering level are implemented in this work package. This includes the management of risk registers and mitigation measures.

Task 2.1 Assessment of existing Arctic Observing Systems and identification of essential gaps relative to the EAV and stakeholders needs. [Lead: **MISU, Michael Tjernström**; Contributors: UHAM, FMI, SMHI, MPG, USFD, AWI, NERSC, AU, DTU, IOPAN, UNIS, NIVA, UIB, UPM, UH, GEUS, IFREMER, UB, US, IGFPAS, GFZ, MPG, EuroGOOS, CNRS-LOCEAN]. Non-European partners: UA (terrestrial), WHOI (ocean), SIO (ocean), ONC (ocean), NASA/JPL (sea ice/ocean), RADI (satellite data/terrestrial), JAXA (sea ice/ocean), NIERSC (sea ice)]

Present observational capacities in the Arctic will be analyzed to identify critical gaps (in time, space and technology) that need to be filled with respect to the stakeholder and scientific requirements identified in WP1. The assessment aims to cover all national and international initiatives in the Arctic, with a focus on European observational capacities, including in-situ and remote sensing platforms ranging from large networks to localized research-based observatories. The analyses will include observations of ocean, atmosphere, cryosphere and land with physical, chemical, and biological parameters. European partners will address the components funded by European agencies, while non-European partners will refer to a similar assessment for their systems. The assessment will take advantage of previous studies of the Arctic observing systems (e.g. Lee et al., 2015). For each system we will analyze and assess observed parameters in time and space, measurement accuracy and representativeness, data processing maturity, data delivery mode, quality control mechanism and information for current and historical time periods, and long-term sustainability (funding mechanism, technical readiness). The storage of and access to the data will also be assessed.

Ocean and sea ice. In Europe, the databases SeaDataNet, EmodNET and PANGAEA have been built up over many years as the major data repositories for ocean data, yet there are many datasets not included. These repositories will be assessed with regards to the Arctic. In INTAROS, the assessment of in situ and remote sensing data will focus on the European Arctic, in particular on Fram Strait, the Nansen Basin, Barents Sea, Greenland Sea, coastal regions and fjords of Svalbard and coastal regions of Greenland. We will evaluate data from moored arrays, mobile platforms (ITPs, FerryBoxes, floats, gliders), tide gauge network, on-ice measurements, ocean bottom-mounted sensors and remote sensing to identify gaps and challenges in the existing observing systems for sea ice and ocean (**AWI, NERSC, IOPAN, AU, NIVA, DTU, UIB, EuroGOOS, CNRS-LOCEAN**). Satellite-derived Arctic Ocean and sea-ice data available through established data repositories such as CMEMS Thematic Assembly Centres, ESA CCI program, will be evaluated (**NERSC, IFREMER**). Observing System Simulation Experiments (OSSEs) will be used to address spatial and temporal observational gaps across the whole Arctic Ocean that are relevant for sea level and heat content estimations (**UHAM, UIB, DTU**). The experiments will also identify critical missing parameters in the operational assimilation routines that would have significant impact on the ice-ocean forecast relevant for stakeholders as defined in WP1.

Atmosphere. We will explore quality and usability of meteorological surface observations from long-term buoy deployments in research projects that were not ingested in GOS, and cloud and atmospheric composition data from stations from international networks such as IASOA and PEEX (**MISU, FMI, UH,**

IGFPAS). Critical spatial gaps in the atmospheric observational network will be identified in terms of their impact on weather forecasting in the Arctic, through the analysis of discrepancies between observations, first-guess, and model fields (**FMI, MISU, SMHI**). Data from hyperspectral IR-sensors (AIRS, IASII & CrIS) will be analyzed and assessed using radiosoundings from permanent land stations (IGRA and IASOA) and measurements from icebreakers with a focus on the lower troposphere. In situ data from supersites, field experiments and other observatories will also be used to assess satellite-based cloud products such as CM-SAF and ESA-CCI (**MISU, FMI, SMHI**). Fields of atmospheric total water vapor (TWV) over sea ice and open water, until now retrieved independently from satellite microwave sounders and imagers, respectively, will be assessed for the mutual compatibility, and inconsistencies will be identified (**UB**).

Terrestrial sphere and cryosphere. We will assess spatial-temporal coverage, sample footprints, and QC/QA of tower-based and airborne observations of surface-atmosphere fluxes (sensible and latent heat, CO_2, and CH_4) in Alaska, Canada, and Siberia (**GFZ, USFD, OU, UH, MPG**). We will address the capability of the existing Arctic network of tall towers to constrain the net exchange fluxes for the Arctic ocean and adjacent terrestrial areas (**MPG**). In situ snow, hydrological, and glaciological Arctic observations stored in national data repositories and international databases (such as Global Runoff Data Centre, World Glacier Monitoring Service, National Snow and Ice Data Center) will be reviewed and assessed (**UPM, SMHI, FMI, US, IGPAN**). Sustainability and efficiency of the Greenland PROMICE and GNET GNSS/GPS observation networks in estimating ice sheet mass balance and changes will be evaluated (**GEUS, DTU**). Permanent and temporary seismic stations, which are or have been operational in the Arctic, will be identified, cataloged, and the data will be assessed (**GEUS, UIB, IGPAN**). Satellite snow, hydrological, and ice mass changes products will be evaluated (**FMI, DTU, SMHI**). The results of existing international snow product inter-comparison initiatives (e.g. ESA SnowPex) for dataset selection and product accuracy definitions will be utilized. The assessment will also include emerging satellite capabilities from new science (non-operational) missions, such as ESA SMOS and NASA SMAP (**FMI**).

Task 2.2. Exploitation of existing data towards improved data products. [Lead: **GEUS, Andreas Ahlstrøm;** Contributors: GFZ, NIVA, IFREMER, NERSC, FMI, DTU, UPM, UB, SMHI, OU, US, JRC. Non-European partners: NIERSC (atmosphere)]

In this Task we will develop higher-level products from existing measurements by applying new methodologies for data processing and derivation of new quantities. Satellite remote sensing data are organized in level 1B, level 2, level 3 and level 4. Except for the operational atmospheric data network, in-situ data do not have this level of standardization, as they are generally sparse and diversified in the Arctic. The in-situ data access is limited due to low level of organization into databases. In the case of remote sensing observations, new products will be obtained from sensors that have become recently available or have long-term perspective. The new products will have improved accuracy and resolution (spatial and temporal) compared to existing products. This will include parameters previously not exploited from remote sensing instruments to serve the needs of operational users such as ice and weather services and modellers. In-situ data from selected repositories representing the spheres will be harmonized according to international standards in line with INSPIRE and GEOSS data sharing principles. New and improved data products will be developed adhering to the same principles. Robust processing chains with full quality control and assurance will be provided by following best practices already implemented operationally by large organizations or networks such as ARM, NOAA, ACTRIS, GRUAN, AERONET, ENVRIplus, ICOS, Arctic-HYCOS.

Ocean and sea ice. Existing datasets of carbonate system chemistry; nutrients and phytoplankton biomass will be harmonized and combined to produce regionally and seasonally downscaled products (NIVA). Routines to retrieve ocean color (for marine ecosystem monitoring), sea level and ocean currents, sea-ice coverage, thickness, drift, and summertime sea-ice concentration from new remote sensing observations, above all Sentinel-1/3, will be upgraded and developed, and the products will be made available for iAOS through the CERSAT, UB's, and NORMAP databases (**DTU, UB, IFREMER, NERSC**). Sentinel-3 OLCI data products will be assessed towards their suitability for Arctic studies. A multi-mission ocean-color data record suitable for climate studies in the Arctic Ocean will be crated with a particular focus on the integration of Sentinel-3 OLCI data (**JRC**).

Atmosphere. Atmospheric in situ data identified in Task 2.1 as not yet harmonized must be processed and quality checked before integration with iAOS. Surface, tower, and vertical profile measurements in the Arctic will be standardized with procedures already developed within their respective infrastructures: e.g. data from some IASOA supersites will be upgraded from level 0 to level 2 according to ACTRIS standards (**FMI**). The application of new algorithms will also provide new atmospheric products (as cloud optical properties and water vapor profiles) within the existing infrastructures (**FMI, DTU**). In situ air surface temperature datasets from the circumpolar Arctic will be processed ensuring standardized metadata (**NIERSC**). The exploitation of satellite microwave sounders and imagers will result in the production of an automatic, near-real time detection of seamless atmospheric total water vapor over Arctic sea ice and open ocean which did not exist before (**UB**).

Terrestrial sphere and cryosphere. A complete data processing (including QA/QC) of a large set of aircraft-based measurements of surface-atmosphere fluxes across the terrestrial Arctic will be performed (**GFZ**). A data-driven upscaling scheme for sensible and latent heat, CO2, and CH4, will be developed, resulting in the generation of gridded flux maps (**GFZ**). Improved processing protocols for the in situ hydrological data and for the data collected via short towers will yield new snow, soil, and GHG products with increased accuracy (**OU**). Methods to estimate ice sheet mass balance, mass changes, and surface velocities from in situ and from remote sensing data will be developed (**UPM, DTU, GEUS, US**). The obtained new products will be made available through the main national data repositories. Emerging snow satellite products (snow extent, melt state, soil freezing/thawing) and novel data sources provided by non-operational science missions (e.g. ESA SMOS, NASA SMAP, TerraSAR-X, Cosmo-Skymed) will be exploited and made available through the Finnish National Satellite Data Centre, operated by FMI (**FMI**).

Task 2.3 Compilation of data products from distributed databases and observatories for their integration in iAOS. [Lead: **AWI, Ingo Schewe;** Contributors: NERSC, IFREMER, UB, FMI, GFZ, NORUT, SMHI, GEUS, USFD, UNIS, US, IGFPAN. Non-European partners: SIO (acoustics), NIERSC (remote sensing), RIHMI (terrestrial/atmosphere)]

Full integration of the diverse data products will require harmonization of protocols both within and across spheres. This includes mandating standardized metadata to allow the integrated system described in WP5 to access each database, identify the existing process chains and tools to be applied to new sites, and provide comprehensive data management. Provision for the preparation and delivery of new and existing data products from Earth Observation and *in situ* data in a format suitable for integration will also be performed.

Ocean and sea ice. Acoustic travel time data and acoustically derived temperature are available from the Fram Strait (DAMOCLES, ACOBAR, and UNDER-ICE) and from the Beaufort Sea through the CANAPE projects (**NERSC, SIO**). Acoustic thermometry data are presently not included in any of the ocean databases. Data will be processed to deliver products that will follow the highest standards in quality, format, and completeness of metadata (according to the assessment performed in Task 2.1). The data products will be ingested in a suitable database such as PANGAEA or NMDC. A near real-time data stream for sensor data from the LTER-HAUSGARTEN extension FRAM will be developed. The established O2A data stream (Observations to Archives) will also provide delayed mode pelagic and benthic data from the high oceanic Fram Strait and from the central Arctic (**AWI**). In situ sea-ice thickness, freeboard and snow data collected over several decades from the Soviet North Pole (NP) drifting stations and Sever expeditions will be processed and made available through an open access database (NIERSC). Long-term satellite sea-ice databases (sea ice concentration and sea ice displacement estimates) will be made available for iAOS through the archiving system at IFREMER, UB and SIOS-KC (**NERSC, IFREMER, UB**).

Atmosphere. Sparse near-surface data, tower measurements, and vertical profiles measured in campaigns or stations not included in established networks will be harmonized following ACTRIS and other relevant protocols, and, together with their metadata, will be made available through open access databases. This will include near-surface meteorological data from the PROMICE network in Greenland, atmospheric observations from Arctic Ocean field experiments (SHEBA and Tara drifting stations, experiments based on Oden, Polarstern, and Amundsen ships) and from experimental buoys (e.g. the O-Buoy and the iAOOS lidar), monthly, daily and sub-daily in situ meteorological data from the Russian territory, UAV observations from Svalbard, airborne observations of atmospheric composition and physical parameters (**MISU, GEUS, NORUT, GFZ, RIHMI, IGPAN**).

Terrestrial sphere and cryosphere. Snow data from weather stations and snow courses, maps of permafrost for the Russian territory, surface albedo and ice ablation data from Greenland, terrestrial turbulence, GHG fluxes, and environmental data from Alaska will be harmonized and made available through open access databases (**UNIS, GEUS, NIERSC, RIHMI, USFD, US, IGPAN**). The database of the Sodankylä Arctic Centre will be updated with the inclusion of in situ automatic and manual measurements collected at the local multi-disciplinary observatory (for cryosphere, meteorology, air-chemistry and composition, phenology), and will be interfaced with the iAOS (**FMI**). An interface will also be built between the hydrological in-situ data from the national hydrological services included in the Arctic-HYCOS project and iAOS (**SMHI**). A metadata catalogue of all Arctic terrestrial fluxes and environmental data products will be made (**USFD**) with links to all existing databases (AON, NGEE, ARM, NOAA, CMDL). From the processing and compilation of all available seismological data a new, high-quality earthquake database and catalogue will be obtained that can serve as a baseline for studying future seismicity changes related to glacial melting and associated crustal stress changes. Direct links will be established to tailored satellite data archives and services of the EU Copernicus Core Land Services and to prototype satellite data products (e.g. ESA GlobSnow, ESA SMOS Cryosphere products, and prototype cryosphere products from Sentinel satellites) critical for the Arctic monitoring (FMI). EO data downlink, processing, and archiving capabilities will be provided by the Finnish National Satellite Data Centre (**FMI**).

2.4 Synthesis and recommendations. [Lead: **SMHI, David Gustafsson;** Contributors: NUIM, FMI, MISU, AWI, GEUS]

A synthesis of the results from Task 2.1-2.3 will be produced, including a summary of the gap analyses, the achieved improvements of the existing system, the available databases, and the developed data products, metadata, guidelines and tools. On the basis of this synthesis, recommendations on how to fill the observational gaps, how to improve sampling strategies and data management, and how to sustain and further enhance the integration of multidisciplinary data repositories will be given. (**SMHI, MISU, GEUS, AWI, FMI**) Building upon the pre-existing assessment work undertaken in GAIA-CLIM, the maturity of the existing observing systems in the Arctic will be summarized using the Maturity Matrix Approach. (**NUIM**). This Task will provide input to the Roadmap for SAOS in WP 1.

Deliverables

Task 2.1

D2.1 Report on present observing capacities and gaps: ocean and sea ice observing system (Resp. **UHAM,** AWI, NERSC, IOPAN, AU, NIVA, DTU, UIB, IFREMER, UB, M12)

D2.4 Report on present observing capacities and gaps: atmospheric observing system (Resp. **MISU, SMHI,** FMI, UH, M12)

D2.7 Report on present observing capacities and gaps: terrestrial and cryospheric observing system (Resp. **USFD, OU,** UH, GFZ, MPG, UPM, GEUS, DTU, FMI, SMHI, M12)

Task 2.2

D2.2 Report on exploitation of existing data: ocean and sea ice (Resp. **DTU,** UB, IFREMER, NERSC, CNRS, **M18**)

D2.5 Report on exploitation of existing data: atmospheric (Resp. **FMI,** DTU, NIERSC, UB, M18)

D2.8 Report on exploitation of existing data: terrestrial and cryospheric data (Resp. **GEUS,** UPM, DTU, SMHI, OU, FMI, GFZ, M18)

Task 2.3

D2.3 Catalogue of products and services based on ocean and sea ice data (Resp. **AWI, M24**)

D2.6 Catalogue of products and services based on atmospheric data (Resp. **GFZ, M24**)

D2.9 Catalogue of products and services based on terrestrial and cryospheric data (Resp. **FMI, M24**)

Task 2.4

D2.10 Report on synthesis and recommendation from WP2 (Resp. **SMHI**, **M30**)

D2.11 Report on the maturity scores of existing observing systems in the Arctic (Resp. **NUIM**, **M30**)

Work package number	3	Lead beneficiary			IOPAN	
Work package title	**Enhancement of multidisciplinary *in situ* observing systems**						
Participant number	1	2	3	4	5	**6**	7
Short name of participant	NERSC	UiB	IMR	MISU	AWI	**IOPAN**	DTU
Person/months per participant:	3	48	8	12	30	48	1
Participant number	8	**9**	10	14	17	20	23
Short name of participant	AU	**GEUS**	FMI	USFD	MPG	UPM	UHAM
Person/months per participant:	28	28	21	4	12	11	3.6
Participant number	26	27	28	30			
Short name of participant	OU	NIVA	CNRS	GFZ			
Person/months per participant:	14.7	12.5	27.8	6			
Start month	**Month 6**			**End month**		**Month 54**	

Objectives

The overall objective of WP3 is to improve critical gaps in the Arctic observations by integration of newly developed and mature technologies for multidisciplinary observations and to build additional capacity of pan-Arctic monitoring networks. We will make best use of existing reference sites and distributed observatories that have been selected as (1) providing the critical data for Arctic climate and ecosystems, yet still missing multidisciplinary dimension or technical advancement and (2) allowing to build on already available infrastructures to optimize the costs and data return. We will extend their temporal and geographic coverage and add new key geophysical and biogeochemical variables through implementing novel technology integrated with standard observations. Specific objectives are:

- Develop and integrate autonomous and robust *in situ* systems for year-round measurements of key geophysical, biogeochemical and biological variables.
- Deploy new sensors and *in situ* platforms for year-round observations in selected reference sites and distributed observatories and to extend existing infrastructures with multidisciplinary measurements.
- Deliver geophysical, biogeochemical, and biological data products to be used for data integration (WP5), demonstration studies (WP6), and stakeholder consultations (WP7).

Description of work

WP3 main activities will focus on developing and implementing innovative solutions and new technologies to fill selected gaps identified in the existing observing systems. Novel instruments and sampling methods will be further integrated with mature components of existing observatories to increase temporal and geographic coverage of *in situ* observational data in the Arctic.

Three reference sites have been selected as providing critical data to understand ongoing climate and environmental changes and their consequences for the Arctic: (Task3.1) Costal Greenland - key location for freshwater output from the Greenland ice sheet to the ocean, (Task3.2) North of Svalbard from the shelf to the deep Nansen Basin - the hot-spot for mass, heat and biological energy input to the European Arctic, and (Task3.3) Fram Strait - the critical gateway for exchanges between the Arctic and the World oceans. The key components in two distributed observatories: (Task3.4) for ocean and sea ice and (Task3.5) for terrestrial and atmospheric measurements will be extended to include multidisciplinary observations, still missing from the central Arctic and remote coastal areas.

To optimize the fieldwork effort and integrity of new multidisciplinary data, we will build on and effectively extend infrastructure already existing in selected reference sites and distributed observatories. Based on WP 2 results we will plan how to optimally fill gaps in selected systems for ocean, sea ice, atmosphere and natural hazards in the early phase of the project. New sensors and integrated platforms and experimental set-ups will be implemented during a two-year long deployment phase with an aim for sustained use in a future iAOS. New collected data will be preprocessed under WP3 to provide standardized data sets ready for integration in WP5, demonstration actions in WP6, and for the consultations with stakeholders (WP7).

The key themes addressed in this work package are: **Atmosphere (A), Ocean (O), Cryosphere (C), Biogeochemistry (BGC), Ecology (E), Natural hazard (NH),** and **Terrestrial observations (T).** All activities undertaken under each Task will be implemented in a three-phase process:

Phase 1: Development of new technologies and integration of multidisciplinary sensors for autonomous *in situ* monitoring systems in the Arctic (**M1-18**).

Phase 2: Implementation of integrated multidisciplinary sensors and platforms for year-round measurements in the selected reference sites and distributed observatories (**M19-48**)

Phase 3: Preparation and delivery of preprocessed new data to WP5 and WP6 (**M19-54**, overlap with Phase 2 due to the near real time data delivery from some sensors).

The data collected under WP3 will contribute to ongoing and future long-term initiatives (e.g. OSPAR, SAON, YOPP). Technical recommendations, based on experience gained from INTAROS deployments and synthetized in Task 3.0 will contribute to the WP1 roadmap for the future sustained Arctic observing system.

Task 3.0 Scientific and operational coordination. [Lead: **IOPAN, A. Beszczynska-Möller and GEUS, P. Voss;** Contributors: all WP3 partners]

The work package leaders will ensure that the planned work is carried out according to plan and budget and that the deliverables are produced and milestones are attained on time. Additionally the leader will ensure that the decisions taken at steering level are implemented in the work package. This includes the management of risk registers and mitigation measures, particularly important for field operations in the high Arctic. The coordination activities for ship time access, required for the field deployments, will take place in Task 3.0. We will develop collaboration with icebreaker operators from China, South Korea, Sweden and Germany (based on tentative agreements), make arrangements with INTAROS partners to optimally use ship time available within the consortium and explore prospects to use of ships of opportunities or support from other projects and programs. Synthesis of technical recommendations for new sensors and technologies implemented under WP3 will be developed as contribution to the roadmap for the future sustained Arctic Observing System in WP1.

Task 3.1 Coastal Greenland. [Lead: **GEUS, Andreas Ahlstrøm;** Contributors: AU, FMI, UPM, CNRS-IUEM, CNRS-Takuvik]

Task 3.1 is focused on the coastal region of Greenland, where actions are taken both offshore, onshore and on the Greenland ice sheet to monitor identified environmental variables. Duration of sea-ice cover and input of glacial meltwater and runoff from land are key drivers of ecosystems in Greenland fjords and coastal waters. These factors also impact the uptake of CO2 by increasing vulnerability to ocean acidification. We will enhance and complement existing monitoring systems with novel solutions, both in terms of instrumentation, platforms and logistics. For the Northeast Greenland site, a combination of ocean moorings (**O: AU**) with new solutions to obtain coverage, duration, thickness and energy balance of snow cover on sea ice (**C, O: AU**) will increase knowledge of how freshening of the Arctic impacts the marine ecosystem. For the entire Greenland coastal zone, we will establish an essential baseline dataset on surface pCO2 and ocean acidification **(O: AU)** enabling future monitoring of the impact of freshening on CO2 uptake of the ocean. To monitor the meltwater output to the ocean from the Greenland ice sheet, we will implement a novel ruggedized system adding to the existing on-ice weather station network for snow-water equivalent on the ice sheet margin (**C: GEUS**). This will enable us to capture meltwater retention mechanisms in the snow and firn on the ice, a main uncertainty in modelling of future ice sheet runoff. Obtaining precise positioning of the same on-ice sheet network (**C: GEUS, DTU**) will provide much needed calibration for satellite-derived ice velocity maps used to calculate the ice-dynamic mass loss to the ocean. Accuracy and spatial representativeness of the *in-situ* snow albedo observations (from PROMICE and GC-Net networks) over Greenland ice sheet will be also improved (**C: FMI**). An improved ground-penetrating radar system (**C: UPM**) and methodology for correction of in-situ ice sheet albedo measurements (**C: GEUS**) will be developed. The ice-driven dynamics of the arctic coastal ecosystems will be studied in the Young Sound through a multi-disciplinary approach (with similar system in Kongsfjorden under Task 3.3 for a comparison of two contrasted fjords), by merging physical oceanography and marine biology, and using the passive acoustics non-invasive technique to characterize both physical (dynamics of sea ice and icebergs, waves-ice interactions) and biological compartments (behavior of organisms at different trophic levels) (**O, C, BGC : CNRS-IUEM**). Task 3.1 will also contribute to a suite of sensors for automated monitoring of the coastal ocean at the Baffin Bay Observatory (in Qiqiktarjuak) (**O: CNRS-Takuvik**), implemented for monitoring of the spring bloom processes and the bio-optical and biogeochemical properties under the ice pack.

Task 3.2. North of Svalbard towards the deep Nansen Basin. [Lead: **UiB, Truls Johannessen**; Contributors: IOPAN, NIVA, IMR, AWI, UNIS, GEUS, CNRS-LOCEAN, NERSC]

In Task 3.2 we will develop and implement an integrated, multidisciplinary moored observatory north of Svalbard, extending from the shelf towards the deep Nansen Basin. The moored array will build on and significantly extend the existing infrastructure of the A-TWAIN oceanographic moorings. To extend capacity of current local platforms towards multidisciplinary long-term and long-range observatory, an unprecedented suite of multidisciplinary sensors and samplers will be integrated in the moored array. The moored observatory North of Svalbard will monitor the dynamics and variability of the Atlantic water inflow to the Arctic Ocean with a main goal to assess how the different components of the flow affect the variability of the transports, including the shelf-basin exchanges, the stratification of the upper Arctic Ocean, the sea-ice cover and Arctic ecosystems. We will implement the state-of-the-art profiling instrumentation combined with point sensors for high-resolution measurements of key physical variables in the whole water column, including the critical uppermost layer (**O, C: IOPAN, CNRS-LOCEAN**). A suite of biogeochemical measurements and sampling will be used to address ecosystem changes in the Arctic Ocean, ocean acidification and carbon cycle, carbon fluxes advected into the Arctic and the role of pollutants in the Arctic environment. Key carbon system variables will be measured using advances sensor technology together with the necessary physical and other biogeochemical variables as oxygen and nutrients. Novel pCO2 sensors will be used to monitor water mass with high pCO2 pressure below the freshwater layer. This is a novel test of autonomous year-round system in the Arctic environment and calibration (QC) of the mooring data will be done using ship-borne classical carbon system measurements (**O, BGC: UiB, IMR**). Autonomous passive contaminant samplers will be developed for moorings aimed in quantification and characterization of known and emerging contaminants (**O, BGC: NIVA**). To monitor the planktonic communities, the sediment trap, underwater vision profiler, and Fast Repetition Rate Fluorimeter (FRRF) will be implemented to determine photosynthetic properties controlling variability in primary production (**O, E: AWI**). A combined ADCP-echosounder will be employed to concurrently record currents and zooplankton to fill the gap in observations of the plankton and fish community under Arctic sea ice (**O, BGC, E: IMR**). New data from these integrated multidisciplinary sensors will enable investigation of the relationship between hydrography and plankton and fish dynamics with focus on the impact of the Atlantic Water inflow in ice-covered waters. Passive acoustics will be used to assess the human impact on the ocean soundscape in the Arctic (**O: NERSC**). Upward-looking ice sonars will be implemented on the deep moorings to measure sea ice thickness and drift velocity (**O, C: UiB**). Additional mooring, instrumented for observations of internal solitary waves, will be deployed by WHOI (**O: WHOI**). Bottom pressure recorders will be deployed on Yermak Plateau (**O: UNIS**) to investigate remotely sensed ocean circulation by taking advantage of satellite gravimetry and altimetry, and provide ground truth for satellite gravity solutions. Ocean bottom seismometers will be installed to increase observational capacity of solid Earth processes and monitor the geohazards (**NH: UiB, GEUS**), increasingly important for assessing natural hazards such as earthquakes and slope instabilities. The installations will be done with the newly acquired Norwegian ROV to assure optimal sensor siting. The spatial design of planned observatory and distribution of instrumentation will be worked out in the early phase to assure the scientifically optimal and cost-effective data return for all disciplines.

Task 3.3 Fram Strait [Lead: **AWI, Thomas Soltwedel**; Contributors: CNRS-IUEM, CNRS-LOV]

An integrated observing system in Fram Strait will build on the existing LTER (Long-Term Ecological Research) observatory HAUSGARTEN, covering the Western Svalbard and Eastern Greenland continental margin and adds to other currently existing moored observations on the shelf and in the Arctic fjords on western Svalbard. The HAUSGARTEN observatory will be extended with an experimental system to study impacts of ocean acidification on benthic organisms and communities (**O, BGC, E: AWI**). The autonomous arcFOCE (Arctic Free Ocean Carbon Enrichment) system, building on an existing deep-water system at MBARI, will be adapted to greater water depths (4000 m), extremely low temperatures, and autonomous operation (no cable connection to land). Ocean observations will be complemented by monitoring of carbon cycle parameters and acoustic measurements based on the AWIPEV station. The first time-series for the carbonate chemistry of Arctic coastal waters in Kongsfjorden as part of the AWIPEV Underwater Observatory will comprise continuous real-time measurements of pCO2, continuous pH measurements and weekly discrete measurements of dissolved inorganic carbon and total alkalinity (**O, BGC: CNRS-IUEM**). A directional acoustic system with hydrophones will be deployed in Kongsfjorden to match a similar system on the Greenland side station (**O, C, BGC: CNRS-LEMAR**) with the aim to monitor the activity of benthic species (bivalves) and sounds produced by icebergs (including localization and detection).

Task 3.4 Distributed systems for ocean and sea ice [Lead: **IOPAN, Agnieszka Beszczynska-Möller**; Contributors: FMI, NIVA, CNRS-Takuvik, CNRS-LOCEAN]

Distributed observing systems for ocean and sea ice will contribute to the existing network of Ice Based Observatories, passive and active mobile platforms and repeated lines by ships of opportunity in the central Arctic. Novel instrumentation including biogeochemical sensors for ecosystem measurements will be deployed on ice-tethered platforms (ITPs) which will be further combined with companion instrument systems measuring meteorological variables, sea ice and ocean mixed layer parameters and upper ocean velocity (**O, C, BGC: IOPAN, WHOI**). An array of simple yet effective sea-ice mass balance buoys (SIMBAs) will be deployed to monitor seasonal evolution of the sea-ice thickness (**C: FMI**). Ice-tethered instrumentation will be deployed in the central Arctic Ocean during the icebreaker cruises in collaboration with partners from Europe, China and South Korea (CHINARE expedition, ARAON, ODEN, Polarstern cruises). Complementary observations of macro and microphysical properties of snow, the atmospheric boundary layer and vertical profiles will be collected from ships of opportunity with portable and accurate spectral and broadband radiometers, and a quadrocopter will be employed to measure spatial variability of broadband and spectral surface albedo (**C: FMI**). A new combined sensor will be developed to monitor ocean acidification and carbonate chemistry observations on FerryBoxes (**O, BGC: NIVA**). This is based on a spectrophotometric carbonate ion sensor (developed in cooperation with the FP7 NEXOS project) that will be coupled to a spectrophotometric pH sensor. To fully characterize the carbonate chemistry parameters, pH and carbonate ion represents one of the most reliable pair of autonomous measurements, especially in the Arctic where freshwater input and high organic matter can potentially compromise traditional carbonate chemistry measurements (DIC and total alkalinity). For inherent optical properties, we will deploy a continuous spectral absorption sensor for multi-wavelength observations for validation of satellite ocean color algorithms and for characterizing in situ dissolved organic matter (**O, BGC: NIVA**). A high throughput microplastics sampler for quantification and characterization of microplastics into three particle size classes will be developed to operate alongside a FerryBox system (**O, BGC: NIVA**). BioArgo floats will provide data, including biogeochemical key variables, from Baffin Bay (**O, BGC: CNRS-Takuvik**). Endurance glider lines will be established and coordinated (in terms of sampling strategy, implementation of data standards and data management in relation to WP5) along the Atlantic water pathways to the European Arctic (e.g. south of Svalbard, Fram Strait, or north of Svalbard) as a joint effort based on different national glider facilities (**O**, **BGC: CNRS-LOCEAN**).

Task 3.5 Distributed systems for atmosphere and land [Lead: **MPG, Mathias Göckede**; Contributors: GFZ, OU, USFD, CNRS-Takuvik, FMI]

Activities in Task 3.5 will focus on demonstrating the opportunities that arise from the use of new technology to fill spatial, temporal and methodological gaps in existing atmospheric and terrestrial networks. We will *enhance monitoring of atmospheric composition and boundary layer properties* by providing information on additional trace gases to improve routine continuous monitoring of atmospheric GHGs that is usually restricted to the total mixing ratios of CO_2 and CH_4 near the surface (**A, BGC: MPG**). We will enhance the atmospheric station at Ambarchik, a coastal site perfectly positioned to capture emission signals from the East Siberian Arctic Shelf (ESAS), with an automated flask sampling system capable of capturing additional trace gases (e.g. N_2O, SF_6, CO, O_2/N_2) and isotopes (e.g. $^{13}C\text{-}CO_2$, $^{13}C\text{-}CH_4$, $^{2}H\text{-}CH_4$, ^{18}O). Isotopic fingerprints will facilitate differentiating between trace gas sources (e.g. geologic vs. biospheric), thus providing in-depth insight into permafrost degradation processes in the ESAS domain. Vertical profiles of atmospheric boundary layer state variables, captured during airborne campaigns along the Alaskan and Canadian Arctic (**A: GFZ**) will provide in-depth insight into mixing and transport processes, thus allowing an improved representation of atmospheric transport modelling within the Arctic.

Recent studies have demonstrated the importance of year-round observations of GHG flux exchange in Arctic ecosystems, with e.g. cold season respiration emitting more than half of the summertime uptake of CO_2 at one study site. To *improve spatial and temporal coverage of GHG fluxes*, we will implement a sequence of measures within a transect of observation sites in the Barrow region, including a de-icing system for sensitive atmospheric instrumentation, a novel temperature sensing system that provides unprecedented spatiotemporal coverage within soil and snow layer, and a new soil diffusivity system for trace gases (**A, T: OU, USFD**). The latter innovation promises to provide continuous, year-round data on CO_2 and CH_4 concentrations, fluxes, consumption, and/or production in remote areas. To assess the regional representativeness of site level datasets, gridded surface-atmosphere flux maps with full uncertainty quantification will be produced based on airborne flux observation transects covering the entire North Slope, including frequent visits of the Barrow site cluster.

Quantifying the effects of snow on surface energy balance and permafrost thermal regime requires *novel in-situ and remote sensing monitoring of snow physical properties*. In particular, deployment of novel technology to monitor snow thermal conductivity at several heights in the snowpack will be pursued. To study the landscape scale impact of climate, surface characteristics, and the nature of the vegetation on snow properties we propose to extend operation of a transect of monitoring sites spanning a latitude range of 55-83°N in the Eastern Canadian Arctic. This in-situ network will be supplemented by drone-based pulsed-LIDAR observations mapping the surrounding terrain at highest resolution to demonstrate the coupled evolution of vegetation, snow depth and permafrost thermal regimes (**T: CNRS-Takuvik**). At Sodankylä-Pallas in Northern Finland, we will install several systems that target an improved ground-truthing of satellite remote sensing products, including an automatic spectro-albedometer covering the full solar range (350-2500nm) at high temporal resolution, and a VNA-based radar system to monitor soil, snow and surface vegetation properties (**A, T: FMI**)

To *improve spatiotemporal coverage of atmospheric observations* in the central Arctic, we will develop a system for semi-autonomous observations on the Swedish research icebreaker Oden, allowing routine data collection with remote control to a home base for near-real time data quality assessment. Observations may include basic meteorology, surface flux and cloud observations **(A: MISU)**. A separate study will deploy stable isotope measurement infrastructure on ships of opportunity in the marginal ice zone north of Svalbard, with a potential extension of the program during airborne IPY field activities. This activity will be linked to new calibration efforts for all isotope parameters, and be integrated into the network of stable isotope observations within the AC-AHC2 project that partly includes the European lower Arctic.

Contribution to WP3 from international partners: WHOI (ITPs, mooring for observations of internal solitary waves), NMEFC and PRIC (icebreaker cruises, SIMBAs).

Deliverables

Task 3.0: Scientific and operational coordination

D3.16 Synthesis and technical recommendation based on the results from the implementation of observing systems in WP3. A report will be prepared as contribution to the Roadmap for a future sustained Arctic Observing System in WP1. (Resp. **IOPAN**, **M54**)

Task 3.1: Greenland sites

D3.1 Technology development and system design for the Greenland sites Report on development of sensors and experimental systems, design of observations and testing phase (Lead**: GEUS**, **M18**).

D3.6 First implementation and operational use of the observing systems. Data delivery and report on results of the observing systems in Greenland (Lead**: GEUS**, **M36**).

D3.11 Final implementation and operational use of the observing systems. Data delivery and report on results of the observing systems in Greenland (Resp. **GEUS, M54**),

Task 3.2: North Svalbard

D3.2 Technology development and system design for the North Svalbard site. Report on development of sensors and experimental systems, design of observations and testing phase (Lead**: UIB**, **M18**).

D3.7 First implementation and operational use of the observing systems. Data delivery and report on results of the observing systems North Svalbard (Lead**: UIB**, **M36**)

D3.12 Final implementation and operational use of the observing systems. Data delivery and report on results of the observing systems North Svalbard (Resp. **UIB, M54**),

Task 3.3: Fram Strait

D3.3 Technology development and system design for the Fram Strait site. Report on development of sensors and experimental systems, design of observations and testing phase (Lead**: AWI**, **M18**).

D3.8 First implementation and operational use of the observing systems. Data delivery and report on results of the observing systems in Fram Strait (Lead**: AWI, M36**).

D3.13 Final implementation and operational use of the observing systems. Data delivery and report on results of the observing systems in Greenland (Resp. **AWI, M54**),

Task 3.4: Distributed system for ocean and sea ice

D3.4 Technology development and system design for the ocean and sea ice system. Report on development of sensors and experimental systems, design of observations and testing phase (Lead**: IOPAN**, **M18**).

D3.9 First implementation and operational use of the observing systems. Data delivery and report on results of the ocean and sea ice system (Lead**: IOPAN, M36**).

D3.14 Final implementation and operational use of the observing systems. Data delivery and report on results of the ocean and sea ice system (Resp. **IOPAN, M54**)

Task 3.5: Distributed system for atmosphere and land

D3.5 Technology development and system design for the ocean and sea ice system. Report on development of sensors and experimental systems, design of observations and testing phase (Lead**: MPG/OU**, **M18**).

D3.10 First implementation and operational use of the observing systems. Data delivery and report on results of the ocean and sea ice system (Lead**: MPG/OU, M36**).

D3.15 Final implementation and operational use of the observing systems. Data delivery and report on results of the ocean and sea ice system (Resp. **MPG/OU, M54**)

Work package number	**4**			**Lead beneficiary**		**NORDECO**
Work package title	**Enhance community-based observing programs for participatory research and capacity-building**					
Participant number	1	2	9	**12**	15		
Short name of participant	NERSC	UiB	GEUS	NORDECO	NUIM		
Person/months per participant:	4	3	2	24	1		
Start month	**Month 1**			**End month**		**Month 36**	

Objectives

The overall objective of WP4 is to enhance community-based observing programs for participatory research and capacity building. Specific objectives are:

- Survey and analyze existing community-based observing programs in the Arctic to identify capabilities, best practices and challenges.
- Advance tools for cross-fertilizing indigenous and local knowledge with scientific knowledge.
- Pilot community-based observing networks of relevant parameters in Longyearbyen, Svalbard, and Disko Bay, Greenland, to support local and national decision-making processes.
- Develop a model of how community-based observing programs can connect and cross-fertilize with iAOS, and to enter the existing and new community-based observations from Longyearbyen, Svalbard, and Disko Bay, Greenland, into existing databases, using the model in practice.

Description of work

This work package is led by Finn Danielsen, NORDECO (lead) and Lisbeth Iversen, NERSC (co-lead). WP4 will build on stakeholder dialogues in WP 1, and gaps in existing data delivery chains identified in WP2, and feed results into WP 5, 6, 7 and the roadmap to future Arctic Observing System developed in WP1. The site-based activities on community-based observing in INTAROS will focus at two Arctic communities, located in Longyearbyen, Svalbard, and Disko Bay, Greenland. The communities have been chosen on the basis of the following criteria: (i) Communities where a process to develop community-based and citizen science observing programs is under way; (ii) Communities where good prior relations and mutual knowledge on participatory research and capacity-building already exists between the partners and with national, municipal and community level authorities and institutions, and where the project therefore has substantial potential for achieving quick results and constructive experiences of direct relevance for iAOS and with other open access global repositories as well as for local and national decision-making; (iii) Communities in countries that have some degree of policies enabling good governance and solving of issues of rights over land and resources, which is important for successful community observing efforts.

The two selected communities, one in Scandinavia (Longyearbyen, Svalbard), and one in Greenland (Disko Bay), (i) are high-risk regions in terms of climate change impacts as well as loss of biological diversity, (ii) can potentially benefit significantly from community-based observing programs in terms of enhancing resilience and adaptation to climate change through improved governance, and (iii) are characterized by economies in which institutional set-ups and available funding would benefit from efficient and low-cost observing programs at local levels. The activities of the present project will contribute significantly to moving forward community-based observing programs in these communities.

Task 4.0 Scientific Coordination [Lead: **NORDECO, Finn Danielsen**]

The work package leader will ensure that the planned work is carried out according to the plan and budget and that the deliverables are produced and milestones attained on time. This includes: management of tasks, deliverables, milestones and exceptions; management of risk registers and mitigation; management and promotion of links between the tasks and other WPs; support the project management leads in monitoring progress; arranging meetings; editing reports and web content. The WP leader will ensure that the decisions taken at steering level are implemented in WP4. In addition this task will have the main responsibility for establishment and continuing cooperation with stakeholders.

Task 4.1 Survey and analyze existing community-based observing programs in the Arctic to identify capabilities, 'best practices' and challenges [Lead: **NORDECO, Finn Danielsen**; Contributors: NUIM, EuroGOOS; Sub-contractors: ELOKA, Yukon River Inter Tribal Watershed Council, Center for Support of Indigenous Peoples of the North]

In many areas of the Arctic, civil society organizations, government agencies or researchers have established community-based monitoring (CBM) programs, which use indigenous and local knowledge and observations and build upon existing community-based approaches to observing the environment. A recent SAON review analyzed a sample of 81 CBM programs in the Arctic (Report of SAON Task 9). To establish a sound basis for enhancing community-based observing in the Arctic, we will build upon SAONs review and, for the first time, identify capabilities, best practices and challenges in current CBM programs across the Arctic.

We will encourage organizers of the programs to share their data with iAOS and with other open access global repositories for tracking larger-scale trends and for ensuring maximum scientific usage. We will also point out the benefits of data sharing. If they are interested, which we firmly believe that almost all the organizers will be, we will assist them, with support from WP4, to assess key aspects of their program's suitability for connecting with iAOS.

The characteristics that will be assessed for each CBM program include:

- Capabilities: The program's data coverage, data format and quality-checking procedures, paying particular attention to gaps in existing Arctic data delivery chains identified in WP2.
- 'Best practices': The experiences of the program with respect to providing knowledge products that are salient, credible, and legitimate (Clark *et al.* 2011) and actionable yielding benefits for the community in terms of improved decision making,
- Challenges: The main challenges of the program, incl. proposed *modus operandi* of possible cooperation with iAOS from the perspective of the CBM program organizers (i.e., how to address principles of intellectual property rights, Free Prior and Informed Consent, respect for knowledge holders, and reciprocity).

We will obtain this information through outreach to indigenous and other civil society organizations and government and academic researchers engaged in community-based monitoring and observing activities, phone interviews and discussions at workshops.

For a sub-set of the Essential Climate Variables that are being observed by the existing CBM programs, NUIM and EuroGOOS will cross-check the survey findings against available regional and international databases to ascertain what data are unique, which could be utilized to improve available holdings for global and regional climate change assessments such as IPCC. In Task 4.4, we will then discuss and, if possible, facilitate their inclusion into these databases, while respecting principles of intellectual property rights, Free

Prior and Informed Consent, respect for knowledge holders, and reciprocity. The survey results will also be used for the library on 'best practice' guidelines in Task 4.2, for piloting CBM in two focal communities to support decision-making in Task 4.3, 4.4 and 6.6, and for competence-building in CBM in Task 7.7. The results will be made broadly available in reports, peer-reviewed literature and on existing websites.

The outreach to indigenous and other civil society organizations and government and academic researchers engaged in CBM will be facilitated through two workshops. The workshops will be organized by ELOKA and Yukon River Inter Tribal Watershed Council (North America), and NORDECO and Center for Support of Indigenous Peoples of the North (Europe). For marine data collection, we will capitalize on the work done on CBM in other parts of the world coordinated under the Intergovernmental Oceanographic Commission of UNESCO and take advantage of their lessons learned, guidelines and best practices. Moreover, Task 4.1 will benefit from the experiences of NUIM with connecting observing systems to global repositories (such as Global Historical Climatology Network - Daily, the International Surface temperature Initiative databank, and the International Surface Pressure Databank).

Task 4.2 Advance tools for cross-fertilizing indigenous and local knowledge with scientific knowledge. [Lead: **NORDECO, Finn Danielsen**; Sub-contractor: ELOKA]

Based on the results of Task 4.1 (survey of best practices in CBM), we will together with CBM program organizers prepare a library of 'best practice' manuals and guidelines that could serve as effective tools for cross-fertilizing indigenous and local knowledge with scientific knowledge in the Arctic. These manuals will include guidelines for data formats, data reporting and flow to recognized databases and support Task 4.3 and 4.4. The library will include 5-10 CBM manuals and guidelines (i) that have already been pilot tested on-the-ground in community-based observing programs in the Arctic, (ii) that in the view of the CBM program organizers have led to salient, credible, and legitimate knowledge products and are used by decision-makers, (iii) that could contribute to iAOS and recognized global repositories, and (iv) that are of a sufficient generic nature so they may be used in other communities in the Arctic. Each manual and guideline will be accompanied by a short, one-page summary on 'what worked, what didn't work and why', written by the CBM program organizers assisted by WP4. A draft version of the library will be presented and discussed at a workshop with indigenous and other civil society organizations and government and academic researchers co-organized by NORDECO and ELOKA. The library will be made available at a dedicated website to enable fieldworkers to access one another's experience and gain advice on how to collect and use data. The CBM program organizers that contribute to the library will receive honoraria.

Task 4.3 Pilot community-based observing networks of relevant parameters for communities in Svalbard and Greenland to support local and national decision-making processes. [Lead: **NERSC, Lisbeth Iversen**; Contributors: NORDECO, UiB, GEUS, NUIM, EuroGOOS, UAF, UVIC. Sub-Contractor: Pole-Position]

In Longyearbyen, Svalbard, and Greenland's Disko Bay, we will identify community-based variables (see examples below) that are relevant for communities and citizens to support local and national decision-making processes. The variables will be identified in dialogue with indigenous and other civil society organizations and local authorities in the focal communities. The Office of the Governor of Svalbard and the Aasiaat Area Office of Qaasuitsup Municipality in Greenland have consented their involvement. In Greenland, this task will build on, and further strengthen, the network of community monitors established by the EU-BEST funded PISUNA project.

A list of provisional variables includes: changes in sea-ice, snow cover, permafrost thawing, land and marine ecosystems (using participatory monitoring with focus groups, composed of experienced fishers and other environmentally interested people, c/o NORDECO and University of Alaska), earthquake hazards (using 'garage-type' geophone device to monitor earthquake activity and Internet questionnaires to collect macroseismic intensity data, c/o UiB and GEUS), air temperature, air humidity, wind speed, atmospheric pressure (c/o NUIM), water level (c/o EuroGOOS), and oceanographic profiles of salinity and temperature (using mobile tablet with ships of opportunity, c/o UVIC). Experiences will be exchanged with IOPAN, Task 3.4 of WP3, on distributed systems for ocean and sea ice.

We will establish tools suitable for measuring the community-based variables on the ground, and pilot their use among 15-20 community members and volunteers in each community over a two-year period. The community members will be compensated for the time they spend on this. We will also test the ability of the tools to provide knowledge products that are salient, credible, and legitimate to local and national decision-makers and present the experiences in a lessons learned report. The data and results will be entered into existing databases and used for model testing in Task 4.4 and analyzed and presented for decision-makers in

Task 6.6. Task 4.3 will be undertaken in close cooperation with the Office of the Governor of Svalbard and with Qaasuitsup Municipality in Greenland's Disko Bay. Pole-Position will be subcontracted by NERSC.

Task 4.4 Make community-based observations accessible for iAOS. [Lead: **NORDECO, Finn Danielsen**; Contributors: NERSC, UiB, GEUS, NUIM, UAF, EuroGOOS, UVIC. Sub-contractor: ELOKA]

Task 4.4 will make community-based observations accessible to iAOS and international databases. We will develop a model of how Arctic CBM programs can connect and cross-fertilize with an iAOS, and enter existing and new community-based observations from the two focal communities in Task 4.3 into existing relevant national, regional and global databases (e.g. the EMODnet and Copernicus) to ensure usage, using the developed model in practice. We will trace additional data from other Arctic CBM programs (identified by NUIM in Task 4.1) and use the developed model to include their data into iAOS and recognized international databases by reformatting, standardizing and entering the data into the possible databases.

To develop the model for connecting CBM programs and iAOS, we will use the results of the survey of existing CBM schemes in Task 4.1, particularly the information on the interest of the existing CBM programs in connecting with iAOS, and on the capabilities of the CBM programs in terms of data coverage and data formats. The information obtained on proposed modus operandi for cooperation in Task 4.1 will also be used in order to describe a realistic and mutually beneficial way of connecting the programs. By developing a simple model of how measurements that are feasible and realistic for local community members to conduct can be connected to iAOS, the opportunities and limitations (e.g. data ownership; potential fatigue of community observers) of the bottom-up approach to large-scale monitoring become explicit. We will discuss and validate the model with indigenous and other civil society organizations and government and academic researchers engaged in monitoring and observations. We will facilitate discussions in an open forum on a website and at a workshop in Copenhagen, and we will revise the model accordingly.

Using the guidance provided by the model developed, the data emanating from the CBM-programs in Svalbard and Greenland (Task 4.3) and additional data from other Arctic CBM programs (identified in Task 4.1) will then be reformatted and standardized and entered into existing recognized international databases for each Essential Arctic Variable. For marine data for example, the data will flow to the EMODnet and Copernicus Marine service databases via the EuroGOOS Arctic ROOS data portal.

Task 4.4 will feed results into Task 6.6, which will analyze data from the focal communities, and facilitate that the findings and recommendations are discussed with government agencies and representatives of local communities, offshore operations, shipping, mining, and tourism in Svalbard and Greenland. ELOKA has valuable experience in connecting and cross-fertilizing indigenous and local knowledge with scientific knowledge and will be subcontracted by NORDECO.

Deliverables

Task 4.1: D4.1 Report from survey of existing community-based observing programs: Results of survey of capabilities, 'best practices' and challenges of the existing community-based observing programs across the Arctic undertaken in cooperation with indigenous civil society organizations. (Resp. **NORDECO**, **M12**)

Task 4.2: D4.2 Library with tools for cross-fertilizing indigenous and local knowledge with scientific knowledge: Catalogue with 'best practice' manuals and guidelines for community-based observing in the Arctic. The manuals will include guidelines for data formats, data reporting and flow to recognized databases. (Resp. **NORDECO**, **M12**)

Task 4.3: D4.3 Lessons learned report on community-based observing parameters piloted in Svalbard and Greenland to inform decision-making. Report from pilot-testing a range of community-based and citizen science observing tools to support local and national decision-making processes in Longyearbyen, Svalbard and Disko Bay, Greenland. (Resp. **NORDECO**, **M36**)

Task 4.4: D4.4 Community-based observations from two focal communities made accessible for iAOS. Model for connecting community-based observing programs and iAOS developed, and existing and new community-based observations from Longyearbyen, Svalbard, and Disko Bay, Greenland, entered into existing recognized databases with the use of the model. (Resp. **NORDECO**, **M36**)

Work package number	**5**			**Lead beneficiary**	**TERRADUE**	
Work package title	**Data integration and management**					
Participant number	1	3	5	7	9	10	15
Short name of participant	NERSC	IMR	AWI	DTU	GEUS	FMI	NUIM
Person/months per participant:	20	12	10	3	2	2	1
Participant number	**24**	31					
Short name of participant	**TERRADUE**	ARMINES					
Person/months per participant:	**53**	16					
Start month	**Month 1**			**End month**	**Month 54**		

Objectives

Integrate multidisciplinary and distributed data repositories into a scalable and resilient Pan-Arctic observing system, iAOS, which will offer seamless access to observations and derived parameters. IAOS will also provide a set of tools for data analysis, transformation and visualization. Develop new geo-statistical methods for interpolation of spatiotemporal datasets. Process new observations from WP2-4, and store generated datasets in an IAOS enabled repository.

Description of work

This work package is led by Pedro Gonçalves, TERRADUE (lead) and Torill Hamre, NERSC (co-lead). As part of iAOS WP5 will integrate distributed databases holding ocean, atmosphere, cryosphere, terrestrial, and community based data, and provide a common entry point to data originating from a wide range of observation networks, scientific campaigns and satellite missions, as well as new data generated within the project. iAOS will use state of the art cloud computing technologies to facilitate seamless access to multidisciplinary data, scalable allocation of data storage and computer power for big data processing, integration and analysis including geo-statistical methods. The usefulness and functionality of the platform in service development will be demonstrated in selected applications.

Task 5.0 Workpackage Coordination [Lead: **TERRADUE, P. Gonçalves and NERSC, T. Hamre**]

This task includes the coordination of the WP, interfaces between WP5 tasks and interfaces with other INTAROS WPs. The work package leaders will ensure that the planned work is carried out according to plan and budget and that the deliverables are produced and milestones are attained on time. Additionally the leaders will ensure the establishment of the link with INTAROS project coordination and that the decisions taken at steering level are implemented in this work package. This includes as well the management of risk registers and mitigation measures.

Task 5.1 System requirements and architecture consolidation. [Lead: **TERRADUE, P. Gonçalves;** Contributors: NERSC, AWI]

This task will define the system requirements and architecture to meet the main challenges for a sustainable pan-Arctic observing system. The interfaces of the databases selected in WP2 will be analyzed in collaboration with the owners of the different databases, and the outcome will be used to define the data search and access services in iAOS. Drawing upon the domain expertise of the INTAROS consortium, this task will define the iAOS essential user functionality for data discovery view, download, transformation, and workflows, which efficiently address the challenges of Big Data (Volume, Velocity, Varity, Veracity, Value). The resulting requirements for cloud deployment of new processing services for multi-source data will include a standard format for defining processing chains (workflows) and assignment of DOIs for the newly generated datasets. This task will also define the architecture driven by a cloud infrastructure to facilitate the discovery, access and processing of information.

Task 5.2 IAOS platform deployment and operation [Lead: **TERRADUE, P. Gonçalves**]

The iAOS platform will provide the underlying infrastructure for the Integrated Arctic Observing System and associated tools for IT management and support. The Cloud Developer Sandbox is an important iAOS component, giving algorithm and service developers (scientists, programmers, value-adding companies) access to a development and run-time environment for their code, where they can use their workspace (i.e.

the sandbox) in the same manner as they would use an account on a traditional workstation - with the added benefit of having additional CPU time and storage space available as needed, without the need for IT staff to increase their disk or processing quotas. This task deals with operations of the platform together with elements defined in Task 5.1 and the services provided by Task 5.5. It will specifically include cloud orchestration, storage virtualisation, Virtual Machine (VM) provisioning, scaling and cloud bursting. iAOS will operate on Cloud Platform under a virtualized data center enabled by the OpenNebula Cloud controller, featuring Orchestration and Auto-Scaling of Cloud Multi-Tier Applications connecting the federation of infrastructures. The task team will be able to define, execute and manage services of interconnected VMs with templates of the different software components implemented.

Task 5.3 Integrate data from existing repositories into iAOS [Lead: **AWI, Ingo Schewe;** Contributors: TERRADUE, NERSC, FMI, UIB, GEUS, IMR, IFREMER, NUIM, NORDECO, CNRS-LOCEAN. Non-European partners: NIPR, ONC, WHOI, UAF, PRIC, RADI, KOPRI, RIHMI]

This task will provide a framework to ease the discovery (i.e. search) and retrieval (i.e. access) of data (remote-sensing and *in situ*). The Cloud Platform provider (TERRADUE) will work closely with IT staff of the each data repository to implement and test the technical integration of the relevant repository into iAOS.

This task will use best practices for search services using OpenSearch with Geo, Time and EO extensions that allow standardized and harmonized access to metadata and data of data providers. This solution will facilitate the aggregation of results between disparate data providers via OpenSearch common standards, allow search engine discovery (using OpenSearch Description Documents) and, mostly importantly, facilitates smooth integration between related server's OpenSearch implementations.

This task will also assess the cloud readiness of existing data infrastructures and define the roadmap to support a federated solution taking in consideration data product accessibility (e.g. delivery methods, tools and protocols). Selected tools to support data access to the relevant archives will be made available on the Cloud Sandbox environment to support service implementation defining the set of input data. This will include multi-dimensional sub-setting and basic processing (e.g. statistics extraction, spatial/temporal rescaling, temporal merging, gap filling, formatting, compositing, etc.) preferentially through OPeNDAP or any standardized Web Coverage Services and Web Coverage Processing Services.

To support the demonstrations in WP6, data will be integrated from, among others:

- Sentinel-1 and Sentinel-2 data through Thematic Exploitation Platform (TEP) tools. (TERRADUE)
- Selected sea-ice parameters from CERSAT. (IFREMER; from WP2)
- Selected satellite-based products from Copernicus - Marine environment monitoring service (CMEMS) and NORMAP will be integrated in IAOS. (NERSC)
- Multidisciplinary data from PANGAEA, among others, oceanographic and biochemical data. (AWI)
- Multidisciplinary data from SeaDataNet, among others, oceanographic and biological data. (IMR)
- Multidisciplinary data from NMDC (Norwegian Marine Data Centre), e.g. oceanographic data. (IMR)
- Ecosystem data from NORWECOM and ATLANTIS models for the Barents Sea. (IMR)
- Fish stock and other relevant data from ICES. (IMR)
- Glaciological and seismological data from EPOS. (GEUS)
- Carbon and other greenhouse gases data from ICOS. (UIB; from WP2)
- Atmospheric data, e.g. aerosols and clouds, from the ACTRIS database. (FMI)
- Atmospheric data, e.g. radiosonde measurements of pressure, temperature, humidity, and wind from the GRUAN network. (NUIM)
- Community-based observations, e.g. observations of temperature, wind or seismic activities from the ELOKA network. (NORDECO; from WP4)
- Glider data from the Coriolis GDAC. (CNRS-LOCEAN; from WP3)

Selected Arctic data from repositories in US, Japan, Canada, South-Korea, Russia and China from non-European partners (NIPR, ONC, WHOI, UAF, PRIC, RADI, KOPRI, RIHMI) will be integrated in IAOS. This includes sea ice parameters such as concentration and drift, oceanographic measurements of wind and currents, and data from passive and active acoustics.

Task 5.4 Development of geo-statistical methods for data integration. [Lead: **ARMINES, H. Wackernagel;** Contributors: NERSC, DTU]

This task will take advantage of the data processing tools available in the Developer Cloud Sandboxes provided by Task 5.2 to improve existing processing services, improve their accuracy or to generate new products by enabling partners to prototype new algorithms and validate services.

This task will integrate existing tools and develop new geo-statistical algorithms for combining multi-source data into new data products that can be used to support better decision-making on local, national and regional scale, and to be assimilated into weather forecasting and climate models. Example of algorithms to be investigated include empirical variogram computations, kriging with external drift, co-kriging, functional (co)kriging, as well as geo-statistical simulation algorithms for big data. The geo-statistical library will be made available in the form of the freeware RGeostats, which is designed as a package of the open source language R. To increase performance the GEOSLIB library (underlying RGeostats; in C++) can serve as basis to add functionalities to the iAOS Cloud Developer Sandbox, improving the algorithms and the code for increased performance for multi-processor computations with big data sets. The most mature of these algorithms will be implemented as a service in Task 5.5, and demonstrated to users and stakeholders in WP6.

Task 5.5 Integration of new processing services. [Lead: **TERRADUE, P. Gonçalves;** Contributors: NERSC, ARMINES]

This task will take advantage of the data processing tools available in the Developer Cloud Sandboxes provided by Task 5.2 to improve existing processing services, improve their accuracy or to generate new products by enabling partners to prototype new algorithms and validate services. The Developer Cloud Sandboxes will support the full life cycle of the integration of new processing services by providing a development platform, access to data, application management and support to large-scale deployment. It will offer an environment where scientists have simultaneous access to data (with connection to the archives), tools and processing resources. Designed for use cases having data-intensive requirements it will allow implementing service processing chains with full control of code, parameters and data flows, in a collaborative way within a shared Platform delivered as a Service (PaaS), and seamlessly leveraging Cloud APIs to stage data and deploy code on computing clusters.

This task will support the integration of services covering the full needs of the Pan-Arctic observing system. To demonstrate the iAOS platform two selected data processing services will be developed and made available for use in WP6. The first service will integrate use remote sensing data (Sentinel-1) to provide time series of ice classification for selected regions. Second service will be developed to process and characterize passive acoustic data (from WP 2) for analysis in combination with time series of satellite remote sensing derived parameters (e.g. ice concentration, ice thickness) covering the regions of interest.

Task 5.6 iAOS portal development. [Lead: **NERSC, T. Hamre;** Contributors: TERRADUE]

This task will develop a web-GIS portal as a component of iAOS. The iAOS portal will provide an intuitive user interface to the search, access and processing services developed in Tasks 5.3-5.5. The iAOS portal will be deployed in the Cloud Platform established in Task 5.2, and provide a joint entry point to the integrated data repositories and the services developed to combined and extract useful information for the targeted user and stakeholder communities in WP6.

The iAOS portal will be based on a web-GIS portal developed by NERSC during the FP7 GreenSeas project, using Open Source JavaScript and Java libraries running within a Java Portlet Specification 2.0 (JSR 286) compliant portal framework (Liferay Community Edition). This portal will be adapted and enhanced according to the requirements identified in Task 5.1, enabling users to, among others, visualize retrieved multi-source data in a common map projection with basic GIS operations (zoom, pan, etc.) and execution of the developed processing services from Task 5.5.

Task 5.7 Synthesis of IAOS infrastructure deployment and operation. [Lead: **TERRADUE, P. Gonçalves;** Contributors: All WP5 partners]

This task will summarize the experiences with deploying and operating the IAOS infrastructure, and identify technical and non-technical challenges that need to be addressed to establish a sustainable pan-Arctic IAOS. The summary will include experiences with setting up and running the cloud platform, integrating data from existing data repositories and integrating new sector specific and cross domain services into the generic platform. Potential challenges to be considered include, among others, maturity of the chosen technical solution, lack or in flux cloud computing and interoperability standards, interoperability in federated cloud infrastructures, evaluation of cost, legal issues, trust, privacy, security, and usability issues for both users (e.g. scientists, decision-makers, operators) and stakeholders (e.g. environmental agencies, local and national authorities, pan-Arctic organizations).

Deliverables **Task 5.1: D5.1** IAOS requirements and architectural design (Resp. **TERRADUE**, NERSC, AWI, **M12, 36**) **Task 5.2: D5.2** IAOS platform and tools (Resp. **TERRADUE**, **M24, 42**) **Task 5.3: D5.3** Data integrated from existing repositories (Resp. **AWI**, all Task partners, **M24, 54**) **Task 5.4: D5.4** Geo-statistical library for iAOS (Resp. **ARMINES**, O; PU, **M36, 54**) **Task 5.5: D5.5** Processing services for iAOS (Resp. **TERRADUE**, NERSC, ARMINES, **M36, 54**) **Task 5.6: D5.6** iAOS portal with user manual (Resp. **NERSC**, TERRADUE, **M24, 54**) **Task 5.7: D5.7** Synthesis of the IAOS infrastructure - experiences and challenges (Resp. **TERRADUE**, all WP partners, **M54**)

Work package number	**6**	**Lead beneficiary**			**IMR**	
Work package title	**Applications of iAOS towards Stakeholders**					
Participant number	1	2	3	5	6	7	8
Short name of participant	NERSC	UiB	**IMR**	AWI	IOPAN	DTU	AU
Person/months per participant:	28	6	50.5	2	4	22	31
Participant number	9	10	12	13	16	17	18
Short name of participant	GEUS	FMI	NORDECO	SMHI	IFREMER	MPG	EUROGOOS
Person/months per participant:	18	13	3	18	4	30	7
Participant number	20	21	22	25	26	27	31
Short name of participant	UPM	UB	UHAM	GINR	OU	NIVA	ARMINES
Person/months per participant:	14.5	7	14.4	1	1.8	6	8
Participant number	34	35	37				
Short name of participant	BSC	DNVGL					
Person/months per participant:	15	12					
Start month	**Month 24**			**End month**		**Month 60**	

Objectives

Demonstrate significance of enhanced integration of data from Arctic observing systems covering a range of remote sensing and in-situ platforms in geographically different locations covered by iAOS. Specific objectives are:

- Produce **decision support tools** for a variety of sectors by integrating data from the Copernicus Marine Service and EMODnet in the Arctic, enhanced by new INTAROS data.
- Assess the impact of observational sea-ice data on **climate prediction** by data denial experiments.
- Assess **prediction skill improvements** on seasonal to decadal time scales due to novel INTAROS observational data sets.
- Showcase **advances in ecological and environmental understanding** by merging and synthesizing iAOS data through ecosystem modelling at the regional (Barents Sea) and local (Greenland) scales.
- Use the existing **ecological and environmental reporting and management systems** of the Barents Sea and off Greenland to demonstrate how an iAOS may be similarly applied to other parts of the Arctic and thus contribute toward, e.g., Arctic Council and OSPAR aims.
- Provide better **ice-ocean state estimates** to establish the background knowledge and constraints for stakeholders interested in risk assessment for Arctic operations.
- Demonstrate uses for **mapping of natural hazards** aiming towards disaster risk reduction.
- Demonstrate the capabilities of the iAOS as a useful **tool to integrate data from a large set of various databases** into modelling experiments through a data assimilation approach by a case study on glacier discharge contribution to sea-level rise.
- Maximize the assimilation of multi-disciplinary data layers into a modelling framework to **constrain Arctic greenhouse gas budgets** based on the optimum information content currently available.
- Identify key processes across disciplines that govern **Arctic greenhouse gas cycles** and their links to **climate change**.

- Showcase 'real-world' examples of the benefits of **integrating data from local and scientific observation systems** towards better-informed decisions and better-documented processes within key sectors in local communities, exemplified by Longyearbyen, Svalbard and Disko Bay, Greenland.
- Demonstrate the **economic value and societal benefit of the iAOS** for Europe and globally through a suite of selected applications towards industry, governance, local communities and research.
- Demonstrate the usefulness of data integration to Norwegian and Greenland **fisheries and environmental authorities.**

Description of work

This work package is led by Geir Ottersen (IMR, lead) and Mikael K. Sejr (AU, co-lead). The ambition of WP6 is to demonstrate application of iAOS by delivering a suite of products targeted at issues of societal importance for Europe and on global scale. These pilot applications will demonstrate services towards selected, but diverse groups of end-users. WP6 will integrate remote sensing data and *in situ* (including CB) observations, delivered through WP5, from a variety of platforms and geographical scales and locations. Incorporation of these data into analysis and modelling systems, including physical and ecological process models, climate models and forecast methods, will provide support for better products to key societal areas.

WP6 will show the iAOS capability for advancing the economic role of the Arctic by providing support for better-documented processes and better-informed decisions within key sectors such as shipping, petroleum, fishing, and tourism. Further, WP6 aims to demonstrate how the iAOS may be applied to further develop the accuracy of climate models, improve the understanding of biogeochemical cycles and ecosystem functioning, enhance fisheries and environmental management, increase the level of preparedness towards natural hazards, and develop better management and decision making concepts for selected local communities. Through WP6 INTAROS will demonstrate enhanced data search and retrieval, assimilation into models, validation of estimated and projected climate parameters, scientific analysis, decision-support and policy-making on local, regional and pan-Arctic scale.

Task 6.0 Scientific Coordination. [Lead: **IMR, Geir Ottersen and AU, Mikael K. Sejr**]

The work package leaders will ensure that the planned work is carried out according to the plan and budget and that the deliverables are produced and milestones attained on time. This includes: management of tasks, deliverables, milestones and exceptions; management of risk registers and mitigation; management and promotion of links between the tasks and other WPs; support the project management leads in monitoring progress; arranging meetings; editing reports and web content. The WP leaders will ensure that the decisions taken at steering level are implemented in WP6. In addition this task will have the main responsibility for establishment and continuing cooperation with a main group of stakeholders.

Task 6.1 Improving skill of climate predictions. [Lead: **SMHI, R. Döscher**; Contributors: BSC, NERSC]

A unified iAOS has a strong potential to impact on our ability to carry out skillful initialized climate predictions for the Arctic region and for the benefit of planning and decision-making in various economical and societal sectors via upcoming climate services. Novel INTAROS observations provided through WP3 and WP5 will benefit the climate prediction and climate services community, especially through an improved accuracy of initial conditions towards more skillful climate prediction. This task aims to assess the impact of observational sea-ice and hydrological data on climate prediction by analyzing model experiments with limited access to observations by evaluating skill improvements due to novel INTAROS observational data sets of ocean and land.

INTAROS observational data provision covers sea-ice properties, ocean temperature, snow thickness, and meteorological and hydrological conditions. The most relevant information for improving climate prediction from an Arctic perspective is better representation of specific geographical key areas and enhanced realism of meridional temperature gradients (land-sea coast, sea-ice edge). Prediction skill can be expected to improve by triggering inter-regional interaction (e.g. Caian et al. 2016) between the Arctic and oscillation patterns such as the NAO, with a direct impact on our ability to predict the climate of Europe and the Arctic.

Activity (1) Climate prediction models (NorCPM and EC-Earth, NERSC and SMHI) assimilate sparse observations in a physically consistent manner to better understand the variability of our climate and provide predictions and their principal dependence on data availability. This work will be coordinated with the Nordic Council of Ministers project ARCPATH (2016-2020), which carries out simulations that will use most of the observations included in INTAROS. Results will be utilized for further analysis in INTAROS.

Depending on the agenda of parallel H2020-BG-10 projects, we plan to analyze so called data denial experiments for the purpose of exploring impacts of data availability.

Activity (2) For assessing the full effect of enhanced initialization on climate prediction skill, INTAROS partners (BSC, NERSC, SMHI) will (1) promote INTAROS data in relevant climate modelling communities including the parallel H2020-BG-10-2016 projects (on the impact of Arctic changes on the weather and climate of the Northern Hemisphere, with expected impact, according to the call, to improve capacity to predict the weather and climate, connected to climate prediction methodology and the on-going "Year of Polar Prediction" initiative, YOPP) and (2) assess the resulting impact on prediction skill.

Activity (3) The benefit of the new integrated observations for predicting river discharge as well as for monitoring the hydrological regime will be demonstrated by means of a hydrological model (Arctic-HYPE) fed with new data. SMHI will achieve this by 1) improved access to meteorological observations, 2) by model state updating/initialization of satellite remote sensing data of the hydrosphere, as well as in-situ observed river discharge data. The demonstration case is aiming at providing improved freshwater inflow to the Arctic Ocean for climate modelling community, as well as improved monitoring and forecasting of river discharge for studies of changes in hydrological regime and water resources management in the Artic region, i.e. water availability for hydropower production. The activity is linked to the WMO Arctic-HYCOS projects and the national hydrological services in the member countries of the Arctic Council.

In addition to liaising with parallel H2020 BG-10 projects, the upcoming "Decadal Climate Prediction Project" (DCPP), with INTAROS participant BSC, will be utilized, especially "component B" which deals with annually repeated experimental real-time multi-model decadal predictions. DCPP is currently being associated with WMO operational activities in designated "Lead Centres". Output data from both YOPP and DCPP are openly available for access of a wider community. Liaisons will be arranged after the start of the projects and use existing networks as well as dedicated visits at relevant partner meetings. SMHI, NERSC, and BSC are all established partners on various climate modelling and prediction projects and networks (e.g. EC-Earth, NorESM, SPECS, EUPORIAS).

Task 6.2 Improved ecosystem understanding and management. [Lead: **IMR, Gro van der Meeren;** Contributors: AU, GINR, DTU]

Task 6.2 will demonstrate for selected cases how data from an iAOS may contribute to advances in ecological and environmental understanding and allow for expanding existing environmental and fisheries reporting and management systems into new geographic areas. This task will produce deliverables targeting specific stakeholder groups through especially 6.8 (Fisheries and environment management), but also 6.6 and 6.7, and furthermore contribute to the WP 1 roadmap for the future Arctic observing system. Task 6.2 will use observations from WP2 and WP3 made available through WP5.

The established ecosystem models NORWECOM (NORWegian ECOlogical Model) and ATLANTIS (3D ecosystem box model) will be employed to integrate data (made available through WP5) originating from a range of in-situ and remote sensing platforms and geographically different locations (IMR). This includes in situ hydrographical and biological (NMDC/IMR, ICES) and earth observation (Copernicus CMEMS) data. Integrated model output fields will contribute to oceanography and ecological science, stakeholder groups (Tasks 6.6, 6.7, 6.8), and data integration by models will be included in the roadmap in WP1. Building on the same data as above we will demonstrate how an iAOS can contribute towards validation and allow for use of ecological models like NORWECOM and Atlantis. This will be done with the Barents Sea (and possible other reference sites) as demonstration areas for how a fully implemented integrated system could be (IMR). The models will provide products for fisheries and environmental research and management (see Task 6.8).

To demonstrate down-scaling to local Arctic coastal ecosystems, we will apply the FLEXSEM (http://marweb.dmu.dk/Flexsem/) model using data assimilation with Arctic observation systems, e.g. PROMICE supplying ice sheet freshwater output estimates, and coupling to regional hydrodynamic (HYCOM/COHERENS) and ecological (ERGOM) models for the Disko Bay region in Greenland to evaluate external impacts of climate and environmental change on local marine resources. Data assimilation of several satellite/in situ data products of the Arctic Ocean biogeochemistry (WP5) will be implemented using state-of-art algorithmic approaches. This provides intelligent extrapolation of ocean parameters to un-sampled parts of the iAOS, as well as a platform to conduct OSSE design studies to optimize future observational deployment (AU, DTU, D6.4).

The Greenland economy relies heavily on fisheries and past changes in commercial fish stocks have had dramatic consequences for both local communities and the national economy. Building on the existing marine observation system in the eastern Baffin Bay, supplemented by other data available through WP5 we will analyze trends in ocean temperature and salinity and quantify impacts on local fish stocks (AU, GINR, D6.5). As compared to the Arctic Ocean the infrastructure for *in situ* measurements of oceanographic and ecological parameters is far more developed in the Barents Sea and in some areas off Greenland. Here a significant amount of data is available. Task 6.2 will build upon the existing environmental and fisheries reporting and management systems for these areas to demonstrate how data from iAOS may allow for implementing similar procedures in other parts of the Arctic (IMR and AU, see also Task 6.8).

Task 6.3 Ice-ocean statistics for decisions support and risk assessment. [Lead: **NERSC, Hanne Sagen**; Contributors: UHAM, IOPAN, ARMINES, AWI, UNIS, DTU, IFREMER, UiB, FMI, CNRS-IUEM, DNVGL; Non-European partners: SIO, WHOI, UAF]

Better ice-ocean state estimates, including long- and short-term statistics, and model predictions can be used to establish background knowledge and constraints important for (1) design and development of new technologies and installations in the Arctic, (2) risk assessment (e.g. sea-ice information combined with weather and wave forecasts), (3) environmental monitoring and (4) weather and ice services. In this Task we specifically address a selected stakeholder dealing with assessments for insurance companies and operators in the Arctic. Requirements will be defined in collaboration with key stakeholder within Arctic shipping, insurance, and offshore industry in Task 6.7. Task 6.3 will provide input to Task 6.7 and to the design of the roadmap for future Arctic observing system in WP1. Following activities will be targeted:

Activity (1) Integrative data analysis (NERSC, IOPAN, AWI, DTU, UNIS, UoB, WHOI, FMI) to provide statistics of ice-ocean time-series for decision support and risk assessments. In this Task, we combine in-situ and remote sensing data though geo-statistical methods with special attention to the new ice-ocean data collected in WP3. Our goal is to improve qualitative and quantitative understanding of dynamic ice and ocean processes that are not properly resolved by coupled ice-ocean models. Cal-Val analysis of Sentinel-derived sea-ice thickness and drift data will be carried out using *in situ* observations from upward looking sonars and ice mass balance buoys. Near-real time ice thickness and concentration charts for operational Sea Ice Services will be produced by combining optical and microwave data with a physical model of sea ice, driven by operational analysis of NWP systems. Sea level information from tide gauges and from satellite altimetry (also Sentinel-3) will be combined to obtain sea level anomalies and associated geostrophic ocean currents (DTU). Very high resolution Sentinel-1A SAR data for the Arctic MIZ areas with colocations with buoys data will be used to develop new algorithms to detect high-resolution phenomena like ocean eddies using high resolution SAR, visible and altimeter sensors (IFREMER). The satellite-derived products (WP2/WP5) will be analysed in combination with *in situ* data from Fram Strait and the central Arctic (WP2/WP3). Sea-ice measurements from SIMBAs and oceanographic measurements from ITPs (including data from INTAROS ITPs and ITP data provided by WHOI), INTAROS moorings in the Nansen Basin, solitary wave moorings in INTAROS and Canada Basin (WHOI), NABOS-2 moorings along the Arctic Ocean Boundary Current (UAF) will be included in the integrative analysis. Remote sensing data, atmospheric data from ITPs, and available atmospheric reanalyses will be used to investigate atmospheric forcing on the sea ice and underlying water column and to understand complex atmosphere-ice-ocean interactions in the Arctic Ocean. Results from this study will contribute to improve parameterization and representation of sea ice and ocean dynamics and processes in the coupled ice-ocean models. They will also feed the time series of observed parameters to *Activity 4,* focused on visualization tools for risk analysis.

Activity (2) Baseline description of Arctic soundscape (NERSC, CNRS-IUEM, SIO) will be established based on a comprehensive passive acoustic data collection available from WP2 and WP3 through WP5. Recent data from Beaufort Sea (CANAPE - SIO), interior Arctic (THAAW-SIO), Fram Strait (ACOBAR, UNDER-ICE - NERSC) will be analysed in this activity to obtain the spatial and temporal characteristics of the soundscape. INTAROS passive acoustic data from a reference site North of Svalbard (NERSC) and acoustic observatories (CNRS-UIEM) in Kongsfjorden (Svalbard) and Young Sound (Greenland) will also be included in the analysis. This is highly relevant for future assessment of human contribution to acoustic noise due to e.g. increased ship and icebreaker traffic, enhanced tourist activities, and oil and gas exploration in the region. (Input to *Activity 4*)

Activity (3) Assimilation of new data into ice-ocean models (UHAM) aims to combine *in situ* and remote sensing observations with ice-ocean models though data assimilation methods, to demonstrate the usefulness of iAOS for process understanding, to improved predictability of the ice-ocean environment and to initialized coupled models in Task 6.1. Ice and ocean products from GECCO will be validated against and improved through the assimilation of *in situ* and remote sensing data from iAOS. Ice-ocean fields from this work will feed to *Activity 4* providing improved 3D time series for the risk assessment platform.

Activity 4 High-resolution data archive for use in risk management for offshore oil and gas and maritime activities (DNV GL). In addition DNV GL will make use of the output from the reanalysis in *Activities 1-3* and data provided by WP2, WP3 and WP5 to establish methods to build and visualize a high quality data library that can be used for long term planning for design and operation in the areas of interest. Flexible, easy-to-use analysis of historical high-resolution ice, atmosphere and ocean data can be used to tackle specific challenges such as operability of oil spill equipment in various environments, requirements for winterization, assessment of search and rescue resources. This could serve as input to improved environmental risk assessments for ice edge, requirements to oil spill response methods and specification of ice management systems. A high-resolution historical ice metocean archive will contribute to more accurate planning and design basis, as we better resolve eddies and local bathymetric conditions. This will again make planning more precise, cut operational expenses due to shorter waiting times for a suitable weather window, and allow for a design which is optimized with respect to relevant environmental loads, hence reducing capital expenditures related to losses due to environmental loads. DNV GL specific work actions will be to:

- Define end user requirements and ensure that the output from the project has a good understanding and sharp focus for the end users in oil and gas and maritime. Particularly to define: (a) sets of variables that should be assessed and (b) end-user requirements from the re-analysis to serve as basis for a high quality data archive.
- Collect data from the re-analysis that will be used to build high quality data library.
- Develop novel visualization methods for the various types of ice-metocean data (time series for grid cell, area wide statistics etc.).
- Employ the DNV GL's Arctic Risk Map as the platform for dissemination of project results to relevant stakeholders, in particular those with interests in risk analysis in the Arctic region. The Arctic Risk Map is well established and widely advertised towards stakeholders, interactive web-based solution, available at https://maps.dnvgl.com/arcticriskmap/.

Task 6.4 Natural hazards in the Arctic. [Lead: **GEUS, Anne Solgaard**; Contributors: UPM, GEUS, FMI]

Natural hazards, such as extreme weather, snow avalanches and earthquakes, pose a threat locally and by teleconnections to populations and infrastructure, also in the Arctic. The ice masses of the Arctic present several types of hazards, for example as a primary source of global sea level rise through mass loss and as producers of icebergs presenting a hazard to ships. The likelihoods of several natural hazards are likely to increase with the expected changes in the climatic conditions in the Arctic. The iAOS will provide a unique dataset, allowing the constraint of event probabilities for natural hazards, and how these are affected by climatic changes.

Task 6.4 aims to demonstrate how iAOS data can be exploited to better understand natural hazards in the Arctic and how these are affected by climatic changes. Hazard information will be targeted based on stakeholder needs identified in WP1. Results will be made available to the relevant user groups through Tasks 6.6, 6.7 and 6.8, to stakeholders in WP7, and will contribute to the roadmap for future Arctic Observing System prepared in WP1.

FMI will post-process AROME model outputs of extreme precipitation events in Svalbard using *in situ* snow and meteorological observations provided by WP5 to improve the extreme precipitation forecasts. The developed post-processing method will provide better forcing for avalanche forecast models. UPM, DTU and GEUS will demonstrate the integration of recently available satellite data from the Copernicus programme (Sentinel-1) with enhanced *in situ* observations of surface mass balance and mass loss (WP2 and WP3 made available through WP5) and innovative modelling to deliver the contribution of mass losses from the Greenland ice sheet and Svalbard glaciers and ice caps to sea-level rise and a method to separate solid iceberg production from the total marine mass loss of selected glaciers. GEUS will use the seismological data made available through WP5 to show the benefits of seafloor monitoring in the Arctic Ocean, for the detection of earthquakes and to the measure of earthquake source parameters, key information to the assessment of earthquake hazard in the Arctic region, especially along the continental shelfs that hold large potentials for future offshore hydrocarbon exploration.

Monitoring environmental parameters over time with iAOS will provide direct data on climatic changes (e.g., temperature, sea level, precipitation, ice cover and thawing of permafrost which will be available from WP5, based on the work done within WP2, 3 and 4).

Task 6.5 Multi-disciplinary data assimilation to advance process understanding in Arctic greenhouse gas exchange. [Lead: **MPG, Mathias Göckede**; Contributors: NIVA, AU, UiB]

Atmospheric inverse modelling constrains regional to global scale greenhouse gas (GHG) budgets based on transport fields and time series of GHG mixing ratios from a network of towers. Geostatistical inverse modelling (GIM) techniques extend this approach, allowing assimilation of additional ancillary data layers that may provide useful information on how the simulated flux fields vary in both space and time. This way, an arbitrary number of spatially explicit data grids, representing both constant and time-varying characteristics of e.g. ice cover, ocean waters, land and atmosphere can be tested against their correlation with observed patterns in the atmospheric mixing ratios. Our data assimilation activities will place a particular focus on novel products generated within WP2 (e.g. upgraded routines by UB, NERSC, etc., to characterize sea ice, or new NIVA database on carbonate system chemistry) and WP3 (e.g. distributed systems to monitor ocean and sea ice characteristics). Moreover, this study will take advantage of the capabilities within WP5 to gather information from existing observation platforms and make them available in the project database in a harmonized format. The geostatistical approach allows identifying the combination of input data layers that generates the most plausible flux fields, adding crucial constraints to the inversion and thus optimizing the information content within the data assimilation framework. Our overall objective here will be to maximize the use of multi-disciplinary observations that are collected within INTAROS WP2-4, and provided in a uniform data format through the INTAROS database (WP5).

A secondary focus within this task (UiB, NIVA) will be on integrating multi-disciplinary observations for the ocean region around Svalbard. The combined assessment of information from e.g. moorings (Task 3.2 North of Svalbard) or shipboard platforms (NIVA Ferrybox observations on ships of opportunity in Task 3.4) will allow us to assess the mass flow of GHGs between the Arctic and Atlantic oceans, and characterize ocean acidification patterns in surface and bottom waters for use in predictive model. Key elements within this project will be monitoring inflow to the Arctic Ocean, export of inorganic carbon from the Arctic Ocean in deep waters through Fram Strait, and the inclusion of coastal data as an important end member to the overall Arctic Ocean carbonate chemistry. These ocean-based (bottom-up) assessments will be complemented by an atmospheric inverse modelling study based on the approach outlined above, focusing here on constraining regional GHG patterns in the ocean domain around Svalbard. This top-down data assimilation will make use of the high-density of available ancillary information in this region, e.g. the pCO2 observations in the Greenland coastal (WP3, AU) that reflect the impact of glacial melt water.

The main products of Task 6.5 will include: i) constraining the net exchange of CO2 and CH4 between surface and atmosphere at high spatiotemporal resolution over both the Arctic Ocean and terrestrial areas in selected regional case studies based on GIM techniques; ii) characterizing GHG mass transport and inorganic carbon chemistry focusing on the ocean region around Svalbard; and iii) identifying the most relevant data layers from the multi-disciplinary INTAROS database that explain GHG patterns in the Arctic and promoting the integration of these layers into process modelling frameworks to improve structural deficiencies in model algorithms. Our activity specifically targets the ESM modelling community as stakeholders, with the aim of supporting the representation of biogeochemical processes in high-latitude ecosystems as well as the assimilation of the most relevant data layers into existing modelling frameworks. Reduced uncertainties in the resulting future climate simulations will in turn help local communities as well as decision makers in economy and management to improve adaptation measures towards climate change impacts in the region. As a specific example, an improved assessment of spatiotemporal patterns in ocean acidity in the region, including better prediction of pelagic/benthic ecosystem response to changes in carbonate chemistry, will contribute towards assessing the sustainability of fisheries in Arctic waters.

Task 6.6. Demonstrating the benefits of cross-fertilizing local and scientific observation systems. [Lead: **NERSC, Lisbeth Iversen**; Contributors: NORDECO, AU; Subcontractor: Pole-Position]

In each of the two focal communities of community-based observing in INTAROS, Longyearbyen, Svalbard and Disko Bay in Greenland, Task 6.6 will prepare, present and discuss a policy brief on topics of high priority to the local communities, while using information from both indigenous, local and scientific observation systems. Key stakeholders have already consented their involvement (The Governor of Svalbard; Aasiaat Area Office, Qaasuitsup Municipality, and representatives of two settlements in Disko Bay).

The specific topics to be dealt with in the policy briefs will be decided upon in dialogue with the local authorities (Governor of Svalbard; Qaasuitsup Municipality). Topics of potential interest for communities include climate change (Task 6.1), natural hazards (e.g. avalanches, land slides, seismic events, extreme weather, Task 6.4) and economic development (e.g. changes in ecosystems, Task 6.2; new transportation routes and associated risks, Task 6.3). The policy briefs will provide pertinent, high quality and near real-time information and guidance to aid local, national and international decision-making. This will showcase 'real-world' examples of the benefits of cross-fertilizing indigenous (Disko Bay) and local observation systems with scientific observation systems. These policy briefs with proposed recommendations will be presented and discussed at a workshop with representatives of local communities, civil society organizations and government and academic researchers in each community (Longyearbyen, Disko Bay). Moreover, the policy briefs will be presented to Senior Arctic Officials of the Arctic Council to promote innovative approaches that connect bottom-up and top-down observation systems for improved decision-making.

Task 6.6 will use data and results in Tasks 4.3-4.4 on community-based observing, and from WP5 and Tasks 6.1-6.4 on climate, ecosystems, ocean physics, and natural hazards. Data from Copernicus monitoring and forecasting services will also be used. Task 6.6 will be undertaken in close cooperation with the Office of the Governor of Svalbard and Qaasuitsup Municipality. The work in Longyearbyen will be undertaken by NERSC and Pole-Position, the work in Disko Bay by NORDECO and AU. Pole-Position will be subcontracted by NERSC.

Task 6.7 Support to Marine and Maritime Industry (Blue Growth). [Lead: **EuroGOOS, Erik Buch;** Contributors: NERSC, JRC, EMODnet]

The Task 6.7 main objective is to demonstrate the value and benefits of an upgraded Arctic Observing System in support of Blue Growth in the Arctic to foster business development, increase safety and protect the environment by integrating data, products and services from EMODnet and Copernicus Marine service with those produced by INTARTOS. The EU initiative Blue Growth is the long-term strategy to support sustainable growth in the marine and maritime sectors as a whole. Task 6.7 therefore aims at demonstrating how an improved Arctic Observing System can support business development, security and efficiency of selected marine industries – maritime transport, oil and mineral exploitation incl. support to oil spill cleanups, tourism, fishery, and wind energy – without compromising the vulnerable Arctic environment.

Critical information for all these industries for long- and short-term investment planning, risk assessment and operational purposes is knowledge of the environmental fields affecting marine operations in the Arctic Ocean. Task 6.7 will therefore employ model analysis or reanalysis of wind, temperature, sea ice, sea state, near surface ocean currents and icing index in combination with *in situ* and remote sensing observations. The aim is to increase the quality and availability of data products needed to improve operational forecasts of marine conditions and to estimate risks and costs associated with activities of specific industries when extending their operations to the Arctic Ocean. In close dialog with selected marine and maritime industry, stakeholders relevant decision support tools will be defined and designed by integrating data from EMODnet and Copernicus Marine Service enhanced by new INTAROS data. Stakeholders will be identified in WP1 and will include representatives from shipping industry, AMSA, IMO, DNV GL, oil industry, insurance companies, petroleum safety authority, fish industry, ICES.

To build up quantitative knowledge about ship traffic in the Arctic, ship traffic patterns will be analyzed by JRC and linked to other developments (such as thawing, erosion, exploration, settlement growth, fishing, global maritime transport routes, pollution, ecology, etc.) in order to better understand the interconnections and thereby enable better decision-making.

Task 6.7 will capitalize on the findings of the AtlantOS study on: "Analysis of the economic potential associated with observatories" and attempt to extend the results to the Arctic region. This study is a forward-looking assessment of the ocean economy to 2030 and beyond, with particular emphasis on the development potential of emerging ocean-based industries. The ultimate aim is to make a concrete and substantial contribution to better understand the role of data and information as part of the ocean economy's long-term outlook and future contribution to growth and jobs. Two stakeholder seminars are planned, one at an early stage (Month 35) and one at the end (Month 55). At the first workshop a small core group of stakeholders (1-2 from each sector) will be established for a more direct dialog for their sectors needs. The results from Task 6.7 will contribute to WP1 for preparation of the roadmap for future Sustained Arctic Observing System.

Task 6.8. Demonstrations for fisheries and environmental management agencies. [Lead: **AU, Marie Maar;** Contributors: IMR]

Task 6.8 will demonstrate the use of iAOS based products for managers, in particular those responsible for the management of the environment and living marine resources. The demonstrations will be given in the form of software available through the INTAROS Portal (WP5), reports and direct interaction at workshops and one-to-one meetings. The expected impact is to provide a scientific basis for better-informed decisions and better-documented processes for managers and policy-makers on local, regional and pan-arctic scales.

Models are essential tools for integrating the data from the various Arctic observing systems and the development of products. Task 6.8 will demonstrate model-based products at different scales (provided by Task 6.2) will be demonstrated. This includes products for fisheries and environmental research and management from existing ecological models NORWECOM and Atlantis (Task 6.2). This will be done with primarily the Barents Sea (and possibly including other reference sites) as exemplary areas to demonstrate the structure and functionality of a fully implemented integrated system. The development and application of fast and flexible modelling tools such as FLEXSEM is an increasingly important and recommended approach to support integrated assessments, adaptive management and conservation of vulnerable marine and coastal ecosystems. FLEXSEM was optimized as a tool for applying an iAOS to Disco Bay, West Greenland in Task 6.2 and can be used to improve downstream applications by resolving system specific issues on local scale (e.g. acidification, fishery, meltwater run-off and sea ice cover). Results will be presented and discussed with stakeholder groups at a workshop.

Deliverables

Task 6.0

D6.18 Synthesis report**,** summary of the results from all work in WP6 (Resp**. IMR, M58**)

Task 6.1

D6.1 Climate model initialization: first report on the added value of using data from INTAROS (Resp. **BSC**, with SMHI and NERSC; **M42**).

D6.11 Climate model initialization: first: final report on the added value of using data from INTAROS (Resp. **SMHI**, contribution from BSC and NERSC; **M58**).

Task 6.2

D6.2 Impact of climate change on Greenland ecosystems and fish resources, first report on decadal scale changes in fish community structure along the West Greenland coast (Resp. **AU**, GINR; **M42)**.

D6.3 Extension of ecosystem management systems: Use the existing environmental and fisheries reporting and management systems of the Barents Sea and off Greenland to demonstrate how data from an iAOS may allow for implementing similar procedures in other parts of the Arctic, first report (**IMR**, AU; **M42**).

D6.12 Impact of climate change on Greenland ecosystems and fish resources, final report on decadal scale changes in fish community structure along the West Greenland coast (Resp. **AU**, GINR; **M58)**

D6.13 Extension of ecosystem management systems: Use the existing environmental and fisheries reporting and management systems of the Barents Sea and off Greenland to demonstrate how data from an iAOS may allow for implementing similar procedures in other parts of the Arctic , final report (**IMR**, AU; **M58**).

Task 6.3

D6.4 Ice-ocean statistics and state estimation: First report on ice-ocean state estimation for Fram Strait and the Arctic Ocean.. This report includes integrative data analysis, baseline description of Arctic sound scape, and results from assimilation experiments (Resp. **UHAM**, NERSC, ARMINES, IOPAN, **M42**).

D6.5 Risk assessment system. First results of using integrated data from iAOS into a risk assessment system (Resp. **DNV GL**, NERSC, UHAM, UB, **M42**)

D6.14 Ice-ocean statistics and state estimation: Final report on ice-ocean state estimation for Fram Strait and the Arctic Ocean. This report includes integrative data analysis, baseline description of Arctic sound scape, and results from assimilation experiments (Resp. **NERSC**, UHAM, ARMINES, IOPAN, **M58**).

D6.15 Risk assessment system. Final results of using integrated data from iAOS into a risk assessment system (Resp. **DNV GL**, NERSC, UHAM, UB, **M58**)

Task 6.4

D6.16 Natural hazard assessment in the Arctic and evaluation of long-term impact of climate change on natural hazards. (Resp. **GEUS**; DTU, FMI, UPM **M58**)

D6.17 Ice discharge from Greenland icesheet: Model-based demonstration of calculations of ice discharge from glaciers to the ocean, aimed to predict the contribution of glaciers to sea level rise. (Resp. **UPM**; **M58**)

Task 6.5

D6.7 GHG budgets - atmosphere: Quantification of GHG budgets for selected regions in the Arctic based on the assimilation of multi-disciplinary data layers into an atmospheric modelling framework, including the identification of key processes across disciplines that govern Arctic greenhouse gas cycles and their links to climate change (Resp. **MPG**; **M54**)
D6.8 GHG budgets - ocean: Quantification of the advective net exchange of GHG between the Atlantic into the Arctic Ocean based on mass balances along the intersection of both regions, including the characterization of transport and carbon transformation processes, and the role of ocean chemistry and acidification patterns (Resp. **NIVA**, UoB, AU; **M54**)

Task 6.6

D6.6 Results of local community study. Report with policy briefs for Longyearbyen and Disko Bay on topics of high priority to the local communities, such as climate change, natural hazards, or economic development, demonstrating 'real world' examples of integrating data from local and scientific observation systems for better-informed decisions and better-documented processes (Resp. **NERSC**, NORDECO, GINR; **M48**)

Task 6.7

D6.9 Reports on business development and economic potential: a) Report on INTAROS fitness for supporting Marine and Maritime Industry business development in the Arctic Ocean. This report will describe the decision support tools designed during the project phase and the stakeholder feedback as expressed during the second stakeholder seminar. b) Report on Economic benefits. This report will wrap up the findings obtained by using the AtlantOS analysis of the economic potential associated with observatories and transferring them to the Arctic region. (Resp. a) and b) **EuroGOOS**; **M54**).

Task 6.8

D6.10 Report on ecosystem management for managers: Ecological model results from the Barents Sea and Disko Bay will be presented and discussed with fisheries and environmental managers at workshops respectively in Norway and on Greenland (**IMR**, AU; **M54**)

Work package number	**7**			**Lead beneficiary**	**USFD**	
Work package title	**Dissemination and outreach**					
Participant number	1	7	8	9	10	12	13
Short name of participant	NERSC	DTU	AU	GEUS	FMI	NORDECO	SMHI
Person/months per participant:	3	2	1	1	3	9	0.5
Participant number	**14**	19	24	25	26	29	32
Short name of participant	**USFD**	EUR OCEAN	TDUE	GINR	OU	UH	IGPAN
Person/months per participant:	8	9.5	2	4.5	3.5	3	2
Start month	**Month 1**			**End month**		**Month 60**	

Objectives

The main objective is to disseminate project results to raise awareness of Arctic challenges and to inform and engage key user and stakeholder communities to improve their understanding of the Arctic environmental state and processes. The further aim is to build capacity in using the new products and services originating from the INTAROS project.

Description of work

WP7 is led by Donatella Zona, USFD (lead) and Ned Dwyer, EurOcean (co-lead). The work will focus on: preparing a dissemination plan and support dissemination events, informing decision-makers in European agencies and businesses, informing Arctic and international bodies, interdisciplinary science dissemination, capacity building for early-career scientists, high-school and general public and local communities.

Task 7.0 Coordination of the Workpackage. [Lead: **USFD, Donatella Zona**]

The work package leaders will ensure that the planned work is carried out according to the plan and budget and that the deliverables are produced and milestones attained on time. This includes management and promotion of links between the tasks and other WPs.

Task 7.1 Plan and support dissemination activities. [Lead: **EurOcean, Ned Dwyer;** Contributors: USFD, NERSC]

Task 7.1 will work closely with WP1 to coordinate the dissemination activities. A dissemination plan will be developed in the beginning of the project and annually updated, containing the description and goals of activities, targeted audiences, methods, timing, and expected outcome. All WP leaders and Theme leaders will provide results to be used in dissemination. All consortium members will promote the project among colleagues and students. Our task is to support the dissemination activities in the project through public project website, eNewsletters, blogs written by scientists and stakeholders, social media (Twitter, LinkedIn, Facebook, ResearchGate), webcasting, video (YouTube); print (brochures, factsheets, press release, policy briefs, photos), project identity toolkit (graphical image, logos, lettering, templates) and branding (e.g. pens, folders, writing pads).

Task 7.2 Informing decision-makers in European agencies and businesses. [Lead: **EurOcean, Ned Dwyer;** Contributors: UH, NERSC]

Task 7.2 will produce information material to disseminate results from INTAROS to the EU Arctic Information Center (www.arcticinfo.eu). The Center produces and disseminates EU policy documents related to the Arctic region. This task will also approach, engage, and inform EU Agencies including European Environment Agency (EEA), and the European Maritime Safety Agency (EMSA). We will participate and present results at the 'European Week of Regions and Cities' open days to promote the Arctic affairs and challenges and to show how observations can assist social and economic development in the region. INTAROS results will also be disseminated at the annual European Maritime Day conference.

A final project event, with a key session focused on decision-makers and policy developers will be organized in Brussels. Task 7.2, working closely with WP1 will produce a summary for policymakers and highlight the project activities, results and the roadmap for future needs and developments through this event. Invitees will in particular include members of the European Parliament and representatives from the European Commission. The results and recommendations from the INTAROS project will be presented towards national and international funding agencies with the aim to encourage long-term funding mechanisms and infrastructure investments to support sustainability of the future Arctic Observing System.

Task 7.3 Informing Arctic and international bodies [Lead: **EurOcean, Ned Dwyer;** Contributor: NERSC]

This task will closely work with the Arctic Council secretariat and its working groups, Indigenous People Secretariat, and Permanent Participants, through the Arctic Portal, to inform them about project activities and results. Arctic Council is the only intergovernmental body dealing with Arctic matters. Moreover project representatives will endeavor to attend appropriate Working Groups' meetings as invited resource persons. INTAROS results will be communicated to the Arctic Council and disseminated through their Arctic Portal. We will inform the OSPAR, ICES about the INTAROS results and how new observing systems for the Arctic can improve the management of the Arctic and Sub-Arctic Seas.

We will approach commercial sector through Arctic Business Council, Norwegian Shipping Association (the largest shipping organization in the world), Association of Arctic Cruise Operators (see letter of support), World Ocean Council (WOC), and GCE Subsea. A specific Task is devoted to business development (Task 6.7). In WP1 stakeholders from the business sector will be involved to define requirements and plans for a future SAOS. We will use international events such as Arctic Frontiers (Tromsø, Norway), future Arctic Observing Summit (AOS2018), Arctic Circle (Iceland), Arctic Science Summit Week, and Nor-Shipping conference (2017) to widely disseminate INTAROS results, including the roadmap for a future SAOS, to diverse stakeholder groups.

Representatives from stakeholder groups will be also invited to the INTAROS workshop. We will participate in the annual Arctic Futures Symposium, hosted in Brussels, highlighting the added value products from the innovative INTAROS observing systems.

Task 7.4 Interdisciplinary science dissemination. [Lead: **USFD, Donatella Zona;** Contributors: OU, DTU, EurOcean]

Task 7.4 will foster development of dissemination for cross-disciplinary high-profile topics in the Arctic such as natural hazards in the Arctic, Greenland ice sheet melt, sea level rise, sea-ice reduction, melting of permafrost, pollution problem (mostly buildup of mid-latitude emissions from fossil fuel combustion, smelting and other industrial processes). Popular science publications will be presented in e.g. iLEAPS (Integrated Land Ecosystem Atmosphere Process Study) Highlights PDF series, the IGBP Global Change Magazine, the Future Earth Newsletter, and the Future Earth blog, and Arctic Council news, and the internal publication of the >30 institution involved in this project (including hundreds of thousands of readers). Interviews to the press will be organized by the press offices of these institutions to present and discuss project highlights, and engagement with the native communities and the policy makers.

Dedicated EGU and/or AGU sessions will be organized during the project to present its outcome to the scientific community. We will also organize side events at OceanObs 2019, and during the annual Arctic Science Summit Weeks. One special issue in a high-profile journal will be initiated and populated jointly with international partners with focus on interdisciplinary research (e.g. the ARCTIC Journal). We will contribute results from INTAROS to White papers prepared for the Arctic Observing Summit 2018.

Task 7.5 Capacity building for early-career scientists. [Lead: **EurOcean, Ned Dwyer;** Contributors: EurOcean, USFD, FMI, NERSC, UH, IMR, GEUS, GINR]

Under Task 7.5 one summer school will be organized with contributions to another, aimed at early-career researchers. The summer school will be organized in year 4 of the project at the University Centre of Svalbard (Norway) in collaboration with NERSC and FMI. The theme will cover observing systems, with a special focus on existing and emerging technologies and solutions for Arctic waters, atmosphere and land, including space-based, *in situ* and community-based observations. Lecturers will be invited from the INTAROS consortium. Teaching material used at the summer schools will be further distributed and utilized as an educational package openly available to schools and universities, interested in observation-based research in the Arctic, e.g. at annual Hyytiälä (Finland) Winter/Summer Schools/Courses organized by UHEL and the courses organized by University of the Arctic.

Short-term scientific exchange and training of 2-6 weeks for PhD students and early-stage researchers will be organized within the consortium. Project partners will provide details of laboratory projects, or ship-based activities where they can offer training and these will be announced widely. Agreements between the partners will be established to improve mobility of young scientists. INTAROS will also contribute to the specialization program on Arctic Affairs, established as collaboration between Aarhus University, Greenland Institute of Natural Resources (GINR), University of Manitoba and University of Greenland. This specialization program provides theory and practical lessons in relation to Arctic monitoring and applications. Contribution from INTAROS will be based on the case studies of WP6.

Task 7.6 Capacity building for high-school and general public [Lead: **GINR, Thomas Juul-Pedersen;** Contributions: USFD, OU, IGPAN]

The main focus of Task 7.6 is to contribute to development and implementation of modules within Climate Change teaching packages for high school students and teachers in Greenland as part of collaboration with high schools in Greenland, Government of Greenland, Greenland Institute of Natural Resources and Aarhus University. Further activities will aim to link high schools with ongoing climate monitoring programs and activities and real life data collection. As part of this task connections will also be made with the 'Arctic in a Class Room (ARCUS)' programme coordinated by the Arctic Research Consortium of the United States. Participation in the "Make an Impact" workshop to explore opportunities for discussing best practice and sharing teaching materials and approaches is also planned.

Two packages of educational materials for teachers and students of lower and upper secondary schools will be prepared to enhance literacy of Arctic Observations among teachers and students (IGFPAS). Each package will consist of methodological material for teachers, and multimedia material and worksheets with tasks for students. For classes using these packages, webinars conducted in national languages and in English will be also offered. Teachers will be prepared for using packages during at least 3 workshops conducted within cooperation with other European projects e.g. Scientix (community for science education in Europe), ERIS (project from ERASMUS+) and EDU-ARCTIC (H2020 project). Moreover schools will be encouraged to use packages via different activities (sending invitation to 15.000+ STEM teachers from EDUSCIENCE project coordinated by IGFPAS, including materials in Scientix repository, contact with teachers from at least 5 European countries taking part in EDU-ARCTIC project).

Separate work will be devoted to prepare informational package and exhibition material, including photos and videos from field work in the Arctic, for use in Science Centers in EU countries e.g. Arktikum Science Centre in Finland or VilVite in Norway. This activity will also contribute to promote tourism, by highlighting the unique nature and environment of the Arctic regions.

Task 7. 7 Capacity building for local communities and civil society organizations. [Lead: **NORDECO, Finn Danielsen**; Contributor: NERSC; Sub-contractors: ELOKA, Yukon River Inter Tribal Watershed Council (YRITWC), and Center for Support of Indigenous Peoples of the North (CSIPN)]

Task 7.7 will build additional capacity of indigenous and other civil society organizations involved with community-based observing in the Arctic building on previous efforts by NORDECO, ELOKA, University of the Arctic, and many partners (see Report of SAON Task #9 in press). We will use the survey of existing community-based observing initiatives (Tasks 4.1 and 4.2) and the lessons from using innovative knowledge products to support decision-making processes (Tasks 4.3, 4.4 and 6.6) as a starting point. Through two workshops to be organized by ELOKA and Yukon River Inter Tribal Watershed Council (North America), and NORDECO, NERSC and Center for Support of Indigenous Peoples of the North (Europe), we will facilitate experience exchange to build further capacity in community-based observing in the Arctic There will be a particular focus on professional and cross-disciplinary skills and competences of the youth to help ensure the sustainability of community-based observing into the future.

Potential topics for the workshops include: (i) using indigenous, local and scientific knowledge for informing decision making within key sectors like fisheries, tourism and industrial development; (ii) facilitating the development of national policies in support of community-based observing and management, incl. access to management processes at higher levels with the aim of input provision; (iii) designing meaningful sampling and communication strategies for maximizing precision and decision-making given available resources; (iv) involvement of school children and the private sector (tourist operators, and staff of mining and hydrocarbon companies) in community-based observing; and (v) institutional and financial sustainability of community-based observing. ELOKA, YRITWC and CSIPN will be subcontracted by NORDECO.

Deliverables

Task 7.1: D7.1 Dissemination Plan: Description of objectives, audiences, tools and planning of all communications and outreach activities. **(**Resp. **NERSC,** USFD, EurOcean, **M3** and **M18, M36, M54, M60**)

Task 7.1: D7.2 Project Website. (Resp. **Eurocean**, **M3**). Continuously maintained and updated.

Task 7.1: D7.3 Suite of Communications Tools: Website, social media accounts, branding materials, print materials, eNewsletter (Resp. **Eurocean,** USFD, NERC**, M1-60).**

Task 7.2&7.3: D7.4 Dissemination material for use towards decision makers, stakeholders, business and general public. **(**Resp. **NERSC, M12** updated **M24, M36, M48**).

Task 7.2&7.3: D7.5 Final Event Report and Summary for policymakers: Report summarizing event outcomes project results and recommendations aimed at policymakers (Resp. **Eurocean, M57)**

Task 7.4: D7.6 The organization of side event at OceanObs 2019 (Resp. **EuroGOOS, M36).**

Task 7.4: D7.7 Special issue in a journal focused on multidisciplinary Arctic research (Resp. **USFD, M54)**.

Task 7.5: D7.8 Scientific Capacity Building achievements: report on summer schools, scientific exchange activities and achievements (Resp. **USFD, M54)**.

Task 7.5: D7.9. Educational packages for early career scientists and students. (Resp. **USFD, M54).**

Task 7.6: D7.10 Materials for high-school students and general public: materials for schools in Greenland, two packages for lower and upper secondary level from IGPAN and reports from 3 workshops for teachers (Resp. **USFD**, OU, IGPAN, **M36).**

Task 7.7: D7. 11 Proceedings of community-based observing workshops: report on activities and recommendations from experience exchange workshops on community-based observing **(**Resp. **NORDECO, M48)**.

Work package number	8		Lead beneficiary		NERSC	
Work package title	Project management					
Participant number	1					
Short name of participant	NERSC					
Person/months per participant:	60					
Start month	Month 1		End month		Month 60	

Objectives

Provide top level management of the project to ensure aims of the project are efficiently and effectively met, on time and with the resources budgeted and that knowledge and innovation are properly managed

Provide effective reporting and communication within the project, between partners and stakeholders and between the consortium and the European Commission (EC)

The management structure and procedures are extensively described in Section 3.2. More on innovation management and exploitation measures is already described in Sections 2.1.2, 2.2.2, and 2.2.5 in the text: that information is not repeated here.

Description of work

Task 8.1 Project management. [Lead: **Stein Sandven, NERSC**]

Management of the project: The Project Management Team (PM-team) at NERSC will be in charge of managing the project using established procedures and qualified personnel at NERSC (see partner description is Section 4). For more information on the composition of the PM-team, see **Section 3.2.2**. Project management includes: (1) the setting up the consortium agreement prior to the signature of the grant agreement. The consortium agreement will regulate the consortium, rules for participation, and ownership and access to key knowledge (IPR, foreground, etc.), (2) the provision of administrative, financial, and legal support to all partners involved during the implementation of the project, (3) the preparation of Project Periodic Reports, the Final Report and the Final Report on the EU Financial Contribution Distribution (including updated plan for dissemination and exploitation of results (in collaboration with D7.1).

Communication with EC: the PM-team will be responsible for the communication of project results to the EC. This will include reporting according to the Grant Agreement (scientific, reporting of science results and finances, communication, and management).. If there are any major problems within the project that cannot be solved through the appropriate management structure, the PM-team will liaise with the EC in order to seek a solution.

Communication activities to promote the project and its findings: The PM-team will engage with public and the media through the press contact at NERSC. The promotion of the project will be done in coordination with WP7.

Coordination of internal communication within the project: The PM-team will ensure optimal internal communication through a dedicated internal website, virtual meetings (e.g. Skype/Webex) and physical meetings. The internal website (D7.2) will be set up for exchange of information and documents among the partners.

Technical support to the steering committee (SC) and advisory panels: The PM-team will also provide administrative support to the SC and the advisory panels (see **Section 3.2**). This will include organization of the GA, SC and panel meetings

A Gender and Diversity Action Plan will be prepared by month 3 with focus on how to improve gender balance and diversity in the project, and in the science and technology related to the project. Monitoring the Gender and Diversity Actions will be done by the PM-team and reported to the SC annually.

Task 8.2 Knowledge management and innovation management. [Lead: **Stein Sandven, NERSC**]

Management of knowledge and innovation is an integral part of the project. Focus will be on the role and synergies between partners' experiences, competences, capabilities, and on how partners will protect, share, manage IPR capital actual exploitation. Detailing of the exploitation plans and preparation for innovation activities will be continuously followed up throughout the project. The innovation management is well integrated in the management structure of the project (see **Section 3.2.3**). A strategy for the knowledge management, protection and for the exploitation of results, the **Exploitation Plan**, will be defined based on the principles explained in **Sections 2.2.2** and **2.2.5**. The strategy will be regularly updated during the project. Updates will be submitted to the EC as an integral part of the Periodic Reports.

At the end of the project a **Strategy for the Intellectual Property exploitation** will be drafted for providing best practices in capturing and assessing the Intellectual Property and providing measures for exploitation after the end of the project. INTAROS will provide open access to peer-reviewed scientific publications through a combination of golden open access and green open access, and it is voluntarily taking part in the European Commission Open Access Data Pilot for Research Data (see Section 2.2.5): **Data Management Plan** [D1.4] will be developed in WP1 in compliance with the guidelines given on data management in the Horizon 2020 Online Manual. This deliverable will updated towards the end of the project.

Deliverables

Task 8.1: D8.1 Design and implementation of the project intranet: The intranet is a tool for the legal, financial and administrative management of the project. It contains contractual and consortium documents, templates for the legal, financial and administrative management, and reports to the EC. The web-based intranet will be set up with the support of the NERSC IT department. (Resp. **NERSC**, **M3**)

Task 8.1: D8.2 The Gender and Diversity Action Plan **(GDAP**). (Resp. **NERSC**, **M3**, updated annually).

Task 8.1: D8.3 Exploitation Plan (EP). Plan identifying types of potential pathways of market-oriented exploitation, converting or transforming knowledge will be developed, together with key factors for a successful innovation management. (Resp. **NERSC**, **M12**)

Task 8.2: D8.4 Strategy for the Intellectual Property exploitation. Strategy for defining measures for exploitation "after the project" phase, providing evidence of best practices in capturing and assessing IP. (Resp. **NERSC**, **M54)**.

Table 3.1b: List of work packages

WP No	WP title	Lead No	Lead Part. Short Name	Person months	Start month	End month
WP1	Requirements and strategy for a Pan-Arctic observ. system	1	NERSC	50	1	60
WP2	Exploitation of existing observing systems	10	FMI	262	1	30
WP3	Enhancement of multidisciplinary *in situ* systems	6	IOPAN	318.6	6	54
WP4	Community-based observing programs	12	NORDECO	34	1	36
WP5	Data integration and management	24	TERRADUE	119	1	60
WP6	Application of iAOS towards stakeholders	3	IMR	316.2	24	60
WP7	Dissemination and outreach	14	USFD	52	1	60
WP8	Project management	1	NERC	60	1	60
				1212		

Table 3.1c: List of Deliverables

Delive-rable number	Deliverable name	WP/task number	Lead partici-pant	Type	Dissemi nation level	Delivery date (in months)
D1.1	Initial requirements report	1.1	EuroGOOS	R	PU	6
D1.2	Engagement strategy	1.3	EurOcean	R	PU	12
D1.3	Data management plan and governance framework	1.4	NERSC	R	PU	12
D1.4	Report on stakeholder feedback	1.2	EuroGOOS	R	PU	54
D1.5	Strategic foresight paper	1.5	EuroGOOS	R	PU	54
D1.6	Roadmap for sustainable Arctic Observing System	1.5	NERSC	R	PU	60

D1.7	Synthesis report on all project results	1.0	NERSC	R	PU	60
D2.1	Report on present observing capacities: ocean-sea ice	2.1	UHAM	R	PU	12
D2.2	Report on exploitation of existing data: ocean-sea ice	2.2	DTU	R	PU	18
D2.3	Catalogue of products: ocean and sea ice data	2.3	AWI	O	PU	24
D2.4	Report on present observing capacities: atmosphere	2.1	MISU	R	PU	12
D2.5	Report on exploitation of existing data: atmosphere	2.2	FMI	R	PU	18
D2.6	Catalogue of products: atmosphere data	2.3	GFZ	O	PU	24
D2.7	Report on present observing systems: land-cryosphere	2.1	USFD	R	PU	12
D2.8	Report on exploitation of existing data: land-cryosphere	2.2	GEUS	R	PU	18
D2.9	Catalogue of products: terrestrial and cryosphere data	2.3	FMI	O	PU	24
D2.10	Report on synthesis and recommendation from WP2	2.4	SMHI	R	PU	30
D2.11	Report on maturity of existing systems	2.4	NUIM	R	PU	30
D3.1	Tech. development and system design: Greenland	3.1	GEUS	R	CO	18
D3.2	Tech. development and system design: North Svalbard	3.2	UIB	R	CO	18
D3.3	Tech. development and system design: Fram Strait	3.3	AWI	R	CO	18
D3.4	Tech. development and system design: ocean – sea ice	3.4	IOPAN	R	CO	18
D3.5	Tech. development and system design: atmosphere-land	3.5	MPG/OU	R	CO	18
D3.6	First implementation and results of use: Greenland	3.1	GEUS	R	PU	36
D3.7	First implementation and results of use: North Svalbard	3.2	UIB	R	PU	36
D3.8	First implementation and results of use: Fram Strait	3.3	AWI	R	PU	36
D3.9	First implementation and results of use: ocean-sea ice	3.4	IOPAN	R	PU	36
D3.10	First implementation and results of use: atmosphere-land	3.5	MPG/OU	R	PU	36
D3.11	Final implementation and results: Greenland	3.1	GEUS	R	PU	54
D3.12	Final implementation and results: North Svalbard	3.2	UIB	R	PU	54
D3.13	Final implementation and results: Fram Strait	3.3	AWI	R	PU	54
D3.14	Final implementation and results: ocean-sea ice	3.4	IOPAN	R	PU	54
D3.15	Final implementation and results: atmosphere-land	3.5	MPG/OU	R	PU	54
D3.16	Synthesis and technical recommendations	3.0	IOPAN	R	PU	54
D.4.1	Survey of existing community-based observing programme	4.1	NORDECO	R	PU	12
D.4.2	Library with tools for cross-fertilizing knowledge	4.2	NORDECO	O	PU	12
D.4.3	Lessons learned report on CB observing parameters	4.3	NORDECO	R	PU	36
D.4.4	CB observations from two focal communities into iAOS	4.4	NORDECO	O	PU	36
D.5.1	iAOS platform requirements and architectural design	5.1	TERRADUE	R	CO	12/36
D.5.2	iAOS platform and tools	5.2	TERRADUE	DEM	PU	24/420
D.5.3	Data integrated from existing repositories	5.3	AWI	R	PU	24/54
D.5.4	Geo-statistical library for iAOS	5.4	ARMINES	DEM	PU	36/54
D.5.5	Processing services for iAOS	5.5	TERRADUE	DEM	PU	36/54
D.5.6	iAOS portal with user manual	5.6	NERSC	DEM	PU	24/54
D.5.7	Synthesis of the IAOS infrastructure	5.7	TERRADUE	R	CO	54

D.6.1	Climate model initialisation: first results	6.1	BSC	R	PU	42
D.6.2	Impact on Greenland ecosystem and fish resources - 1	6.2	AU	R	PU	42
D6.3	Extension of ecosystem management: first results	6.2	IMR	R	PU	42
D6.4	Ice-ocean statistics and state estimation: first results	6.3	UHAM	R	PU	42
D6.5	Risk assessment system: first results	6.3	DNV-GL	R	PU	42
D6.6	Results of local community study	6.6	NORDECO	R	PU	48
D6.7	Greenhouse gas budgets - atmosphere	6.5	MPG	R	PU	54
D6.8	Greenhouse gas budgets - oceans	6.5	NIVA	R	PU	54
D6.9	Report on business development and economic potential	6.7	EuroGOOS	R	PU	54
D6.10	Report on ecosystem management for managers	6.8	IMR	R	PU	54
D6.11	Climate model initialisation: final results	6.1	SMHI	R	PU	58
D6.12	Impact on Greenland ecosystem and fish resources - 2	6.2	AU	R	PU	58
D6.13	Extension of ecosystem management: final results	6.2	IMR	R	PU	58
D6.14	Ice-ocean statistics and state estimation: final results	6.3	NERSC	R	PU	58
D6.15	Risk assessment system: final results:	6.3	DNV-GL	R	PU	58
D6.16	Natural hazard assessment from climate change	6.4	GEUS	R	PU	58
D6.17	Ice discharge from Greenland ice sheet	6.4	UPM	R	PU	58
D6.18	Synthesis report	6.0	IMR	R	PU	58
D.7.1	Dissemination Plan	7.1	NERSC	R	PU	3-60
D.7.2	Project Website	7.1	Eurocean	DEC	PU	3
D.7.3	Suite of Communications Tools	7.1	Eurocean	O	PU	1-60
D.7.4	Dissemination material towards stakeholders	7.2,3	NERSC	O	PU	12/48
D.7.5	Final Event Report and Summary for policymakers	7.2,3	Eurocean	R	PU	58
D.7.6	Organization of side event at OceanObs 2019	7.4	EuroGOOS	O	PU	36
D.7.7	Special issue in a Arctic research focused journal	7.4	USFD	R	PU	54
D.7.8	Scientific Capacity Building achievements	7.5	USFD	R	PU	54
D.7.9	Educational packages for early career scientists	7.5	USFD	O	PU	54
D.7.10	Materials for high-school students and general public	7.6	USFD	O	PU	36
D.7.11	Proceedings of community-based observing workshops	7.7	NORDECO	R	PU	48
D.8.1	Implementation of intranet for project management	8.1	NERSC	R	CO	3
D.8.2	The Gender and Diversity Action Plan	8.1	NERSC	R	CO	3
D.8.3	Exploitation Plan	8.1	NERSC	R	CO	12
D.8.4	Strategy for the Intellectual Property exploitation	8.2	NERSC	R	CO	54

3.2 Management structure, milestones and procedures

3.2.1 Description of the organization structure and the decision-making

The organizational structure of INTAROS is set up for efficient management of the project and to provide good communication between the partners, the Coordinator and the European Commission. The Consortium consists of 48 partner institutions and 1 third party institution (which will not sign the Grant Agreement or receive EU funding). Stakeholders are involved as partners, third parties, or as member of a stakeholder advisory panel. The stakeholders will participate in work packages, annual meetings and dedicated workshops. The organization structure is defined with specific roles for decision-making, executive and management and advisory bodies.

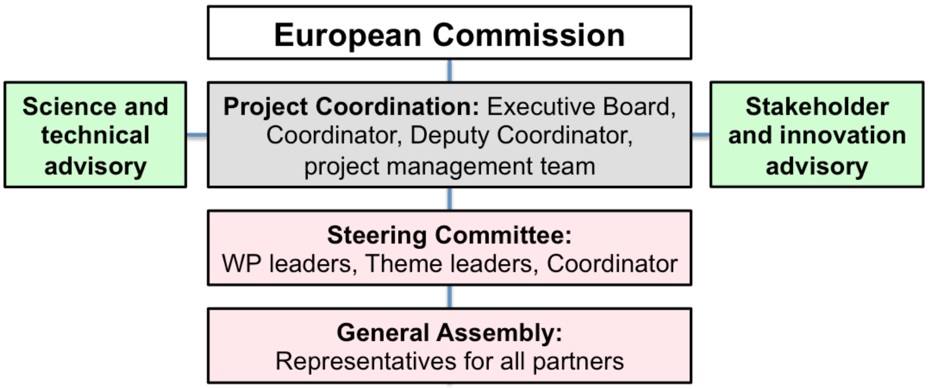

Figure 4. INTAROS governance structure.
Executive body in grey, decision-making bodies in pink, and advisory panels in green.

Decision-making

General assembly (GA): The highest decision-making body is the General Assembly (GA). The GA is responsible for taking key decisions for the project as a whole. It is comprised of one representative of each consortium partner, and chaired by the Coordinator. Formal meetings of the GA will be held during the annual project meetings. The matters to be acted upon by the GA include: the strategic orientation of the project (scientific, technical, dissemination, exploitation, engagement and communication), changes in the work plan, the budget, possible changes in the consortium membership, amendments of the Consortium Agreement, or major decisions about the project.

Executive and management

Executive board (EB) is the supervisory body for the execution of the project, reports to and is accountable to the GA. The EB recommends an action plan to the GA and is responsible for its execution. It is comprised of the Coordinator, Deputy Coordinator, and four members of the Steering Committee: Agnieszka B. Möller (IOPAN), Roberta Pirazzini (FMI), Finn Danielsen (NORDECO), and Ralf Doescher (SMHI).

Coordinator of the project is Prof. Stein Sandven (NERSC) and the deputy coordinator is Dr. Hanne Sagen (NERSC). Together, they have responsibility of overall scientific coordination of the project and function as liaison with the European Commission on behalf of the consortium. The EB is supported by the Project Management Team (PM-team) and the WP leaders, to monitor progress of activities.

Project management is led by the Coordinator and carried out by the PM-team. This team includes a Project Manager (PM), an assistant project manager, press contact, and financial/administrative personnel. The PM-team is in charge of the day-to-day management of the project, monitoring the progress of the project, and submission of deliverables to the Commission. The PM-team facilitates and conducts communication within the Consortium, coordinates reporting, organizes project meetings and reviews.

Furthermore, the PM with support from the assistant project manager ensures that plans under knowledge and innovation-related activities and the Gender and Diversity Action Plan are made available and shared with the partners. This plan will focus on how to improve gender balance and diversity in the project, and in the science and technology related to the project. The annual report will include Gender and Diversity Actions. The press contact is responsible for promoting the project and its findings and engaging with the public and media about the project in coordination with WP7: Dissemination and Outreach. The project economist at NERSC is in charge of the financial and administrative management of the project and guides the partners in the implementation of the financial rules of Horizon 2020. He will also follow up the requirements from the Grant and the Consortium Agreement, support the partners in financial reporting, and help with formalities of the financial reports and of the certificate of financial statements.

Coordination of Work Packages and Tasks. A leader and a co-leader are appointed to coordinate the work packages (WP). The responsibilities of WP leaders are: 1) to ensure that the planned work in the WP is carried out according to plan and budget and that the deliverables are produced and milestones are attained on time; 2) to provide a two-way link between Task activities and Coordinator/Steering Committee to implement decisions at WP level; 3) ensure cooperation with the third parties involved in the relevant WPs and Tasks. The WPs are organized in Tasks lead by Task leaders. Task leaders are responsible for implementation of the work and follow up the deliverables of the Task. The Task leaders report to the WP leader. The WP leaders are members of the Steering Committee. WP leaders are listed in Table 3.1a.

Theme leaders have been appointed to oversee that each of the scientific disciplines is adequately represented thorough out the project. The Theme leaders are: Mikael Tjernstrøm (MISU/atmosphere); Thomas Soltwedel (AWI/Ocean), Georg Heygster (UB/Sea Ice), Andreas Ahlestrøm (GEUS/Glaciology); Shaun Quegan (USFD/Terrestrial); Torill Hamre (NERSC/data management); Ralf Döscher (SMHI/modelling); Finn Danielsen (NORDECO/Communites).

Steering Committee (**SC**) makes propositions to the EB on the project work plan, innovation-related issues, and on matters necessary for the project advancement and success, the work plan, the progress reports on the state of advancement of the project, and in general propositions for the proper implementation of the project. It is comprised of all work package leaders and theme leaders. SC will monitor and follow up the Gender and Diversity Action Plan in INTAROS during the project period. SC is comprised of the Coordinator, Deputy Coordinator, WP leaders, and theme leaders and chaired by the Coordinator. The Project Officer of the European Commission may participate to the project meetings of these bodies as an observer.

External advisory panels

Stakeholder and Innovation Advisory Panel (SIAP): This panel will include representatives of the selected key stakeholders who will be identified in Task 1.2. They will be involved in the development of the Engagement Strategy (Task 1.3). Its role is to support the project to efficiently engage with stakeholders, attract more users, identify ways to improve usage of data and information from society to science and vice versa. The panel will also be invited to contribute to the development of the roadmap for the future sustainable Arctic Observing System in WP 1.5. Several stakeholders confirm in letter of support (e.g. Michel Rixen, WCRP) that they are willing to sit in the panel. Support letters are included in the annexes of the proposal.

Scientific and Technical Advisory Panel (STAP): This panel is established for ensuring scientific evaluation of the project and links to other programmes and for advising on the project's scientific approach and orientation by liaison with the SC. It is comprised of selected key international experts with relevant technical and scientific background. For the STAP we have already contacted the following international experts (membership will be defined during the preparation of the Consortium Agreement): Hajo Eicken (Director, International Arctic Research Center), Andrey Proshutinsky (WHOI, Letter of support). Additional 4-5 members will be appointed at the beginning of the project.

In order to help the EB, PM-team and WP leads to monitor progress of activities, the following intermediary control points ("milestones") have been defined.

Table 3.2 a: List of milestones.

MS No	Milestone name	Related WPs	Due date	Means of verification
1	First workshop with stakeholders and INTAROS consortium partners	All WPs	**3**	Minutes of the workshop
2	Initial requirement report	WP1	**6**	Report available on the website. Responsible: EuroGOOS
3	Assessment and gap analysis of present observing systems	WP2	**12**	3 reports available on website: ocean and sea ice (resp. UHAM), atmosphere (resp. MISU) and terrestrial-cryosphere (resp. USFD)
4	New sensors and platforms ready for deployment	WP3	**18**	Deployments are verified by the responsible Task leaders: Greenland (GEUS), North Svalbard (UiB), Fram Strait (AWI), Arctic Ocean (IOPAN), Siberia (MPG), Alaska (OU), Canada (CNRS)
5	Data repositories available for	WP2	**24**	First set of data available for the iAOS platform.

	accessing data			Responsible data providers: ocean and sea ice (AWI), atmosphere (GFZ), terr./cryosphere (FMI)
	Prototype iAOS platform in operation	WP5		Test of iAOS platform functionality. Resp. TERRADUE
6	Results of the first year implement-tation of sensors and platforms	WP3	**36**	Documentation of delivered data ands reports from the first year's field observations: Responsible Task leaders: Greenland (GEUS), North Svalbard (UiB), Fram Strait (AWI), Arctic Ocean (IOPAN), Siberia (MPG), Alaska (OU), Canada (CNRS)
	Complete the Community-based observing system work	WP4		Delivery of reports to the website. Responsible: NORDECO
	Provide geostatistical library and processing services in the iAOS platform	WP5		Geostatistical library: to be verified by ARMINES and task leaders in WP6. Processing services: to be verified by TERRADUE and task leaders in WP6
7	First results from application studies towards stakeholders	WP6	**42**	Progress report on application studies from WP 6 using data from WP2, WP3 and WP.
8	Final results implementation of sensors and platforms	WP3	**54**	Documentation of delivered data ands reports after completion of the field observations: Responsible Task leaders: Greenland (GEUS), North Svalbard (UiB), Fram Strait (AWI), Arctic Ocean (IOPAN), Siberia (MPG), Alaska (OU), Canada (CNRS)
	Complete the iAOS platform with libraries, processing services and user manual	WP5		Documentation of functionalities by responsible: TERRADUE and by Task leaders in WP6
	Results from application studies towards stakeholders	WP6		Reports provided on Task 6.5, 6.6, 6.7, and 6.8 from WP 6
	Second stakeholder workshop with strategic foresight discussion	WP1 WP7		Report on stakeholder feedback. Strategic foresight paper.
9	Complete all application studies towards stakeholders	WP6	**58**	Final reports on WP 6
10	Completion of the project	WP1	**60**	Roadmap for sustainable iAOS (NERSC) Synthesis report from the whole project (NERSC)

3.2.2 Appropriateness of the organizational structure and decision-making mechanisms

The organizational structure of INTAROS is set up so as to be appropriate for project of this complexity, involving around 50 partners and third party members across 20 countries. The decision-making mechanism is defined such that the General Assembly, containing a representative of all partners, is the highest body making ultimate decisions over the project as a whole, while the Steering Committee/Executive Board controls the progress of the project and reports to the General Assembly. The Coordinator and management team run the project on a daily basis, while the WP leaders and theme leaders, selected for their scientific expertise on specific areas, will be responsible for shaping the WPs and Themes as they develop. Ensuring continuous, external monitoring and guidance of the project will fall to the Scientific and technical Advisory Panel, while ensuring stakeholder engagement and steering the WPs to produce innovative synergies and ideas will be the responsibility of the Stakeholder and Innovation Advisory Panel. The full details of the organization and decision making process is described in section 3.2.1.

3.2.3 Innovation management in the management structure and work plan

Innovation activities are an important part of INTAROS, and the panel "*Stakeholder and innovation advisory panel"* with representatives from different stakeholders, technologies, and scientists will be established to create innovative synergies. The Executive Board will 1) define innovation strategies and guideline for the consortium, 2) having the WP/Task leaders following up guidelines on innovation management. The EB will be prepared to help to facilitate for processes to get from invention to innovation and will consult experts from for example NCPs, EEN, European IPR Helpdesk, ESP@CENET.

The integration of stakeholders and companies in the project helps to bridge the gap between scientific research, technology, and the market, and this can foster development of new prototypes of services and products. Several work packages in INTAROS (WP3, WP5, WP6) will demonstrate the innovation potential of the project (ref. Section 1.4.2).

At the beginning of the project an exploitation plan will be developed clearly stating the potential research outcomes from the project, which can lead to innovation. The plan will also address IPR issues. Towards the end of the project, the exploitation plan will be updated with a Strategy for the Intellectual Property exploitation after the project, and discuss possible business plans if relevant.

3.2.4 Risks to the project

The following risks have been identified when developing the INTAROS work plan.

Table 3.2b: Critical risks for implementation of the project

Description of risk (indicate level of likelihood: Low/Medium/High)	WPs involved	Proposed risk-mitigation measures
Lack of interest among relevant stakeholders to be engaged in the project. (*Low*)	WP1 WP6 WP7	Significant stakeholder communication and engagement efforts have been built into all aspects of the project. The Consortium will use its extensive network in Arctic science, communities and operators to inform stakeholders and actively engage them through workshops and the Pan-Arctic Observing Forum.
Large degree of interdependency arising from (lack of) progress in other WPs (*Low*) Delays in deliverables or milestones *(Low)*	All WPs	Close attention and proactive management by coordinators and WP leads, e.g. raising awareness progress issues at Steering committee and Executive Board meetings. Implement mitigation action to minimize the delays and their possible impacts on the project. Additional meetings among WPs.
Lack of interest among key partners to join collaboration and establish Pan-Arctic Observing Forum (*Low*)	WP1	Ensure that Pan-Arctic Observing Forum is closely connected to existing network and can offer benefits to members
Lack of long-term funding of observing systems (*Medium-High*)	WP1	Involve funding agencies and stakeholders in the Pan-Arctic Observing Forum from the start of the project. Build on existing international frameworks through SAON and GEO.
Lack of agreement on data sharing principles and data standards (*Low*)	WP1 WP2	Work closely with other Arctic data management experts in the Pan-Artic Forum to resolve open issues and ensure INTAROS follows internationally accepted standards.
Access to data from Russia (*Low-Medium*)	WP2	Involve Russian partners (NIERSC and RIHMI) to ensure that there will be relevant data available for the project
Access to ice-going vessel for deployment and recovery of moorings, ice-tethered profiler and ice mass balance buoys (*Low*)	WP3	Several partners in the consortium have access to ice-going vessels, which can be used in the project (AWI, IMR, MISU), including icebreakers from China, Japan and South Korea.
Loss of equipment or failure to function resulting in loss of data (*Low-Medium*)	WP3	Robust and well-proven platforms and technologies are used in the deployments to minimize the risk for failure. Design of experiments according to the highest standards.
Hindrances in translating community-based data into decision-making (*Medium*)	WP4 WP6	The project will integrate community-based data into iAOS and recognized international databases and actively promote the use of the results for decision-making.
Integration challenges when accessing existing Arctic data repositories (*Low-Medium*)	WP5 WP6	Several partners have expertise in integrating data from distributed data repositories, and will jointly work to define standard protocols and metadata to enable technical integration. Each repository to be integrated has a partner with the needed technical expertise to integrate it into iAOS.
Scalability or usability issues with the iAOS Cloud Platform reduces the benefits for stakeholders (*Low)*	WP5 WP6	The Terradue Cloud Platform has been successfully used in more than 30 EO projects for ESA and EC, processing large amounts of satellite data and extract geophysical parameters. Experience will be used to help the scientists in the project to develop useful services for WP6.
Loss or late/low availability of key personnel (*Low*)	All	Transfer responsibilities (and if necessary funds) between partners if a partner with shortage of personnel cannot hire qualified candidates within a reasonable time frame to meet the project schedule.

3.3 Consortium as a whole

The INTAROS consortium is composed of institutions which all have leading expertise in various thematic areas of Arctic observing systems covering atmosphere, ocean, cryosphere and terrestrial sciences. In addition to 37 European partners the consortium includes 11 partners from US, Canada, Japan, China, Korea and Russia. The consortium has therefore strong links to the major national and international programmes, projects, research infrastructures and organizations related to Arctic observing systems. INTAROS is a multidisciplinary project, which need a consortium with a broad composition of expertize covering all the disciplines, and technologies for integrating data and models following the Earth System Science approach. INTAROS has focus on applications of the Arctic Observing System towards stakeholders such as local communities, tourism, shipping, fishing and other maritime industries. In addition to the consortium members, the project will have a Stakeholder and Innovation Advisory Panel with external members.

The consortium covers a wide range of ocean sciences by partners who have specific and complementary expertise in physical, biological, chemical, and acoustical oceanography. These include NERSC, UiB, IMR, AWI, IOPAN, DTU, AU, UHAM, GINR, NIVA, UNIS, CNRS-LOCEAN/IUEM/TAKUVIK, WHOI, SIO, U-Alaska, and U-Victoria. Some of them are also partners in AtlantOS and play a key role in Copernicus marine services. Furthermore, partners in the consortium have access to a number of research vessels including ice going/icebreakers (e.g. IMR/UiB, AWI, MISU, PRIC, KOPRI).

There are also partners with expertise in atmosphere and terrestrial data, in particular MISU, FMI, SMHI, MPG, USDF, OU, GFZ, U-HEL, NUIM, CNRS-TAKUVIK, NIERSC. Partners with expertise in glaciology and sea ice include DTU, GEUS, UPM, FMI, NERSC, UB, Ifremer and JPL. Partners with expertise in seismology include GEUS and UiB. Partners with expertise in modelling and data assimilation include SMHI-Climate, BSC, UiB, UHAM (also expertize in OSSEs) and NERSC. Partners with expertise in data management and databases include: AWI, TERRADUE, IMR and NERSC. NORDECO has a specific role in community-based observing systems, ARMINE in geostatistical methods, NORUT in operation of UAV/drones, and Eurocean in dissemination/outreach. JRC participates as third party working with studies of Arctic shipping and DNV-GL is partner with the role to develop a risk assessment system for Arctic management and operations. Some of the partners are included because they represent stakeholder groups or large network such as EuroGOOS, PEEX/U-Hel, ArcticNET/U-Laval and Ocean Network Canada/U-Victoria. Partners from China, Japan and Korea are included because they represent large national institutions with increasing multidisciplinary research and monitoring activities in the Arctic. SME's are represented by NORDECO, TERRADUE and Seascape Consultants Ltd. Local communities are involved as subcontractors. The partner description specifies the specific role and contribution form each partner.

3.4 Resources to be committed

Budget Lines	Costs	EC Contribution requested	In % of the Total Grant
Personnel Cost	8 034 228,00	8 034 228,00	51,87
Other Direct Cost	4 221 591,00	4 221 591,00	27,25
Subcontracting	170 440,00	170 440,00	1,10
Indirect Cost	3 063 955,00	3 063 955,00	19,78
Grand Total	**15 490 214,00**	**15 490 214,00**	**100,00**

Table 3.4a: Summary of staff effort

No	Acronym	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	Total
1	Management								60,0	**60,0**
1	NERSC	17,0	12,0	3,0	4,0	20,0	28,0	3,0		**87,0**
2	UiB	3,0	7,0	48,0	3,0	0	6,0	0		**67,0**
3	IMR	3,0	0	8,0	0	12,0	50,5	0		**73,5**
4	MISU	2,0	13,0	12,0	0	0	0	0		**27,0**
5	AWI	0	12,0	30,0	0	10,0	2,0	0		**54,0**
6	IOPAN	3,0	2,0	48,0	0	0	4,0	0		**57,0**

7	DTU	1,0	24,0	1,0	0	3,0	22,0	2,0		**53,0**
8	AU	0	2,0	28,0	0	0	31,0	1,0		**62,0**
9	GEUS	2,0	12,0	28,0	2,0	2,0	18,0	1,0		**65,0**
10	FMI	4,0	29,0	21,0	0	2,0	13,0	3,0		**72,0**
11	UNIS	0	0	0	0	0	0	0		**0**
12	NORDECO	2,0	0	0	24,0	0	3,0	9,0		**38,0**
13	SMHI	0	13,0	0	0	0	18,0	0,5		**31,5**
14	USFD	0,5	7,0	4,0	0	0	0	8,0		**19,5**
15	NUIM	0	11,0	0	1,0	1,0	0	0		**13,0**
16	IFREMER	0	9,0	0	0	0	4,0	0		**13,0**
17	MPG	0	24,0	12,0	0	0	30,0	0		**66,0**
18	EUROGOOS	8,0	2,0	0	0	0	7,0	0		**17,0**
19	EUROCEAN	1,5	0	0	0	0	0	9,5		**11,0**
20	UPM	0	8,0	11,0	0	0	14,5	0		**33,5**
21	UB	2,0	11,0	0	0	0	7,0	0		**20,0**
22	UHAM	0	12,0	3,6	0	0	14,4	0		**30,0**
23	NORUT	0	3,0	0	0	0	0	0		**3,0**
24	Terradue	0	0	0	0	53,0	0	2,0		**55,0**
25	GINR	0	0	0	0	0	1,0	4,5		**5,5**
26	OU	0	7,0	14,7	0	0	1,8	3,5		**27,0**
27	NIVA	1,0	5,0	12,5	0	0	6,0	0		**24,5**
28	CNRS	0	0	27,8	0	0	0	0		**27,8**
29	U Helsinki	0	6,0	0	0	0	0	3,0		**9,0**
30	GFZ	0	24,0	6,0	0	0	0	0		**30,0**
31	ARMINE	0	0	0	0	16,0	8,0	0		**24,0**
32	IGPAN	0	2	0	0	0	0	2		**4**
33	U SLASKI	0	2	0	0	0	0	0		**2**
34	BSC	0	0	0	0	0	15,0	0		**15,0**
35	DNV GL	0	3,0	0	0	0	12,0	0		**15,0**
		50,0	**262,0**	**318,6**	**34,0**	**119,0**	**316,2**	**52,0**		**1 211,8**

The other partners: NIERSC, WHOI, SIO, U Alaska, JPL, U Laval, U Victoria, NMEFC, PRIC, NOPR, KOPRI are non EU partners with no funding from EU.

Table 3.4b: 'Other direct cost' items

1 NERSC	**Cost(€)**	**Justification**
Travel	150 000	NERSC personnel, project meetings and workshops related to INTAROS. Invited Stakeholders and non-European partners to project workshops.
Equipment	50 000	Passive acoustic instrument (1)
Other goods/services	100 000	Costs associated with field experiment north of Svalbard. Support for workshops, annual meetings (GA), publications. Audit.
Total	300 000	

2 UIB	**Cost(€)**	**Justification**
Travel	150 000	GFI Travel to project meetings and conferences. GFI Travel and mobilisation for cruises. GEO Travel to project meetings and conferences.
Equipment	209 500	GFI Chemical Sensors, pH, pCO2.
Other goods/services	83 000	GEO OBS+ROV Campaign WP3. GEO Publication costs. GEO Certified Financial Statement Audit Costs.
Total	442 500	

3 IMR	Cost(€)	Justification
Travel	43 600	General Assembly + extra travel per year for WP and task leader
Equipment	50 000	Echosounder for biological observations.
Other goods/services	28 900	Moorings and batteries. AUDIT Certificate. Open access publishing.
Total	122 500	

4 MISU	Cost(€)	Justification
Travel	15 000	Travel to annual meetings + travel associated with field work
Equipment	17 000	Computer equipment + instrumentation costs for ship system
Other goods/services	8000	Estimate five papers
Total	40 000	

5 AWI	Cost(€)	Justification
Travel	10 000	Five annual meetings
Equipment	330 000	Sediment trap, underwater vision profiler, fluorometer and nitrate sensor for North of Svalbard. arcFOCE system for HAUSGARTEN/FRAM observatory.
Other goods/services	14 500	Lab material, batteries, mooring consumables, publications.
Total	354 500	

6 IOPAN	Cost(€)	Justification
Travel	40 000	Travel to meetings and conferences. Fieldwork and participation in cruises.
Equipment	480 000	One standard ITP and one multidisciplinary ITP. Instruments for moorings: one LR-ADCP, two ULS, Arctic Winch.
Other goods/services	192 500	Mooring material and usable equipment. Usable material for ITPs deployment support. Mooring instruments maintenance and calibrations. Data telemetry setup and running costs for ITPs. Publications. Audit.
Total	712 500	

8 AU	Cost(€)	Justification
Travel	20 000	10000 for participation in meeting 10000 for field work in NE Greenland
Equipment	104 000	Instrumentation for moorings (SeaBird CTD, acoustic release), camera system for snow and ice coverage, instrument for CO2 and pH, computer for model runs
Other goods/services	27 000	Shipment of equipment. Additional equipment for mooring (rope, floatation).
Total	151 000	

9 GEUS	Cost(€)	Justification
Travel	73 500	Travel and logistics for Greenland field tests. Travel to join OBS+ROV Campaign, deployment and collection. Travel to project meetings and conferences.
Equipment	190 000	Equipment for exploiting Sentinel-1 data and in-situ AWS data, gap assessments and product compilation (WP2). Precision 2-axes electronic tilt meters, 3-axes electronic compasses, higher-standard reference tilt meter and compass (WP3). Dual frequency GPS+Galileo receivers, dual frequency GPS+Galileo antennas, Iridium SBD satellite modems, data logging and power supplies (WP3). Neutron flux snow water equivalent probe, data logging and power supply (WP3).
Other goods/services	5000	EU Audit
Total	268 500	

10 FMI	Cost(€)	Justification
Travel	10 000	Travels to Project meetings.
Equipment	87 000	Snow albedo over Greenland Sea ice mass balance array
Other goods/services	6500	Tools for instrument calibration, transportation, data logging.
Total	103 500	

11 UNIS	Cost(€)	Justification
Equipment	75 000	Three bottom pressure recorders.
Total	75 000	

12 NORDECO	Cost(€)	Justification
Travel	96 760	Travel for participants in 8 workshops in WP4, WP6 and WP7
Consumables	77 120	Accommodation for participants in 8 workshops in WP4, WP6 and WP7
Other goods/services	119 061	Publications (30120): Policy briefs 2, library of community-based observation tools, three reports, two workshop proceedings. Other (88941): compensation to fishermen lost work time, honoraria, contributions to library of CBM tools
Total	292 941	

14 USFD	Cost(€)	Justification
Travel	12 500	Travel bursary for students (short term scientific missions and travel to summer schools). Travel to annual meetings.
Equipment	5000	High-resolution temperature sensing systems.
Other goods/services	7000	Supplies for photos show. ESA workshop. Support for EGU sessions & special issue
Total	24 500	

16 IFREMER	Cost(€)	Justification
Travel	24 000	2 meetings/year for 2 persons and 1 conference international/year for 2 persons
Equipment	2500	Computer
Total	26 500	

17 MPG	Cost(€)	Justification
Travel	14 000	Travel to install flask system (4k€), travel support to attend project meetings (5x 2k€), travel support for international conferences (4x 3k€)
Equipment	93 000	Automated flask sampler instrument (50k€), flasks and boxes for sampling and transport (36k€), computer hardware (7k€)
Other goods/services	119 000	WP3 support: customs (8k€). Shipping (3k€), flask analysis (45k€), sample logistics (45k€), service contract (30k€); audit fee (4k€)
Total	226 000	

19 EUROCEAN	Cost(€)	Justification
Travel	7500	Attendance at project meetings
Equipment	2000	Depreciation of the web server
Other goods/services	54 950	Development and production of communications and dissemination materials; organization and hosting of summer schools, outreach workshops and final event
Total	64 450	

20 UPM	Cost(€)	Justification
Travel	7500	Travel for consortium/scientific meetings and meetings with stakeholders
Equipment	7500	GPR system
Other goods/services	7000	Fieldwork costs for testing/collecting data with new GPR system, other costs
Total	22 000	

22 UHAM	Cost(€)	Justification
Travel	30 000	Project meetings/Assemblies
Other goods/services	12 000	Total student support
Total	42 000	

23 NORUT	Cost(€)	Justification
Travel	5000	Annual project meetings, field travel 2 persons Svalbard 2 times
Other goods/services	2000	Aircraft operating costs, satcom, insurance, maintenance, field logistics
Total	7000	

24 Terradue	Cost(€)	Justification
Travel	5250	7 meetings (1 KO, 3 consortium, 3 review)
Equipment	40 000	Provision of ICT resources and Cloud services for WP5
Total	45 250	

25 GINR	Cost (€)	Justification
Travel	7500	Travel Nuuk-Denmark-TBD: 3rd level Programme on Arctic Affairs
Other goods/services	2500	High School Activities in Greenland
Total	10 000	

26 OU	Cost (€)	Justification
Travel	40 200	Travel to meetings (7,500) Alaska to collaborate with US networks, travel of post-doc to collect data and install instruments in Alaska
Equipment	90 000	Diffusivity Equipment
Other goods/services	41 250	Supplies for de-icing, tubing, measurement of temperature profile, water table, and active layer, material for diffusivity system. Auditing.
Total	171450	

27 NIVA	Cost(€)	Justification
Travel	7500	Attend five annual meetings.
Equipment	57 000	Autonomous passive contaminant samplers for moorings. Sensors/samplers for FerryBox systems in the Arctic.
Other goods/services	78 500	Passive contaminant samplers for moorings - travel and sample analysis. Sensors/samplers for FerryBox - consumables, travel, internal renting, analysis
Total	143 000	

28 CNRS	Cost(€)	Justification
Travel	137 200	Travel to fielwork in Svalbard and northern Canada
Equipment	104 100	Monitoring equipment to be deployed in Svalbard and northern Canada: acoustic recorder, chemical and physical sensors, radiometer
Other goods/services	248 700	Equipment shipping to field, glider and drone rental, chemical analyses, sensor calibration, consumables for equipment, publications, travel to project meetings.
Total	490 000	

Table of content:

4. Members of the consortium

4.1. Participants

1. Nansen Environmental and Remote Sensing Center (NERSC)

Expertise and experience of the organization

Nansen Environmental and Remote Sensing Center is a non-profit research center affiliated with the University of Bergen, with focus on marine and Arctic science. NERSC is a project-based center with major funding from the European Union research programmes, Norwegian Research Council, the European Space Agency, the Norwegian Space Center, industry and other governmental and international agencies. Since 2012 the Nansen Center is a national environmental research institute and receives basic funding from the Ministry of Climate and Environment through the Research Council of Norway. As a national environmental research institute the Center has in particular strengthened the expertise within studies of regional climate change research and studies of the oceans and sea ice in the Arctic oceans Research activities include satellite remote sensing, ocean acoustics and development of information systems where observational data are integrated with models and disseminated to users. Satellite methods and monitoring systems are developed for sea ice, icebergs and ocean variables. Acoustic methods used are ocean acoustic tomography and passive listening of ambient noise with focus on the Arctic region. The goal of the research work is to develop observing systems to support operational oceanography and climate research. A system to provide daily sea ice information from satellites and models is developed under Arctic ROOS and products are disseminated to users free-of-charge (http://arctic-roos.org). Development of operational monitoring and forecasting of the Arctic Ocean is a contribution to *Copenicus Marine Environmental Monitoring Services (CMEMS)* where NERSC is leading the Arctic Marine Forecasting Center. NERSC is leader of the ARCPATH Centre of Excellence (NordForsk). ARCPATH has focus on improving Arctic climate prediction by reducing uncertainties originating from changes in sea ice and the ocean; how changes in climate interact with factors relating to local communities. NERSC also develops web-based dissemination systems where users can search, display and download observational data and model results from ocean and coastal areas. The INARCTOS coordinator, Prof. Stein Sandven, was the managing director at NERSC from 2010 to 2015. He has been coordinator of many Arctic research projects during the last 30 years, including 17 EU projects under FP5, 6 and 7. The NERSC staff includes 79 persons from 18 countries (2015 figures), comprising researchers and senior scientists, 11 Post-docs, six Ph.D. students and administrative/ technical personnel. The scientific production in 2014 included 65 referee publications, one book and seven book chapters, 102 publications in conference proceedings, 17 technical and special reports for clients and one popular science articles – totally 193 publications. More information is available at www.nersc.no.

Role in the project

NERSC will: 1) coordinate the INTAROS project using its long experience in coordination of EU projects (Prof. Stein Sandven). 2) Lead WP1 on stakeholder engagement and roadmap for the SAOS (Sandven), 3) Co-lead WP4 and contribute with research on local communities and climate impact (Lisbeth Iversen) 4) Co-lead WP 5 and contribute with expertise in databases and integration of multi-modal data (Torill Hamre), 5) WP3 with collection of passive acoustic data, 6) WP6 data analysis and preparation of integrated data for climate model projections, 7) WP7 dissemination of project results.

Key personnel CVs

Stein Sandven (M), Cand. real, Physical Oceanography at NERSC and Professor 2 at UNIS, Svalbard, Managing Director of NERSC from 2010 to 2015. He has 30 years of experience in polar oceanography, satellite remote sensing and underwater technologies for marine applications. Published over 50 scientific articles in refereed journals. Coordinator of 17 EU projects, including the recent ACOBAR project, and several ESA, INTAS and national research projects over the last 20 years. . In recent years he has conducted a series of projects for offshore companies involved in oil and gas exploration in Arctic waters. The companies include StatoilHydro, Total, Shell aShtokman Development AG and Gas de France de Suez. From 2010-2014 he was involved in development of the Svalbard Integrated Observing System (SIOS) which was an EU research infrastructure preparatory phase project. He is presently leader of the s the ESA project CCI project on sea ice. He is chair of Arctic ROOS, the Arctic Regional Ocean Observing System under EuroGOOS. Experience in teaching students in remote sensing at University of Bergen and University of Svalbard including supervision of M. Sc. and Ph. D. students. Member of ESA's CryoSat Science Advisory Group. Member of Norwegian Academy of Science for Polar Research. Member of Committee on Space Research (COSPAR). Coordinator of INTAROS (WP8) lead of WP1 and contributor to WP7.

Dr. Hanne Sagen (F), Research scientist, Applied Mathematics, (1998). HS leads the group for Polar acoustics and oceanography. HS have been deputy-coordinator in the EU projects (AMOC(1998-2001) and ACOBAR (2008-2013)), and she was Co-lead of the High tech Workp ackage in DAMOCLES IP (2005-2010). She is project leader of the UNDER-ICE – Arctic Ocan under melting ice; ACOBAR-II: Analysis and publication of results from the Fram Strait, and SSF - Ocean Flagship. She is also leading two Arctic project funded by Office of Navel Research. Sagen has coordinated and led annual ocean/acoustic cruises to the Fram Strait since 2007 (involving open ocean vessel, icebreakers and aircraft missions). Her research is primarily within acoustic oceanography in the Arctic regions, including passive acoustics and acoustic thermometry. Her expertise also includes data analysis, use of data assimilation schemes, inversions, and has contributed to environmental assessment of acoustic system in the Fram Strait. Sagen has a strong international network in USA, and Europe within research and technologies. She is former member of the Norwegian National International Polar Year Committee, and Arctic Observing Summit (2013) Organizing Committee. Since 2013 Member of the ITU/WMO/UNESCO-IOC Joint Task Force (JTF). Green Cables. Since 2015 the Norwegian deputy National Correspondent in the International Association of Physical Sciences of the Oceans (IAPSO). She is member of the steering committee of the Quiet Ocean Experiment. She will be the Deputy coordinator of INTAROS (WP8), and she will Lead Task 6.3.

Dr. Torill Hamre (F), research leader, PhD Informatics, University of Bergen, Norway (1995). Associate professor II at University of Bergen. Co-author of 3 Java introductory programming books. She has more than 25 years of experience in software development and analysis of satellite data. Research interests include development of marine information systems using web GIS technologies, and marine data management. Coordinator of NETMAR (FP7). Deputy coordinator of EC projects DISMAR (FP5), MONRUK (FP6) and InterRisk (FP6). Current projects include H2020 SPICES (WP lead, sea ice classification) and WP lead in Norwegian research infrastructure projects NMDC (Norwegian Marine Data Centre), GeoAccessNO and NorDataNet (Norwegian Scientific Data Network). In INTAROS, she will be deputy leader of WP5

Lisbeth Iversen (F) holds an adjunct position at the Nansen Centre for Climate Research in Bergen with expertice on the Socio-Economic / community approach within climate research, in addition to participation in national and international networks in this field. She is currently working on a case study as part of the project HIARC (Anthropogenic Heat Islands in the Arctic – Windows to the Future of the Regional Climates, Ecosystems and Societies) with the still largely overlooked phenomenon of ecosystem and societal adaptation to warmer micro-climates, created by anthropogenic heat pollution in the arctic urbanized/industrialized areas over the last 30 – 40 years. With Heart For Arendal August 2013 (ongoing) - executive chairperson; working through local mobilization and participation to develop a sustainable welfare model and network, in an interaction between the municipality sector, organizations and the private sector. Commissioner of the local government of the city of Bergen (2003-2013): Leading the political mobilization and implementation processes within the subject; climate, urban development, the planning and construction of the light rail, local area development and social affairs. She will co-lead and contribute in WP4.

Dr. Yongqi Gao (M), Prof., is a research director at NERSC, co-director and professor at Nansen-Zhu International Research Centre, and adjunct Prof. at University of Bergen. Gao has more than 15 years experience in climate simulations. Gao has been leaders of projects supported by the National Natural Science Foundation of China and the Research Council of Norway. Gao is now the leader of Nordic Center of Excellence ARCPATH (2016-2020) involving 11 Pan-Arctic institutions focused on changes in the Arctic that will happen in the near future, with the overarching goal of fostering responsible and sustainable development. He has been principal investigator at NERSC for various national and international projects such as Research Council of Norway supported Snowglace, NordForsk Greenice, EU THOR and EU NACLIM. Gao has published more than 80 scientific papers in peer-reviewed journals. and been working with the exchange between the North Atlantic and the Nordic Seas, and between the Nordic

Seas and the Arctic Ocean. In recent years, Gao has strong interest in the air-sea interactions with special focus on how climate in different regions (Arctic, Atlantic and Pacific Oceans) interact. He will contribute to Task 6.1.

Dr. Mohamed Babiker (M) is a research scientist who holds a Ph. D. from the University of Bergen (2004). He has more than 15 year experience using Remote Sensing and Geographic Information System for satellite data processing in the polar regions covering sea ice mapping, iceberg detection and glaciers monitoring. Babiker has been involved in several scientific cruises in the arctic. His expertise and training is in remote sensing, Geographic Information Systems, hydrology, sea ice mapping and coding, sea ice drift and geostatistics. Babiker was the deputy coordinator of SIDARUS and MAIRES, and is currently the project manager of SONARC. He has been active in ESA-funded polar projects and related (inter)national activities at Nansen Center for over ten years. He will contribute to WP3 and Task 6.3

Dr. Kjetil Lygre (M) has wide experience within research on mesoscale and large scale dynamical oceanographic an biogeochemical process studies, both from a data analysis and modelling perspective. He was project manager of EU FP7 project GreenSeas (2011-2014) and has been involved in several other EU projects like AICSEX, CARBOCEAN, MONARCH-A. He will be INTAROS Project Manager (WP8).

Publications, and/or products, services or other achievements

1. **Sandven S., H. Sagen**, L. Bertino, A. Beszczynska-Möller, E. Fahrbach, P. F. Worcester, M. A. Dzieciuch, W. Walczowski, P. Wieczorek, E. Skarsoulis, A. Morozov, D. Dumont, C. Lee, B. D. Dushaw, E. Hansen, and H. Rohr. The Fram Strait integrated ocean observing and modelling system. In Sustainable Operational Oceanography, Proceedings of the Sixth International Conference on EuroGOOS, 4–6 October 2011, Sopot, Poland, pp. 50-58, Published by EuroGOOS, 2013 (http:// http://eurogoos.eu/documents/conference-proceedings/).
2. Mikhalevsky, P.N., **H. Sagen**, P. Worcester, A. Baggeroer, S. Moore, C. Lee, K. Vigness-Raposa, L. Freitag, A. Beszczynska-Moeller, T. Duda, B. Dushaw, J.C. Gascard, A. Gavrilov, A. Morozov, W. Munk, M. Rixen, **S. Sandven**, E. Skarsoulis, K. Stafford, and E. Tveit, Multipurpose acoustic networks in the integrated Arctic Ocean observing system, Invited Community White Paper, Arctic Observing Summit, 18 pp., Vancouver, Canada April 30 – May 2, 2013. Submitted for publication as part of special issue on Arctic Observing Systems in the Journal “Arctic”.
3. D. Tollefsen and **H. Sagen**. Seismic exploration noise reduction in the Marginal Ice Zone, The Journal of the Acoustical society of America 136(1):EL47, July 2014.
4. **Hamre, T.**, H. Krasemann, S. Groom, D. Dunne, G. Breitbach, B. Hackett, K. Sørensen, S. Sandven: Interoperable web GIS services for marine pollution monitoring and forecasting. In Journal of Coastal Conservation, pp 1-13, Volume 13, Number 1. DOI 10.1007/s11852-009-0046-y. April, 2009. http://www.springerlink.com/content/q288j64362329230/fulltext.pdf
5. Li, F., Wang, H.J., **Gao, Y.Q.** (2015): Extratropcial Ocean Warming and Winter Arctic Sea Ice Cover since the 1990s. Journal of Climate, 28, 5510-5522, doi: 10.1175/JCLI-D-14-00629.1

Projects, and/or activities

1. EU integrated project DAMOCLES. Main role in DAMOCLES was the implementation of a single track acoustic tomography experiment, and exploitation of the data. Hanne Sagen led the work with the tomography and Stein Sandven led the dissemination work package.
2. EU collaborative project - ACOBAR project (Acoustic Technology for Observing the interior of the Arctic Ocean), completed in 2013. Main achievement was to implement a multipurpose acoustic system for tomography, passive acoustic and navigation of gliders. Data have been inverted and compared to ice – ocean models. Assimilation concepts have been investigated. See http://acobar.nersc.no. Project publications are under development in ACOBAR II funded by the Research Council of Norway. Data from this project will be used in the INTAROS project. Project coordinator: Stein Sandven, Deputy-coordinator: Hanne Sagen
3. UNDER-ICE (Arctic Ocean under Melting Ice) (2013-2017). This is an ongoing project continuing and extending the ACOBAR experiment. The project also involves data assimilation and ice-ocean modelling. See http://under-ice.nersc.no Project coordinator: Hanne Sagen, Deputy coordinator: Stein Sandven. This project is co-funded by industry. Partners: IOPAN, UNIS and SIO are project members. The project will provide acoustic and oceanographic data to INTAROS.

4. ARCPATH Centre of Excellence (NordForsk) includes partners from Norway, Denmark, Sweden and Iceland in addition to Canadian, Chinese, Russian and US partners. It focuses on improving Arctic climate prediction by reducing uncertainties originating from changes in sea ice and the ocean; how changes in climate interact with factors relating to local communities; and supplying this knowledge as potential "pathways to action" through innovative adaptation plans for responsible development.
5. NORwegian Satellite Earth Observation Database for MArine and Polar Research (NORMAP) infrastructure project (2010-1016) funded by the Research Council of Norway. NORMAP is developing a web portal with a metadata catalogue and visualization tools that offer seamless access to a distributed system of data providers offering Earth Observation products for high latitudes and the Arctic Ocean. The NORMAP system is developed using internationally approved interoperability standards such as OPeNDAP, OGC WCS, OCT CSW, ISO 23950 and ISO 19115, using open source software. Web site: http://normap.nersc.no.

Significant infrastructure, and/or major items of technical equipment

NERSC contributes with acoustic equipment for passive and acoustic tomography experiments, software, models, and results from previous experiments.

2. University of Bergen (UiB)

Expertise and experience of the organization

The **University of Bergen (UiB)** is a young and modern university (www.uib.no). The UiB has high level of research and education in all of its six faculties, Natural Sciences and Mathematics, Medicine and Dentistry, Social Sciences, Humanities, Psychology and Law. In total, the UiB has 14,450 students and 3,460 faculty and staff. Yearly around 250 candidates are awarded with a PhD degree. UiB is currently involved in 28 H2020 collaborative research projects, 7 of which it coordinates. UiB currently hosts 5 Marie Curie projects. In addition, UiB hosts 7 ERC Advanced Grants, 2 ERC Starting Grants, 2 ERC Consolidator Grants and 1 ERC Synergy Grant. UiB holds a significant research profile in marine and climate sciences.

The **Department of Earth Science (UiB-GEO)** embodies research and research-based education within central geological and geophysical disciplines, including marine geoscience, petroleum, Quaternary geology, climate and earthquake-seismology. The research is conducted on land and sea all over the globe, including extensive activity in the Arctic. The department has an international profile with more than 110 research positions and 32 technical/ administrative staff members from more than 30 different countries. UiB-GEO is a partner in the Centre of Excellence in GeoBiology. UiB-GEO coordinates and is involved in several European projects as EPOS-IP, EU-MIDAS, two Marie Curie projects, GLImER and GLANAM and two ERC projects, ice2ice and C4T.

The **Geophysical Institute (UiB-GFI)** is an internationally acknowledged contributor in the areas of marine and climate research. The institute's research strategy rests upon use of own cutting edge measurement techniques developed in collaboration with technology partners in combination with theoretical studies and modelling. Polar research is one of the institute's four interdisciplinary focus areas. UiB-GFI has a leading role in chemical oceanography and ocean biogeochemistry. UiB-GFI also holds key competence in sea ice observation and interpretation, and in scientific data management. UiB-GFI has completed a series of collaborative EU projects, many of them as coordinator, and currently coordinates the collaborative EU projects PREFACE and SEAMAN, the Marie Curie projects COCLIMAT, STEPS, HIMWARC, and SOCCLI, and one ERC consolidator grant (STERCP). GFI is currently partner in 10 collaborative EU projects (ECO2, FixO3, GEOCARBON, GROOM, INGOS, IS-ENES 2, NACLIM-2, SUMO, AtlantOS, CRESCENDO).

UiB-GEO and UiB-GFI are both involved in the **Bjerknes Centre for Climate Research**, a collaboration between UiB, Uni Research, Institute of Marine Research and the Nansen Environmental and Remote Sensing Center. The Centre has a staff of 200 persons from 36 nationalities, and conducts climate research in past, present and future climate, using field observations, theory and numerical models. The Centre coordinates the national climate modeling effort, with the Norwegian Earth System Model being a major data provider for CMIP5 and IPCC.

Role in the project

UiB-GEO will be responsible for seismological data processing under WP2, combining historical data with OBS data. UiB-GEO will develop and implement new technology for OBS deployment and contribute to QC of OBS data under WP3. It will contribute macroseismic intensity data to WP4 in addition to representing macroseismic data collection as a methodology. UiB-GEO will assure seamless integration of INTAROS data with the EPOS platform under WP5.

UiB-GFI will be the theme leader of theme biogeochemistry. UiB-GFI will be responsible for management of biogeochemical data (WP 5) and for sea ice observations and interpretation of changes in Arctic sea ice volume (WP 3). It will also contribute to WP1 (stakeholder needs), WP2 (gap analysis), WP6 (demonstration projects) and WP7 (outreach).

Key personnel CVs

Dr. Mathilde B. Sørensen (F) is Associate Professor of seismology and research coordinator for geohazards at UiB-GEO. She holds a PhD in seismology (2006) from UiB. She has a strong background in earthquake seismology, seismic hazard, tsunami hazard and seismotectonics. Curerntly, her main research interests include interdisciplinary studies of the coupling between different types of natural hazard events and the importance of triggering and event cascades in natural hazards assessment. In parallel she is interested in the coupling between hazard and risk, and how improved accuracy in hazard assessments can help improve damage and loss estimates, especially for earthquake events. She has been involved in a large number of international research project, funded by the EU and by other national and international funding sources. Sørensen will be involved in W3.

Prof. Truls Johannessen (M) is professor in chemical oceanography at the UIB-GFI. TJ's research deals with various aspects of climate research, oceanography and earth systems. TJ participated in the co-ordination of multi-institutional national programs, has coordinated EU projects and been a member of several steering committees. As an example TJ joined the IOC-SCOR-JGOFS CO_2-panel 1995 - 2001 and was a member of the SOLAS scientific steering committee (SSC) from 2000 to 2009. He is now the director of ICOS-OTC and leads ICOS Norway. He is the lead-/co-author of more than 80 scientific papers, 3610 reads and 2356 citations.

Dr. Tore Furevik (M) is Professor in physical oceanography at UIB-GFI and director of the Bjerknes Centre for Climate Research. Furevik is former president of the Bergen Geophysical Society (2001-03) and the Norwegian Geophysical Society (2008-09). His research focus is on climate modelling, large-scale variability in the atmosphere and ocean, air-sea-ice interactions and teleconnections. He has published 37 papers in international peer-reviewed journals or books (Google Scholar: 1500 citations, H index 20), and been an expert referee for a number of international journals and science foundations. He coordinates the Norwegian research school in climate dynamics (2009-2016), and he seats in the steering board for the national climate program Klimaforsk, and is representing Norway in JPI-Climate. He has given 100 popular lectures and appeared 250 times in national and international media.

Dr. Lars H. Smedsrud (M) Professor in Oceanography at the UIB-GFI, and professor II at University Centre in Svalbard. Doctor of Science in March 2000 with the PhD thesis on frazil ice formation and sediment entrainment in polar waters. Smedsrud is a co_PI in Arctic ECRA (European Climate Research Alliance), a co-leader in the Bjerknes research group on air-ice-ocean processes and a member of the Climate and the Cryosphere (CliC) Scientific Steering Group. Previously Smedsrud worked with different aspects of ice formation in the Arctic, and ice shelves in Antarctica. He has a wide field experience from Antarctica and the Arctic, has been cruise leader in the International Polar Year project “Bipolar Atlantic Thermohaline Circulation”, participated in several international laboratory experiments, and worked with a number of numerical models. Among active research topics are polynya dynamics on Svalbard, formation and melt of sea ice in the Arctic Ocean, and transport of oceanic heat by Atlantic water.

Dr. Harald Sodemann (M) Associate Professor in Meteorology at the UIB-GFI, is an expert on atmospheric moisture transport and stable water isotope research (h-Index 20, 48 peer-reviewed publications, 1147 citations). PhD thesis in 2006 at ETH Zürich. His particular research focus is on process understanding of the hydrological and biogeochemical cycle by means of stable water isotopes through both numerical and experimental methods, with applications from weather to (paleo)climate time scales. Sodemann has previously worked on identifying the relation between atmospheric circulation and moisture transport for Greenland, Antarctica, the European Alps and Norway, among other regions. Sodemann is a member of the development team of the community model FLEXPART. He has extensive field experience from five airborne field campaigns. Sodemann is a PI of the stable isotope FARLAB infrastructure at UIB.

Dr. Are Olsen (M) is associate professor in Biogeochemistry at UIB-GFI. His research deals with the magnitude and impact of ocean uptake of fossil fuel CO_2. He is strongly engaged in international coordination of carbon observations and syntheses, and is member of the International Ocean Carbon Coordination Project's SSG, CLIVAR's Global Synthesis and Observations Panel, ICES/OSPAR study group of Ocean Acidification and SOCAT's Global Coordination Committee. Olsen chaired the Arctic/Nordic Seas working group of the CARINA synthesis project, and now chairs its follow up, GLODAPv2. Olsen has authored/co-authored more than 50 publications in the international peer-reviewed literature, and coordinated several research projects.

Dr. Kuvvet Atakan (M) is a Professor in seismology at UiB-GEO. Atakan has since mid-1990's participated and lead various national and international scientific projects within the fields of seismotectonics and seismic hazard with significant research output. He is currently involved in the ESFRI Research Infrastructure Project EPOS (European Plate Observing System) and is member of the Board of National Scientific Representatives for the EPOS Implementation Phase Project. He is the coordinator and project leader for the national EPOS-Norway project. Atakan has previously held various administrative positions at the University of Bergen among others as Vice-Rector during the period 2009-2013.

Dr. Rolf B. Pedersen (M) is Professor at UiB-GEO and a driving force and former director of Centre for Geobiology at UiB. He was one of the key people in establishing the Norwegian National Deep-Sea Robotics Facility. Pedersen is an expert on oceanic crust and the geology, geochemistry and geobiology of oceanic spreading ridges. Since the late 1990's he has been exploring the Arctic Mid-Ocean Ridge System and has led many national and international deep-sea expeditions to this area.

Publications, and/or products, services or other achievements:

1. **Atakan, K.**, Bjerrum, L.W., Bungum, H., Dehls, J., Kaynia, A., Keers, H., Kierulf, H., Kværna, T., Langeland, T., Lindholm, C.D., Maupin, V., Ottemöller, L., **Sørensen, M.B.**, and Yuen, M.Y. 2015. The European Plate Observing System and the Arctic. *Arctic*, 68(S1), 69-75.
2. Le Quéré, C, R Moriarty, R M Andrew, G P Peters, P Ciais, P Freidlingstein, S D Jones, S Sitch, P Tans, A Arneth, T A Boden, L Bopp, Y Bozec, J G Canadell, F Chevallier, C E Cosca, I Harris, M Hoppema, R A Houghton, J I House, A K Jain, **T Johannessen**, E Kato, R F Keeling, V Kitidis, K Klein Goldewijk, C Koven, C Landa, P Landschützer, A Lenton, I D Lima, G Marland, J T Mathis, N Metzl, Y Nojiri, A Olsen, T Ono, W Peters, B Pfeil, B Poulter, M R Raupach, P Regnier, C Rödenbeck, S Saito, J E Salisbury, U Schuster, J Schwinger, R Séférian, J Segschneider, T Steinhoff, B D Stocker, A J Sutton, T Takahashi, B Tilbrook, G van der Werf, N Viovy, Y-P Wang, R Wanninkhof, A Wiltshire, N Zeng: *Global Carbon Budget 2014*. 09/2014; 7(7):521-610. DOI:10.5194/essdd-7-521-2014
3. Watson, AJ, U Schuster, DCE Bakker, NR Bates, A Corbière, M González-Dávila, T Friedrich, J Hauck, C Heinze, **T Johannessen**, A Körtzinger, N Metzl, J Olafsson, **A Olsen**, A Oschlies, XA Padin, B Pfeil, JM Santana-Casiano, T Steinhoff, M Telszewski, AF Rios, DWR Wallace, R Wanninkhof: Tracking the variable North Atlantic sink for atmospheric CO2. *Science* 12/2009; 326(5958): 1391-3. DOI:10.1126/science.1177394
4. I. H. Onarheim, **L. H. Smedsrud**, R. B. Ingvaldsen, and F. Nilsen. Loss of sea ice during winter north of Svalbard. *Tellus A*, 2014, Volume 66, 23933, doi:10.3402/tellusa.v66.23933
5. Miles, M.W., Divine, D.V., **Furevik, T**., Jansen, E., Moros, M., and Ogilvie, A.E.J., 2014: Signal of persistent multidecadal variability in arctic sea ice. *Geophys. Res. Lett.* 41, 2013GL058084.

Projects, and/or activities:

1. Coordinator for EPOS-Norway (RCN funded) and national coordinator and WP leader in EPOS-IP (EU project) projects.
2. Director for ICOS Ocean Thematic Centre and coordinator of ICOS Norway (EU ERIC land mark project).
3. Member of the SSC for FixO3 (EU project).
4. Participate in Atlantos (EU project) – see also list of current EU projects in partner description above

Significant infrastructure, and/or major items of technical equipment:

UiB-GEO has more than 100 years of experience in seismic monitoring and is responsible for operating the Norwegian National Seismic Network (NNSN – www.skjelv.no). NNSN operates stations in Spitsbergen, Bjørnøya, Hopen and Jan Mayen islands, which are relevant to the current proposal. UIB will also contribute to INTAROS by supplying the Norwegian ROV asset, a 5.4 million Euro vehicle asset, for highly competitive rental rate including full heave-compensated winch and launch-recovery system installed on the R/V G.O.Sars. UIB-GFI and UIB-GEO contribute with their joint Norwegian National Infrastucture lab FARLAB (Facility for Advanced Isotopic Research and Monitoring of Weather, Climate, and Biogeochemical Cycling) providing 3 state-of-the-art field going laser spectrometers for measuring the triple stable water isotope composition in water vapour, precipitation, and ocean waters. UIB-GFI provide labs and facilities for ICOS ocean thematic center and national ICOS laboratories and ships. The biogeochemistry group for BCCR are also situated in these facilities. In addition, UiB-GFI in cooperation with UNI Climate service 4 VOS lines, important sections in the Nordic Seas including 75N and are operating station MIKE in cooperation with the Institute of Marine Research. The biogeochemistry group at BCCR is heavily involved in SOCAT and GLODAP activities synthesizing carbon system variables on a global scale.

3. Institute of Marine Research / Havforskningsinstituttet (IMR)

Expertise and experience of the organization

IMR is Norway's leading oceanographic research institution. With its staff of about 700, three major research sites and several regional laboratories it is the 2nd largest marine research institute in Europe. It is responsible for monitoring hydrographic properties, chemistry, contaminants, radioactivity, pH, CO2, nutrients, plankton in addition to living marine resources including fish, marine mammals and benthos. While international in scope and ambition, IMR's field activities are focused on the North, Norwegian and Barents Seas, and the recent years expanding more into Arctic and Antarctic regions. IMR scientists have also surveyed and mapped several regions of the deep Atlantic including sections along the Mid-Atlantic Ridge as well as in the Nordic seas. IMR is a governmental research institute under the Norwegian Ministry of Fisheries and Trade. On the basis of best possible science IMR provides advice to Norwegian authorities and informs industry and the general public. IMR operates 5 research vessels, from 2017 also the new ice going RV Kronprins Haakon and has for more than a century accumulated comprehensive experience and knowledge on field work at sea. IMR scientists participate in numerous international organizations, including ICES, OSPAR, Arctic council work groups (AMAP, CMBP, PAME) and is part of data networks like EMODnet, SeaDataNet.

IMR scientists also lead or participate in many international projects including AtlantOS, CERES, MERMAID, COPERNICUS, MyOcean I&II. IMR has long experience in leading EU projects over all and at the WP level and has a highly skilled professional support staff dedicated to this.

IMR has a central position in Norway, Europe and in the Arctic and Antarctic, providing and sharing data though national and international networks. NMD and NMDC are integrated in the institute and will provide competence and access to their wide networks to INTAROS as well as their large data bases.

IMR's mandate and activities, especially those related to monitoring the marine environment, fit perfectly with and will be essential to the tasks it will carry out within INTAROS.

Role in the project

IMR will interact with most WPs within INTAROS. Due to the experience in applied science and tight collaboration with national and international scientific networks (WP1), as well as managers and policymakers. By leading WP6 IMR will put these qualities into it and lead the work on demonstrating the usage of an iAOS for stakeholders within many fields, with particular responsibility for developing the iAOS demonstration for ecosystem understanding and management (lead task 6.2). IMR will also contribute to WPs 3 and 5 and interact closely with all other WPs.

Key personnel CVs

Dr. Geir Ottersen (M) leads WP6 and will also interact with WPs 1 and 7. His work focuses primarily on climate variability and its effects on marine ecosystems, including commercial fish stocks. He has 25 years experience at IMR, a formal background in statistics and oceanography. In addition to being an IMR principal scientist since 2003 he has been a member of the leader group at Centre of Ecological and Evolutionary Synthesis, a centre of excellence at the University of Oslo. GO was a member of the SSC of GLOBEC 2000-2005 and chair of the GLOBEC Cod and Climate Change program 2006-2009. He leads and has led several projects funded by the Research Council of Norway and was IMR lead Partner in the EU InterReg project PartiSEApate. GO has published around 55 peer reviewed papers, including in Science, PNAS and GCB co-edited two books (AGU and OUP) and authored several book chapters. He has been an editor for several journals, now PLOS ONE.

Dr. Jan Erik Stiansen (M) participates in WPs 1 and 6 and interacts also with other WPs . He is head of the department of Oceanography and Climate, a research group of about 35 scientists and personnel. His primary research focus is effect of climate change on the fish stocks and ecosystems in the Arctic. He has lead several projects and networks, and has been editor of the Norwegain-Russian environmental status report, and is a long term member of ICES/AFWG as well as ICES/ACOM attendee. He is presently leading the Norwegian part of the IMR/PINRO joint ecosystem survey in which annually cover the Barents Sea and lateral polar Sea shelf, monitoring the entire ecosystem from hydrography through fish stocks to mammals and pollution.

Arnfinn Morvik (M) participates in WP5. He is a senior systems developer at IMR. Formal background is a MSc in informatics. He has 25 years experience with programming and system development. He has been working at IMR since 2012. At IMR, he is involved in several internal development projects, and leads WP 5 in NMDC, a national infrastructure project for marine data founded by the Research Council of Norway.

Dr. Angelika Renner (F) participates in WPs 3 and 6, but will also interact with WPs 6 and 7. A young physical oceanographer and sea ice physicist with strong interdisciplinary links. Her research focuses in particular on connections between sea ice properties and oceanic heat transport in the European Arctic. AR has extensive experience in Arctic fieldwork, results of which are published in over 20 peer-reviewed articles. She is currently subject editor for Polar Research, and board member of the Association of Polar Early Career Scientists. AR has contributed to a wide range of science communication and outreach activities, and teaches at the University of Tromsø, Norway, and the University Centre of the Westfjords, Iceland.

Dr. Ken Drinkwater (M) participates in WPs 1 and 6 and interacts also with 2. His primary research interests are focussed upon climate variability and change and their effects on the biological components of the ecosystem. He has over 40 years experience, initially in Canada and since 2003 at IMR. He led the GLOBEC Cod and Climate Change program as Chair and then co-Chair from 1998 to 2004, has been co-Chair of the Ecosystem Studies of Subarctic and Arctic Seas (ESSAS) since 2005 and was a member of the SSC of IMBER (2009-2014) and CLIVAR (2010-2014). He has led and leads several Research Council of Norway funded projects and presently is leader of WP2 on Enhancement of ship-based observing networks in the EU funded AtlantOS project and Norwegian lead in the Japan, US and Norwegian Arctic project, RACArctic. He has published over 100 primary publications, co-authored 15 book chapters, 7 as lead author, and co-edited 11 special issues in primary journals, 4 as lead editor. He is presently one of two co-chief editors for Deep-Sea Research II.

Dr. Alf Håkon Hoel (M) participates in WPs 1 and 6, interacting with WPs 1 and 7. He is a political scientist by training and has worked on issues related to the management of living marine resources his entire career. His research interest is in international relations in marine and Arctic affairs in particular, and he has published widely in these areas. Presently, he is a research director at IMR and a special advisor and Norwegian governmental representative in the Arctic council.

Dr. Henrik Søiland (M) participates in WP3. He focuses mainly on physical oceanographic observations. He has 20 years of experience at IMR, and has been lead scientist on many field experiments in the Nordic Seas with international partners. He has also been lead physical oceanographer on multi disciplinary cruises on the Mid Atlantic Ridge and in the Southern Ocean. He has broad experience with a wide range of oceanographic instrumentation. A central part of his work has been in utilizing acoustically tracked subsurface floats (RAFOS) to study the flow and dynamics in the Norwegian Sea and use of vessel mounted ADCP together with hydrography to map the eddy field in the area.

Dr. Gro I. van der Meeren (F) leads Task 6.2. She focuses on marine ecosystem processes, evaluations holistic ecosystem assessments, based on environmental monitoring and biological surveys, into management information and advice. She has 28 years experience at IMR. She is a member of OSPAR ICG-COBAM, ICES WGIBAR, WGINOR, WGLMEBP and previously WGECO. She has been part of the EU InterReg projects including "PartiSEApate" and "NorthSEE", all related to internationally collaboration towards better management of the marine ecosystems and environments. She is currently co-chairing the European Marine Board WG on "Advancing Citizen Sciences for Sea and Ocean Research". She has published more than 30 papers and co-authored chapters in 3 books.

Dr. Morten D. Skogen (M) participates in WP6. He has almost 25 years of experience in ecosystem modeling with a special focus on lower trophics and Individual Based Models. He is main responsibility for development and maintenance of the ecosystem model NORWECOM.E2E, and has published 45 peer review papers.

Dr. Cecilie Hansen (F) participates in WP 6. She has her background in mathematics and oceanography, and 10 years experience with NPZD, IBM and end-to-end modelling. She has implemented the Atlantis model for the Nordic and Barents Seas (NoBA). Through her work with end-to-end models, she focuses on the combined effect of climate and fisheries on the ecosystems in the Barents and Norwegian Sea, including effects of management strategies and ocean acidification.

<u>Publications, and/or products, services or other achievements</u>

1. Ottersen G., Kim S., Huse G., Polovina J. J. and Stenseth N. C. 2010. Major pathways by which climate may force marine fish populations. Journal of Marine Science 79: 343-360.
2. Stenseth NC, Ottersen G, Hurrell JW, Belgrano A. 2004. Marine Ecosystems and Climate Variation: The North Atlantic, Vol. Oxford University Press, Oxford, UK. 252+14 p.
3. Søiland, H. and Rossby, T., 2013. On the structure of the Lofoten Basin Eddy. Journal of Geophysical Research, Vol 118 , Doi: 10.1002/jgrc.20301
4. Drinkwater KF, Miles M, Medhaug I, Otterå, OH, Kristiansen T, Sundby S, Gao Y. 2014. The Atlantic Multidecadal Oscillation: its manifestations and impacts with special emphasis on the Atlantic region north of 60°N. Journal of Marine Systems 133: 117-130.
5. Hoel, A.H. 2015: Oceans governance, the Arctic Council and ecosystem-based management. In: Jensen, L.C. and Hønneland, G.: Handbook of Arctic Politics. Edward Elgar, Cheltenham, pp. 265 – 280.

<u>Relevant projects, and/or activities:</u>

1. **AtlantOS** (Optimizing and Enhancing the Integrated Atlantic Ocean Observing System) is an EU funded project (2015-2018). It aims to achieve a sustainable, efficient, and fit-for-purpose Integrated Atlantic Ocean Observing System (IAOOS), by defining requirements and systems design, improving the readiness of observing networks and data systems, and engaging stakeholders around the Atlantic.

2. **RACArctic** (Resilience and Adaptive Capacity of Arctic marine systems under a changing climate) is a Belmont Forum funded project (2015-2018) undertaken jointly by Japan, the USA, and Norway. The objective is to synthesize information from completed and ongoing regional studies on how climate variability and change in the Subarctic to Arctic transition zone may affect future marine ecosystems of the Pacific and Atlantic Arctic.

3. **CERES** (Climate change and European aquatic RESources) will provide the knowledge, tools and technologies needed to successfully adapt European fisheries and aquaculture sectors in marine and inland waters to anticipated climate change. We will identify and communicate risks, opportunities and uncertainties thereby enhancing the resilience and supporting the development of adaptive management and governance systems in these blue growth sectors. *CERES* strongly supports important European policy goals including self-sufficiency of the domestic supply of fish and shellfish.

4. **A-TWAIN** (Long-term variability and trends in the Atlantic Water inflow region) was established to gain understanding on how the inflowing current system is distributed at different depths along the continental slope, how it responds to local, short lived atmospheric changes, and how it varies on seasonal and inter-annual timescales.

5. **Copernicus**. IMR is the Arctic Thematic Assembly Centre (TAC) for the In-situ TAC component of the sustained Copernicus Marine Environment Monitoring Service (CMEMS). As the Arctic TAC IMR collects, transforms, quality controls and makes available all types of marine near real time in-situ data for public consumption through the well defined formats and services defined within the scope of CMEMS.

The Arctic TAC's focus area is marine areas above the 65th parallel north. IMR has functioned as the Arctic TAC since the start of the MyOcean project in 2009.

Significant infrastructure, and/or major items of technical equipment:

IMR will contribute with 3 currents meters type RCM 7 and 1 type RCM8 for the new mornings north of Svalbard. IMR will have the benefit from monitoring and surveys from ships doing annual surveys targeting ecosystem, both in summer and winter in the Arctic, and particularly on the Barents Sea and the shelf north of Svalbard. In addition IMR record oceanographic data from a number of trans-ocean sections and fixed stations.

Integrated in IMR is also NMDC (Norwegian Marine Data Centre), a national research infrastructure funded by the Norwegian Research Council for 5 years (2012-2017) with an additional 5-year operation period (2017-2022). It aims to establish a national infrastructure to serve the marine science community with a seamless access to documented marine datasets covering waters of Norwegian interests. The project has 16 Norwegian partners and is coordinated by the Institute of Marine Research.

4. Stockholm University, Department of Meteorology (MISU)

Expertise and experience of the organization

Stockholm University (SU, www.su.se) is the largest university in Sweden, with over 64,000 students and 5,000 staff. The **Department of Meteorology** (MISU, www.misu.su.se) is the leading meteorological department in Sweden, established 1947 and first lead by the renowned professor Carl-Gustaf Rossby, one of the fathers of modern dynamic meteorology, and later by professor Bert Bolin; father of the Intergovernmental Panel of Climate Change (IPCC). Today research at the department spans four specialties: Dynamic Meteorology, Physical Oceanography, Atmospheric Physics and Chemical Meteorology. In particular within Dynamic Meteorology and Chemical Meteorology, there are substantial experiences in Arctic research, both modeling and observations. The department belongs to the Mathematics and Physics sub-faculty of the Faculty of Sciences, and has about 80 staff; ~30 scientists and ~30 PhD students, while the rest are Technical and Administrative (TA) support staff. Among the scientists ten are professors/lecturers, five Assistant Professors (or similar) and the rest are postdoctoral scholars. MISU also has two undergraduate programs; a bachelor program in *Meteorology* and a Masters program in *Atmospheric sciences, Oceanography and Climate*. Together with three other departments at SU, MISU is part of the *Bolin Centre for Climate Research* (www.bolin.su.se).

Role in the project

MISU will contribute to WP1, WP2 and WP3. In WP2 we will explore the possibility to more efficiently use hyperspectral infrared satellite information to study of the vertical structure of the atmosphere over the Arctic Ocean, where very little other information on this exist. We will start by utilizing coastal sounding sites and soundings from expeditions and gradually in collaboration with other partners build a database on the vertical structure of the Arctic atmosphere, with a specific focus on temperature and moisture. We will also explore how to use satellite data for the vertical structure of clouds, using active sensors south of 82 °N to calibrate other sensors to expand the data to areas farther north. In WP3 we will develop a program and best practices for in situ Arctic observations on ships-of-opportunity, using a concept that we will develop on the Swedish research icebreaker Oden, in collaboration with the Swedish Secretariat for Polar Research (WP1). Initially we will base the observations on reasonably simple concepts and gradually expand to instruments which make it possible to probe the vertical structure of the atmosphere. The leading idea is that as many ships as possible should take observations when navigating the Arctic Ocean, first all research icebreakers (regardless of the specific science targets of the expeditions) and later also other ships.

Key personnel CV

Dr Michael Tjernström (M) is a professor of Meteorology with over 30 years of research experience and an expert in atmospheric dynamics with experience in both experimental and numerical modelling meteorology, dealing with mesoscale and boundary-layer processes, in particular in the Arctic. He has published over 100 scientific peer-review papers and led three Arctic research missions on the Swedish icebreaker *Oden* (AOE-2001, ASCOS 2008 and ACSE 2014). He is Sweden's representative on the IASC Atmospheric Working Group and has recently served as Chair for the Department of Meteorology, on the

Bolin Centre for Climate Research board, as Chair of the International Study of Arctic Change and on the ECMWF Science Advisory Committee.

Dr Gunilla Svensson (F) is a professor of Meteorology and an expert on modelling of turbulence and clouds in weather prediction and climate models. She has published over 50 peer-review science papers and serves on several national and international research boards and science steering groups, including for the Polar Prediction Project (WWRP) and the Polar Climate Predictability Initiative (WCRP). She also was the coordinator of the Bolin Centre's strategic climate modelling initiative.

Dr Joseph Sedlar (M) is an Early Career Scientist with almost ten years of experience of experimental Arctic research. He participated in one Arctic expedition (ASCOS) as a PhD student and has extensive experience using satellite data to study atmospheric vertical structure and clouds over the Arctic Ocean. He has published ~25 scientific peer-review papers and was awarded the 2016 Outstanding Young Scientists Award by the European Geophysical Union.

<u>Publications, and/or products, services or other achievements:</u>

1. **Sedlar, J.**, **M. Tjernström**, T. Mauritsen, M. Shupe, I. Brooks, P. Persson, C. Birch, C. Leck, A. Sirevaag, and M. Nicolaus, 2011: A transitioning Arctic surface energy budget: the impacts of solar zenith angle, surface albedo and cloud radiative forcing. *Climate Dynamics*, **37**, 1643–1660, doi:10.1007/s00382-010-0937-5.
2. **Tjernström, M.**, C.E. Birch, I.M. Brooks, M.D. Shupe, P.O.G. Persson, **J. Sedlar**, T. Mauritsen, C. Leck, J. Paatero, M. Szczodrak and C.R. Wheeler, 2012: Meteorological conditions in the Central Arctic summer during the arctic summer cloud ocean study (ASCOS), *Atmospheric Chemistry and Physics*, **12**, 6863–6889, doi:10.5194/acp-12-6863-2012.
3. Vihma, T., R. Pirazzini, I. A. Renfrew, **J. Sedlar**, **M. Tjernström**, T. Nygård, I. Fer, C. Lüpkes, D. Notz, J. Weiss, D. Marsan, B. Cheng, G. Birnbaum, S. Gerland, D. Chechin, and J. C. Gascard, 2014: Advances in understanding and parameterization of small-scale physical processes in the marine Arctic: A review. *Atmospheric Chemistry and Physics*, **14**, 9403–9450, doi:10.5194/acp-14-9403-2014
4. **Tjernström, M.**, M. D. Shupe, I. M. Brooks, P. O. G. Persson, J. Prytherch, D. Sailsbury, **J. Sedlar**, P. Achtert, B. J. Brooks, P. E. Johnston, G. Sotiropoulou and D. Wolfe, 2015: Warm-air advection, air mass transformation and fog causes rapid ice melt, *Geophysical Research Letters*, **42**, 5594–5602, doi:10.1002/2015GL064373.
5. Devasthale A., **J. Sedlar**, B. H. Kahn, **M. Tjernström**, E. J. Fetzer, B. Tian, J. Teixeira, T. S. Pagano and the AIRS Science Team, 2015: A decade-long mapping of the Arctic atmosphere: novel insights from NASA's Atmospheric Infrared Sounder (AIRS) instrument, *Bulletin of the American Meteorological Society*, In revision.

<u>Projects, and/or activities:</u>

1. Arctic Clouds in Summer Experiment (ACSE): A part of the SWERUS-C3 (**SWE**dish-**R**ussian-**US** investigation in **C**arbon-**C**rysophere-**C**limate interactions) expedition to the Eastern Arctic during three months of summer 2014 on the Swedish icebreaker Oden.
2. Advanced Simulation of Arctic climate change and impact on Northern regions (ADSIMNOR), Strategic modeling project funded by *Formas*, 2009 – 2014 (Theme Leader and member of Steering Group)
3. Arctic Summer Cloud Ocean Study (ASCOS): Expedition to the central Arctic Ocean on the icebreaker Oden, 40 days during the summer 2008. ASCOS was part of the International Polar Year (IPY) and the EU-funded project DAMOCLES.
4. Developing Arctic Modeling and Observing Capabilities for Long-term Environment Studies (DAMOCLES), 2005 – 2009: Task Leader, *European Union 6th Framework Program*
5. Arctic Ocean Experiment 2001 (AOE-2001): Expedition to the central Arctic Ocean on the icebreaker Oden, two months during the summer 2001.

<u>Significant infrastructure, and/or major items of technical equipment:</u>

Potential access to the Swedish research icebreaker *Oden*.

5. Alfred-Wegener-Institut - Helmholtz-Zentrum für Polar- und Meeresforschung (AWI)

Expertise and experience of the organization

The AWI is a foundation under public law and member of the Helmholtz Association - the largest scientific organization in Germany. As an internationally respected center of expertise on polar and marine research, the AWI is one of the very few scientific institutions in the world that are equally active in the Arctic and Antarctic. It coordinates German polar research efforts, while also conducting research in the North Sea and adjacent coastal regions in Germany. Combining innovative approaches, outstanding research infrastructure and years of expertise, the AWI explores nearly all aspects of the Earth system - from the atmosphere to the deep ocean floor. In this regard, initiatives to better grasp the climate-related processes on our planet have increasingly taken center stage.

The AWI's researchers operate various observatories that gather measurement data over longer timeframes. They research the atmosphere, ice, oceans and coasts. They explore the deep seas, the glaciers and the permafrost soils of the polar regions first-hand, and they analyze data from climate archives like sediment and ice core samples.

The Institute's work is characterized by a high degree of international and interdisciplinary collaboration. Field research under extreme conditions is just as much a part of the Institute's day-to-day work as are analyses using cutting-edge laboratory equipment and high-performance supercomputers. Having recognized that polar and marine research often poses serious logistical challenges, the AWI also maintains an excellent infrastructure, allowing it to make resources available for the national and international research communities – including several research ships, aircraft, and stations in the Arctic and Antarctic.

In cooperation with the Center for Marine Environmental Sciences (MARUM, University of Bremen), the AWI maintains the World Data Center for Marine Environmental Sciences (WDC-MARE). The data center aims at collecting, scrutinizing, and disseminating data related to Global Change and earth system research in the fields of environmental oceanography, marine geosciences, and marine biology. It focuses on georeferenced data using the PANGAEA® information system as its long-term archive and publication unit. Services supplied by this system are project data management, archiving, publication, and dissemination via visualization and analysis software.

Pursuing research in the polar regions and our oceans always goes hand-in-hand with the development of technological innovations. As such, technology transfer yields new products and services. Last but not least, the AWI is continually engaged in the education and training of young researchers, students, pupils or trainees.

Role in the project

The AWI operates the LTER (Long-Term Ecological Research) observatory HAUSGARTEN in the Fram Strait between NE Greenland and the Svalbard archipelago. The central HAUSGARTEN station at about 79°N, 04°E in the eastern Fram Strait (~2,500 m water depth) serves as an experimental area for unique biological experiments at the deep seafloor, simulating various scenarios in changing environmental settings.

Within WP3, the AWI will develop, validate and implement an experimental system that enables scientists to study impacts of ocean acidification on (benthic) marine organisms. Comparable "Free Ocean Carbon Enrichment" (FOCE) experimental set-ups are already operational or in preparation, however, a similar approach for the Arctic Ocean is so far missing. AWI will implement an "arcFOCE" for long-term experiments in deep arctic waters. arcFOCE will enable us to generate - for the first time - data on the resistance of arctic marine benthic organisms and communities to a reduction in ocean pH, thereby filling existing knowledge gaps.

Within WP3, the AWI will also contribute to the work planned for the INTAROS reference area North of Svalbard by adding various biogeochemical and biological instruments to the moored array foreseen to be installed within the projects time frame. Instruments include a Fast Repetition Rate fluorometer (FRRf), a nitrate sensor, an Underwater Vision Profiler (UVP), and sediment traps. The instruments will provide continuous measurements of nutrient concentrations, photosynthetic rates, particle and zooplankton concentrations as well as particle fluxes to the seafloor, thereby providing the opportunity to link productivity, ecosystem structure and particle dynamics to the tendency of the water column to sequester carbon.

Within WP2 and WP5, the AWI will provide general access to various data domains like geochemical, biological observational and occurrence data from Arctic marine and terrestrial environments by the PANGAEA data repository. PANGAEA data access methods include the pangaea.de website, a public PANGAEA web based metadata catalogue and data portal based on ElasticSearch full-text engine, documented web services and APIs for advanced interaction with PANGAEA digital data libraries. PANGAEA offers an integrated internet-based data publication service by using persistent and unique identification (DOIs), which ensures citability of data. PANGAEA also supports the integration of metadata within domain specific scientific portals (OBIS, GBIF) using appropriate exchange standards (OAI-PMH, DIGIR, OpenSearch etc.). Furthermore, PANGAEA guides data publication via Data Journals such as the Earth System Science Data Journal (ESSD) and Scientific Data by the Nature publishing group.

Key personnel CVs

Dr. Thomas Soltwedel (M) is a deep-sea ecologist in the HGF-MPG Joint Research Group on Deep-Sea Ecology and Technology at AWI. Since 1991, he participated in numerous national and international research projects and ESFRI roadmap programs. He works with Remotely Operated Vehicles and autonomous free-falling devices carrying a wide range of instruments (e.g. respiration chambers, cameras, current meters, and optodes). Moreover, he is involved in a large number of unique long-term experiments at the deep seafloor. He has well-grounded sea-going experience from over 30 expeditions and published his scientific results in more than 80 peer-reviewed articles. Dr. Soltwedel is leading the time-series work at the LTER (Long-Term Ecological Research) observatory HAUSGARTEN.

Dr. Ingo Schewe (M) is a deep-sea ecologist working on causes and effects of physical, chemical and biological gradients on the biodiversity of benthic assemblages. Since 2005, he participated in several EU funded projects with special emphasis on data-management and data-product issues. He was leader of data-management work-packages in the projects HERMES, HERMIONE, and SIOS. Dr. Schewe is responsible data-manager and PANGAEA data-curator for HAUSGARTEN datasets at AWI and leads the data-management task of the infrastructure project FRAM.

Dr. Christiane Hasemann (F) is working on the biodiversity and functioning of benthic deep-sea ecosystems in the Arctic Ocean, focusing on small-scale distribution and diversity patterns of deep-sea meiofauna communities. She participated in different national and international projects (e.g., COBO, HERMES, HERMIONE, and TRANSDRIFT). Dr. Hasemann is involved in the time-series and in-situ experimental work at LTER observatory HAUSGARTEN as part of the Ocean Observing System FRAM (Frontiers in Arctic Monitoring) to determine the factors controlling biodiversity of the small sediment-inhabiting biota.

Prof. Anya Waite (F) is a biological oceanographer, Section Head of Polar Biological Oceanography at AWI, and Professor of Oceanography in the Department of Biology at the University of Bremen. Her work is generally multidisciplinary, combining isotope biochemistry, molecular ecology, traditional microscopy and shipboard manipulation and experimentation. She was Board Member of the American Association for Limnology and Oceanography (ASLO) from 2011 to 2014, was co-author for the IPCC AR5 Report and Special Issue on Extreme Events (Open Ocean), and is currently on the Editorial Board of Limnology and Oceanography. Prof. Waite has worked in every world ocean and has led 15 research voyages as Chief Scientist and has participated in over 30 cruises.

Publications, and/or products, services or other achievements

1. Soltwedel, T., Bauerfeind, E., Bergmann, M., Bracher, A., Budaeva, N., Busch, K., Cherkasheva, A., Fahl, K., Lalande, C., Metfies, K., Nöthig, E.-M., Meyer, K., Quéric, N.-V., Schewe, I., Wlodarska-Kowalczuk, M., Klages, M. (2015). Natural variability or anthropogenically-induced variation? Insights from 15 years of multidisciplinary observations at the arctic marine LTER site HAUSGARTEN. Ecological Indicators, doi.org/10.1016/j.ecolind.201510.001
2. Soltwedel, T., Mokievsky, V., Rabouille, C., Sauter, E., Volkenandt, M. and Hasemann, C. (2013): Effects of experimentally increased near bottom flow on meiofauna diversity in the deep Arctic Ocean. Deep-Sea Research Part I Oceanographic Research Papers, 73 (3), pp. 31-45.
3. Soltwedel, T., Schauer, U., Boebel, O., Nöthig, E.-M., Bracher, A., Metfies, K., Schewe, I., Klages, M.

and Boetius, A. (2013): FRAM - FRontiers in Arctic marine Monitoring: Permanent Observations in a Gateway to the Arctic Ocean. OCEANS Bergen, 2013 MTS/IEEE. doi:10.1109/OCEANS Bergen.2013.6608008

4. Soltwedel, T. and Klages, M. (2009): The HAUSGARTEN - from snap shots to time series. Biological studies in polar oceans: Exploration of life in icy waters. Gotthilf and Irmtraut Hempel (Eds), Wirtschaftsverlag NW, Verlag für neue Wissenschaft, ISBN: 978-3-86509-865-8.
5. Soltwedel, T., Bauerfeind, E., Bergmann, M., Budaeva, N., Hoste, E., Jaeckisch, N., Juterzenka, K. v., Matthießen, J., Mokievsky, V., Nöthig, E.-M., Quéric, N., Sablotny, B., Sauter, E., Schewe, I., Urban-Malinga, B., Wegner, J., Wlodarska-Kowalczuk, M. and Klages, M. (2005): HAUSGARTEN: multidisciplinary investigations at a deep sea, long term observatory in the Arctic Ocean. Oceanography, 18 (3), pp. 46-61.

Projects, and/or activities

1. EMSO: Within the European large-scale, distributed, marine Research Infrastructure (RI) consortium EMSO (European Multidisciplinary Seafloor & Water Column Observatory), the LTER observatory HAUSGARTEN in Fram Strait represents the northernmost ocean observation system.
2. SIOS: HAUSGARTEN observatory is also part of the ESFRI roadmap program SIOS (Svalbard Integrated Arctic Earth Observing System) aiming at establishing a regional observation system for long-term measurements in and around Svalbard, addressing Earth System Science (ESS) questions related to Global Change. Within SIOS, AWI leads the work package WP6 “Data Management & Utilisation Plan”.
3. ICOS-D: Within the German branch of the European research infrastructure program ICOS (Integrated Carbon Observation System) the AWI contributes to the ocean network by conducting en route measurements of CO_2 and other physical and biogeochemical parameters by vessels of opportunity (Volunteer Observing Ships, VOS). Moreover, CO_2 sensors on a frequently used Autonomous Underwater Vehicle (AUV) and moored sensors at the LTER observatory HAUSGARTEN provide additional data to the project.
4. FRAM: The HGF infrastructure project FRAM (Frontiers in Arctic marine Monitoring), led by AWI, aims at permanent presence at sea, from surface to depth, for the provision of near real-time data on Earth system dynamics, climate variability and ecosystem change. FRAM implements existing and next-generation sensors and observatory platforms, allowing synchronous observation of relevant ocean variables as well as the study of physical, chemical and biological processes in the ocean.
5. FIXO3: Within the framework of a ‘Trans-National Access’ (TNA) initiative of the European project FIXO3 (Fixed-point Open Ocean Observatories), the AWI provides access to the FRAM Ocean Observing System thereby supporting external and joint scientific projects logistically.

Significant infrastructure, and/or major items of technical equipment

The AWI is running the LTER observatory HAUSGARTEN in Fram Strait. Multidisciplinary investigations covering all parts of the open-ocean ecosystem are carried out at a total of 21 permanent sampling sites in water depths ranging between 250 and 5,500 m. Since 1999, repeated sampling in the water column and at the seafloor during yearly expeditions in summer months was complemented by continuous year-round sampling and sensing using autonomous instruments on anchored devices.

Time-series studies at the HAUSGARTEN observatory provide insights into processes and dynamics within an arctic marine ecosystem and act as a baseline for further investigations of ongoing changes in the Fram Strait. Long-term observations at HAUSGARTEN significantly contribute to the global community’s efforts to understand variations in ecosystem structure and functioning on seasonal to decadal time-scales in an overall warming Arctic and will allow for improved future predictions under different climate scenarios.

The LTER observatory HAUSGARTEN is also part of the FRAM (Frontiers in Arctic marine Monitoring) infrastructure project, financially supported by the German Helmholtz Association (HGF). The FRAM Ocean Observing System serves national and international tasks towards a better understanding of the effects of change in ocean circulation, water mass properties and sea-ice retreat on Arctic marine ecosystems and their main functions and services. Products of the FRAM research infrastructure are continuous long-term data with appropriate resolution in space and time, as well as ground-truthing information for ocean models and remote sensing.

6. Institute of Oceanology Polish Academy of Sciences / Instytut Oceanologii Polskiej Akademii Nauk (IOPAN)

Expertise and experience of the organization

IOPAS was established in 1951 and with nearly 200 employees (with 31 professors in the staff) is the largest marine research institute in Poland. Its mission is focussed on basic marine research. One of the IOPAN strategic directions is to study the role of oceans in the climate change and its effects on European seas. The main areas of IOPAN research activity are the European Arctic Seas and the Baltic Sea. IOPAN is divided into five departments (Physical Oceanography, Marine Chemistry, Marine Physics, Marine Ecology, Genetics and Marine Biotechnology) with extensive expertise both in collecting and analysis of environmental observations, and running state-of-the-art numerical models. IOPAN operates its own research vessel, Oceania, well suited for longer expeditions and multidisciplinary measurements in the subpolar areas. Since 1987 IOPAS has conducted extensive field campaigns, each summer covering the eastern regions of the Nordic Seas, Fram Strait, west Spitsbergen fjords and the open water area north of Svalbard. For year-round observations IOPAN maintains arrays of oceanographic moorings in Fram Strait and northeast of Svalbard. The institute is strongly involved in international collaboration, and multidisciplinary research activities and field campaigns have been carried out in the frames of numerous national and international projects.

Role in the project

In INTAROS IOPAN is mainly involved in **WP3** (as a co-leader) with several activities focused on filling the gaps in the ocean observing system by integration of new technology into with existing infrastructure. IOPAN will be responsible for deployment of the novel Ice-tethered Platforms (ITPs) with CTD/O2 and bio-optical sensors (potentially also ocean current sensor), which in combination with Sea Ice Mass Balance Buoys will establish the Ice Based Observatories (IBOs). IOPAN will also contribute to **WP3** with moorings north of Svalbard (equipped with profiling instrumentation, MMPs and ADCPs, and new BGC sensors), autonomous measurements at the ocean-glacier interface in Svalbard fjords and Lagrangian measurements with Arctic Argo floats. Data collected by IOPAN during field campaigns will be processed under WP3 and delivered to **WP5** to integrated with other data sets and to **WP6** for demonstration cases. IOPAN will also contribute to **WP2** with existing data streams from on-going observations (repeated hydrography and mooring data from the Nordic Seas, Fram Strait and Svalbard fjords). IOPAN will also be involved in **WP1** with evaluation of the existing and future new technologies for ocean observations for the purpose of the future sustained iAOS in INTAROS.

Key personnel CVs

Dr. Agnieszka Beszczynska-Möller (F) is physical oceanographer with 23 years of experience in observational oceanography in the polar regions. ABM has an extensive expertise in application of different observational platforms and instrumentation, including oceanographic moorings, ship-borne oceanographic measurements, floats and gliders. In 2003-2013 she was responsible for the AWI moored array and glider observations program in Fram Strait. AMB participated in approx. 28 Arctic expeditions on different research vessels and icebreakers (*Polarstern*, *Oceania*, *Lance*, *Merian*, *Mosby*, *KV Svalbard* and others) and served as chief scientist in several expeditions of *Polarstern* and *Oceania*. She participated/s in several EU and international projects, including VEINS, ASOF-N, DAMOCLES IP, ACOBAR, GROOM, SIOS and German national projects PACES and HAFOS. She is a member of ICES Ocean Hydrography Working Group and editor of ICES Report on Ocean Climate as well as a member of EGO (European Glider Observatory). ABM serves as Polish representative in the SAON (Sustained Arctic Observing Networks) Board. She coordinates the Polish-Norwegian project PAVE and is WP leader in the Polish-Norwegian projects AWAKE-2 and GLAERE. In INTAROS she will be a co-leader of WP3 and thematic leader for ocean observations, her field work responsibility will include ITPs and moorings north of Svalbard.

Assoc. Prof. Waldemar Walczowski (M) is the research scientist with 30 years of experience in the ocean observations with PhD and habilitation in physical oceanography. He is the Head of the Physical Oceanography Department at IOPAN and leads IOPAN research activities in the European Arctic. He has an extensive experience in the fieldwork in different polar regions, both in the open ocean, semi-enclosed seas (Baltic Sea) and Arctic fjords. WW participated as PI in numerous projects focused on Arctic oceanography (including VEINS, ASOF-N, DAMOCLES IP, C3O, SIOS, SIDERI, E-AIMS). He is the coordinator of Polish-Norwegian projects AWAKE and AWAKE2 and a member of several national and international Boards and Panels (including AOSB, IASC, EuroARGO and SAON). He is a member of Polish Committee of Polar Research and a scientific coordinator of the IOPAN research vessel *Oceania*. In INTAROS he will be involved in WP3 and responsible for fjord observations and Arctic Argo floats.

Publications, and/or products, services or other achievements

1. Beszczynska-Möller, A., Fahrbach, E., Schauer, U., and Hansen, E., 2012. Variability in Atlantic water temperature and transport at the entrance to the Arctic Ocean, 1997–2010. ICES J.Mar.Sci., vol. 69(5), doi:10.1093/icesjms/fss056.
2. Beszczynska-Möller A., R. Woodgate, C. Lee, H. Melling, M. Karcher, 2011. A synthesis of exchanges through the main oceanic gateways to the Arctic Ocean. TOS Oceanography, 24(3): 82–99, doi: 10.5670/oceanog.2011.59.
3. Walczowski W., 2014. Atlantic Water in the Nordic Seas. Springer International Publishing, 300 pp.
4. Walczowski W., 2013. Frontal structures in the West Spitsbergen Current margins. Ocean Sci., 9, 957-975, doi: 10.5194/os-9-957-2013.
5. Walczowski W., Piechura J., Goszczko I., Wieczorek P., (2012). Changes in Atlantic Water properties as: an important factor in the European Arctic marine climate, ICES J.Mar.Sci., vol. 69 (5), 864-869.

Projects, and/or activities

1. **AWAKE-2** (coordinated by IOPAN) is the Polish-Norwegian project with the aim to understand the interactions between the main components of the climate system in the Svalbard area: ocean, atmosphere and ice to identify mechanisms of inter-annual climate variability and long-term trends. IOPAN is responsible for oceanographic observations in the Hornsund fjord and in the neighboring open ocean.
2. **PAVE** (coordinated by IOPAN) is the Polish-Norwegian project is the multidisciplinary research project focused on investigating the response of the Arctic sea ice and biological environment to variability and recent warming of the Atlantic Water (AW) inflow through Fram Strait and the Barents Sea. Under PAVE IOPAN is responsible for ocean measurements in Fram Strait and north of Svalbard, including deep moorings in collaboration with A-TWAIN, and synthetic analysis of physical and biological observations in both branches of Atlantic water.
3. **E-AIMS** and **SIDERI** are the FP7 projects focused on the Argo floats. IOPAN was/is responsible for testing the capabilities of new ARGO floats, in particular new generation Arctic floats adapted to operation in the polar environment (Iridium comms, RAFOS capabilities, ice detection).
4. **NAtMAP** is the FP7 ERA-Net joint research effort with a focus on North Atlantic model biases and their links to the Arctic climate. IOPAN collaborates with scientists from Germany and Russia to improve Arctic predictions by amending North Atlantic model biases and generate knowledge that can be used to advice the modeling community on strategies for the construction of better Arctic prediction systems. In NAtMAP IOPAN is responsible for validation of numerical models with observational data sets.
5. **AREX** is the long-term observational program in the Nordic Seas, Fram Strait and the southern Nansen Basin, based on institutional funding and carried out by IOPAN since 1987. During the annually repeated summer expedition of rv *Oceania* (2-2.5-month long), oceanographic and biogeochemical measurements and samples are collected at the standard sections across the northward flow of Atlantic water from the northern Norway to the area north of Svalbard. Additionally extensive observational program is carried out in the West Spitsbergen fjords (Horsund, Belsund, Kongsfjorden, Rijpfjorden).

Significant infrastructure, and/or major items of technical equipment:

IOPAN runs own research vessel *Oceania* (52m), which is well suited for longer expeditions and multidisciplinary measurements in the subpolar areas in the open water and at the edge of marginal ice zone. In Svalbard fjords IOPAN also works from the Polish Polar Station in Hornsund, using own small boats and mobile equipment from spring to autumn season.

7. Technical University of Denmark (DTU)

Expertise and experience of the organization

The Technical University of Denmark (DTU) is a leading technical university in northern Europe consisting of 19 institutes covering a wide variety of scientific fields, with a total staff of about 6000, 10000 undergraduate students enrolled, and 1200 Ph.D. students. Two institutes from DTU participates in the proposal, DTU Space and DTU Aqua.. *DTU Aqua* has a permanent staff of 215 persons and conducts research and advices on matters of fisheries, fisheries management, aquaculture, and the marine environment. The institution carries out research, investigations and education concerning sustainable exploitation of living marine and fresh water resources. DTU Aqua deals with considerations regarding the whole chain from water to table. This includes interaction between the aquatic environment, productivity and variation in fish stocks, methods for stock assessment, development of methods for sustainable fisheries management, and stock enhancement. DTU Aqua deals with considerations regarding the whole chain from water to table. This includes interaction between the aquatic environment, productivity and variation in fish stocks, methods for stock assessment, development of methods for sustainable fisheries management, and socioeconomic aspects. DTU Aqua is strongly involved in arctic marine research, both field work and analytical, as well as advice giving in relation to arctic ecosystems through its collaboration with GINR. DTU Aquas experience in developing ecosystem models goes back to the first North Sea model and since then the institute has been influential on stochastic as well as deterministic ecosystem models, e.g. state space models, size spectrum models and end-to-end models, and has a broard experience with the challenges of ecosystem model coupling. DTU Aqua is deeply involved in the work of ICES, transforming knowledge into advice, and facilitating science-based decision-making by interacting with stakeholders with very diverse backgrounds.

DTU Space, the National Space Institute at DTU is the national institute for space-related activities in Denmark. The institute conducts research in astrophysics, solar system physics, geodesy, remote sensing, space instrumentation and space technology. DTU Space has significant activities within the areas of Earth Observation and Arctic Studies. Main application areas are sea level, sea ice, land ice, geodesy, and oceanography. DTU Space operates permanent GPS-stations and tide gauges in Greenland. As part of the geodetic activities in Greenland, DTU Space has been pioneering the use of GPS for monitoring the ice sheet mass changes. In the frame of the US NSF funded project GNET both its value and its consistency with GRACE was further demonstrated. DTU Space has participated in numerous EU and ESA projects on the developments of services on the enhancement of satellite based sea level data and compilation and analysis of climate sea level records. Recently, in the EU FP-7 funded project LOTUS a special effort in preparing the use and take-up of Sentinel-3 SAR altimetry in the Polar oceans has been made. Also, DTU Space has participated in the ESA project SAMOSA (Development of SAR Altimetry Mode Studies and Applications over Ocean, Coastal Zones and Inland Waters) and CP4O (CryoSat Plus for Oceans).

Role in the project

DTU Space will contribute in the fields of Cryosphere and Oceanography, mainly in WP2. Within Cryosphere, DTU Space will integrate GPS station in Greenland and the associated modeling of ice sheet mass changes, also integrating GRACE. Within Oceanography, DTU Space will develop further the monitoring of sea level in the Arctic region using satellite altimetry and tide gauges. DTU Aqua will mainly be involved in WP6, contributing to the work on local and regional ecosystem models in the Baffin Bay, focusing on issues of data assimilation and potentially effects of higher trophic levels and fishing, based on experiences with the Atlantis model.

Key personnel CVs

Dr. Asbjorn Christensen (M) at DTU Aqua is a senior computational scientist working with spatial deterministic ecosystem models. His interest focus is on physical-biological interaction, spatial ecological dynamics and life history optimization. He has published diverse work on ecology, fisheries science, numerical modelling and computational physics. He is the principal developer of the IBMlib software for individual-based modelling and has taken part in numerous relevant national and EU projects as institute PI, e.g. recently, OpEc, MyOcean, COCONET, VECTORS and is a core member of the Danish Marine Ecology Modelling Centre (MEMC) and a member several of ICES working groups WGEVO, WGIPEM, and WGOOFE.

Per Knudsen (M), Professor and Head of Geodesy at DTU Space. He has participated in several projects on sea level from space for various purposes, such as marine gravity field, mean sea surface, sea level changes, and ocean tides and on combination of space and in-situ data. He has co-authored over 64 papers in peer-reviewed journals. He was chairman in the European Sea Level Service and member of the board of the Permanent Service for Mean Sea Level (PSMSL) as well as the ESA Sentinnel-3 Mission Advisory Group.

Ole Baltazar Andersen (M), PhD and Senior Scientist at DTU Space. Ole Andersen has a vast experience in modeling sea level using satellite altimetry and also participated in several projects on sea level from space for various purposes, such as marine gravity field, mean sea surface, sea level changes, and ocean tides.

Publications, and/or products, services or other achievements:

1. Christensen, A., Butenschőn, M., Gűrkan, Z., and Allen, I. J.: Towards an integrated forecasting system for fisheries on habitat-bound stocks. Ocean Science 9: 261-279 (2013).
2. Maar, M., Rindorf, A., Møller, E.F., Christensen, A., Madsen, K.S. and van Deurs, M.:Zooplankton mortality in 3D ecosystem modelling considering variable spatial-temporal fish consumptions in the North Sea. Progress in Oceanography 124: 7891 (2014)
3. Khan, Shfaqat Abbas ; Kjaer, Kurt H. ; Bevis, Michael ; Bamber, Jonathan L. ; Wahr, John ; Kjeldsen, Kristian K. ; Bjork, Anders A. ; Korsgaard, Niels J. ; Stearns, Leigh A. ; van den Broeke, Michiel R. ; Liu, Lin ; Larsen, Nicolaj K. ; Muresan, Ioana Stefania. Sustained mass loss of the northeast Greenland ice sheet triggered by regional warming. in journal: Nature Climate Change (ISSN: 1758-678X) (DOI: http://dx.doi.org/10.1038/NCLIMATE2161), vol: 4, issue: 4, pages: 292-299, 2014
4. Khan, Shfaqat Abbas ; Aschwanden, Andy ; Bjørk, Anders A. ; Wahr, John ; Kjeldsen, Kristian K. ; Kjær, Kurt H. Greenland ice sheet mass balance: A review. Reports on Progress in Physics (ISSN: 0034-4885) (DOI: http://dx.doi.org/10.1088/0034-4885/78/4/046801), vol: 78, issue: 4, 2015
5. Knudsen, Per ; Bingham, R. ; Andersen, Ole Baltazar ; Rio, Marie-Helene (2011) A global mean dynamic topography and ocean circulation estimation using a preliminary GOCE gravity model Journal of Geodesy (ISSN: 0949-7714) (DOI: http://dx.doi.org/10.1007/s00190-011-0485-8), vol: 85, issue: 11, pages: 861-879

Projects, and/or activities:

1. Asbjorn Christensen has participated in several recent and on-going influential EU projects as ecosystem model specialist and institute PI for DTU Aqua, e.g MEECE (Marine Ecosystem Evolution in a Changing Environment, 2008-2013, FP7-ENV), OPEC (OPerational ECology: Ecosystem forecast products to enhance marine GMES applications, 2012-2015, FP7-SPACE), VECTORS (Vectors of Changes in Marine Life, Impact on Economic Sectors, 2011-2015, FP7-OCEAN), MyOcean 1, 2 and FO, (2008-2015, FP-SPACE), MESMA (Monitoring and Evaluation of Spatially Managed Areas, 2008-2013, FP7-ENV), CoCoNET(Towards COast to COast NETworks of marine protected areas, 2012-2016, FP7-OCEAN) and BalticCheckpoint (Sea-basin checkpoints, 2015-2018, MARE/2014/09), as well as several influential danish projects, e.g. IMAGE (Integrated management of agriculture, fishery, environment and economy, 2014-2016, Danish Environmental Protection Agency) and SUNFISH (Sustainable fisheries, climate change and the North Sea ecosystem, 2008-2013, Danish Council for Strategic Research)

2. Asbjorn Christensen develops a novel software platform in collaboration with Anchor Lab K/S, Denmark (2014 -) integrating near real time and historic observations with ecosystem model output for optimization of fisheries effort.

3. Asbjorn Christensen has a lead role in developing several research ecosystem models, e.g. IBMlib (hydrodynamic particle tracking software library for individual-based modelling (2005-, Can. J. Fish. Aquat. Sci. 65: 1498 (2008)), SPAM (Sandeel Population Analysis Model): Spatial life cycle population dynamics simulation tool, using input from IBMlib (2008 - , Ocean Science 9: 261 (2013)), LPP (Larval Predation Model). Size-based larval community model for spatiotemporal larval zooplankton grazing (2011-, Progress in Oceanography 124: 7891 (2014))

4. Per Knudsen was coordinator in EU projects GOCINA and GOCINO as well as in ESA projects GUTS and and GUT on the use of altimetry jointly with GOCE geoid for ocean circulation. Coordinator of the EU-FP7 LOTUS project (FP7-SPACE-2012-1) focusing on Sentinel-3. He also participated in MyOcean

1, 2 and FO, (2008-2015, FP-SPACE), the MONARCH-A project (FP7-SPACE-2009-1) and currently in EfficienSea 2 (H2020-MG-2014_TwoStages).

5. Shfaqat Abbas Khan has collaborated with Danish and US partners on the establishment and use of GPS stations in Greenland for monitoring ice sheet mass changes. He is the prime scientist from DTU Space contributing to the US NSF funded project GNET for demonstrating the capabilities of using GPS for monitoring the ice sheet in Greenland.

Significant infrastructure, and/or major items of technical equipment:

Intensive ecosystem model runs and development for the project can be performed at the DTU high-performance computing center. DTU owns 12 permanent GPS stations and 4 tide gauges in Greenland. In addition, DTU jointly with US partners operates about 60 GPS stations in Greenland.

8. Aarhus University (AU)

Expertise and experience of the organization

Aarhus University has 37,500 students; about 1,900 PhD students - of which one in four has a foreign nationality - and close to 700 postdoctoral scholars together with 8,000 employees (2012). AU has four faculties which cover the entire research spectrum – basic research, applied research, strategic research and research based advice to the authorities.

In recent years AU has been moving up the most important university ranking lists. In 2014 the university was number 68 at the Leiden Ranking, and number 138 of 17,000 universities on the Times Higher Education World University Ranking (2013). In 2015, AU was no. 27 on the U.S. News Best Global Universities ranking list and no. 7th in Europe within the subject Environment/Ecology (http://www.usnews.com/education/best-global-universities/search?region=europe&subject=environment-ecology&name=). Internationalization is part of the University's mission and it continuously works to strengthen the international profile of the University through a series of initiatives which will increase international research partnerships and the number of international students. The University is involved in environmental monitoring and impact assessments and advices the Danish and Greenlandic Governments on numerous issues related to climate and environment. Aarhus University has the established Arctic Research Centre (ARC) in order to address on-going changes in the Arctic from a multidisciplinary perspective, comprising academics from social, natural, and health sciences. ARC is partner in the Arctic Science Partnership (www.asp-net.org) which is a research and training collaboration between University of Manitoba, Canada, the Greenland Institute of Natural Resources and ARC.

Role in the project

Institute of Bioscience and the Arctic Research Centre will be involved in WP 3, deploying new monitoring systems to improve the existing climate monitoring program Greenland Ecosystem Monitoring (www.G-E-M.dk). We will also contribute to WP6 demonstrating how ecosystem models and existing Arctic observation systems can be used to synthesize data and improve decision making by various stakeholders primarily in Greenland.

Key personnel CVs

Dr. Mikael K. Sejr (M) is head of the Marine Monitoring program in East Greenland. He will co-lead WP6 and be responsible for the implementation of new equipment in the existing GEM program in WP3. He has worked in previous Arctic EU projects (Arctic Tipping Points) and has large experience in leading projects and field work in the Arctic. He works with carbon cycling the Arctic coastal areas and has contributed to several national and international assessments on impacts of climate change. He holds a Ph.D. in Arctic marine ecology.

Dr Marie Maar (F) is a Senior Researcher at the Department of Bioscience, Aarhus University. She has >12 years experience within ecosystem modelling and is the scientific coordinator of the Marine Ecological Modelling Centre in Denmark. She will co-lead task 6.2 and be responsible for the demonstration study of integrating new AIOS data into ecosystem modelling in Greenland fjords. She has participated in 7 EU funded projects and 10 National funded projects, and was internal project lead on 7 projects. 36 published articles, total citations= 565, H-index=15 (Web of Science) and 19 (Google Citations).

Dr Eva Friis Møller (F) is Senior Researcher at the Department of Bioscience, Aarhus University, and will contribute to WP6. She has 15 years of experience in Arctic marine ecology, including laboratory work, field studies and modelling. Involvement in various EU projects including the Arctic component in EUROBASIN (2011-2014) and ATLAS (2015-2019) and a number of national projects. Contributions to several ecosystem impact assessments. 41 published articles, total citations= 697, H-index=19 (Web of Science 19/01/16, Web of Science Researcher ID: I-7468-2013).

Publications, and/or products, services or other achievements:

1. Wassmann P, Duarte CM, Agusti S, Sejr MK (2011) Footprint of climate change in the Arctic marine Ecosystems. Global Change Biology 17:1235-1249
2. Sejr MK, Krause-Jensen D, Dalsgaard T, Ruiz-Halpern S, Duarte CM, Middelboe M, Glud RN, Bendtsen, J, Balsby TJS, Rysgaard S (2014) Seasonal dynamics of autotrophic and heterotrophic plankton metabolism and pCO2 in a subarctic Greenland fjord. Limn Oceanogr 59:1764-1778
3. Renaud P, Sejr MK, Bluhm BA, Sirenko B, Ellingsen IH (2015) The future of Arctic benthos: Expansion, invasion and biodiversity. Progress in Oceanography doi.org/10.1016/j.ocean.2015.07.007
4. Maar M, EF Møller, Z Gürkan, S Jónasdóttir, TG Nielsen (2013) Sensitivity of Calanus finmarchicus and Calanus helgolandicus distributions to environmental changes in the North Sea. Progress in Oceanography 111: 24-37
5. Møller EF , Maar M, Jónasdóttir S, Nielsen TG, Tönnesson K (2012) The effect of changes in temperature and food on the development of Calanus finmarchicus and Calanus helgolandicus populations. Limnology and Oceanography 57: 211-220

Projects, and/or activities:

1. The Baffin Bay System Study, 2016-2018.
2. Impacts of glacial meltwater on coastal carbon cycling, 2015-2018.
3. Vectors of Changes in Marine Life, Impact on Economic Sectors (Vectors, FP7-OCEAN), 2011-2015.
4. European Basin-scale Analysis, Synthesis and Integration (EURO-BASIN, EU-FP7), 2011-2014.
5. Marine Arctic Spatial modelling, Danish Environmental Protection Agency, 2014-2016.

Significant infrastructure, and/or major items of technical equipment:

AU manages three major field stations in East Greenland (Daneborg, Zackenberg and Station Nord). At Daneborg AU manages the research vessel R/V Aage V Jensen. In relation to the GEM monitoring program we are responsible for the marine infrastructure in terms moorings and other instruments

9. Geological Survey of Denmark and Greenland (GEUS)

Expertise and experience of the organization

The Geological Survey of Denmark and Greenland, GEUS, is a research and advisory institute in the Danish Ministry of Climate and Energy also operating in the private sector, with a staff of 350 where approx. 200 hold PhD or MSc degrees. GEUS' overall mission is to provide, use, and disseminate knowledge of geological materials, processes and relations that is important for the use and protection of geological resources in Denmark and Greenland, supporting administrative and legislative work in Danish Ministries and the Greenland Home Rule Authority. GEUS' main tasks are geological mapping, data collection and storage, to carry out research projects, to give advice, and to disseminate geoscientific knowledge. The survey's annual turnover is approx. 30 mill. Euro. Governmental appropriations comprise ca. 60-65 % while other public funding, mainly from research programmes and commercial consulting work, account for ca. 35-40 %. GEUS has carried out extensive field programmes in Greenland for >60 years and heads the National Monitoring Programme for the Greenland Ice Sheet. As a government funded research institute, GEUS has accounting procedures that meet EU requirements and has EU-specialized accountants to help with financial management of EU projects.

Role in the project

GEUS leads WP3 & the Glaciology Theme in INTAROS. Planned integration efforts in INTAROS revolves around connecting the Danish governmental Programme for Monitoring of the Greenland Ice Sheet (PROMICE) with other Arctic observation networks (WP2, WP3), in order to produce improved climate services for society and establish a sustained monitoring of the connection between the Greenland Ice Sheet with the surrounding ocean and atmosphere (WP6). Additionally, GEUS will provide fundamental knowledge on how to successfully monitor seismicity and collect the data needed for geohazard monitoring in the Arctic (WP2, WP7). Based on GEUS' permanent earthquake monitoring in Greenland, GEUS will provide the tools and the experience to extend earthquake monitoring and geohazard evaluation into the Arctic (WP2, WP3). Furthermore, GEUS will use its experience from community-based surveys in Greenland following major earthquakes to enhance community-based observation programs (WP4).

Key personnel CVs

Dr. Andreas P. Ahlstrøm, Senior Scientist (M) Phys.Geography/Geophysics, PhD (2003). 39 peer-rev. papers (co)authored, >20 years field experience; Design/management of the Danish national monitoring programme for the Greenland ice sheet PROMICE (Lead 2007-12) and the monitoring programme GlacioBasis, NE Greenland (Co-lead); WP Leader EU FP7 Ice2sea (2009-2013), Theme & Outreach Leader Nordic Centre of Excellence SVALI (2010-2016); Consultancy on mining and hydropower in Greenland; Ministerial advisor on UN-FCCC; Four E-learning outreach projects; Appointed to AMAP Climate Expert Group (Arctic Council); Natl. Rep. to IASC Network on Arctic Glaciology (Chairman 2008-2012), Intl. Assoc. of Cryospheric Science & Intl. Glaciological Society.

Dr. Jason E. Box, Professor (M) Phys.Geography/Atmospheric&Oceanic Sciences, PhD (2001). 92 peer-reviewed papers (co)authored, >20 years field experience; Installed/management the US Greenland Climate Network (GC-Net) of automatic weather stations 1995-2005; PI Danish Council for Independent research (Grant 4002-00234) (2014-2018); PI Geocenter Denmark grant (2013-2017), 5 M USD external grants in the US from 2003-2012. Extensive experience using optical remote sensing, regional climate model output, and surface meteorological station data in climate studies; American Geophysical Union Cryosphere Focus Group Chair (2011-2012).

Dr. Michele Citterio, Senior Scientist (M) Earth Sciences, PhD (2006). 29 peer-reviewed (co)authored papers, >10 years of field experience in glaciated environments, in the hardware and software design and operation of automatic weather stations (AWS) and related sensors, and in glaciological applications of optical remote sensing, GIS and GPS techniques. PI of the GlacioBasis Monitoring Programme (2008-ongoing, 1 M EUR) and researcher with the Programme for monitoring the Greenland ice sheet (PROMICE). Steering Group member of the World Meteorological Organization Global Cryosphere Watch (WMO-GCW).

Dr. Robert S. Fausto, Scientist (M) Physics-Geophysics, PhD (2009). 26 peer-reviewed papers (co)authored, more than 10 years of field experience in glaciated environments. Principal investigator on the Danish Prodex-CryoClim grant, researcher on the Danish Council for Independent research (Grant 4002-00234) (2014-2018) and the Programme for monitoring the Greenland ice sheet (PROMICE) grant. Experience in sensor development for automated ice ablation measurements, ice sheet and regional climate model development, and using optical remote sensing and automatic weather stations data for cryospheric and climate related studies.

Dr. Anne M. Solgaard, Scientist (F) Physics-Geophysics, PhD (2012). Solid background in development and application of ice flow models including ice sheet-atmosphere interaction, the history of the Greenland Ice Sheet and coupling between ice flow and atmospheric models for use in millennium-scale experiments. Glaciological field work experience from Greenland, Svalbard and Norway.

Dr. Peter Henrik Voss, Scientist (M) Geophysics, PhD (2005). 15 years of experience with seismology and has participated in more than a dozen field campaigns including several in Greenland. Main collaborator in the earthquake monitoring of earthquakes in Greenland, including experience in real time data handling and processing. Participated in WG1 (Seismological Observatories and RIs) of the European Plate Observing System (EPOS) Preparatory Phase project.

Dr. Trine Dahl-Jensen, Senior Scientist (F) Geophysics, PhD (1989). >30 years of experience in marine & onshore fieldwork in the Arctic, both active source and passive source seismology, most as PI or co-PI. Experienced in analysing both marine wide-angle data and earthquake data for large-scale structure, mainly in and around Greenland. Danish PI for GLISN, which is a collaboration of 10 nations operating seismological monitoring stations in Greenland.

Dr. Tine B. Larsen, Senior Scientist (F) Geophysics, PhD (1996). Expertise in seismology and modelling, incl. seismicity of Denmark and Greenland, glacial earthquakes, teleseismic surface waves, and seismic monitoring. Greenland Lithosphere Analysed Teleseismically on Ice (GLATIS) co-PI (1999-2002), Glacial Earthquakes – a new tool for monitoring climate change and ice streams? (2005-2006), East Greenland glacier dynamics: earthquakes, climate change and uplift in an interdisciplinary study (EGGCITE, 2007-2010). Participant in the Greenland Ice Sheet Monitoring Network project (GLISN, 2009-).

Dr. Thomas Funck, Senior Scientist (M) Geophysics, PhD (1996). 26 years of experience with ocean bottom seismometer work and participated in 27 marine expeditions (6 as chief or co-chief scientist). Main collaborator in the Continental Shelf Project of the Kingdom of Denmark with extensive work in the Arctic, including active source seismic experiments with seismometer deployment on the sea ice and use of sonobuoys. WP leader for the Tectonostratigraphic Atlas of the NE Atlantic Ocean.

Publications, and/or products, services or other achievements:

1. Andersen, M.L., L. Stenseng, H. Skourup, W. Colgan, S.A. Khan, S.S. Kristensen, S.B. Andersen, J.E. Box, A.P. Ahlstrøm, X. Fettweis, R. Forsberg (2015) 'Basin-scale partitioning of Greenland ice sheet mass balance components (2007-2011)', Earth and Planetary Science Letters, Volume 409, 89–95, doi:10.1016/j.epsl.2014.10.015.
2. Box, J.E., W. Colgan. 2013. Greenland ice sheet mass balance reconstruction. Part III: Marine ice loss and total mass balance (1840–2010). Journal of Climate, 26, 6990–7002. doi:10.1175/JCLI-D-12-00546.1.
3. Clinton, J.F., Nettles, M., Walter, F., Anderson, K., Dahl-Jensen, T., Giardini, D., Govoni, A., Hanka, W., Lasocki, S., Lee, W.S., McCormack, D., Mykkeltveit, S., Stutzmann, E., Tsuboi, S., 2014. Seismic Network in Greenland Monitors Earth and Ice System. Eos, Transactions American Geophysical Union, 95, 13-14.
4. Nettles, M., Larsen, T. B., Elosegui, P., Hamilton, G.S., Stearns, L.A., Ahlstrøm, A.P., Davis, J.L., Andersen, M.L., de Juan, J., Khan, S.A., Stenseng, L., Ekström, G., Forsberg, R., 2008: Step-wise changes in glacier flow speed coincide with calving and glacial earthquakes at Helheim Glacier, Greenland. Geophysical Research Letters, 35, L24503.

Projects, and/or activities:

1. The GLISN (Greenland Ice Sheet Monitoring Network) project has established a real-time sensor array of 33 stations to upgrade the Greenland seismic infrastructure for detecting & locating glacial earthquakes and other cryo-seismic phenomena. Telemetry gives resolving capability & rapid scientific response. Free data: http://glisn.info/
2. The Programme for Monitoring of the Greenland Ice Sheet (PROMICE) monitors changes in the mass budget of the Greenland ice sheet loss, quantifying both the surface melt and the iceberg loss by a network of weather stations in the melt zone, satellite imagery, on-ice GPS, airborne laser and radar surveys. Free data: http://promice.org
3. GEUS is a partner in the ESA Ice Sheets Climate Change Initiative which includes the Greenland Ice Sheet as a monitored Essential Climate Variable (ECV) incl. surface elevation, ice velocity, calving front location, grounding line location & gravimetry mass balance. Free data: http://www.esa-icesheets-greenland-cci.org/

Significant infrastructure, and/or major items of technical equipment:

Seismic network in Greenland: As the national authority for earthquake monitoring in Greenland GEUS is operating a net of permanent seismic broad band stations in Greenland; the data from these stations are open and freely available, along with the seismic stations in the GLISN project, see http://glisn.info/.

Weather and mass balance stations network on the Greenland ice sheet: GEUS operates the permanent national AWS network of the Programme for Monitoring of the Greenland Ice Sheet (PROMICE) with free data access on http://promice.org.

10. Finnish Meteorological Institute / Ilmatieteen Laitos (FMI)

Expertise and experience of the organization

The Finnish Meteorological Institute (FMI) is a research and service agency under the Ministry of Transport and Communications. FMI has a staff of approximately 700 employees, half of them working in the Research and Development division. FMI produces weather and marine forecasts and services for the needs of safety, transport, the economy and citizens. It acquires and maintains reliable information on the physical state and chemical composition of the atmosphere and of the seas, as well as their impacts on the various sectors of Finnish society and internationally. FMI performs and advances research on the atmosphere, physical oceanography, polar areas and the near-space as well as many other related issues. It combines its know-how into consultancy and development services in Finland and abroad, notably regarding issues pertaining to the environment, the transport sectors, and generic weather related security.

Role in the project

FMI leads WP2 in INTAROS. In WP1, FMI will assess the impact of assimilating new in situ and atmospheric profiles on the forecast of near-surface parameters in the Arctic, and will contribute to development of a long-term implementation strategy for the integrated Arctic observing system in collaboration with ENVRIplus. The planned activities in WP2 include assessment and exploitation of the in situ atmospheric composition and cloud data belonging to main infrastructures/networks in the Arctic, contribution to the assessment and integration of in situ snow observations, and evaluation and exploitation of existing and emerging remote sensing snow products. FMI will also collaborate with MISU and SMHI to perform the gap analysis of the atmospheric observational network from the point of view of weather prediction, and to assess the quality of satellite hyperspectral infrared sensors and satellite-based cloud products. FMI will contribute to WP3 by providing specialized instruments/infrastructures for the measurement and calibration of snow, surface spectral/broadband albedo, cloud properties, atmospheric composition and snow/sea ice thickness. Through its involvement in the ENVRIplus program, FMI will ensure that the integration of the Arctic Observing System in WP5 will be done in coordination with ENVRIplus activity. In WP6, the integrated data will be applied by FMI to improve the satellite based sea ice concentration and thickness products applied by Operational Ice Services in the Arctic, and to improve the forecast of extreme precipitation events in Svalbard, providing better forcing for avalanche forecast models. FMI will take part on the education and dissemination effort of INTAROS (WP7) by contributing to the organization of two summer schools (in Svalbard and in the FMI Arctic Centre of Sodankylä), and of two focused conference sessions.

Key personnel CVs

Dr. Roberta Pirazzini (F) is expert in measurement and modelling of snow albedo and snow physical properties and has authored a dozen of related peer-reviewed publications. She has led and/or carried out several field campaigns in the Arctic, Antarctic, Alps, and in the Baltic Sea ice to address the link between snow properties and albedo. She has contributed to the development of a unique automatic spectro-albedometer (SVC-FMI) at high spectral and temporal resolution covering the whole solar spectrum, and leads the planning and realization of the new radiometric laboratory in FMI. She has participated to the EU projects ARTIST and DAMOCLES and in the Nordic Centre of Excellence SVALI, aiming to improve physical understanding, modeling and observing capability in the Arctic. She is presently vice MC member of the COST Action ES1404 "*A European network for a harmonized monitoring of snow for the benefit of climate change scenarios, hydrology and numerical weather prediction*", coordinated by FMI.

Dr. Bin Cheng (M) Adj. Prof**.** is a sea ice modeler and physicist. He has been working on snow and sea ice thermodynamic modelling as well as in situ observations and field data analyses. He has been working on various National and international research projects funded by EC, (e.g. DAMOCLES), Research Council of Norway (AMORA: Advancing Modelling and Observing solar Radiation of Arctic sea ice—understanding changes and processes), Academy of Finland (CACSI: Changing Arctic Climate System: Interaction of Stratosphere, Troposphere, and Sea Ice) and Chinese Ministry of Science and Technology (Cooperative study on application of multi-satellite remote sensing data for ship navigation in the Arctic Ocean). He has authorship for 52 peer-reviewed publications.

Dr. Tiina Nygård (F) has nearly 10 years of experience in polar meteorology. Her expertise covers both meteorological observations and atmospheric modelling and the research topics span from local boundary layer studies to climatological research. She has been involved in many field campaigns (several scientific cruises, land-based fieldwork, and an aircraft campaign) in the Arctic, and she has an extensive record in university teaching of theory and fieldwork of polar meteorology (at the University Centre in Svalbard and in University of Helsinki). Dr. Nygård has investigated atmospheric vertical structure in the Arctic and Antarctic and has, for example, published the first climatology of humidity inversions in the Antarctic based on radiosoundings. In addition, she has done various model experiments with the mesoscale model WRF and worked with eight different global reanalyses. She has authored 12 peer-reviewed articles.

Dr. Eija Asmi (F) is the head of atmospheric aerosols group of FMI consisting of 20 PhD and PhD students working on aerosol physical and chemical characterization. She is responsible of the measurement networks in Finland and in several stations abroad, including aerosol profiling and airborne observations. Her main expertize is in measurements of polar aerosols and aerosol-cloud interactions. She and her group are responsible for several year-round aerosol observations in the Arctic. She has about 40 published peer-reviewed articles (h-index 17), and she is active in several national and international networks and programs, including ACTRIS-2, Finnish Center of Excellence (FCoE), International Arctic Systems for Observing the Atmosphere (IASOA), and Association for polar early career scientists (APECS).

Adj. Prof. Ewan O'Connor (M) is Tenure-track Professor, he develops and uses new radar and lidar techniques to retrieve cloud, aerosol and turbulent parameters to understand cloud processes and to evaluate and improve numerical weather forecast and climate models. He is responsible for the design and implementation of the Finnish Doppler lidar network, the new ACTRIS/Cloudnet site at Sodankylä, and for the cloud portion of the ACTRIS Data Centre. He has been involved in several international research projects as WP leader, and is chair of the working group on Doppler lidar within EU COST Action TOPROF. He has published over 40 papers, and is currently co-supervising two postgraduates.

Dr. Sanna Sorvari (F) is Research Manager with over 15 years' experience in climate change research. She has coordinated, initiated and planned international and national research activities in environmental science, recently contributing to the establishment of the ESFRI Environmental Research Infrastructures at the national and European level (e.g setting-up ICOS RI and ICOS ERIC, supporting ANAEE and ACTRIS to develop their RI strategies). She has facilitated the collaborative work of Environmetal RIs at the European level (being WP leader for ENVRI, Theme leader for ENVRI+ -projects) and at the international level (being WP leader for COOPEUS-project, COOP+, and member of ICSU-WDS). She is also a member of H2020 Expert Advisory Board for RIs and e-RIs.

Anna Kontu (F) PhD student, has ten years of experience in organizing and performing snow measurement campaigns to study the link between snow properties and microwave and optical remote sensing data. She is experienced in operating active and passive microwave as well as optical instrumentation. She is responsible for snow measurements and microwave observations at FMI Arctic Research Centre in Sodankylä. Her research interests include interaction of microwave radiation with snow cover, soil, and ice-covered water. She has authored or co-authored 15 publications on remote sensing of the cryosphere.

Publications, and/or products, services or other achievements:

1. Vihma, T., **R. Pirazzini**, I. Fer, I. A. Renfrew, J. Sedlar, M. Tjernström, C. Lüpkes, **T. Nygård**, D. Notz, J. Weiss, D. Marsan, **B. Cheng**, G. Birnbaum, S. Gerland, D. Chechin, and J. C. Gascard (2014). Advances in understanding and parameterization of small-scale physical processes in the marine Arctic climate system: a review. Atmos. Chem. Phys., 14, 9403-9450, doi:10.5194/acp-14-9403-2014.
2. Karvonen, J., **Cheng, B**., Vihma, T., Arkett, M., and Carrieres, T. 2012. A method for sea ice thickness and concentration analysis based on SAR data and a thermodynamic model, The Cryosphere, 6, 1507-1526, doi:10.5194/tc-6-1507-2012.
3. **Nygård, T**., Valkonen, T. & Vihma, T. (2014) Characteristics of Arctic low-tropospheric humidity inversions based on radio soundings. *Atmos. Chem. Phys.,* 14:1959–1971. doi: 10.5194/acp-14-1959-2014
4. Raatikainen, T., Brus, D., Hyvärinen, A.-P., Svensson, J., **Asmi, E**., and Lihavainen, H.: Black carbon concentrations and mixing state in the Finnish Arctic, Atmos. Chem. Phys., 15, 10057-10070, doi:10.5194/acp-15-10057-2015, 2015.
5. ESA DUE GlobSnow Climate Data Record on Snow Water Equivalent and Snow Extent: www.globsnow.info.

Projects, and/or activities:

1. H2020 ENVRIplus – Theme leader – The project brings together Environmental and Earth System Research Infrastructures, projects and networks together with technical specialist partners to create a

more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe.

2. H2020 ACTRIS 2 – WP leader – The project integrates state-of-the-art European ground-based stations making long term observations of aerosols, clouds and short lived gases to provide 4-D integrated high-quality data from near-surface to high altitude (vertical profiles and total-column). It consolidates and improves services offered within FP7 funded Integrated Infrastructures Initiative ACTRIS (2011-2015). ACTRIS offers processing and quality assurance protocols to ensure harmonization, systematic and timely collection, calibration and distribution of data/products for atmospheric and climate services. ACTRIS will ensure long-term sustainability through transformation into ACTRIS-ESFRI.
3. FP7 SEN3APP – Coordinator - The project addresses the needs for continuous and accurate monitoring of snow, glaciers, lake-ice, soil (frost) and land cover/forest changes in the Earth's cryosphere, using remote sensing information. The project makes use of the constellation of Sentinel satellites, providing development, implementation and validation of Sentinel data processing lines for cryospheric (terrestrial) and land cover/phenology applications.
4. ESA/SMOS+ Innovation Permafrost and SMOS Frost2- Coordinator -Dedicated project to expand original goals of the SMOS mission to include detection of soil Freezing/Thawing state.
5. Finnish Academy project "Towards better tailored weather and marine forecasts in the Arctic to serve sustainable economic activities and infrastructure" (TWASE) – The project aims to improve the predictability of Arctic weather, marine and sea ice conditions and their consequences on navigation, aviation, and wind energy production by increasing data assimilation and post-processing in NWP systems.

Significant infrastructure, and/or major items of technical equipment:

1. The **FMI Sodankylä-Pallas research station** is a cal/val site for the NASA SMAP and ESA SMOS missions representing the Arctic boreal forest zone. It hosts a unique infrastructure for long-term multidisciplinary measurements: soil, ecosystem, cryosphere, atmosphere (troposphere, clouds stratosphere, ionosphere). The site is part of integrated atmospheric networks such as GAW, ACTRIS, IASOA, ICOS, and EMEP, and provides excellent facilities and technical support for experimental campaigns at a large scale.
2. FMI has installed and is responsible of aerosol particle and greenhouse gas, in addition to some meteorological, measurements and data analysis, management, and processing and storage of data from **two stations in Russian Arctic**: **Tiksi** (since 2010) and **Cape Baranova** (since 2015). FMI measurements in Russia are done in collaboration with AARI, Russia. FMI has also meteorological and turbulent fluxes measurements in Ny Ålesund, Svalbard. FMI has active long-term measurement programs of several atmospheric and cryospheric components also in Antarctica, and is currently active in stations Aboa, Neumayer and Marambio.
3. FMI has a newly equipped **radiometric laboratory** to accurately calibrate radiances or irrandiances and characterize cosine response, temperature dependence, and linearity of spectro/broadband radiometers.
4. FMI hosts the **Finnish National Satellite Data Center (NSDC).** The Centre enables tailored downlink, archiving, processing and dissemination of EO data and products from multiple satellite sensors and operators. FMI has already established co-operation for satellite reception with operators such as ESA, NASA, EUMETSAT and KNMI. Received and archived remote sensing satellite systems include e.g. Cosmo-Skymed, TerraSAR-X, FY-3 (China) and EOS-Aqua.
5. FMI hosts the **Cloudnet portion of the ACTRIS Data Centre**, receiving cloud radar, lidar and microwave radiometer data from 10+ (and increasing) sites across Europe and globally. The Cloudnet database enables processing, synergistic combination and archiving, with dissemination of data and higher level products through the ACTRIS Data Portal.

11. The University Centre in Svalbard (UNIS)

Expertise and experience of the organization

The University Centre in Svalbard in Longyearbyen (UNIS) was established in 1993 to provide university level education in Arctic studies, to carry out high quality research, and to contribute to the development of Svalbard as an international research platform. UNIS is the world's northernmost higher education institution. UNIS offers education and performs research based on Svalbard's location in the High Arctic and the advantages this represents. Located in Longyearbyen in central Spitsbergen, allowing year-round access to a wide range of glacier types in Arctic fjords, access to the Barents-, Greenland and Arctic Ocean, UNIS is well equipped with infrastructure for both marine and terrestrial field, lab and experimental research. UNIS is a highly interdisciplinary institution with four departments representing Biology, Geophysics, Geology and Technology. The Air-Cryosphere-Sea Interaction (ACSI) group at UNIS, lead by Prof. Frank Nilsen, treats the three most dominant geophysical components in the Arctic climate system on Svalbard. There is an urgent need to better understand the dynamical processes behind the variable heat transport to the Arctic, in both the atmosphere and the ocean, and the impact this has on freshwater fluxes from melting snow- and ice masses in the Arctic. These types of interaction studies are conducted through field based research projects and student course activity within the ACSI group at UNIS. Ongoing research activity and infrastructure in the Research Council of Norway project "Remote Sensing of Ocean Circulation and Environmental Mass Changes (REOCIRC)" (led by UNIS) will be brought into INTAROS and be further strengthened through the INTAROS network.

Role in the project

In WP3, Task 3.2, Bottom pressure recorders (BPR) will be deployed by UNIS on Yermak Plateau to investigate remotely sensed ocean circulation by taking advantage of satellite gravimetry and altimetry, and provide ground truth for satellite gravity solutions. The BPR sensors are placed at the edges of the ocean current in order to measure the pressure difference across the current. There are two main branches of interest and the most important one is the West Spitsbergen Current (WSC) that carries warm and saline Atlantic Water (AW) into the Arctic Ocean and the Coastal Current (CC) that transports fresh and cold Arctic Water (ArW) northwards along the coast. UNIS will analyze data, study the dynamics of these currents including air-ice-ocean forcing mechanisms, and combine the data sets with other INTAROS data set in order to understand the variability of the Arctic climate system.

Key personnel CVs

Dr. Frank Nilsen (M), Professor in Physical Oceanography and the Acting Managing Director at UNIS with the leave of absence as the Head of the Arctic Geophysics department at UNIS. Main field of interest is polar oceanography linked to air-ice-ocean interaction processes. Cooling of the Atlantic Water entering the Arctic Ocean through Fram Strait and north of Svalbard is one of the main research interests. Process studies of topographic vorticity waves and eddies along the West Spitsbergen slope gives knowledge and a better understanding of the exchange mechanisms between the deep ocean and shelf areas. Through the REOCIRC project a method is developed for using satellite measurement to estimate the strength of the West Spitsbergen Currents. A new mooring system is designed to validate the satellite data where the main task is to measure the ocean bottom pressure (OBP).

Publications, and/or products, services or other achievements:

1. Onarheim, I. H., L. H. Smedsrud, R. B. Ingvaldsen, F. Nilsen (2014), Loss of sea ice during winter north of Svalbard. Tellus A, 66, 23933.
2. Luckman, A., Benn, D.I., Cottier, F., Bevan, S., Nilsen, F., Inall, M. (2015), Calving rates at tidewater glaciers vary strongly with ocean temperature. Nature Communications. doi 10.1038/ncomms9566.
3. Inall, M. E., F. Nilsen, F. R. Cottier, and R. Daae (2015), Shelf/fjord exchange driven by coastal-trapped waves in the Arctic, J. Geophys. Res. Oceans, 120, doi:10.1002/2015JC011277.
4. Muckenhuber, S., Nilsen, F., Korosov, A., Sandven, S. (2016), Sea ice cover in Isfjorden and Hornsund, Svalbard (2000–2014) from remote sensing data, The Cryosphere, 10, 149-158, doi:10.5194/tc-10-149-2016.
5. Nilsen, F., Skogseth, R., Vaardal-Lunde, J., and Inall, M. (2016), A Simple Shelf Circulation Model - Intrusion of Atlantic Water on the West Spitsbergen Shelf, J. Physical Oceanography, In press.

Projects, and/or activities:

1. Remote Sensing of Ocean Circulation and Environmental Mass Changes (REOCIRC) (RCN), PI (2013-17). Main objective is to study the Absolute Dynamic Topography (ADT) of the West Spitsbergen Current (WSC) by taking advantage of advances in satellite gravimetry (GOCE) and altimetry, and providing ground truth for satellite gravity solutions (GRACE) from in situ ocean bottom pressure measurements.

2. AWAKE-2: Arctic climate system study of ocean, sea ice and glaciers interactions in Svalbard area, PI. Polish-Norwegian Research Fund (198675) (2013-16) The main objective of the AWAKE-2 project is to

understand the interactions between the key components of the climate system in the Svalbard area: ocean, atmosphere and ice to identify mechanisms of climate interannual variability and long-term trends. The key question is how the hydro-glaciological system response to climatic and oceanic changes.

3. The Oceanography of Grønnfjorden and Billefjorden (GrønnBille). To analyse long-term data on variability, patterns and trends in the physical environment affecting the timing of blooms in Billefjorden and Grønfjorden.
4. IPY project Integrated Arctic Ocean Observing System – Closing the loop (RCN) co-PI (2007-10).
5. IPY project Bipolar Atlantic Thermohaline Circulation- BIAC, (RCN) PI of WP2 (2007-10).

Significant infrastructure, and/or major items of technical equipment:

Three moorings across the Yermak Plateau (YP): The two moorings closest to the coast captures the pressure difference across the Coastal Current (CC). The West Spitsbergen Current flows parallel to the CC on the YP and we are able to capture both this current in our mooring section.

12. Nordic Agency for Development and Ecology / Nordisk Fond for Miljø og Udvikling (NORDECO)

Expertise and experience of the organization

Nordisk Fond for Miljø og Udvikling (NORDECO) is registered in Greenland/Denmark as a social enterprise (SME) with headquarters in Copenhagen. NORDECO has 10 staff members and an annual turnover of EUR 1.5M.

NORDECO is an inter-disciplinary organization aimed at developing and applying natural and social science to real-world development challenges. NORDECO develops tools and methods, carries out research, connects persons and institutions, builds capacity, and supports interventions on the ground. Founded in 1991, NORDECO has the declared goal of supporting local, innovative conservation and development initiatives in remote communities.

Globally, NORDECO has spearheaded the development of bottom-up approaches to natural resource monitoring and management, where local people or local government staff are directly involved in data collection and interpretation, and where monitoring is linked to the decisions of local people, using methods that are simple, cheap and require few resources. Such approaches can help generate transparency, accountability and local ownership in sustainable natural resource management initiatives.

NORDECO is coordinating the international Monitoring Matters Network, which involves researchers and practitioners from universities, community-based and non-governmental organizations, and government agencies (www.monitoringmatters.org). The research publications by NORDECO on community-based observing systems are among the most cited in their field and have contributed to changes in national and international policies.

NORDECO is a member of the University of the Arctic and of the Civil Society Organisation Network of the Global Environment Facility, a volunteer structure of GEF-accredited organisations. NORDECOs work is highly interdisciplinary with scholars from sociology, development studies, anthropology, forestry and ecology.

Role in the project

NORDECO will lead WP4 on community-based observing programs. In addition, NORDECO will contribute to showcase ‘real-world’ examples of the benefits of cross-fertilizing indigenous, local and scientific observation systems and connecting with decision-makers in WP6. NORDECO will also assist with outreach and competence-building in WP7. NORDECOs Senior Ecologist Finn Danielsen will be theme leader for community-based systems.

Key personnel CVs

Dr. Finn Danielsen (M) is Senior Ecologist and co-founder of NORDECO. He has been recognized as “*the world leader in the field of participatory monitoring”* (dr. scient. evaluation). In the past 15 years, he has led multiple research and demonstration projects on community-based monitoring and traditional knowledge for the EU, Nordic Council of Ministers, the World Bank and the ministries of foreign affairs of the Nordic countries, some of them with budgets >3M €. He has substantial experience from working together with indigenous and civil society organisations in all 8 Arctic countries. He is Member of Council, Univ. of the Arctic (2012-) and member of two IUCN Specialist Groups. He is reviewer for 25+ international journals, incl. *Science*, *Nature* and *PNAS*. He has been evaluator of EU FP7 proposals. He has a total of 99 publications listed in ResearchGate incl. 3x*Nature*, 3x*Science*. His bibliometrics are: >3,600 citations (adding >450 per year); h-index 23; two papers cited >500 times and 8 >100 times. He is currently 12 among the most cited scientists in the area of natural resource management globally (Google Scholar 2016). He led the establishment of the PISUNA community-based observing program in Greenland with focus on Disko Bay. He also led the European mapping of community-based monitoring and Traditional Knowledge programs in the Arctic for EU DG Mare, and he authored the chapter on community-based observing for the Arctic Biodiversity Assessment, Arctic Council. He is associate editor of *Conservation Letters* and *Citizen Science Theory and Practice*.

Dr. Martin Enghoff (M) is Senior Social Scientist with substantial experience from working with participatory natural resource management in the Arctic, Sub-Saharan Africa, South East Asia, South Asia, and Europe. He has participated in the a number of EU funded projects in the Arctic and has worked extensively with institutions like the World Bank, EU, Nordic Council of Ministers and the ministries of foreign affairs in the Nordic countries. His key expertise includes local development, institutional performance, participatory tools development and capacity building. Experience from several seasons of field work in Greenland with focus on communities in Disko Bay.

Mr. Michael Køie Poulsen (M) is Senior Ecologist. Community-based monitoring and management is his special interest. He has unsurpassed practical experience from five continents in involving local communities in establishing simple cost-effective participatory monitoring for improved management of natural resources. Experience from several seasons of field work in Greenland with focus on communities in Disko Bay and Upernavik.

Publications, and/or products, services or other achievements:

1. Johnson, N., Danielsen, F., Pulsifer, P. et al. (2016). Community-Based Monitoring in a Changing Arctic: A Review for the Sustaining Arctic Observing Networks. Final report of Sustaining Arctic Observing Networks Task #9. 71 pp. March 2016. Ottawa: Inuit Circumpolar Council.
2. Johnson, N., Danielsen, F., Pulsifer, P. et al. (2015). The contributions of community-based monitoring and traditional knowledge to Arctic observing networks: Reflections on the state of the field. Arctic 68, 28–40.
3. Danielsen, F., Enghoff, M. et al. (2014). Counting what counts: using local knowledge to improve Arctic resource management. Polar Geography 37, 69–91.
4. Danielsen, F. et al. (2013). Linking public participation in scientific research to the indicators and needs of international environmental agreements. Conservation Letters 7, 12-24.
5. Danielsen, F. et al. (2010). Environmental monitoring: the scale and speed of implementation varies according to the degree of peoples involvement. Journal of Applied Ecology 47: 1166–1168.

Projects, and/or activities:

1. Community-based monitoring and Traditional Knowledge program in Northwest Greenland with focus on the communities in Disko Bay. 'Protecting Biodiversity and Creating Multiple Benefits for Local Communities in Greenland' (EU OROCT BEST grant, € 0,3 mio., 2012-2016). NORDECO is PI.
2. Enhancing the use of indigenous and local knowledge to guide Arctic resource management, 'Nordic Resource Management', w/20 partners in 8 countries (Nordic Council of Ministers, € 0,3 mio., 2015-2017). NORDECO is PI.
3. 'Monitoring Matters: Comparative Analysis of Innovative Approaches. Global Comparison of the Accuracy of Community Based Observing' (Danida's Research Council, € 1,2 mio., 2007-10). NORDECO was Co-PI.
4. 'Opening Doors to Native Knowledge' - Greenland (Nordic Council of Ministers, € 2,1 mio., 2009-2011) and Arctic Russia (€ 1,2 mio., 2013-2014 and 2016). Field activities Northwest Greenland. NORDECO was PI.
5. 'Study on Local and Traditional Knowledge in the EU Arctic' (EU DG Mare € 0,1 mio., 2013-2014). NORDECO was Team Leader for the mapping of CBM programs under COGEAs framework contract with DG Mare).

Significant infrastructure, and/or major items of technical equipment:

www.arcticcbm.org Live map of 81 community-based monitoring and Traditional Knowledge programs in the Arctic.

Spectrum of community-based observing approaches which is widely used by scholars and practitioners ("Local participation in natural resource monitoring: a characterization of approaches". F. Danielsen, M. Enghoff, M. Poulsen *et al.* 2009. *Conserv. Biol.* 23, 31-42). This and the related 21 papers have been cited >1000 times (GoogleScholar).

Community-based observing programs have been established with local partners among indigenous and civil society organizations, government departments and scientists in >10 countries on five continents, including Greenland (www.pisuna.org). Several schemes continue without external involvement, >10 years after they were established.

Sub-contractor: Exchange for Local Observations and Knowledge of the Arctic (ELOKA)

Expertise and experience of the organization

Established in 2006 and primarily funded by the National Science Foundation, ELOKA's mission is to provide data management and user support to facilitate collection, preservation, exchange, and use of local and traditional knowledge of the Arctic. In support of community partners ELOKA stewards a wide variety of information resources. This includes the Yup'ik Environmental Knowledge Project led by Calista Education and Culture, the SIZONet observing application, and an online application documenting community-based observing programs across the Arctic (http://arcticcbm.org). In addition to our technical work, ELOKA has hosted many workshops over many years to facilitate collaboration and expand our understanding within the field (see http://eloka-arctic.org/outreach).

Role in the project

Dr. Pulsifer and his colleagues in ELOKA will: (i) facilitate outreach to indigenous and civil society organisations engaged in community-based observing, advance tools for cross-fertilizing indigenous and local knowledge with scientific knowledge, and facilitate making community-based observations accessible for iAOS (WP4), and (ii) facilitate competence-building and experience-exchange among civil society organisations (WP7).

Key personnel CVs

Dr. Peter Pulsifer (M) is a research scientist at the National Snow and Ice Data Center, U.S.A. Here he leads ELOKA. His research addresses questions around computer-based information representation with a particular focus on interoperability. As an applied researcher, for 17 years Dr. Pulsifer has focused on theory and practice in the context of polar information management, incl. community-based observing systems. Recently, he has worked with members of Arctic communities to facilitate the sharing of local observations and indigenous knowledge. As Chair of the international Arctic Data Committee, and now the co-chair of the Interagency Arctic Research Policy Committee (U.S.A.), he is central in the coordination of polar data.

Publications and projects

1. Pulsifer, P. et al. (2014). Towards an International Polar Data Coordination Network. Data Science Journal, 13, 94–102.
2. Pulsifer, P. et al., Eds. (2014). Special Issue 'Local Knowledge and Data Management in the Arctic'. Polar Geography, 36 (1).
3. Pulsifer, P. et al. (2012). The role of data management in engaging communities in Arctic research. Polar Geography, 35(3) 1-20.
4. Pulsifer, P. et al. (2011) Towards an Indigenist Data Management Program. The Canadian Geographer, 55(1) 108-124.
5. Pulsifer, P. et al. (2010). Creating an Online Cybercartography Atlas of Indigenous Sea Ice Knowledge and Use. In Krupnik, I. et al. (Eds.), Arctic Residents Document Sea Ice and Climate Change. Berlin: Springer.

Projects include: (i) Atlas of Community Based Monitoring and Traditional Knowledge in a Changing Arctic (http://arcticcbm.org) to showcase the many community-based monitoring (CBM) and traditional knowledge (TK) initiatives across the circumpolar region; (ii) The Seasonal Ice Zone Network (SIZONet) application containing thousands of community-based observations of coastal Alaska (http://eloka-arctic.org/sizonet/); and (iii) The Yup'ik Environmental Knowledge Project (https://eloka-arctic.org/communities/yupik).

Significant infrastructure

ELOKA has developed (i) a content management system optimized to represent local and traditional knowledge; (ii) a framework and methodology for establishing highly interactive, media rich online mapping applications; and (iii) a repository system optimized for long-term preservation and stewardship of quantitative and qualitative data to ensure that these data can be accessed for decades to come.

Sub-contractor: Center for Support of Indigenous Peoples of the North (CSIPN)

Expertise and experience of the organization

Center for Support of Indigenous Peoples of the North (CSIPN) is a non-governmental organization focused on promotion of indigenous peoples' rights and advancing the economic, social and cultural development of the indigenous communities of the Russian North, Siberia and the Far East by providing capacity building, advocacy and support services. It's ultimate objective is to ensure indigenous peoples' sustainability by being directly involved in development matters and to ensure their participation in the decision-making processes at the international, national and local levels. The headquarters is located in Moscow. CSIPN has a special consultative status under the ECOSOC of the United Nations. The Center is member of the University of the Arctic. Key areas of work include finding solutions to the question of economic survival and sustainable development for northern peoples. CSIPN leads national and international projects on indigenous rights, indigenous knowledge, climate change monitoring, regional and local sustainable development strategies, co-management, and ecotourism development.

Role in the project

Dr. Sulyandziga and his staff and volunteers in CSIPN will: (i) facilitate outreach to indigenous and other civil society organisations engaged in community-based observing and advance tools for cross-fertilizing indigenous and local knowledge with scientific knowledge (WP4), and (ii) facilitate competence-building and experience-exchange among civil society organisations (WP7).

Key personnel CVs

Dr. Rodion Sulyandziga (M) is Director of the Center. His work focus on Indigenous People (IP) rights and community sustainable development. For >20 years, he led projects on strengthening IP rights, knowledge, and community-based observing and management.

Publications and projects

Dr. Sulyandziga is an Editor-in-Chief of book series titled "Indigenous Peoples' Library" that is very popular in the Russian indigenous society. He recently headed the international projects: (i) Development of Water-Power Engineering in Siberia: (ii) Socio-Cultural and Environmental Security; (iii) Innovative Model of Aboriginal Ecotourism in Russia; (iv) Indigenous Monitoring and Education on Climate Change: from Grassroots Measures to State Adaptation Plan; and (v) Initiatives of the Indigenous Peoples of the Russian Arctic under Climate Change Conditions. At present, he leads the international project "Co-management model as an innovative response to the new challenges to Russian indigenous communities".

Sub-contractor: Yukon River Inter-Tribal Watershed Council (YRITWC)

Expertise and experience of the organization

The Yukon River Inter-Tribal Watershed Council (YRITWC) is an indigenous grassroots non-profit organization, consisting of 73 First Nations and Tribes, dedicated to the protection and preservation of the Yukon River Watershed. The YRITWC provides Yukon First Nations and Alaska Tribes with technical assistance, such as facilitating the exchange of information, coordinating efforts between First Nations and Tribes, undertaking research, and providing training, education and awareness programs. An important area of work is community-based water quality monitoring to detect changes in the landscape and to guide resource management.

Role in the project

Ms. Fidel and her colleagues and volunteers in YRITWC will: (i) facilitate outreach to indigenous and civil society organisations engaged in community-based observing and advance tools for cross-fertilizing indigenous and local knowledge with scientific knowledge (WP4), and (ii) facilitate competence-building and experience-exchange among civil society organisations (WP7).

Key personnel CVs

Maryann Fidel (F) is an interdisciplinary Environmental/Social Scientist. She is responsible for indigenous knowledge aspects of research projects, coordinating with Tribes, and GIS mapping of traditional values. Her work addresses socio-cultural effects of climate change, co-production of data products that address decision-making, socio-spatial analysis, building capacity of indigenous peoples to conduct relevant research, community-based observing, and social science using both quantitative and qualitative methods. In the past she worked at the Aleut International Association (5 years) where she managed international community-based monitoring efforts in the Bering Sea. She developed an innovative mapping technique for summarizing community-mapped information for use in decision-making (Fidel *et al.* 2012). She supervised a network of 8 indigenous communities.

Publications and projects

1. Alessa, L., Fidel, M. *et al.* (2015) The role of Indigenous science and local knowledge in integrated observing systems. *Sustainability Science* 10:2. DOI 10.1007/s11625-015-0295-7
2. Fidel, M. *et al.* (2014) Walrus harvest locations reflect adaptation *Polar Geography* 37:48-68
3. Hughes, L., Fidel, M. *et al.* (2013) Arctic marine subsistence use mapping: Tools for communities. *Environmental Law Reporter* 43:10909-10924
4. Huntington, H., Fidel, M. *et al.* (2013) Mapping human interaction with the Bering Sea ecosystem. *Deep Sea Research II* 94:292-300.
5. Fidel, M. *et al.* (2012) Subsistence Density Mapping Brings Practical Value to Decision Making. In: *Fishing People of the North.* University of Alaska Fairbanks.

In 2006, YRITWC established the Indigenous Observation Network (ION), one of the largest indigenous observation networks in the world, to conduct large-scale water quality monitoring.

13. Swedish Meteorological and Hydrological Institute / Sveriges Meteorologiska och Hydrologiska Institut (SMHI)

Expertise and experience of the organization

SMHI is a government agency under the Swedish Ministry of Environment offering products to support decision-making in the environmental sector. SMHI is responsible for national meteorological, hydrological and oceanographic monitoring, forecasting and production of climate change projections, and operates the dissemination of flood alerts to other EU member states in the EFAS system for EU Copernicus. The main fields of research include weather and climate modelling, data assimilation, hydrology, oceanography and air quality. Climate research is a cross departmental activity, with all six research sections contributing to the development of climate projections, impact assessments and communication with stakeholders, regional authorities and major utilities. Overall, SMHI has a strong R&D focus with 110 full time scientists and just as many in IT. Currently, it is adapting according to EU open data strategy and the INSPIRE directive with open archives in standard formats, metadata catalogues, download facilities and APIs. SMHI is active in many EU (FP7 and Horizon2020), Copernicus and ESA projects, and is representing Sweden in relevant international organisations, e.g. ECMWF, WMO, EUMETSAT and IPCC.

Role in the project

SMHI will be involved in WP2 and WP6 of INTAROS, contributing with observation system analysis, improved exploitation of in-situ and remote sensing data, as well as demonstration of the impact of an integrated Arctic Observation System within the fields of atmospheric remote sensing, hydrological monitoring and modelling, and climate modelling. SMHI contribution is based on strong involvement in Arctic climate, meteorology and hydrological and research through previous and ongoing projects, for instance WMO Arctic HYCOS.

Key personnel CVs

Dr. Ralf Döscher (M) is Science Coordinator of the Rossby Centre with a background in coupled climate modelling. Ralf is chair of the EC-Earth Earth System Model consortium since 2014. Recent research activities cover studies of climate processes by regional downscaling, climate prediction and ESM development. Ralf co-coordinated the EU project DAMOCLES. He is also involved in a range of national and international projects and networks, such as FP7 EMBRACE and the ongoing H2020 CRESCENDO and PRIMAVERA.

Dr. David Gustafsson (M) is a Research Leader in the Hydrology Research Unit at SMHI. David has a background in modelling cold climate hydrological processes, and is now working with in-situ and satellite data assimilation in hydrological models. He is currently involved in the EU projects CryoLand.

Dr. Abhay Devasthale (M) is a Senior Research scientist in the Atmospheric Remote Sensing group, specialized in satellite-based observations of clouds and thermodynamics (temperature and humidity). He is currently leading GlobRAD project that is focused on investigating global radiative heating/cooling effects from satellites and is funded by Swedish Space Board. He is also a SMHI member of EUMETSAT's Satellite Application Facility on Climate Monitoring (CM-SAF) and ESA's Climate Change Initiative (ESA CCI Clouds).

Dr. Mihaela Caian (F) – Senior Research Scientist at Rossby Centre/ SMHI. Mihaela has large experience in global and regional climate modelling and works presently on decadal climate prediction. She is particularly involved in improving the initialization of the EC-Earth decadal prediction system. She is involved in the EU-projects SPECS, EMBRACE and PRIMAVERA.

Publications, and/or products, services or other achievements:

1. Magnusson J, Gustafsson D, Hüsler F, Jonas T (2014): Assimilation of point SWE data into a distributed snow cover model comparing two contrasting methods. WRR, 50.
2. Andersson JCM, Pechlivanidis IG, Gustafsson D, Donnelly C, and Arheimer B (2015). Key factors for improving large-scale hydrological model performance European Water 49:77-88.
3. Devasthale, A., et al., A decade long spaced based observations of the Arctic troposphere: novel insights from the Atmospheric InfraRed Sounder instrument, BAMS, under revision, 2016.
4. Devasthale, A., Sedlar, J., Koenigk, T., and Fetzer, E. J.: The thermodynamic state of the Arctic atmosphere observed by AIRS: comparisons during the record minimum sea ice extents of 2007 and 2012, Atmos. Chem. Phys., 13, 7441-7450, doi:10.5194/acp-13-7441-2013, 2013.
5. Döscher, R., Vihma, T., and Maksimovich, E.: Recent advances in understanding the Arctic climate system state and change from a sea ice perspective: a review, Atmos. Chem. Phys., 14, 13571-13600, doi:10.5194/acp-14-13571-2014, 2014.

Projects, and/or activities:

1. IMPREX (IMproving PRedictions and management of hydrological Extremes) will improve forecast skill of meteorological and hydrological extremes in Europe and their impacts, by applying dynamic model ensembles, process studies, new data assimilation techniques and high resolution modeling. Horison2020 project; SMHI = partner in consortium. (on-going)
2. CRYOLAND aimed at developing, implementing and validating a standardized and sustainable service on snow and land ice monitoring as a Downstream Service within Copernicus. SMHI coordinateed the user community interaction and development of satellite data integration in hydrological modelling. EU FP7; SMHI = partner in consortium (finished)
3. SWITCH-ON (Sharing Water-related Information to Tackle Changes in the Hydrosphere – for Operational Needs) aims to take advantage of the large sources of open data related to water (from GEOSS, Copernicus, etc), and repurpose them with a focus on usability and value-adding for end-users, both within government and business as well as within civil society. EU FP 7; SMHI = coordinator. (on-going)
4. CM-SAF (EUMETSAT's Satellite Application Facility on Climate Monitoring): aims to deliver climate data records of various Essential Climate Variables (ECVs). SMHI is leading EU consortium that provides long-term, climate quality cloud property sets from space based sensors (mainly AVHRR).
5. GlobRAD: aims to improve our understanding of the vertical structure of radiative heating/cooling globally using data from advanced satellite sensors (such as those on the A-Train convoy of satellites).

One of its major focuses lie on characterizing the Arctic atmosphere. SMHI is leading the project with contributions from Stockholm University, University of Wisconsin (USA) and JPL/NASA (USA).

Significant infrastructure, and/or major items of technical equipment:

SMHI is located in Sweden with its main office in Norrköping, with a lecture hall and several lecture rooms that can host workshops and training courses with up to about 60 participants. For hardware, SMHI has besides its own supercomputers (the latest one with 641 nodes of 16 processors each) access to large storage space and computing clusters at the National Supercomputer Centre (NSC) at Linköping University, where e.g. many of the Rossby Centre climate model simulations for the CORDEX downscaling project have been carried out.

14. University of Sheffield (USFD)

Expertise and experience of the organization

The University of Sheffield with 26,000 students, is one of the world's leading universities, offers world-class teaching and research excellence across a wide range of disciplines, and has five Nobel Prize winners among former staff and students Five departments have been ranked in the top five percent from the UK Higher Education Institutions: Biological Sciences, Computer Science, Civil Engineering, Education and Architecture, Landscape and Town and Regional Planning. Global research partners and clients include Boeing, Rolls-Royce, Unilever, AstraZeneca, Glaxo SmithKline, Siemens and Airbus, as well as many UK and overseas government agencies and charitable foundations.

Role in the project

The University of Sheffield will be involved in WP2 of INTAROS, by delivering year round CO_2 and CH_4 flux measurements and meteorological data from several eddy covariance and meteorological towers positioned across a variety of tundra ecosystems from the coast to central Alaska. USFD will perform the uncertainty, gap-analysis, and gapfilling of the terrestrial fluxes and meteorological variable, to enhance the observational capability in the Arctic. USFD will continue to develop and implement de-icing systems to enhance data coverage in the Arctic during the winter period, within WP3. USFD will also develop new high spatial and temporal resolution temperature sensing systems to continuously monitor active layer depth, water table depth, and snow depth as well as the temperature profile and the zero curtain position, timing, and temperature, and will finish developing a soil diffusivity system to resolve soil and snow diffusivities, concentrations, and fluxes of CO_2 and CH_4. This is a new system that promises to provide continuous, year-round data on CO_2 and CH_4 concentrations, fluxes, consumption, and/or production in remote areas. In addition, USFD will lead the Terrestrial component of WP1: Requirements for an Integrated Arctic Observing System and be involved in WP1 with the roadmap to a sustainable Integrated Arctic Observation System. Through links with the Inuit College in Barrow, Alaska, USFD will also work on addressing the impact of climate change on native communities in WP7, assess the challenges these communities are facing with sea ice loss, and lead and coordinate a variety of outreach and dissemination activities for WP7.

Key personnel CVs

Prof. Shaun Quegan (M) led the National Environmental Research Council Earth Observation Centre of Excellence in Terrestrial Carbon Dynamics (CTCD), aimed at giving greater understanding and better quantitative estimates of the role of terrestrial ecosystems in the Earth's carbon cycle. He then took over leadership of the Carbon Cycle Theme in the UK National Centre for Earth Observation (NCEO) when it was inaugurated in April 2008 and subsumed CTCD. His main interests lie in using the full range of remote sensing and ground-based data to improve and constrain models of land-atmosphere carbon and water fluxes. A significant part of his recent work has been concerned with high latitude processes, largely because of the wealth of satellite data that gives information on key processes (e.g. wetlands, seasonal lakes, snow, fire, land cover). This has allowed a range of models (including LPJ, JULES, CLM4, ORCHIDEE and SDGVM) to be tested, methods to overcome their failings to be developed, and assessment of the consequences for carbon fluxes to be assessed (Quegan et al. 2011; Kantzas et al. 2013, 2014, 2015).

With Thuy Le Toan of CESBIO, he was the lead proposer of the BIOMASS P-band radar mission to measure forest biomass globally from space (Le Toan et al. 2011); this has been selected as the next Core mission in the European Space Agency Earth Explorer series, and he is the Chairman of the BIOMASS Mission Assessment Group. He is a member of the Terrestrial Observations Panel on Climate, the JAXA

Kyoto and Carbon Panel (where he leads a project concerned with monitoring deforestation in Indonesia), was Chairman of the Terrestrial Carbon Observations Panel from 2002-2005, was a member of ESA's Earth Science Advisory Committee from 2002-2007, and led the Group on Earth Observation (GEO) Forest Carbon Tracking task "Linking In Situ Forest Measurements, Remote Sensing and Carbon Models". He led the land component (aimed at improving estimates of carbon and water fluxes at high latitudes) in the EU FP7 project: "Monitoring and Assessing Regional Climate Change in High latitudes and the Arctic (MONARCH-A)". Over the last three years he has been working with the Nansen Centre, St Petersburg, in the context of the EU FP7 funded "European-Russian Centre for cooperation in Arctic and Sub-Arctic environmental and climate research (EuruCAS)" with an emphasis on carbon processes (especially fire) at boreal latitudes. He also currently leads the modelling activity (with the University of Helsinki) in the EU FP7 project "Enabling intelligent GMES services for carbon and water balance modelling of northern forest ecosystems (NorthState)".

Dr. Donatella Zona (F) is a Research Fellow and Lecturer in the Department of Animal and Plant Sciences, of the University of Sheffield. Her background integrates the study of the functioning of a variety of ecosystems, natural (arctic tundra) and managed (oak forest, agro-ecosystems), and on the patterns and controls on non-CO_2 gasses such as O_3, CH_4, N_2O fluxes, whose emissions are very difficult to measure and model. She successfully led a work package of a COST action (Advancing the Integrated Monitoring of Trace Gas Exchange between Biosphere and Atmosphere), and organized more than five EGU sessions and workshops over the last five years. She holds also an appointment as assistant professor in San Diego State University in the USA, where she is the PI of the NSF-funded "Methane loss from Arctic": towards an annual budget of CH_4 emissions from tundra ecosystems across a latitudinal gradient (http://www.nsf.gov/awardsearch/showAward?AWD_ID=1204263). This project resulted in the first paper including continuous year round observation from the Arctic, just published on PNAS, which attracted more than 400,000 views in a variety of new articles in the US, Canada, and Europe, including Washington Post, Le Scienze (Italian Scientific American), etc. She has been engaging with the press, giving interviews to comments on her own paper (radio interview for the Canadian CBC radio), and also on other studies published in the Arctic, including two interviews for the BBC to comment on studies in the Arctic Ocean.

Publications, and/or products, services or other achievements:

1. Le Toan T., S. Quegan, M. Davidson, H. Balzter, P. Paillou, K. Papathanassiou, S. Plummer, F. Rocca, S. Saatchi, H. Shugart, L. Ulander (2011).The BIOMASS Mission: Mapping global forest biomass to better understand the terrestrial carbon cycle, Remote Sens. Env., 115, 2850–2860.
2. Quegan S, Beer C, Shvidenko A, McCallum I, Handoh I C, Peylin P, Rödenbeck C, Lucht W, Nilsson S & Schmullius C (2011), Estimating the carbon balance of central Siberia using a geographical information system, atmospheric inversion and dynamic vegetation models, Global Change Biology, 17, 351–365.
3. Kantzas, E., M. Lomas, and S. Quegan (2013), Fire at high latitudes: Data-model comparisons and their consequences, Global Biogeochem. Cycles, 27, doi:10.1002/gbc.20059.
4. Zona D, et al. 2016. Cold season emissions dominate the Arctic tundra methane budget. Proceedings of the National Academy of Sciences, 113(1):40-45.
5. Zona D., Lipson D. A., Richards J. H., Phoenix G. K., Liljedahl A. K., Ueyama M., Sturtevant C. S., Oechel W. C., 2014. Delayed responses of an Arctic ecosystem to an extremely dry summer: impacts on net ecosystem exchange and vegetation functioning, Biogeosciences, 11, 5877–5888, doi:10.5194/bg-11-5877-2014.

Projects, and/or activities:

1. Leading the modelling activity (with the University of Helsinki) in the EU FP7 project "Enabling intelligent GMES services for carbon and water balance modelling of northern forest ecosystems (NorthState)".
2. EU FP7 funded "European-Russian Centre for cooperation in Arctic and Sub-Arctic environmental and climate research (EuruCAS)" with an emphasis on carbon processes (especially fire) at boreal latitudes
3. Scientific committee of iLEAPS (integrated Land Ecosystem - Atmosphere Process Study; 2014-) http://www.ileaps.org/
4. Leading of the Work package (WP2) of the COST Action (ES0804 BE) Advancing the Integrated Monitoring of Trace Gas Exchange between Biosphere and Atmosphere (Work towards comprehensive multi-species flux monitoring sites, 2011-2013).

5. Convening and organizing of the EGU sessions: ex. 2015: “Understanding CO2 and CH4 fluxes from WETLANDS: reducing the gap between experimentalists and modellers”. 2014: “Towards a full greenhouse gas balance of the biosphere (terrestrial & aquatic ecosystems)”, 2012 “Towards a full GHG balance from the biosphere. How important are N2O and CH4 emissions in different ecosystems? How difficult is it to measure and to model their emission?” (Co-conveners: K. Pilegaard, T. Vesala); 2010: “Understanding the impacts of hydrological changes on terrestrial ecosystems: results from large-scale water manipulation experiments across different biomes” (Co-conveners L. Misson, W.C. Oechel).

Significant infrastructure, and/or major items of technical equipment:

USFD operates in collaboration with OU five eddy-covariance and meteorological towers in Alaska, which include a full suite of measurements. Three sites are located in Barrow including one at the NOAA observatory CMDL site. Another site is located in Atqasuk, 100 km to the south of Barrow and Ivotuk 300 km to the south of Barrow. All sites operate year-round. The Barrow-North Slope has the capability to comprise a super site. These sites include gas analyzers to measure CO_2 and CH_4 fluxes, and environmental probes to measure soil and air temperature, soil moisture, rainfall, radiation, etc. One of the Barrow site has also a diffusivity system to measure soil CO2 and CH4 concentration and diffusion through the soil and snow layers.

15. National University of Ireland Maynooth (NUIM)

Expertise and experience of the organization

Maynooth University - The National University of Ireland Maynooth (NUIM) was established in 1997, but it traces its origins to the foundation of St. Patrick’s College Maynooth in 1795. Maynooth University has three faculties: Arts, Celtic Studies & Philosophy, Social Sciences, and Science & Engineering, and is internationally recognised for the quality and value of the research and scholarship. In 2011, it became the first institution outside of North America to be included in the Princeton Review of Best Colleges. Recent Statistics: 8300+ Undergraduates; 1500+ Postgraduates; 400 Research and Doctorate students; 446 Academic and Research Staff; €21m Research Income per annum.

Our research strengths focus on six thematic priorities: People, Place and Environment; Social and Economic Transformations; Human Health; Mathematics, Computation and Communications; Humanities in Practice: Sources Resources & Discourses; and Human Cultures, Experience and Creativity. In all our priority areas, research from Maynooth University influences, and is cited above global averages for each discipline.

The Irish Climate Research UnitS was set up by the School of Geography in the early 2000s and has built a strong reputation nationally and internationally in climate change research. Members of ICARUS span the full range from observations through modelling to applications.

Role in the project

NUIM shall contribute to WPs 2

Key personnel CVs

Prof. Peter Thorne (M) joined NUIM in February 2015 and is the director of ICARUS. Prior to Maynooth University he has worked at the Nansen Environmental and Remote Sensing Center in Norway, NOAA’s National Climatic Data Center and, the UK Met Office’s Hadley Centre. He has over a decade’s experience of analysis of climate data from in-situ and satellite measurements and has published over 60 peer-reviewed papers on climate data analyses and model intercomparisons, including in Nature, Science and PNAS.

Prof. Thorne was a Lead Author on the atmospheric observations chapter of the most recent 5th Assessment Report of the IPCC Working Group 1, attending the final Stockholm plenary and contributing to the SPM. He has also been a lead author on the 2014 US National Climate Assessment and the first US Climate Change Science Program report on temperature trends in the lower atmosphere published in 2006. He is chair of the International Surface Temperature Initiative, Co-Chair of the GCOS Reference Upper Air Network and Chairs the World Meteorological Organisation Commission for Climatology Rapporteurs on Observational Matters. From 2016 he has been made a member of the GCOS Atmospheric Observations Panel for Climate. Prof. Thorne is project coordinator of the H2020 GAIA-CLIM project and shall act as the institutional PI on the current project.

Publications, and/or products, services or other achievements:

1. Bodeker, G. et al., "Reference upper-air observations for climate: From concept to reality" BAMS, in press, http://dx.doi.org/10.1175/BAMS-D-14-00072.1
2. Huang, B. et al. (2015), "Extended Reconstructed Sea Surface Temperature version 4 (ERSST.v4), Part 1. Upgrades and Intercomparisons", J. Clim., 28, 911–930. doi: http://dx.doi.org/10.1175/JCLI-D-14-00006.1
3. Mears, C. A., Thorne, P. et al. (2012) "Assessing the value of Microwave Sounding Unit-radiosonde comparisons in ascertaining errors in climate data records of tropospheric temperature" J. Geophys. Res., 117, D19103, doi:10.1029/2012JD017710
4. Thorne, P. W., J. R. Lanzante et al. (2011). "Tropospheric temperature trends: History of an ongoing controversy." WIRES: Climate Change. **2:** 66-88, DOI: 10.1002/wcc.80
5. Immler, F. J., J. Dykema, et al. (2010). "Reference Quality Upper-Air Measurements: guidance for developing GRUAN data products."Atmospheric Measurement Techniques **3**(5): 1217-1231, doi:10.5194/amt-3-1217-2010

Projects, and/or activities:

1. GAIA-CLIM (H2020)

2. TRANS-ADAPT (JPI Climate)

16. Ifremer / Institut Francais de Recherche pour L'exploitation de la Mer (IFREMER)

Expertise and experience of the organization

IFREMER was created by decree of 5 June 1984, it is the only French organisation with an entirely maritime purpose. It operates under the joint auspices of the Ministries of Education, Research and Technology, Fisheries and Amenities, Transport and Housing. Being involved in all the marine science and technology fields, IFREMER has the capability of solving different problems with an integrated approach. IFREMER scope of actions can be divided into four main areas, each of them including different topics: i) understanding, assessing, developing and managing the ocean resources, ii) improving knowledge, protection and restoration methods for marine environment, iii) production and management of equipment of national interest. Moreover, IFREMER undertakes to provide assistance to the government, public authorities and organisations concerned with the scientific, technical or economic research, gather, disseminate and enhance national and international oceanographic information, contribute to the implementation of international cooperation agreements in the marine field.

Specific Ocean Remote Sensing Activities relevant to INTAROS: In the framework of its activities in Observation and monitoring of the sea, IFREMER operates, since 1991, the " Centre ERS d'Archivage et de Traitement" (CERSAT) which has evolved to a multi-satellite/multi-sensor data processing/geophysical product provider and data distribution center in close collaboration with the scientific teams of the Laboratoire d'Océanographie Spatiale. The laboratory has acquired a 20 year experience in Ocean and Sea ice data processing. It has developed specific scatterometer based geophysical products related to Ocean Winds and Sea ice monitoring using successively the ERS AMI-Wind, NSCAT, SeaWinds on QuikSCAT and ASCAT. The main sea ice studies concern sea ice type delineation and sea-ice drift. Validated data and geophysical products are available through the Ifremer web site.

With their long-term time series of ocean parameters from satellites, Ifremer through the CERSAT archive center has a known robust observation data center with free, easy and open access to the data. Ifremer is or has been involved in many projects of development, validation, integration and dissemination (sharing) of the data, in particular in the Arctic (EU DAMOCLES, SWARP, SPICES, also Space Agency project like GlobIce, CCI Sea Ice, etc.... Ifremer integrates new sensors to the sea ice parameters datasets and prepare future missions (for example CFOSAT, CSCAT). Ifremer researchers have the experience of the syngery of the data (radiometer, scatterometer, SAR), and proposes here an original work combining Sentinel-1 data with buoys in the MIZ.Through the projects, Ifremer has a wide user communities, including the modeling community.

Role in the project

Ifremer will provide the long term satellite sea ice datasets of concentration and displacement archived at the CERSAT, and will participate to the data integration in the system (WP2). In addition Ifremer will provide snapshots of the Sentinel-1A SAR data for the Arctic MIZ areas and supersites of the project combining with buoys, new algorithms will be developed to detect high resolution phenomena like ocean eddies using high resolution SAR, visible and altimeter sensors (WP6).

Key personnel CVs

Dr. Fanny Girard-Ardhuin (F) received her Ph. D. in radar meteorology at the Laboratoire d'Aérologie in Toulouse in 2001. Her thesis deals with atmospheric boundary layer studies, using wind profiler radar with Radio Acoustic Sounding System (RASS). Research fellow at Telecom Bretagne in 2002, she analyzed Synthetic Aperture Radar (SAR) data, in particular for oil spill detection. She joined what is now the Division of Radar Application of Collecte Localisation Satellites in 2003 to implement oil slick detection algorithms applied on SAR images and test synergistic data analysis for slick classification. Since 2004 at Ifremer Laboratory of Oceanography from Space, she is involved in sea ice monitoring from active and passive sensors, in particular for sea ice drift estimation and multi-year ice and ice edge detection, and participates to small icebergs detection, ocean currents and ocean parameters estimate by synergy of data. She is or has been involved in national and international projects with E.U. such as DAMOCLES, SWARP, SPICES, GMES MyOcean, ESA projects about sea ice such as GlobIce, Sea Ice Climate Change Initiative. At LOS she is the responsible of the sea ice database made from satellites available through the CERSAT portal. She is a member of the European Space Agency Science Advisory Group for scatterometer sensors for sea-ice applications and member of the scientific commitee of the *Chantier Arctique* initiative.

Jean-Francois Piollé (M) is an engineer with more than 15 years experience. From 1996 to 1999, he worked as a computer engineer at Cap Gemini, contributing to the development of several processing and analysis tools for marine data. From 1996-onwards he works as a data manager at CERSAT/IFREMER. His main realizations include the development of an open objective analysis chain for the production of various gridded fields of sea-surface parameters (wind, fluxes, gas exchange coefficient, and the conception of advanced data dissemination and indexing tools. He has been responsible for the EO data management and dissemination at CERSAT since 2002. In the context of several ESA and EU projects (Medspiration, GlobWave, Mersea, O&SI SAF, MyOcean2), he has been responsible for the design and development of automated NRT processing systems and frameworks able to cope with large volume of data (hundreds of GB/day) from EO missions. He has played a leading and active role in the GHRSST specification development, is also co-author of the ODYSSEA multi-sensor SST analysis. He also placed IFREMER at a central position of GHRSST system, setting up a European GDAC and developing the central GHRSST Match-Up Database. He is now leading and coordinating the space remote-sensing component of operational oceanography at Ifremer. He is also actively involved in the cal/val of upcoming Sentinel-3 SLSTR instrument (for SST). He is also involved in the wave activities through SAR wave mode Cal/Val works for Envisat and upcoming Sentinel-1, reprocessing activities and as the manager of the central processing and data center for GlobWave project.

Publications, and/or products, services or other achievements

1. Girard-Ardhuin, F., R. Ezraty, 2012 : Enhanced Arctic sea ice drift estimation merging radiometer and scatterometer data. IEEE Trans. Geosci. Remote Sensing, vol. 50 (7), July 2012, pp 2639-2648. Doi : 10.1109/TGRS.2012.2184124
2. Sumata, H., T. Lavergne, F. Girard-Ardhuin, N. Kimura, M.A. Tschudi, F. Kauker, M. Karcher, R. Gerdes, 2014 : An intercomparison of Arctic ice drift products to deduce uncertainties estimates. J. Geophys. Res. Ocean, vol. 119, July 2014. DOI : 10.1002/2013JC009724
3. Tournadre, J. N. Bouhier, F. Girard-Ardhuin, F. Rémy, 2015 : Large icebergs caracteristics from altimeter waveforms analysis. Journal of Geophys. Res., vol 120. DOI : 10.1002/2014JC010502. Publisher's official access
4. Ardhuin, F., F. Collard, B. Chapron, F. Girard-Ardhuin, G. Guitton, A. Mouche, J. Stopa, 2015 : Estimates of ocean wave heights and attenuation in sea ice using the SAR wave mode on Sentinel-1A. Geophys. Res. Letters, vol 42. DOI : 10.1002/2014GL062940.
5. Le Traon, P.Y., D. Antoine, A. Bentamy, H. Bonekamp, L.A. Breivik, B. Chapron, G. Corlett, G. Dibarboure, P. DiGiacomo, C. Donlon, Y. Faugère, J. Font, F. Girard-Ardhuin, F. Gohin, J.A.

Johannessen, M. Kamachi, G. Lagerloef, J. Lambin, G. Larnicol, P. Le Borgne, E. Leuliette, E. Lindstrom, M. Martin, E. Maturi, L. Miller, L. Mingsen, R. Morrow, N. Reul, M.H. Rio, H. Roquet, R. Santoleri, J. Wilkin, 2015: Use of satellite observations for operational oceanography : recent achievements and future prospect. Journal of Operational Oceanography, vol 8, n S1, s12-s27, July 2015. DOI: 10.1080/1755876X.2015.1022050.

Projects, and/or activities

1. Sea Ice Climate Change Initiative is an ESA project, Ifremer participate to the sea ice drift and thickness algorithms.
2. EU SWARP project: Ifremer provides ocean swell data from model and analyses the Sentinel-1A images to study sea ice-waves interactions in the MIZ
3. EU SPICES project: Ifremer develops scatterometer detection of ice type, in particular from the recent ASCAT sensors
4. CERSAT is a ESA project: the CERSAT is based at Ifremer, it process, archives and distrbutes data from satellites of the ocean parameters such as sea ice, wint, SST, etc...
5. GlobWave is an ESA project: Ifremer is in charge of the processing and archiving of ocean wave data from altimeters and buoys

Significant infrastructure, and/or major items of technical equipment:

The CERSAT (Centre d'Exploitation et de Recherche Satellitaire, http://cersat.ifremer.fr) is part of the ESA (European Space Agency) ground segment for the ERS-1 and ERS-2 Earth observation satellites. Since 1996, the CERSAT has been evolving towards a multi-mission centre, archiving data from various sensors similar or complementary to those of ERS (SSM/I, ADEOS/NSCAT, QuikSCAT, SeaWinds, WindSat, ASCAT, generating homogeneous series of value-added products from its growing database: mean wind fields, turbulent and radiative fluxes, waves, sea-ice characterization maps or multi-sensor colocated datasets. Today, CERSAT can provide consistent and continuous time series of key ocean surface parameters such as multi-mission scatterometer (ERS-1, ERS-2, NSCAT, QuikSCAT, ADEOS-2, METOP/ASCAT) measurements (but also from other sensors such as altimeters or microwave radiometers), covering more than 20 years of sea surface wind vectors, wind stress, curl and divergence at global scale but also sea-ice paremeters. The CERSAT at Ifremer owns a dedicated operational platform for real-time and delayed dataflow management, processing and archiving.

17. Max Planck Society / Max Planck Gesellschaft zur Förderung der Wissenschaften e.V. (MPG)

Expertise and experience of the organization

The Max-Planck-Institute for Biogeochemistry (MPI-BGC) is a research institute of the German Max-Planck Society (MPG), founded in 1997. The research mission of the Max-Planck-Institute for Biogeochemistry is the investigation of the global biogeochemical cycles and their interaction with the climate system. The institute combines strong observational and process-based studies (soil carbon, plant community and growth, vegetation-atmosphere fluxes) with global scale modelling (e.g. vegetation dynamics, global carbon cycle, aerosol). The MPI-BGC is one of the pivotal European research institutions in its field, and as such was co-ordinating the EU-funded CARBOEUROPE-IP project (FP6) and the EU FP7 collaborative project CARBO-Extreme, and is currently leading the EU Horizon 2020 project BACI. Moreover, the institute is strongly involved in more than ten collaborative EU projects, co-leads international collaborative efforts such as FLUXNET, and has an annual budget turnover of around 15 million €, with an average of 20% from competitive third-party funding. The researchers at the institute have published more than 130 papers a year in the last seven years in highly respected peer-reviewed journals (e.g. including 25 papers in Nature, Science, PNAS) that lead to an MPG evaluation of an "outstanding publication record". Not only does the institute have an outstanding international reputation for research but it has strong commitment to higher education and scientific training, housing 60 Ph.D. students from 26 countries and operating the International Max Planck Research School for global Biogeochemical Cycles. The institute successfully maintains numerous and geographically and disciplinarily wide-ranging collaborations.

The department of Biogeochemical Systems maintains regular long-term in-situ measurements of methane and carbon dioxide, among other trace gases and isotopes, at tall towers in western Siberia (ZOTTO), Germany (Ochsenkopf), Poland (Bialystok), the Amazonian site ATTO, and smaller measurements masts in Namibia, Cape Verde, and Ambarchik in Northeast Siberia. In the Kolyma Lowlands region around Chersky, Northeast Siberia, a cluster of permafrost observation sites has been established, including eddy-covariance towers. Flasks measurements are taken from the WMO GAW background sites in Alert and Shetland Islands. The department contributes to the TCCON network of FTS measurements with its site at Ascension Island, providing total column measurements at a remote ocean site important for satellite validation. The department is also responsible for the greenhouse gas measurement package within the IAGOS project, which measures high precision atmospheric abundances of CO_2, CH_4, CO, and water vapor continuously in situ on board passenger aircraft. Other IAGOS measurement packages measure ozone, CO, NO_y, and aerosols. The department uses these and other atmospheric measurements, including satellite measurements of atmospheric composition and surface properties, in a top-down modelling framework, including both global and regional scale inversion systems, to better understand the carbon cycle at a variety of spatial and temporal scales.

Role in the project

MPI-BGC will be leading Task 3.5 (innovative observations in the atmospheric and terrestrial spheres) and Task 6.5 (data assimilation to advance process understanding in Arctic greenhouse gas exchange). The group will furthermore contribute to WP2 (GHG observation network evaluation study) and WP3 (new trace gas flask observation technology at the Ambarchik observation site in NE Siberia). All contributions by MPI-BGC will build on our demonstrated expertise in both observations and modeling of atmospheric trace gases, and the use of both elements to constrain surface-atmosphere exchange processes and identify key processes in the Arctic carbon cycle.

Key personnel CVs

Dr. Mathias Göckede (M) is leading a research group focusing on 'Integrating surface-atmosphere exchange processes across scales – Modeling and Monitoring' at MPI-BGC. His research concentrates on feedback processes between terrestrial ecosystem functionality and climate change, and the observation of greenhouse gas exchange processes with interdisciplinary approaches. **Prof. Dr. Martin Heimann (M)** is director at MPI-BGC, member of the Max-Planck-Society and honorary professor at the Friedrich-Schiller-University of Jena, Germany. Over the last four decades he has worked on analyzing and modeling the global carbon cycle. His research focuses on modeling and quantification of the interactions between the biogeochemical cycles and the physical climate system, and the development of observing systems for long-lived biogeochemical trace gases. He has (co-)authored >200 papers in Earth System Science, has been coordinator of numerous carbon cycle research projects (e.g. EU projects TCOS-Siberia, CarboEurope-IP, has been a lead author in Working Group I of the last 4 IPCC reports, and serves as editor of several scientific journals.

Publications, and/or products, services or other achievements

1. Heimann, M. and Reichstein, M. (2008) Terrestrial ecosystem carbon dynamics and climate feedbacks. Nature 451, 289-292;
2. Göckede, M., Turner, D.P., Michalak, A.M., Vickers, D., and Law, B. E. (2010) Sensitivity of a subregional scale atmospheric inverse CO2 modeling framework to boundary conditions. J. Geophys. Res.-Atmos. 115, D24112;
3. Göckede, M., and 50 co-authors (2008) Quality control of CarboEurope flux data - Part 1: Coupling footprint analyses with flux data quality assessment to evaluate sites in forest ecosystems. Biogeosciences 5, 433-450;
4. Heimann, M. (2011) Atmospheric science: Enigma of the recent methane budget. Nature 476 (7359), 157-158;
5. Kirschke, S., Bousquet, P., Ciais, P., Saunois, M., Canadell, J. G., Dlugokencky, E. J., Bergamaschi, P., Bergmann, D., Blake, D. R., Bruhwiler, L., Cameron-Smith, P., Castal-di, S., Chevallier, F., Feng, L., Fraser, A., Heimann, M., Hodson, E. L., Houweling, S., Josse, B., Fraser, P. J., Krummel, P. B., Lamarque, J.-F., Langenfelds, R. L., Le Quere, C., Naik, V., O'Doherty, S., Palmer, P. I., Pison, I., Plummer, D., Poulter, B., Prinn, R. G., Rigby, M., Ringeval, B., Santini, M., Schmidt, M., Shindell, D. T., Simpson, I. J., Spahni, R., Steele, L. P., Strode, S. A., Sudo, K., Szopa, S., van der Werf, G. R.,

Voul-garakis, A., van Weele, M., Weiss, R. F., Williams, J. E., and Zeng, G. (2013) Three dec-ades of global methane sources and sinks. Nat. Geosci. 6, 813-823.

Projects, and/or activities:

Previous collaborative research projects involving contributions from MPI-BGC include, amongst others, CARBO-EXTREME (EU), CarboEurope IP (EU), GHG-Europe (EU), GREENCYCLES (EU), IAGOS (EU), ICOS (EU) PAGE21 (EU), and SIB-LAB (BMBF). As a leading European research institute on biogeochemical cycles, MPI-BGC is closely integrated into numerous collaborative projects such as AquaDiva (DFG), CarboPerm (BMBF), BACI (EU), EuNetAir (EU), ICOS-INWIRE (EU), IGAS (EU), InGOS (EU), Terra-bites (EU COST), and others

Significant infrastructure, and/or major items of technical equipment

MPI-BGC is sub-divided into three departments that share a number of excellent central facilities (e.g. laboratory analyses including state-of-the-art isotope work, central IT services, etc.) providing outstanding assistance for conducting research projects. All central facilities are integral parts of MPI-BGC, located in-house and dedicated almost exclusively to support MPI-BGC research. For the proposed project, particularly the support group for field experiments with an outstanding reputation for conducting high-quality micro-meteorological experiments and long-standing fieldwork experience in Russia will be instrumental. In terms of computational resources for modeling activities, the MPI-BGC hosts several high-performance clusters (e.g. one with 100 CPU's of 2.3GHz) that are regularly upgraded, and also provides access to state-of-the-art supercomputers hosted by the German Climate Computing Center (DKRZ) in Hamburg.

18. EuroGOOS AISBL (EuroGOOS)

Expertise and experience of the organization

EuroGOOS AISBL (European Global Ocean Observing System) Founded I 1994 and registered as an International Non-Profit Association in 2013. EuroGOOS represents 40 national governmental agencies, research organisations and private companies from 19 EU countries, committed to European-scale operational oceanography (OO) within the context of IOC/GOOS. EuroGOOS works in the collective interest of its members, to improve the quality and cost effectiveness in the production of OO services at national, regional and global levels. The establishment of regional systems (ROOS) and strong cooperation within these enable the involvement of many more regional partners and countries in the promotion and development of OO. Through its Working Groups and Task Teams, EuroGOOS develops strategies, priorities and standards in order to establish a concerted European approach to the development of OO to the benefit of sustainable blue growth. EuroGOOS has had a strong involvement in the establishment of the concept of EOOS – an integrated and operational European Ocean Observing System. The EuroGOOS Conference, organized every three years, is a milestone in OO, providing a forum for international scientific experience sharing.

Role in the project

EuroGOOS will actively contribute with operational marine expertise, international cooperation and management to:

- WP1: (deputy lead) establish links to and maintain cooperation with stakeholders, formulation of an engagement strategy, establishment of an Arctic Forum and the establishment of an roadmap for a future Sustainable Arctic Observing System.
- WP2: assess the marine component of the existing Arctic observing system and gap analysis
- WP6: Demonstrate how improved operational Met-Ocean-Ice product and services can support Blue Growth in the Arctic and transform results from the AtlantOS study on "Analysis the economic potential associated with observatories" into an Arctic context.

Key personnel CVs

Dr. Erik Buch (M) is acting chair of EuroGOOS. Master of Science, Physical Oceanography, 1978; Ph.D in Physical Oceanography, 1983; Bachelor of Commerce, Management, 1990 and Project Management, 1994. Senior scientist at Greenland Fisheries Research Institute, 1982; Head of Fisheries Department, same institute, 1985. Vice-Director, same institute, 1986. Head of Oceanographic Department, Royal Danish Administration of Navigation and Hydrography, 1990. Director of Division for Operational Oceanography, DMI 1998 (renamed to Centre for Ocean and Ice in 2006). Danish representative in EuroGOOS since 1995. Member of EuroGOOS Board 1999-2003 and since 2008; chair since 2013. Chairman of EuroGOOS Baltic Task Team (BOOS) 1998-2009. Danish IOC delegate since 2007. Initiator, coordinator or WP-leader of a number of research projects with relation to marine climate and operational oceanography. Great experience in oceanographic data collection, analysis and presentation.

Dr. Glenn Nolan (M), Secretary General, EuroGOOS AISBL charged with implementing the EuroGOOS Strategic Plan for the 2014-2020 period. The plan includes cooperation within EuroGOOS and the Regional Operational Oceanographic Systems (ROOSes), liaison with major international initiatives including Copernicus, EMODNET, ARGO and the GOOS regional alliances. Also responsible for the scoping and co-production of products and services within Europe (through EuroGOOS members) and for promoting operational oceanography in Europe and further afield. The role also involves the day to day management of the EuroGOOS organization. Dr. Nolan has 20 years experience as an oceanographer and in the management and roll-out of oceanographic and marine climate programmes. Previously responsible for the Irish National Weather Buoy Network, Irish Tide Gauge Network, Ocean Modelling, Remote Sensing, Coastal and deep water oceanography at the Irish Marine Institute, he headed the Marine Climate Change team at the Marine Institute between 2007 and 2009. His own research is primarily in the area of coastal processes and in the descriptive physical oceanography of the Irish region having conducted more than 30 research cruises in Irish waters, the Caribbean and the sub-polar regions, 14 as chief scientist. He has considerable experience in management of large-scale research projects. Board Member: European component of the Global Ocean Observing System (EuroGOOS) 2005-2011. Steering Group Member: Iberia Biscay Ireland Regional OOS (2006-2015). Steering Group Member: North West Shelf OOS (2005-present). ICES Working Group on Oceanic Hydrography (2004-Present) (co-chair 2008-2010). CMEMS Strategic Advisory Council member, EuroARGO Steering Group member, GOOS Steering Committee member (2015 to present).

Patrick Gorringe (M) is Senior Operations Officer at EuroGOOS AISBL. Since 2002 employed at the Swedish Meteorological and Hydrological Institute, SMHI, and on secondment to EuroGOOS AISBL since 2004 where the focus of his work is within operational oceanography, in particular observational data. He is a member of a number of advisory boards and involved in projects and initiatives related to marine data management and dissemination of data on European and Global scales. He has also worked in Australia coordinating real-time data for the Integrated Marine Observing System (IMOS)..

Dr. Vicente Fernandez (M) holds a Ph.D. in Physical Oceanography by the University of Balearic Islands and a Master in Environmental Engineering and Management. Since end of year 2015 he is Science Officer at EuroGOOS AISBL with a main role in H2020 project AtlantOS, analyzing present ocean observing capabilities and defining data requirements for the establishment of an integrated Ocean Observing system for the Atlantic Ocean. He has an extensive experience on numerical ocean modelling, ocean data analysis and management and coastal High Frequency (HF) Radar ocean observing systems. During his carrier he has worked in several international oceanographic research, operational centers, private companies, as well as an environmental consultant.

Publications, and/or products, services or other achievements

1. Holt,J., Hughes,S.L., Hopkins,J., Wakelin,S.L., Holliday,N.P., Dye,S., Sætre Hjøllo,S., Lavin,A., Mork,K.A., Nolan,G., Proctor,R., Read,J., Shammon,T., Sherwin,T., Smyth,T., Tattersall,G., Ward,B. and Wiltshire,K., 2012 Multi-decadal variability and trends of the temperature of the northwest European continental shelf: a model-data synthesis, Progress in Oceanography, Volume 106, November 2012, Pages 96–117.
2. Sharples,J., Ellis,J.R., Nolan,G., Scott,B.E, Fishing and the oceanography of a stratified shelf sea, Progress in Oceanography, Volume 117, October 2013, Pages 130-139, ISSN 0079-6611, http://dx.doi.org/10.1016/j.pocean.2013.06.014.
http://www.sciencedirect.com/science/article/pii/S007966111300102X)
3. Barrick, D., V. Fernández, M. I. Ferrer, C. Whelan, and Ø. Breivik. "A Short-term Predictive System for Surface Currents from a Rapidly Deployed Coastal HF Radar Network." Ocean Dynamics, Vol. 62, pp. (2012).
4. Abascal, A. J., S. Castanedo, V. Fernández, and R. Medina. "Backtracking Drifting Objects using Surface Currents from High-Frequency (HF) Radar." Ocean Dynamics, Vol. 58, 1-18 (2012).

5. Barciela, R.M., Gorringe, P., Parner, H., and Obaton, D. 2015. Report of the Process Service for OSPAR Request on Handling Large Amounts Data, Copenhagen, Denmark, 3–4 February 2015, ICES CM 2015/ACOM:52. 24 pp.

Projects, and/or activities

1. **AtlantOS** – aims to achieve a transition from a loosely-coordinated set of existing ocean observing activities producing fragmented, often monodisciplinary data, to a sustainable, efficient, and fit-for-purpose Integrated Atlantic Ocean Observing System (IAOOS).
2. European Marine Observation and Data Network (**EMODnet**) consists of more than 100 organisations assembling marine data, products and metadata to make these fragmented resources more available to public and private users relying on quality-assured, standardised and harmonised marine data which are interoperable and free of restrictions on use. EMODnet is currently in its second development phase with the target to be fully deployed by 2020
3. **ENVRI-Plus** – will provide common solutions to shared challenges for European Environmental and Earth System Research Infrastructures (RIs) in their efforts to deliver new services for science and society.
4. **JERICO-NEXT** -aims at extending the EU network of coastal observations developed in JERICO (FP7) by adding new innovative infrastructures while integrating biogeochemical and biological observations.
5. **COLUMBUS** - help develop the blue economy in a way that not only fuels EU growth and job creation but also maintains public support for the commercial use of marine resources while ensuring the protection of the marine environment using innovation from research projects.

19. EurOcean / Fundação EurOcean (Representação em Portugal) (EurOcean)

Expertise and experience of the organization

The EurOcean Foundation is presently composed of 12 Members, which are key European marine research and funding organisations as well as groups focussed on marine outreach. Members are FCT (PT), GeoEcoMar (RM), IEO (ES), Ifremer (FR), IMR (NO), IOPAS (PL), MI (IE), VLIZ (BE), FRCT-Azores (PT), NAUSICAÄ (FR), IOI-International Ocean Institute (MT) and CNR (IT). Cooperating members are the IOC-UNESCO (Intergovernmental Oceanographic Commission), CPRM (Conference of the Peripheral Maritime Regions) and FdM (Fondation de Malte). As such EurOcean has strong connections with national and international bodies related to marine research, its application and dissemination of best practices and information in the marine field.

Focus activities are: 1) development and maintenance of InfoBases of marine relevant information and knowledge; 2) analysis and synthesis of information to help understanding of investments in marine research 3) communications & dissemination of information on marine research activities and projects.

EurOcean has participated in more than a dozen FP7 and H2020 projects and of particular relevance to this proposal is its work in communications and dissemination which it has carried out for a number of these projects, including FP7 EUROFLEETS 2, which focusses on consolidating a cooperation strategy for optimising the sharing and use of research vessels, including polar going ones in Europe. Through this project and others, EurOcean has developed and maintained websites, compiled eNewsletters, developed video materials, designed and edited brochures and information packs, conceived project promotional materials (pens, folders, gadgets, etc), arranged workshops, conference and stakeholder engagement activities. Moreover EurOcean maintains the Research Data Infrastructures (http://rid.eurocean.org) and related InfoBases which catalogue over 900 pieces of research infrastructure in six major categories. In addition EurOcean hosts and maintains Knowledge Gate (http://kg.eurocean.org) which catalogues all marine relevant projects in a range of European funding programmes (e.g. ERDF, FP7, H2020).

Role in the project

EurOcean is the co-lead on WP 6 on Communications and Dissemination and also contributes to mapping existing infrastructure and WP1 on future sustainability of an Arctic observation system.

Key personnel CVs

Ms. Sandra Sá (F): Science Officer since 2009. Sandra has an extensive background in Communication and Dissemination activities at National and European Level. In EurOcean she is also responsible for the information management of the Internet Portal, namely, for marine infrastructures. She has actively coordinated participation in several FP7 European Projects, such as EUROFLEETS2 and SEAS-ERA where she is responsible for a number of communication and outreach activities as well as databases management.

Ms Cristina Costa (F): Office Coordinator and a EurOcean Project Manager since 2009. Cristina has extensive knowledge on European funding mechanisms and has actively coordinated participation in several FP7 European projects such as MarineTT and STAGES and recently, as the operational leader of H2020 COLUMBUS a project with a focus on identification and Collection of EC funded Knowledge. She is also the Office lead on FP7 RISC-KIT, where she is responsible for a number of communication and outreach activities, including capacity building.

Dr. Ned Dwyer (M): Executive-Director since January 2015 his work includes management of the EurOcean Centre including project and financial management, definition and implementation of work plans and the coordination of EurOcean's participation in H2020 projects. Prior to EurOcean, Ned Dwyer (PhD in Remote Sensing), was the deputy-Director of the Coastal and Marine Research Centre (CMRC) at University College Cork, Ireland, where he managed CMRC`s contribution to numerous nationally and European funded projects and was responsible for the Centre´s outreach activities.

Publications, and/or products, services or other achievements:

1. Benchmark Study on VLIZ participation in European Funded Marine projects (2010-2015),2015, EurOcean Office
2. STAGES Marine Strategy Framework Directive (MSFD) Decision Support Resources, 2014, EurOcean Office
3. FP7 Marine Projects Belgium national profile, 2012, EurOcean Office
4. Marine Science and Technology Projects Funded under the 6th framework Programme of the European Community; An independent Statistical overview by EurOcean, 2009, EurOcean Office

Projects, and/or activities

1. FP7 EUROFLEETS 2 – Partner – The aim of this FP7 project is to consolidate a cooperation strategy for optimising the sharing and use of research vessels, including polar going ones in Europe. It enhances transnational access to ships, implements common procedures and facilitate operational interoperability in marine research tools and equipment. EurOcean´s major role is in relation to communication and outreach activities. It is also responsible for the management and update of the Research Vessels and Large Exchangeable Instruments infobases
2. FP7 RISC-KIT – Partner - The aim of the FP7 project is to develop and deliver ready-to-use methods, tools and management approaches to reduce risk and increase resilience to low-frequency, high-impact hydro-meteorological events on European coasts. EurOcean is responsible for the dissemination and knowledge transfer activities of the project
3. FP7 NetBiome-CSA – Partner- NetBiome-CSA (FP7) aims to extend and strengthen research partnerships and cooperation for smart and sustainable management of tropical and subtropical biodiversity in European Outermost Regions and Overseas Countries and Territories. EurOcean leads communication and dissemination activities
4. FP7 Sea for Society – Partner -FP7 project aiming at mobilising stakeholders and citizens to put the ocean at the centre of their lives. EurOcean is the leader of the Communication Work Package
5. H2020 COLUMBUS – Partner - This H2020 project ensures accessibility and uptake of FP7 and H2020 research Knowledge Outputs by end- users EurOcean is responsible for the collection, management and provision of available information of the marine and marine-related funded projects and of their Knowledge Outputs

Significant infrastructure, and/or major items of technical equipment:

Marine Research Infrastructures Infobase (http://rid.eurocean.org) a comprehensive catalogue of more than 900 existing facilities in Europe which are dedicated to marine sciences broad range of activities, including in-situ observing systems, research vessels and underwater equipment. It provides information on the characteristics for each facility, as well as the links and contacts to access the further details provided by the operator. The RID infrastructure is publicly available and is updated on a constant basis

Marine Knowledge Gate 2.0 InfoBase (http://www.kg.eurocean.org) a tool that provides an inventory of over 6000 European and national funded Marine Science and Technology Projects and their Knowledge Outputs

20. Technical University of Madrid / Universidad Politécnica de Madrid (UPM)

Expertise and experience of the organization

The "Universidad Politécnica de Madrid" (http://www.upm.es/) is a rather young university, established in 1971, though it was created from the merging of pre-existing engineering schools, some founded during the 18th century. It is focused on engineering studies, and is structured into 18 schools and faculties, plus 17 research centres. It currently has an academic and research staff over 3000 people (plus 500 non-permanent researchers) and an administration and services staff of over 2000. The number of undergraduate students is above 35000, while Master's and PhD students are above 2000 and 3000, respectively.

The research team participation in this proposal is the Glaciology Section of a wider research group within the university, the Group of Numerical Simulation in Science and Engineering (http://www.krios-hyperion.com/), made up of 10 academic and research staff plus 10 other researchers or graduate students. The Glaciology Section focuses its research on numerical modelling of glacier dynamics, ground-penetrating radar applications to glaciology, and glacier mass balance.

Role in the project

UPM team will participate in work packages WP2 (assessment of existing cryospheric observing systems), WP3 (development of a new ground-penetrating radar with improved technical characteristics) and WP6 (showing to stakeholders the performance of the iAOS by means of a demonstration combining a large set of data from various sources into a modelling experiment, using a data assimilation approach).

Key personnel CVs

Dr. Francisco Navarro (M), Geophysicist, team leader

His research focus is on dynamics and mass balance of glaciers, with emphasis on numerical modelling of glacier dynamics, applications of ground-penetrating radar to estimate the ice-thickness distribution of glaciers and the physical properties of glacier ice, and mass balance calculations by the glaciological and the geodetic methods. His current main positions of relevance are:

- Director of the Group of Numerical Simulation in Science and Engineering of Universidad Politécnica de Madrid.
- Co-ordinator of the Doctorate Programme Engineering Mathematics, Statistics and Operation Research, a joint PhD programme of Universidad Complutense de Madrid and Universidad Politécnica de Madrid.
- Chair of (and Spanish Representative to) the Cryosphere Working Group of the International Arctic Research Committee (IASC),
- Spanish representative to the Physical Sciences Standing Scientific Group of the Scientific Committee on Antarctic Research (SCAR),
- Member of the Steering Committee of the Ice Sheet Mass Balance and Sea Level (ISMASS) joint working group SCAR-IASC-CliC,
- Vice-Chairman of the International Advisory Board of the Centre for Polar Studies, Poland,
- Associate Editor of the journal Frontiers in Cryospheric Sciences and member of the Editorial Committee of the Russian journal Ice and Snow.

He also recently served as Vice-President of the International Glaciological Society (2012-2014).

Dr. María Isabel Corcuera (F), Mathematician/Geodesist. Her research focus is on dynamics and mass balance of glaciers, with emphasis on applications of the finite element method to the modelling of glacier dynamics. She is currently the responsible for the Glacier Mass Balance research line of the Group of Numerical Simulation in Science and Engineering. She has recently worked on combining glacier remote sensing observations and modelling of glacier dynamics to infer, by inverse methods, glacier ice-thickness distributions, used to estimate the glacier discharge to the ocean from the marine-terminating ice caps.

Dr. Javier Lapazaran (M), Telecommunications Engineer. His research focus is on ground-penetrating radar applications in glaciology and geostatistics, with emphasis on radar data collection, processing and analysis techniques, retrieval of ice-thickness distributions from radar data, and their spatial interpolation to construct digital elevation models of ice-thickness and calculating glacier volumes. He is currently the responsible for the Ground-penetrating Radar research line of the Group of Numerical Simulation in Science and Engineering. He is Deputy Director for Academic Planning of the School of Telecommunication Engineering of Universidad Politécnica de Madrid. He is a Review Editor of Frontiers in Cryospheric Sciences.

Dr. Jaime Otero (M), Mathematician/Geodesist. His research focus is on glacier dynamics, with emphasis on numerical modelling of dynamics and thermal regime of glaciers, and their interaction with the oceans. During the last few years, he has focused on the calving problem and, more recently, on the submarine melting at the front of tidewater glaciers. He is currently the responsible for the Numerical Modelling research line of the Group of Numerical Simulation in Science and Engineering. He is a Review Editor of Frontiers in Cryospheric Sciences.

Publications, and/or products, services or other achievements:

1. Hanna, E., Navarro, F.J. and 10 others (2013). Ice-sheet mass balance and climate change. *Nature*, **498**, 51-59, doi:10.1038/nature12238.

2. Navarro, F.J., Jonsell, U.Y., Corcuera, M.I. & Martín-Español, A. (2013). Decelerated mass loss of Hurd and Johnsons glaciers, Livingston Island, Antarctic Peninsula. *J. Glaciol*., **59**(214), 115-128, doi: 10.3189/2013JoG12J144.

3. Navarro, F.J., Martín-Español, A., Lapazaran, J.J., Grabiec, M., Otero, J., Vasilenko, E.V. & Puczko, D. (2014). Ice volume estimates from ground-penetrating radar surveys, Wedel Jarlsberg Land glaciers, Svalbard. *Arct. Antarct. Alp. Res.*, **46**(2), 394-406, doi:10.1657/1938-4246-46.2.394.

4. Martín-Español, A., Navarro, F.J., Otero, J., Lapazaran, J.J. & Blaszczyk, M. (2015). Estimate of the total volume of Svalbard glaciers, and their potential contribution to sea-level rise, using new regionally-based scaling relationships. *J. Glaciol*., **61**(225), 29-41, doi: 10.3189/2015JoG14J159.

5. Osmanoğlu, B., Navarro, F.J., Hock, R., Braun, M. & Corcuera, M.I. (2014). Surface velocity and mass balance of Livingston Island ice cap, Antarctica. *The Cryosphere*, **8**, 1807-1823, doi: 10.5194/tc-8-1807-2014.

Projects, and/or activities

1. Research project "Mass discharge from glaciers to the ocean: improving current estimates and forecasting future contributions under a changing climate" (PI: Francisco Navarro), funded by the Ministry of Economy and Competitiveness (National Plan of R+D), 2015-2017.
2. Research project "Calving fluxes, surface mass balance and hydrothermal structure: understanding the dynamic response of glaciers to climate changes" (PI: Francisco Navarro), funded by Ministry of Economy and Competitiveness (National Plan of R+D), 2012-2014.
3. Research project "Sensitivity of Svalbard glaciers to climate change (SvalGlac)" - International research project (2010-2013) within PolarCLIMATE ERA-NET by the European Science Foundation-European Polar Board, led by Prof. Jacek Jania (Poland) and Prof. Francisco Navarro (Spain), co-coordinators (8 partners & 5 associate partners).
4. Research project "The dynamic response of Arctic glaciers to global warming" (GLACIODYN), International Polar Year 2007-2008 project endorsed by the Joint Committee for the International Polar Year 2007-2008 on 30-11-2005, lead by Prof. Johannes Oerlemans, Utretch University, The Netherlands (PI of Spanish team: Francisco Navarro).
5. "Airborne radio-echo sounding of Sermeq kangigdleq and its catchment area, Southern Greenland", research contract with the Geological Service of Denmark and Greenland (GEUS), June-October 2013 (PI: Francisco Navarro).

Significant infrastructure, and/or major items of technical equipment:

- In-house built ground-penetrating radars VIRL2, VIRL6 and VIRL7 with flexible antennas of 15-25 and 75 MHz.

- Ground-penetrating radar Ramac/GPR, with ProEx control unit and rigid antennas of 25 and 200 MHz, and flexible antenna (of RTA type -rough terrain antenna) of 100 MHz.
- GNSS differential (Leica 1200) and stand-alone GNSS systems for support of geodetic and ground-penetrating radar glaciological fieldwork.
- Electronics lab for development of radar systems.
- Computing system Shuttle H2216, with 2 Intel Xeon E5-2650 processors of 8 cores each, and a data server NETGEAR ReadyNAS 316 RN31600 18 TB, for support of modelling work (for local work; there is also access to CESVIMA supercomputing system).

21. University of Bremen / Universität Bremen (UB)

Expertise and experience of the organization

www.iup.uni-bremen.de/eng The Institute of Environmental Physics, founded in 1993, has over 100 Ph.D. students and postdocs exploring the system Earth with physical methods. Foci are the atmospheric, oceanic and cryospheric sciences and remote sensing methods, among other with satellites, and ground based, airborne and shipborne sensors. Many projects use external platforms or carrier systems, among them the research vessel Polarstern of the Alfred-Wegener-Institute in Bremerhaven, research aircrafts, stratospheric balloons and ground based stations all around the world, from the tropics to the poles. Most important tools for our work are the satellite experiments like SCIAMACHY on ENVISAT and AMSR-E /AMSR2 on AQUA and GCOM-W. For these instruments the institute operationally calculates a high number of retrieval data products, among of them atmospheric parameters and daily maps of sea ice concentration and thickness which are appreciated since 1999 by a worldwide user community, see ww.iup.uni-bremen.de/8084/amsr2.

Role in the project

- WP2: New technologies to fill the gap in the in situ observing system:
  - Near real time retrieval of atmospheric total water vapor over Arctic sea ice and open ocean from microwave sounders and imagers
  - Detection of polar mesocyclones using satellite microwave sounder data (AMSU-B, MHS)
  - Sea ice concentration under summer conditions
- WP5: Validation activities for the three products above.

Key personnel CVs

Georg Heygster (M), Academic Director, Dr. rer. Nat. (1979) in Physics. Leader of the Physical Analysis of Remote Sensing images (PHAROS) Group at IUP. He has over 20 years' experience in research in remote sensing of the earth surface (sea ice, snow, land cover) and atmosphere (water vapor, cloud liquid and ice water), especially of the polar regions and tropics. Moreover he has worked on regional remote sensing applications, and on the development of new sensors. Published over 75 scientific articles in refereed journals. Coordinator of several projects funded by EU (IOMASA, PELICON), ESA, DFG (German research foundation) and others. Teaching remote sensing and image processing including supervision M. Sc. and Ph. D. students.

Christian Melsheimer (M), senior researcher, Dr. rer. nat. (1998) in Geosciences, has been working in the field of remote sensing for more than 10 years. He has experience in satellite remote sensing (both active and passive) of the ocean and the atmosphere, e.g. with synthetic aperture radar (SAR) data, microwave radiometer data or with visible/near-infrared data. In the past years, his research has been focussing on passive microwave remote sensing of the polar atmosphere and polar surfaces (ice and ocean) and on radiative transfer in the atmosphere in the microwave frequency range.

Larysa Istomina (F), postdoc researcher, Dr. rer. nat. (2011) in Physics, has been working in the field of remote sensing for more than 6 years. She has experience in satellite remote sensing of both Arctic surface and atmosphere with nadir-looking and multiviewing radiometers in the visible and near-infrared regions of spectrum. In the past years, her research was focused on sea ice albedo and melt pond evolution, both spaceborne and in situ observations.

Publications, and/or products, services or other achievements:

1. G. Spreen, L. Kaleschke and G. Heygster 2008: Sea ice remote sensing using AMSR-E 89 GHz channels. J. Geophys. Res 113, C02S03, doi:10.1029/2005JC003384.
2. Melsheimer, C., T. Frost, G. Heygster 2015: Detectability of Polar Mesocyclones and Polar Lows in Data from Space-borne Microwave Humidity Sounders. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, doi:10.1109/JSTARS.2015.2499083
3. Istomina, L., G. Heygster, M. Huntemann, H. Marks, C. Melsheimer, E. Zege, A. Malinka, A. Prikhach, and I. Katsev 2015: Melt pond fraction and spectral sea ice albedo retrieval from MERIS data – Part 2: Case studies and trends of sea ice albedo and melt ponds in the Arctic for years 2002–2011 The Cryosphere 9:4, 1567--1578, doi:10.5194/tc-9-1567-2015
4. Istomina, L., G. Heygster, M. Huntemann, P. Schwarz, G. Birnbaum, R. Scharien, C. Polashenski, D. Perovich, E. Zege, A. Malinka, A. Prikhach, and I. Katsev 2015: Melt pond fraction and spectral sea ice albedo retrieval from MERIS data – 1: Validation against in situ, aerial, and ship cruise data. The Cryosphere 9, 1551-1566, doi:10.5194/tc-9-1551-2015
5. C. Melsheimer, G. Heygster 2008: Improved retrieval of total water vapor over polar regions from AMSU-B microwave radiometer data. IEEE Trans. Geosci. Remote Sens. 46(8), p.2307-2322, doi:10.1109/TGRS.2008.918013.

Projects, and/or activities: Recent project contributions

1. EU project Space-borne observatons for detecting and forecasting sea ice cover extremes (SPICES, 2015-2018): Retrieving from satellite observations (1) melt pond fraction and albedo of summer sea ice; (2) thickness of thin ice with L band sensor SMAP (Soil Moisture Active and Passive, NASA)
2. EU project Polar Ice (2014-2016): Sea ice thickness from L band sensor SMOS (Soil Moisture and Ocean Salinity, ESA) and multisensor sea ice thickness product.
3. ESA Climate Change Initiatiave projects on Sea Ice (SICCI, phases I and II): Influence of sea ice thickness on microwave brightness temperatures, high resolution sea ice concentrations from high frequency microwave observations, snow thickness on sea ice.
4. Band Radiometry for Sea Ice Applications: ESA STSE study 2007-2009 (Lead)
5. IOMASA – Integrated Observing and Modelling of the Arctic Sea ice and Atmosphere: EU FP5 project 2004-2007 (Co-ordinator).

22. University of Hamburg, Center for Earth System Research and Sustainability / Universität Hamburg (UHAM)

Expertise and experience of the organization

The Center for Earth System Research and Sustainability (CEN) is a recognized research center at the University of Hamburg. It brings together the expertise of nine university institutes and facilities and is part of the KlimaCampus Hamburg. Members include oceanographers, meteorologists, marine biologists, geophysicists, geologists, soil scientists, geographers and biogeochemists, as well as researchers in the business and social sciences, all of whom are actively engaged in climate, environmental and earth system research. As such, CEN links the natural and social sciences and combines resources to address far-reaching, cross-disciplinary questions.

The Institut für Meereskunde, as one of the members of CEN, performs basic research and academic education in physical oceanography. It has a staff of 60 researchers and is equipped for sea going ocean work. It has access to the fleet of German research vessels. The observational activities have always been complemented by modelling studies, notably, but not exclusively, on circulation in the North Atlantic. Remote sensing and data assimilation is another expertise for which UHAM is well known. The institute performs the German ECCO effort (GECCO) by which global and regional data assimilation is being performed over the past 50 years. It has access to the university's computer centre and the German Climate Computing Centre (DKRZ). The institute's research plan calls for focus in the European Arctic and Sub-arctic Seas in the fields of experimental, modelling and remote sensing work.
UHAM has been actively participating in various European projects as well as in the North Atlantic field work for CLIVAR. UHAM has a well-established and reputed ability for participating EC research projects in different disciplines and receives professional support by the financial and administrative staff of the University. UHAM is well prepared for procedures implemented in projects funded by European

Commission and builds up on the experience made in coordinating and participating in over two hundred EC funded projects from FP5 throughout H2020. UHAM provides experienced, skilled and significantly endowed technical and administrative resources.

Role in the project

Within **WP2** UHAM will be contributing to the following: Identification of key parameters required to observe the physical state of the Arctic: to this extent a coupled phyical model will be run and key parameters will be identified from the resulting time-varying state. Potential parameters: SSH, hydrography in upper Arctic, barotropic stream function, bottom pressure, sea level pressure, run-off and surface buoyancy forcing, wind stress, atmospheric temperature. Identification of sampling requirement of the identified key parameters: to this end the space-time variability of those parameters will be analyzed in coupled model simulations. From the results a sampling strategy will be identified; as well as the observing components that are suitable to perform the observations.

UHAM will contribute to **WP6** with focus on the integration information production: Setup of an Arctic synthesis system for an integrated interdisciplinary observing system. This work will build on previous MONARCH-A work, improve and expand it using the GECCO and CESAM model environments.

UHAM will also compile roadmap within **WP1**.

Key personnel CVs

Dr. Detlef Stammer (M) is Professor of physical oceanography and earth system remote sensing, and Head of the Remote Sensing and Data Assimilation Department at UHAM. He has worked with climate observations and models for nearly 20 years, with a focus on using remote sensing data and global data assimilation. He has led the US ECCO consortium and providing the first dynamically consistent re-analysis of the global ocean. He worked at the Massachusetts Institute of Technology and the Scripps Institution of Oceanography before moving to Hamburg. He has been a member of numerous national and international panels on remote sensing and data assimilation. He is one of leaders of the CliSAP Excellence Initiative in Hamburg and was Head of the SICSS Graduate School of CliSAP. He is director of the Center for Earth System Research and Sustainability (CEN) at the University of Hamburg. He is co-chair of WCRPs core project CLIVAR on the ocean-atmosphere system and leads the WCRP grand challenge on regional sea level change and coastal impacts. He has been participating in numerous EU framework projects such as Monach-A, THOR, NACLIM and SPICES, as well as projects funded by *European Space Agency* (ESA). Recently he is pioneering coupled data assimilation building and using a coupled adjoint assimilation model (CESAM). Detlef will be involved in WP2, WP6 and WP1.

Dr. Armin Köhl (M) is Senior Researcher, his expertise is on data assimilation into numerical circulation models. He has also been involved in EU FP7 THOR and NACLIM projects. Armin will be involved in WP2, WP6 and WP1.

Dr. Nuno Serra (M) is Senior Researcher, his expertise is on ocean modeling and the Arctic circulation. He has also been involved in the EU FP7 MONARCH-A and NACLIM projects. Nuno Serra will be involved in WP2 and WP1.

Relevant publications, products, service and/or other achievements

1. Agarwal, N.; Köhl, A.; Mechoso, R.; Stammer, D. (2014): On the Early Response of the Climate System to a Meltwater Input from Greenland. Journal of Climate 27, 8276-8296. doi: 10.1175/JCLI-D-13-00762.1
2. Agarwal, N., Jungclaus, J. H., Köhl, A., Mechoso, C. R., & Stammer, D. (2015): Additional contributions to CMIP5 regional sea level projections resulting from Greenland and Antarctic ice mass loss. Environmental Research Letters, 10(7), 074008. doi: 10.1088/1748-9326/10/7/074008
3. Johannessen, J.A.; Raj, R. P.; Nilsen, J. E. O.; Pripp, T.; Knudsen, P.; Counillon, F.; Stammer, D.; Bertino, L.; Andersen, O. B.; Serra, N.; Koldunov, N. (2014): Toward improved estimation of the dynamic topography and ocean circulation in the high latitude and Arctic Ocean : the importance of GOCE. Surveys in Geophysics 35, 661-679. doi: 10.1007/s10712-013-9270-y
4. Koldunov, N., A. Köhl, and D. Stammer (2013): Adjoint-based sensitivities of Arctic Sea ice properties. Climate Dynamics, 41, 227-241, doi: 10.1007/s00382-013-1816-7.

5. Koldunov, N.; Serra, N.; Köhl, A.; Stammer, D.; Henry, O.; Cazenave, A.; Prandi, P.; Knudsen, P.; Andersen, O. B.; Gao, Y.; Johannessen, J. (2014): Multi-model Simulations of Arctic Ocean Sea Surface Height Variability in the Period 1970-2009. Journal of Geophysical Research, Volume 119, Issue 12, 8936–8954, doi: 10.1002/2014JC010170

Relevant Projects

NACLIM (funded by EU FP7, 2012 - 2017): North Atlantic Climate. NACLIM aims at investigating and quantifying the predictability of the climate in the North Atlantic/European sector related to North Atlantic/Arctic sea surface temperature (SST) and sea ice variability and change on seasonal to decadal time scales. Long-term observations of relevant ocean parameters that are necessary to assess the forecast skill of the model-based prediction results are to be carried out. The project identifies those observations that are keys to the quality of the prediction and in turn optimize the present observing system. NACLIM quantifies the impact of North Atlantic/European climate change on high trophic levels of the oceanic ecosystem as well as on urban societies. NACLIM is a follow-up of the EU FP7 funded project THOR: "Thermohaline Overturning – at Risk?", which addressed the call on Stability of the ThermoHaline Circulation/THC of the EU FP7 programme.

RACE I and II (funded by BMBF Germany, 2012 – 2018): Regional Atlantic Circulation and Global Change. The joint initiative RACE investigates the regional Atlantic circulation and global change. Changes of the future Atlantic circulation over the next 10 to 100 years are one of the foci. Results will help to quantify repercussions on the global ocean, the climate system and the European shelf area, including humans. Investigations include an improved process understanding which will enhance knowledge about the adaptation possibilities of a future ocean circulation. Hence, simulating regional processes may be improved.

SPP 1889 (funded by DFG large-scale priority programme, Germany, 2016 - 2022): Regional Sea Level Change and Society (SeaLevel) within the SPP programme. SPP 1889 is proposed to advance the understanding of regional climate-related coastal sea level change and its interactions with socio-economic developments. Work focuses on two study regions, notably the North and Baltic Seas with potential impacts on Germany and the South-East Asia region encompassing several coastal mega cities and delta regions. The selected regions contrast developed and developing countries and thus differ fundamentally in their regional societal impact of and adaptation potential to sea level change. Developing successful strategies to cope with sea level change in these two regions largely depends on advancing our understanding of processes influencing regional sea level, on available scientific information on sea level change at the coastlines and their uncertainty, on available resources and economic power, and on adequate planning and effective local governance structures.

Relevant significant infrastructure and/or technical equipment

CliSAP: Universität Hamburg's Cluster of Excellence "Integrated Climate System Analysis and Prediction" (CliSAP) is a vital alliance among natural sciences and humanities, the cluster is funded by the German Research Foundation (DFG). Major CliSAP contributors are the Max Planck Institute for Meteorology (MPI-M), the Helmholtz-Zentrum Geesthacht (Centre for Materials and Coastal Research, HZG), and the German Climate Computing Center (DKRZ). CliSAP is aiming to cross academic boundaries and bringing academic disciplines together to answer questions in the context of climate and societal changes. The scientists from key research areas of meteorology, oceanography, geophysics, and ecology are working in unison with social scientists, economists, media experts, and peace researchers. The cluster's primary focus is on climate variability and predictability; in particular, regional variations and the interaction between climatic change, economic, and social factors.

DKRZ: the German Climate Computing Center, provides the facilities of supercomputer that is capable of addressing the complexity of world climate and the endless change in both its individual components and their manifold interaction with high performance computing platforms, sophisticated and high capacity data management, and superior service for premium climate science.

ICDC Data Center: The CliSAP-Integrated Climate Data Center (ICDC) allows easy access to climate relevant data from in-situ measurements and satellite remote sensing. These data are important to determine the status and the changes in the climate system. Additionally some relevant re-analysis data are included, which are modeled on the basis of observational data.

23. Northern Research Institute Tromsø (NORUT)

Expertise and experience of the organization

Norut Northern Research Institute (Norut) is a Norwegian research group that produces knowledge with practical applicability relevant to the High North within technology and social science. Norut has 64 employees where the earth observation department is the largest with 27. Norut has performed research and development on unmanned aircraft technologies since 2005. Together with commercial partners Norut has developed the Cryowing drone family with aircraft ranging from 2 to 60 kg and range up to 1200 km. Norut has performed operations and collected environmental data in Antarctica, Greenland, Iceland, Finland, Svalbard, Norway and from ships. Research is done on robust platforms, sensors and remote sensing services for arctic use. Norut has a range of sensor packages, UV/VIS/IR cameras, hyperspectral imagers, ground penetrating radars, laser altimeters, meteorological sensors and aerosols.

Role in the project

Norut plans an extensive field campaign based out of Ny-Ålesund, where Norut established the Arctic Unmanned Aircraft Facility in 2015 (WP2). This facility consists of an aircraft hanger/workshop and an instrumented operations room. The plan for the campaign is to deploy for 3 weeks in the Aug/Sept timeframe, to measure sea-ice properties in transects northwest across the Fram Strait coordinated with satellite overpasses. Properties to be measured are; sea-ice concentration; sea- ice thickness distribution, snow depth on sea-ice and sea-ice drift velocities. The plane planned used for the work is the Cryowing Explorer a 60 kg, 5.2 meter wingspan gas powered aircraft developed by Norut, instrumented with laser altimeter, a survey grade GPS and a ground penetrating radar. The campaign is co-financed by the NRC projects ARCEx and CIRFA in addition to the Intaros Horizon2020 project.

Key personnel CVs

Assoc. Prof. Rune Storvold (M) is a senior scientist at Norut and has an adjunct position at the Norwegian University of Science and Technology. He has headed the UAS activities at Norut since its startup in 2005. He has a master in physical optics and PhD in atmospheric science. Research interests focus on remote sensing of the atmosphere and the cryosphere using optical and microwave sensors. Dr. Storvold is co-chair for the UAS expert group under the Arctic Council Arctic Monitoring and Assessment Program and are currently involved in 5 EU/EEA projects as well as a PI and CO-PI in several projects funded by the Norwegian Research Council involving use of unmanned aircraft.

Dr. Agnar Sivertsen (M) is a senior scientist at the Norut earth observation group. He has a master degree in applied physics and a PhD in statistics from the University of Tromsø. At Norut Agnar is working with automatic detection and classification of sea ice using UAS and is also leading the project "Kompetansesenter for Luftfartbasserte Tjenester" (KSLT). In KSLT the plan is to equip two manned aircrafts with sensors for detection of sea ice, oil spill and other objects with regard to search and rescue. Research interests focus on remote sensing, automatic image analysis and signal processing.

Dr. Stian Solbø (M) is a senior scientist at Norut, where he has been heavily involved in drone research the last decade, and PI for several drone related projects. His main research interest is remote sensing, and retrieval of geophysical parameters from UAS-borne sensors. Solbø has long experience from field campaigns and piloting drones in Svalbard, Greenland and Antarctica.

Publications, and/or products, services or other achievements:

1. R. Storvold, Brenda Mulac, Sergey Lesenkov, Doug Marshall, and John Burkhart, "Use of Unmanned Aircraft for Scientific Data Collection in the Arctic", The Arctic Herald No 1(5), pp. 64-71, Russian Geographic Society, ISSN 2304-3032, Moscow, 2013.
2. R. Storvold, B. Mulac, "Arctic Council, Arctic Monitoring and Assessment Program",2013 RPAS Yearbook - RPAS the Global Perspective, 11th edition, June 2013.
3. S. A. Solbø and R. Storvold,"Mapping Svalbard Glaciers with the Cryowing UAS", UAVg conference Rostock, Sept. 4-6th 2013
4. D. Stødle, N. Borch, R. Storvold," High-performance fusion of UAS sensor and image data with raster maps and topography in 3D", UAVg conference Rostock, Sept. 4-6th 2013

Projects, and/or activities

1. **Arctic EO (2009-2017)** The project "Arctic Earth Observation and Surveillance Technology" is one of five projects funded under the NORSATSING initiative. This is a 5+3 year program where the continuation is dependent on a mid-term evaluation of the program as a whole. Continuation was just approved an a project plan for the 3 last years will be made by the end of the year. The main focus of the project is development of new and improved remote sensing methods and models based on satellites and unmanned aircraft. Applications are mapping and characterization of sea-ice, oil-spills, and glaciers; target detection; atmospheric trajectory modeling including chemistry. As supporting activities the project conduct research on RPAS flight control and sensor development (drop sondes, Radars (GPR and SAR), BC-sampler)
2. **NorthState (2013-2017)** The project "Enabling intelligent GMES services for carbon and water balance modeling of northern forest ecosystems" is a EU FP7 Space Program funded project that just got funding and activities is expected to start October 1st. The main goal is to develop innovative data fusion methods that exploit the new generation of multi-source data from Sentinels and other satellites in an intelligent, self-learning framework that is interfaced to state-of-the art carbon and water flux models, with a view monitoring these fluxes over boreal Europe and reducing their current large uncertainties. This will provide a paradigm for the development of products for future GMES services that will be applicable far beyond its specific application to the boreal zone.
3. **Research Centre for Arctic Petroleum Exploration (2013-2021)** This centre is funded by the NRC Petromaks 2 program and Norut's part of the project is to develop RPAS based remote sensing capabilities for characterization of sea-ice and tracking of Icebergs.
4. **E-GEM (2013-2017)** This is an EU FP7 Space Call project investigating use of bistatic GNSS-R signal to retrieve ocean state, soil moisture, biomass and cryosphere parameters using RPAS, for assessment of potential new satellite sensors.
5. **CIRFA (2015-2023)** Centre for Integrated Remote Sensing and Forecasting for Arctic Operations is a centre for research-based innovation (CRI). The Centre shall do research on methods and technologies that can reliably detect, monitor, integrate and interpret multi-sensor data describing the physical environment of the Arctic, and efficiently assimilate this information into models to perform predictions of sea ice state, meteorological and oceanographic conditions, on both short and long timescales.

Significant infrastructure, and/or major items of technical equipment

ASUF (Arctic Centre for Unmanned Aircraft) facility in Ny-Ålesund, Svalbard, consisting of a building with workshop/hanger facilities and an operations room with communication and control systems for operating advanced long range unmanned aircraft systems. A 900 runway is located by the building. Further Norut owns a fleet of aircraft for low altitude long range science missions http://www.asuf.no .

24. Terradue Srl (TDUE)

Expertise and experience of the organization

Terradue Srl addresses the Earth Sciences research & education sector, with core competencies aimed at engineering distributed systems and Cloud services, providing consultancy for international organizations, and developing partners programs in support of Terradue's Open Source Platforms and Standardization strategy. Terradue is a leading Cloud Services provider with current developments focusing on empowering researchers within seamless eScience infrastructures, for curating and delivering scientific information, and to create Cloud marketplaces for environmental data analytics and promoting a vision where scientific publications are fully reproducible, verifiable experiments and part of an interoperable ecosystem.

The company founders worked for nearly four years in the development of the Grid infrastructure in ESRIN, the ESA G-POD (Grid Processing on Demand for Earth Observation). Since 2006 Terradue maintains and supports the integration of operational applications and services according to ESA Software Engineering standards. Terradue is also responsible of the integration of the ESA EO routine production processors and Principal Investigators scientific applications on the infrastructure in the frame of a dedicated announcement of opportunities.

Role in the project

Terradue brings to the consortium its expertise in the provision of EO data and distributed computing platforms, enabling scientific applications to exploit distributed processing capabilities without re-engineering them. Terradue will lead WP5 and provide its cloud platform and framework for developing and hosting services and products for WP6.

Key personnel CVs

Dr. **Pedro Gonçalves (M)**, Terradue founder and Chief Technical Officer. Pedro is an Environmental Engineer and did a post-doc in ESA-ESRIN where he led the development and transfer to operations of the G-POD. Pedro is the editor and collaborator of several Open Geospatial Consortium specifications dealing with discovery and access of Earth science information focusing on integration with the Open Linked Data architecture. Pedro focuses on leveraging the processing power and agility of cloud computing for the development of new exploitation platforms for environmental and climate change data.

Emmanuel Mathot (M) has a background in Computer Science and is Terradue's Project Technical Leader. Before joining Terradue, Emmanuel spent over five years in ESA ensuring the operations G-POD operations where he managed the hosting of Principal Investigator scientific algorithms. In Terradue, Emmanuel brought the enhancement of the distributed processing capabilities with the introduction of the private, commercial and hybrid Cloud managed transparently by OpenNebula and the Hadoop Map/Reduce.

Cesare Rossi (M) focus on developing and maintaining a high performance and distributed computing infrastructure to support EO applications, by leveraging well known programming models for processing and generating large data sets with distributed algorithms (MapReduce). Cesare is involved in performance analysis of EO algorithms in distributed and hybrid Cloud environments, collecting execution metrics and presenting results in a comprehensive manner. Cesare has a strong academic background, with a particular interest in distributed systems and high performance computing (Grid Computing and Cloud Computing), developed during five years at the University of Rome "Tor Vergata" and a year of trainee at the ESRIN - ESA's centre for Earth observation

Publications, and/or products, services or other achievements

1. Global monitoring of plankton blooms using MERIS MCI, J Gower, S King, P Goncalves Inter. Journal of Remote Sensing 29 (21), 6209-6216, 2008
2. Building a mosaic of clouds, B Di Martino, D Petcu, R Cossu, P Goncalves, T Máhr, Euro-Par 2010 Parallel Processing Workshops, 571-578, 2011
3. Variational optimization for global climate analysis on ESA's high performance computing grid, A Löscher, C Retscher, L Fusco, P Goncalves, F Brito, Remote Sensing of Environment 112 (4), 1450-1463, 2008
4. GENESI-DR Portal: a scientific gateway to distributed repositories, P Goncalves, F Brito, F D'Andria, R Cossu, L Fusco, EGU General Assembly Conference Abstracts 12, 12234, 2010
5. Local and remote geoprocessing applications, PP Gonçalves, M Costa, Computers, environment and urban systems 23 (4), 287-303, 1999

Projects, and/or activities

1. European Space Agency (ESA) Thematic Exploitation Platforms (TEP) Focuses on the capitalization on Ground Segment capabilities and ICT technologies to maximize the exploitation of EO data from past and future missions. These projects intend to develop an innovative operations concept complementary to its current ESA EO Payload Data Ground Segment (PDGS). Terradue was actively involved on the precursor activities for the definition of the TEP reference architecture and is currently participating is the prime contractor of the GeoHazards TEP and is participating in the Urban and Hydrology TEPs leading the tasks of implementation and integration of thematic services on Earth Observation Cloud Platform
2. ESA Grid Processing on-Demand: Terradue is responsible for the maintenance and evolution of the ESA Grid Processing on-Demand (ESA G-POD) Web Services infrastructure for Earth Observation. This solution manages over 350 computing nodes in Italy and UK hosting a large number of EO processors and scientific applications running against several tens of Terabytes of on-line EO data.

3. ngEO – ESA's Next Generation User Services for Earth Observation Provides a set of generic services discover and download all Copernicus GMES Sentinel and 3-rd party Earth Observation Missions managed by the European Space Agency.
4. EC FP7 GENESI-DEC and DR: Aimed at establishing open Earth Science access for science users of data, information, products and knowledge originating from space, airborne and in-situ sensors.
5. EC FP7 SenSyF Development and testing of new processing chains and methods for Sentinel and Copernicus/GMES contributing mission data on a continuous basis, and the delivery of higher-level products and services complementing the information provided by the operational services.

Significant infrastructure, and/or major items of technical equipment

Terradue Cloud Platform is designed for two ICT provisioning scenarios in mind. The first scenario relies on a stable and predictable demand on the infrastructure (for persistent storage of large, stable datasets and for systematic processing), where it is possible to predict the need and consequently size the ICT a-priori. ICT resources rental or subscription to dedicated hosting solutions is used for this scenario. The second scenario is for applications that rely on growth hypothesis to scale up their processing and/or storage needs associated with variable, time-limited or unpredictable demands on the infrastructure. The Terradue Cloud Platform is ready for provisioning resources through cloud bursting for dynamically covering such needs. Typically these are processing on demand associated with user requests, or temporary resources needed for re-processing.

The core services of the Terradue Cloud Platform are currently located at *Hetzner Online AG* facilities in Germany. *Hetzner* is a strategic partner of Terradue and it is responsible of the bare metal maintenance operations and it guarantees the normal working of the IT infrastructure itself. The ICT facility is a Private Cloud platform, delivering PaaS and SaaS resources to the Earth Observation scientific community. It is built as a cluster of management servers and clusters of high performance workers nodes. The management part of the infrastructure provides services to the infrastructure and users like the VPN service, the first level Support system, and the IaaS cloud controller.

The Terradue Development Infrastructure is located in Rome on the company's own premises, where the maintenance operations are directly performed by the Terradue's Operational Team. The TDI is a Private Cloud platform to provide PaaS and IaaS services to the Terradue's Development Team. It is built as a cluster of management servers, a cluster of workers nodes and a cluster of storage nodes. Similarly VM configurations exist in order to serve different computing requirements for the development and testing activities. The management part of the infrastructure provides services like the VPN and the IaaS cloud-dev controller.

25. Greenland Institute of Natural Resources / Grønlands Naturinstitut (GINR)

Expertise and experience of the organization

The Greenland Institute of Natural Resources conducts research into Arctic ecosystems, monitors the living resources and the environment in Greenland and advises the Government of Greenland and other authorities on sustainable exploitation of living resources and safeguarding the environment and biodiversity.

The Institute has three departments: Department of Fish and Shellfish, Birds and Mammals, and Environment and Mineral Resources. The institute also comprise a cross-disciplinary Greenlandic/Danish climate centre: The Greenland Climate Research Centre. The centre conducts research into effects of climate change on the Arctic environment and Greenlandic society.

Research is conducted into Arctic ecosystems and how they are affected by climatic and human impacts focusing primarily on living marine resources, as well as land-based resources. Research is directed towards physical and chemical processes in the environment in relation to climate change and its impact upon fisheries, hunting, construction, and transportation.

The institute monitors animal populations, vegetation, physical and chemical parameters in order to follow trends associated with environmental change. Monitoring activities focuses on exploited species and constitutes a significant part of the continuous scientific documentation of population dynamics. Climate parameters are continuously monitored through all the monitoring programmes.

The Greenland Institute of Natural Resources advises the Greenland Home Rule on sustainable exploitation of living resources and safeguarding of the environment and biodiversity. The institute communicates knowledge of environmental issues and key findings to local and international stakeholders and interested parties, as well as being dedicated to publish achieved research results.

The institute is actively engaged in the development, implementation and teaching of Greenland/Arctic natural science topics together with Greenlandic, Danish and Canadian universities. The institute's educational program targets national and international university students, as well partaking in the development of educational tools and programs for high schools students in Greenland.

Role in the project

The Greenland Institute of Natural Resources will be actively involved in WP6 and WP7. The institute will contribute to WP6 by together with Aarhus University delivering monitoring data from the marine subprogram of the Greenland Ecosystem Monitoring programme (GEM). The institute will contribute to WP7 by implementing knowledge, results and findings achieved through this program into the institute's educational program targeting national and international university students and Greenlandic high school students.

Key personnel CVs

Dr. Thomas Juul-Pedersen (M) is a research scientist and education coordinator at the Greenland Climate Research Centre, Greenland Institute of Natural Resources (GINR). He is leading the marine monitoring program in SW Greenland (part of Greenland Ecosystem Monitoring) and collaborating with Aarhus University on the parallel program in NE Greenland. Thomas has more than 15 years of experience working with Arctic marine ecology, including more than a year in total on Arctic fieldwork. He is currently the Greenland representative on and has previously been the co-chair of the Marine section of the Circumpolar Biodiversity Monitoring Programme (CBMP). He has experience in leading national and international research/monitoring projects and meetings, and is active in the development, implementation and teaching of natural science course on university and high school level. He holds a Ph.D. in Arctic Biological Oceanography.

Publications, and/or products, services or other achievements

1. Juul-Pedersen T, Arendt KE, Mortensen J, Blicher M, Schrøder DS, Rysgaard S (2015) Seasonal and interannual phytoplankton production in a sub-Arctic tidewater outlet glacier fjord, SW Greenland. Marine Ecology Progress Series, Vol. 524: p. 27-38
2. Sørensen HL, Meire L, Juul-Pedersen T, Meysmann F, Rysgaard S, Thamdrup B, Glud RN (2015). Seasonal carbon cycling in a Greenlandic fjord: An integrated pelagic and benthic study. Marine Ecology Progress Series, DOI: 10.3354/meps11503
3. Meire L, Søgaard DH, Mortensen J, Meysman FJR, Soetaert K, Arendt KE, Juul-Pedersen T, Blicher ME, Rysgaard S (2015). Glacial meltwater and primary production are drivers of strong CO2 uptake in fjord and coastal waters adjacent to the Greenland Ice sheet. Biogeosciences, Vol. 12, p. 2347-2363
4. Krawczyk DW, Witkowski A, Juul-Pedersen T, Arendt K, Mortensen J, Rysgaard S (2015). Microplankton succession in a SW Greenland tidewater glacial fjord influenced by coastal inflows and run-off from the Greenland Ice Sheet. Polar Biology, DOI: 10.1007/s00300-015-1715-y
5. Juul-Pedersen T, Nielsen TG, Michel C, Møller EF, Tiselius P, Thor P, Olesen M, Selander E, Gooding S (2006). Sedimentation following the spring bloom in Disko Bay, West Greenland, with special emphasis on the role of copepods. Marine Ecology Progress Series, Vol. 314, p. 239-255

Projects, and/or activities

1. Juul-Pedersen T – Project lead (2005-ongoing) MarineBasis-Nuuk (Part of the Greenland Ecosystem Monitoring) 220.000 euro/annually
2. Juul-Pedersen T – Funding holder/program lead by AU (2002-ongoing) MarineBasis-Zackenberg (Part of the Greenland Ecosystem Monitoring) 260.000 euro/annually
3. Juul-Pedersen T – Project lead/co-lead (2012-15) GEM Strategic Initiatives (MarineBasis) >200.000 euro
4. Juul-Pedersen T – Project lead (2016) Natural Science Education Program in Greenland 165.000 euro
5. Juul-Pedersen T – Project lead (2016) CBMP-Marine Steering Group Greenland/Denmark 26.000 euro

Significant infrastructure, and/or major items of technical equipment

The Greenland Institute of Natural Resources have two larger research ships for inshore and offshore research and fish surveys, as well as five smaller research vessel. Field equipment for water and sea ice work is present and the institute comprises fully equipped modern laboratory facilities as well as guest accommodation and office space. A research cabin is situated in a neighboring fjord within a permanent climate monitoring area. Construction of a new natural science education building is in progress, which will provide the institute with dedicated teaching facilities including a large auditorium, classrooms, guest apartments and office space as well as fully equipped teaching laboratories.

26. Open University (OU)

Expertise and experience of the organization

The Open University, is one of the largest academic institution in Europe, with 250,000 students, including a variety of departments with a large breath of research expertise. The Faculty of Mathematics, Computing and Technology (MCT), is home to OU departments of Computing and Communications, Engineering and Innovation, and Mathematics and Statistics. The Faculty of Science is home to three academic departments (Environment, Earth and Ecosystems; Life, Health and Chemical Sciences; and Physical Sciences), and three research and scholarship centres: CEPSAR (the Centre for Physical Sciences Research), BRN (Biomedical Research Network), and eSTEeM (a joint Centre with MCT focusing on STEM pedagogical research and enterprise). International Development research at the OU is pioneering a different approach including 'inclusive innovation', working with poor and marginalized people developing their own solutions.

Role in the project

OU will contribute to WP2 and WP3 by providing new high spatial and temporal resolution temperature sensing systems to continuously monitor active layer depth, water table depth, and snow depth as well as the temperature profile and the zero curtain position, timing, and temperature, and eddy covariance data from five sites in Alaska. OU will finish developing the soil diffusivity system using LGR analyzers, AlphaGuard ^{222}Rn detector, and Membrana tubing to resolve soil and snow diffusivities, concentrations, and fluxes of CO_2 and CH_4. This is a new system that promises to provide continuous, year-round data on CO_2 and CH_4 concentrations, fluxes, consumption, and/or production in remote areas.

Key personnel CVs

Prof. Walter Oechel (M) is Professor in Biosphere Atmosphere Exchange at Open University, UK. His research focuses on developing a predictive capability and understanding the impacts and (OU) feedbacks of terrestrial ecosystems on global change. He has studied the ecology, ecosystem function, and impacts of global change on Arctic ecosystems in Alaska, Canada, and Russia in the course of which he discovered that Arctic ecosystems of Alaska switched from a sink to a source of CO2 to the atmosphere as a result of climate warming (Oechel et al., 1993, 2000, 2014), that the carbon balance of Arctic ecosystems acclimated to global warming (Oechel et al. 2000). In a recent paper, published in PNAS, he showed that 50% or more of the methane (CH_4) from Arctic ecosystems was emitted during the cold season, and that drier upland tundra was a larger emitter of CH_4 than inundated wetland tundra. He has also conducted work on climate change and ecosystems in Indonesia, Italy, France, Mexico, and California. His funding has exceeded £30 million over the last 30 years and he is a Highly Cited Researcher with over 250 ISI publications, more than 15,000 citations and an H index of 60. In 2015, he was identified as one of the "World's Most Influential Scientific Minds" by Thomson Reuters.

Publications, and/or products, services or other achievements

1. Zona D, […],W. Oechel. 2016. Cold season emissions dominate the Arctic tundra methane budget. Proceedings of the National Academy of Sciences, 113(1):40-45.
2. Zona D., Lipson D. A., Richards J. H., Phoenix G. K., Liljedahl A. K., Ueyama M., Sturtevant C. S., Oechel W. C., 2014. Delayed responses of an Arctic ecosystem to an extremely dry summer: impacts on net ecosystem exchange and vegetation functioning, Biogeosciences, 11, 5877–5888, doi:10.5194/bg-11-5877-2014.
3. Ikawa, H and W.C. Oechel. 2011. Air-sea CO2 exchange of beach and near-coastal waters of the Chukchi Sea near Barrow, Alaska. Continental Shelf Research, 31 (13), 1357-1364.

4. Oechel, W. C., C.A. Laskowski, G. Burba, B. Gioli, A. A.M. Kalhori. 2014. Annual patterns and budget of CO2 flux in an Arctic tussock tundra ecosystem. Journal of Geophysical Research: Biogeosciences, 119 (3), 323-339.
5. Oechel, W.C., G.L. Vourlitis, S.J. Hastings, R.C. Zulueta, L. Hinzman, and D. Kane. 2000. Acclimation of ecosystem CO2 exchange in the Alaskan Arctic in response to decadal climate warming. Nature. 406, 978-981.

Projects, and/or activities

1. With NSF funding, Prof. Oechel developed the first university owned and operated EC flux aircraft anywhere in the world, the Sky Arrow 650TCN Environmental Research Aircraft for CO2, H2O, energy and latter CH4.
2. Prof. Oechel has developed new approaches and methodologies: Pioneer in the development of Free Air Carbon Enrichment (FACE) facilities, use of natural CO2 springs in Iceland and in Italy.
3. Prof. Oechel developed and employed for 7 years eddy covariance for marine fluxes of CO2, heat, and water vapor fluxes. He has developed and employed P CO2 measurements for coastal marine, bay, and tropical river fluxes. He also developed a boat based eddy covariance systems for measurement of CO2 fluxes based on the technology and approaches employed by the SDSU flux Sky Arrow. This boat based eddy covariance system was successfully utilized in the Ph.D. program of Hiroki Ikawa for measurements in the San Diego Bay and the Point Loma Kelp Beds.
4. Prof. Oechel helped to precipitate the NSF GK-12 program. He was PI on the NSF GK-12 project that put graduate and undergraduate science students in the classroom with K-12 teachers. The program used real time data and video from Baja California, California and Alaska to illustrate key climate, climate change, ecological, and scientific principles. The students of teachers that participated in PISCES showed improved test scores in standardized testing even after PISCES graduate students were no longer participating in the classroom.

Significant infrastructure, and/or major items of technical equipment

OU operates five eddy covariance and meteorological towers in Alaska, which include a full suite of measurements. Three sites are located in Barrow including one at the NOAA observatory CMDL site. Another site is located in Atqasuk, 100 km to the south of Barrow and Ivotuk 300 km to the south of Barrow. All sites operate year-round. The Barrow-North Slope has the capability to comprise a super site. These sites includes gas analyzers to measure CO_2 and CH_4 fluxes, and environmental probes to measure soil and air temperature, soil moisture, rainfall, radiation, etc. One of the Barrow site has also a diffusivity system to measure soil CO_2 and CH_4 concentration and diffusion through the soil and snow layers.

27. Norwegian Institute for Water Research / Norsk Institutt for Vannforskning (NIVA)

Expertise and experience of the organization

The Norwegian Institute for Water Research (NIVA) is Norway's leading center of expertise in water related issues. NIVA's competence spans a wide range of environmental issues including marine biology and ecology, chemistry, pollution, sediments, and physical processes. NIVA is organized in two research centers: Center for Freshwater Research and Center for Coastal and Marine Research. The latter Centre undertakes among many disciplines including sensor development, research on use of remote sensing data, in situ measurements for marine ecosystem research and policy advice, and Arctic Ocean research. NIVA has a large pool of instruments for measurements of ecological and oceanographic processes both for moored and ship-borne configurations (e.g. FerryBox).

Role in the Project

WP1: Task 1.3 Engagement strategy and pan-Arctic Observing Forum

WP2, Tasks 2.1 and 2.2; Evaluation of existing systems and exploitation of existing and new ocean data

WP3: Tasks 3.2 and 3.4; Autonomous platforms and marine sensors on FerryBox and Svalbard moored buoy array (carbonate chemistry, microplastics, contaminants)

WP6: Task 6.5: Ocean acidification and inorganic C cycling. Location: Barents Sea, Svalbard, Lofoten Islands-Tromso-Kirknes; Stakeholder data uses from maritime and aquaculture industries; Links to WP1, 2, 3, and 4

Key Personnel CVs

Dr. Andrew King (M) is a Research Scientist at NIVA and holds an adjunct professor position at the University of Rhode Island. His research focuses on marine biogeochemistry with emphasis on biological interactions with nutrient and trace elements. His interests also include observing and understanding the effects of ocean acidification on marine biogeochemical cycles. He routinely combines field observations on research cruises with carefully designed shipboard and laboratory based experiments. He has over 20 peer reviewed publications.

Kai Sørensen (M) (cand. Mag.) is a Research Manager at NIVA for department of biogeochemistry and oceanography. He is a marine chemist with long experience in marine optics, remote sensing and in situ observation. He is leading the NIVA FerryBox infrastructure system which is used for national biogeochemical research, monitoring of eutrophication and marine acidification, and satellite validation projects. He has experience from NIVAs infrastucture as former technical manager for NIVAs Research Station and manager of NIVAs biological and chemical laboratories

Dr. Richard Bellerby (M) is scientific leader of the NIVA research group on ocean acidification and coordinator of biogeochemistry research. He is a marine biogeochemist studying the interactions between carbon biogeochemical cycling ecosystems, and climate change through observations and modelling. His research is towards an understanding of the response and feedback of ocean carbon biogeochemistry and marine ecosystems to climate variability. He has over 90 peer reviewed publications.

Dr. Luca Nizzetto (M) is a Research Scientist at NIVA and Senior Researcher at the Research Centre for Toxic Compounds in the Environment (RECETOX), Czech Republic. His research focuses on the integrated assessment of fate, distribution, impact and management of anthropogenic contaminants in the environment. He has focused in particular on the coupling between fate, transport and distribution of organic contaminants and biogeochemical cycles through both experimental activity and modelling. He has over 30 peer reviewed publications.

Dr. Wenche Eikrem (F) is a Research Scientist at NIVA, Associate Professor at University of Oslo and Curator of the Hasle diatom collection at the Natural History Museum in Oslo. She is a marine biologist experienced in the taxonomy and identification of microalgae/protists including toxic algae. Main research interests are biogeography and diversity of microalgae and her work includes the description of several species new to science. She has more than 40 peer reviewed publications. She is member of the ICES working group on biodiversity, editor of the microalgal list at Artsdatabanken, Norway.

Dr. Bert van Bavel (M) is Professor and an international leading scientist in the field chemical analysis of environmental contaminants and quality control. He has been leading the research group Environment and Health and head of the chemistry department at Örebro University. He is currently a Research Manager at (NIVA) for the section Environmental Chemistry. He is the co-author of more than 300 publications in environmental chemistry, including several key papers being among the first to discover brominated flame retardant and organic fluor compounds in humans and the environment. He has managed numerous national and international projects, including the WP 'Tools, Innovation and Applications: Monitoring, Remediation, Fragmentation and Modelling within the EU project Clean Sea.

Publications, and/or products, services or other achievements

1. Sørensen, K. (Ed.) (2006). FerryBox- From On-line Oceanographic Observation to Environmental Information. Report on the use of FerryBox data for validation purposes of satellite data. Deliverable D-5-4. EU-project FerryBox, Contract no. EVK2-2002-00144
2. Bellerby, R.G.J., Miller L., Croot P., Anderson L., Azetsu-Scott K., McDonald R., Steiner A. and Olafsson J., 2014. Acidification of the Arctic Ocean. In: Arctic Ocean Acidification Assessment, Arctic Monitoring and Assessment Programme, (AMAP), Oslo.
3. Gledhill, D.K., M.M. White, J. Salisbury, H. Thomas, A.L. King and 20 others. 2015. Ocean and coastal acidification off New England and Nova Scotia. Oceanography, 28(2):182-197, doi: 10.5670/oceanog.2015.41.
4. Nizzetto, L., Gioia, R., Li Jun, Pomati, F., Bettinetti, R., Dachs, J., Jones, K.C., Biological pump control of the fate and distribution of hydrophobic organic pollutants in water and plankton., 2012. Environ. Sci Technol, 46, 3204-3211.

5. B. van Bavel, D. Geng, L. Cherta, J.N. Mestre, et al. Atmospheric-Pressure Chemical Ionization Tandem Mass Spectrometry (APGC/MS/MS) an Alternative to High-Resolution Mass Spectrometry (HRGC/HRMS) for the Determination of Dioxins. (2015) Analytical Chemistry; 87(17)

Projects, and/or activities

1. NIVA participated in the FerryBox (EU) projects with NIVAs FerryBox lines with special attention to variables to be used for satellite validation. In the ongoing JERICO (EU) project NIVA works among many WPs especially in the development work packages on contaminants and carbon sensor systems.
2. EUFP7 NEXOS project we have special task on new carbon systems sensors.
3. EU-project EPOCA and SENSEnet are highly relevant for new sensor within ocean acidification and carbonate systems.
4. Two NIVA-coordinated TOXICALGAE and Chem Mariner-projects funded by the Norwegian Research Council are relevant for respectively the pelagic biodiversity activity and the activity on contaminants using passive sampling of organic contaminants in marine waters.
5. WP leader on Horizon 2020 JERICO-NEXT project on coastal ocean observations using mobile and fixed platforms on carbonate system variability, phytoplankton diversity, and emerging contaminants.

Significant infrastructure, and/or major items of technical equipment

FerryBox underway ocean observing systems on commercial container and ferries M/S Norbjorn (Tromso-Svalbard) and M/S Trollfjord (Bergen-Kirknes). These include plumbing and pumps, underway CTD, fluorescence, turbidity, pCO_2, pH, and radiance sensors. Cooperating project using a fleet of Waveglider autonomous vehicles in the marginal ice zone near Svalbard.

28. National Center for Scientific Research / Centre National de la Recherche Scientifique (CNRS)

Expertise and experience of the organization

CNRS is a public organization under the responsibility of the French Ministry of Education and Research. CNRS carries out research in all fields of knowledge, including environmental sciences. It employs a large body of tenured researchers, engineers and support staff. Four CNRS units (Unités Mixtes de Recherche, UMR, and Unité mixte Internationale, UMI) are involved in INTAROS : (1) The Laboratoire d'Océanographie et du Climat: Expérimentations et Approches Numériques (LOCEAN) in Paris, (2) the Institut Universitaire Européen de la Mer (IUEM) in Brest, through the Laboratoire des sciences de l'Environnement Marin (LEMAR) and the Laboratoire d'Océanographie Physique et Spatiale (LOPS), (3) the Laboratoire d'Océanographie de Villefranche (LOV) in Villefranche sur mer and (4) the Centre International d'Étude et de Modélisation des Écosystèmes et Géosystèmes Arctiques et Subarctiques (TAKUVIK) in Québec (Canada).

CNRS-LOCEAN (UMR 7159) is a leading laboratory in France employing about 100 permanent scientists in the field of ocean and climate research. The laboratory research focus is a better understanding of the role of the ocean in the coupled climate system and its variability. Topics range from the ocean general circulation to ocean-atmosphere interactions, ocean-sea ice dynamics and biogeochemistry and their coupling at various scales, ocean biology and ecology, and the ocean carbon cycle. LOCEAN is involved in many observational programmes, including several in the polar oceans and coordination of international projects involving ocean observation networks and monitoring systems. LOCEAN is a leading institute in ocean modelling, being responsible for the NEMO model system.

CNRS-IUEM (UMS3113) is a research institute devoted to the ocean and the coastal environment, with a strong multi-disciplinary approach addressing the different scales of the marine environment, from the deep sea floor to the waves at the surface, from microorganisms to complex ecosystems and global biogeochemical cycles, including interactions with human exploitation, and maritime economics and law. Research at IUEM is carried out through Joint Research Units among which : (1) **LEMAR** with activities on the marine ecosystem functioning and their response to global change. (2) **LOPS** with research devoted to observing and understanding the ocean dynamics from the global scale to the very sale scales of ocean waves, including ocean turbulence and the coastal oceanography.

CNRS-LOV (UMR 7093) is a joint research unit of CNRS and Université Pierre et Marie Curie (UPMC), the largest scientific university in France and one of the most prestigious universities. LOV is part of the

Observatoire Océanologique de Villefranche-sur-mer (OOV), a centre of excellence in oceanography. LOV has been involved in numerous EU projects and has led many initiatives on ocean acidification.

CNRS-TAKUVIK (UMI 3376 CNRS/Université Laval) Since its establishment in 2011 at Université Laval in Québec City, Canada, Takuvik Joint International Laboratory has fast become a leader in the study of ongoing climatic and anthropogenic changes in Arctic marine and terrestrial ecosystems and geosystems. Its state of the art facilities enable researchers to monitor phytoplankton ecophysiology and bio-optical properties under controlled conditions in laboratory and through ocean colour remote sensing. Takuvik has a strong expertise in developing bio-optical instrumentation for the Arctic Ocean. The Canada Excellence Research Chair in remote sensing of Canada's new Arctic frontier, held by Marcel Babin, is a keystone of the Takuvik program.

Role in the project

CNRS will contribute more specifically to INTAROS in WP3 through deployment and exploitation of autonomous observing systems and integration of multidisciplinary data. Contribution of **CNRS-LOCEAN** to WP3 will focus on supplementing the multidisciplinary mooring network on the northern Svalbard slope as part of the "North-Svalbard" super site and maintaining endurance glider lines in the European Arctic. **CNRS-LOV** will contribute to WP3 through: (1) near real time data of the carbonate system in Kongsfjord, (2) a web interface with public access, (3) a compilation of ocean acidification data in the Arctic and (4) a technical paper on the time series station. Contribution of **CNRS-IUEM** to WP3 will be trough deployment and exploitation of passive acoustic observatories at the "Greenland Coast" and "Fram Strait" sites, allowing to characterize simultaneously the ice environment and the coastal marine ecosystems of these regions. Contribution of **CNRS-TAKUVIK** to WP3 will be made through monitoring of the biogeochemical properties of the Baffin Bay with the deployment of 18 bio-Argo floats and observations of the coastal environment at a state-of-the-art field station in Qikiqtarjuaq (currently under development). In WP3 TAKUVIK will also monitor snow and permafrost properties through a network of 9 automated field stations distributed from 55°N to 83°N. TAKUVIK will also contribute to WP2 through monitoring of the pan-arctic polar environment based on satellite observations of the ocean color combined with a large suite of additional remotely-sensed information such as ice extent and thickness.

Key personnel CVs

CNRS-LOCEAN

Dr. Christophe Herbaut (M) Dr. Christophe Herbaut (male) is a research scientist at CNRS working at LOCEAN. He is physical oceanographer. His research has focused on the exchanges between the Arctic and the North Atlantic oceans, and the variability of the Arctic sea ice. He has a strong experience in implementing coupled ocean sea-ice models. He has been involved in several European projects in the Arctic (DYNAMITE, THOR, NACLIM).

Dr. Marie-Noelle Houssais (M) is Directeur de Recherche at CNRS working at LOCEAN. She is a physical oceanographer. Her main research interests focus on polar processes and sea ice ocean interactions and their role in the thermohaline circulation, from observations and models. She has a long experience in sea-going projects. She has coordinated the ALBION project on the dense shelf water formation on the East Antarctic shelf and its link to the glacial environment. She has been involved in several EU Arctic projects (in THOR and NACLIM as WP leader).

Dr. Laurent Mortier (M) is Professor of physical oceanography at ENSTA-Paristech. Laurent Mortier has been playing a major role in the development of the French National Glider Facility and the european EGO coordination between European institutions and SMEs. He has coordinated the FP7 design study for gliders (GROOM) for a European Research Infrastructure, and coordinates the ongoing H2020 BRIDGES project for developing a European deep glider. He is PI of the French Mediterranean Observing System MOOSE where gliders are routinely deployed

Dr. Pierre Testor (M) is a research scientist at CNRS working at LOCEAN in physical oceanography at meso and submeso scales, and on the exchanges between the coastal ocean and the deep ocean. In the last five years he has been investigating and monitoring the deep convection through coordinated multi-platform observing systems. He is an expert in ocean gliders, and has coordinated the glider community (EGO, Everybody's Gliding Observatories) through different projects. He was the Chair of the COST Action "EGO" and co-coordinated the FP7 GROOM design study.

CNRS-TAKUVIK

Dr. Marcel Babin (M) is an internationally recognized authority in marine optics and remote sensing. He holds the Canada Excellence Research Chair in Remote Sensing of Canada's New Arctic Frontier and is director of TAKUVIK. Dr. Babin was PI of the Malina project a joint France-Canada-US project that explored biodiversity and ecosystem processes in the Arctic Ocean, and is currently PI of the GreenEdge (2014-2017) project, an international consortium to study the dynamics of ice-edge phytoplankton spring blooms and their role in future Arctic marine ecosystems.

Dr. Florent Dominé (M) is an expert in snow physics and chemistry. Recently, his research interests have focused on interactions between snow, climate, vegetation and permafrost. He has set up snow and permafrost monitoring stations spanning the full range of permafrost types and vegetation cover in the Canadian subarctic and Arctic. He has developed new understandings of the relationship between climate, vegetation type and snow physical properties and on their impact on the permafrost thermal regime. He has authored or co-authored 110 peer-reviewed publications.

CNRS-IUEM

Dr. Laurent Chauvaud (M) is Directeur de Recherche at CNRS. He has a 20 years' experience in coastal ecosystems functioning, specialized in the role of suspension feeders in the control of primary production. He developed the use of bivalves as biological archives of the environment and the use of accelerometry and passive acoustics for ecosystem monitoring. He was PI of the international B.B. Polar (2013-2015) project using marine invertebrates to monitor environmental parameters of the Arctic ecosystems. He has authored ~80 publications.

Dr Fabrice Ardhuin (M) is Directeur de Recherche at CNRS, currently director of LOPS. He spent 9 years as a researcher and program manager for the Service Hydrographique et Océanographique de la Marine (Brest, France). He is a worldwide recognized expert in modelling and remote sensing of ocean waves from very high resolution sensors and various aspects of wave-current interactions, for which he was awarded the 2008 Fofonoff award by the American Meteorological Society. In 2009, he got an ERC Young Investigator Award for the IOWAGA project.

Dr Christine David-Beausire (M) is Physicienne Adjointe from the CNAP, a research national organization devoted to long term observing systems. Since 2015, she is Deputy Director of IUEM. She is an atmospheric physicist specialized on stratospheric particles and their role in ozone chemistry and climate-stratosphere interactions. She was Deputy Director at the French Polar Institute for 2 years. She is now coordinating the long term observing systems at IUEM and recently developed interests in polar coastal oceanography in the Arctic and East Antarctica.

Non academic sub-contractors (for CNRS-IUEM)

- **TBM** environment is an engineering consulting firm specialized in ecosystem management and cartographic and fauna-flora inventories In INTAROS, TBM will be in charge of the technical analysis of the responses of the polar benthic communities using passive acoustic monitoring and explanatory data acquired from accelerometers.
- **SOMME - Société d'Observation Multi-Modale des Environnements** main objective is the development of new methodologies for operational observation of the environment and marine organisms. In INTAROS, SOMME will adapt the passive acoustics algorithm and perform the data processing and coupling with accelerometer data.

CNRS_LOV

Dr. Jean-Pierre Gattuso (M) is a CNRS Senior Research Scientist with more than 30 years experience on marine ecosystems, the ocean carbon cycle and microbial processes, and is a leading expert on ocean acidification. He coordinated the European Project on Ocean Acidification EPOCA and co-organized two major ocean acidification experiments in the Arctic. He is a lead author for the 5th Assessment Report of the IPCC (WGII). He led the launch of the Ocean Acidification International Coordination Center at the International Atomic Energy Agency in Monaco.

Publications, and/or products, services or other achievements

1. Ardhuin, F., F. Collard, B. Chapron, F. Girard-Ardhuin, G. Guitton, A. Mouche and J. Stopa (2015). Estimates of ocean wave heights and attenuation in sea ice using the sar wave mode on sentinel-1A. Geophysical Research Letters, 42 (17), 2317-2325, Doi :10.1002/2014GL062940.
2. Babin, M., Bélanger, S., Ellinsten, I., Forest, A., Le Fouest, V., Lacour, T., Ardyna, M., Slagstad, D., 2015. Estimation of primary production in the Arctic Ocean using ocean colour remote sensing and coupled physical-biological models: strengths, limitations and how they compare. Progress in Oceanography. 139: 197-220.
3. Bosse A., P. Testor, L. Mortier, L. Prieur, V. Taillandier, F. d'Ortenzio and L. Coppola (2015) Spreading of Levantine Intermediate Waters by submesoscale coherent vortices in the northwestern Mediterranean Sea as observed with gliders, J. Geophys. Res., Accepted manuscript online: DOI: 10.1002/2014JC010263.
4. Gattuso J., Magnan A., Billé R., Cheung W. W. L., Howes E. L., Joos F., Allemand D., Bopp L., Cooley S., Eakin C. M., Hoegh-Guldberg O., Kelly R. P., Pörtner H., Rogers A. D., Baxter J. M., Laffoley D., Osborn D., Rankovic A., Rochette J., Sumaila U. R., Treyer S. & Turley C., 2015. Contrasting futures for ocean and society from different anthropogenic CO_2 emissions scenarios. Science 349:aac4722.
5. Herbaut C, M.-N. Houssais, S. Close, A.-C. Blaizot, 2015 : Two wind-driven modes of winter sea ice variability in the Barents Sea. Deep Sea Res. Part I, 2015, 106, pp.97-115. <10.1016/j.dsr.2015.10.005>.

Projects, and/or activities

1. EU NACLIM (2012.11-2016.11), supported by FP7 of the European Commission. The goal is to investigate the predictability of the climate in the North Atlantic sector related to Arctic/ North Atlantic sea surface temperature and sea ice variability and change. LOCEAN is partner.
2. EU SWARP (2014-2017), supported by FP7 of the European Commission. The objective is to extend operational downstream services supporting maritime transport safety in the Marginal Ice Zone (MIZ): forecasts of waves into ice-covered seas, forecasts of sea ice in the presence of waves and remote sensing of waves and sea ice conditions. IUEM-LOPS is partner.
3. EU AtlantOS, (2015-2019), supported by Horizon 2020 of the European Commission. The goal is to deliver an advanced framework for the development of an integrated Atlantic Ocean Observing System. LOCEAN and LOV are partners through CNRS.
4. EU BRIDGES (2015-2019) supported by Horizon 2020 of the European Commission. The goal is to develop two deep gliders with a wide range of scientific payloads for application in marine sciences and ocean monitoring for operational application and marine European directive. LOCEAN is scientific coordinator.
5. NAOS project (2012-2019) is supported by the French EQUIPEX program. The main objective is to use the Argo technology enhanced with biogeochemical sensors for monitoring the global ocean. The WP4 of this project is focusing on the deployment of such floats in the Arctic Ocean. TAKUVIK and LOV are coordinators of this WP.

Significant infrastructure, and/or major items of technical equipment:

1. National glider Facility (CNRS/INSU) in la Seyne (France)
2. National Instrumental Pool (CNRS/INSU) in Brest (France)
3. National Service of CO_2 measurements in the Ocean in Paris (France)
4. AWIPEV Underwater Observatory in Ny-Ålesund (Svalbard)
5. 18 Bio-Argo floats adapted to polar environment (Takuvik)
6. Network of more than ten automated field stations for measurements of snow and permafrost properties
7. State-of-the-art field station in Qikiqtarjuaq, Baffin Bay, for the monitoring of the Canadian coastal waters (proposal under evaluation)
8. Computer capacity for satellite ocean color data processing and other products

29. University of Helsinki / Helsingin Yliopisto (U Helsinki)

Expertise and experience of the organization

The Department of Physics, Div. Atmospheric Sciences at the University of Helsinki has over 30 years of experience in atmospheric research. 150 scientists and doctoral students are currently engaged in this area. The main research subjects are aerosol dynamics, atmospheric chemistry, climate change, dynamic and radar meteorology, forest-atmosphere interactions, aerosol-cloud-climate interactions, and urban air quality. With the multidisciplinary team structure and comprehensive measurement and modeling tools, ATM is one of the few groups in the World capable of efficiently combining the climate change, greenhouse gases, trace gases, aerosol processes and vegetation processes.

Role in the project

University of Helsinki (UHEL) will contribute to

- WP2: coordination of several Russian data pools (10-15 institutes) via PEEX HQ including conceptual design of in situ station network in Russian with common data formats and SMEAR data concept
- WP7: organization of the data analysis summer school at the Hyytiälä field station, the SMEAR-II super site, contributing the dissemination of the project outcome to several stakeholder groups vie Future Earth Europe Alliance activities and via Pan-Eurasian Experiment (PEEX) to Russian stakeholder communities, organization of Europe-Russia-China workshop to support the EU strategy for the Arctic and better informed decision making.

Key personnel CVs

Markku Kulmala (M), Academy Prof. directs the Div.Atmospheric Sciences at the Depart.Physics, and has served as a 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 (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. Hari is the primary inventor of the SMEAR 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 85. 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), Litke Medal (2015).

Dr. Hanna K. Lappalainen (F) Pan-Eurasian Experiment (PEEX) Executive Officer, works currently at PEEX HQ, at the Univ. Helsinki. She has experience of coordinating large-scale research projects and funding applications and has been working as a research coordinator and a science officer in the projects such as EU-FP7-EUCAARI (2007-2010, 15 Meuro) and "Finnish Center of Excellence in Physics, Chemistry, Biology and Meteorology of Atmospheric Composition and Climate Change" (2012-2013). Lappalainen has received NASA Goddar. Team Award EOS-AURA satellite OMI-Team in 2005 and IEAS silver medal in 2015.

Dr. Antti Lauri (M) obtained his PhD degree in 2007, he has worked as the education coordinator in several local, national, and Nordic programmes, including the Nordic MSc Programme in Atmosphere-Biosphere Studies (ABS), the National Doctoral Programme in Atmospheric Composition and Climate Change, the Nordic Graduate School in Biosphere-Carbon-Aerosol-Cloud-Climate Interactions (CBACCI), and the Nordic Centres of Excellence CRAICC and eSTICC. He has been active in developing training in transferable skills such as project management, proposal writing, scientific outreach, international collaboration, and pedagogy. In 2014 he was selected as a permanent member in the Teachers' Academy of the University of Helsinki, currently involving 70 top teachers of the university.

Dr. Tuukka Petäjä (M) Professor, 2013-; Head of Aerosol laboratory, 2013-; Head of Värriö sub-arctic research station and SMEAR I-II stations, 2013-; Pan Eurasian Experiment science director 2014-; Post-doctoral researcher at National Center for Atmospheric Research (NCAR) 2007-2008. Thompson Reuters Highly Cited Scientist, 2014-15; Academician, International Academy of Eurasian Studies, 2014; Science and Technology in Society Future Leader, New York Academy of Sciences, 2015; Väisälä award, for innovations in aerosol science and technology, 2013; PI for Biogenic Aerosols – Effects on Clouds and Climate (BAECC) for US Department of Energy. Currently 223 peer reviewed journal articles out of which 7 in Science, 4 in Nature and 1 in Physical Review Letters, 1 in Nature Protocols, 2 in Nature Geosci.; Full publication list available in http://www.researcherid.com/rid/A-8009-2008; Total citations: 6930, h-index: 44 (ISI Web of Knowledge, 14.12.2015); ISI ranking in Geosciences: 128; Research topics: Mass spectrometry and measurement techniques for aerosols and trace gases; Comprehensive long-term observations and field campaigns; Aerosol-cloud-climate-biosphere interactions;

Dr. Tanja Suni (F) obtained her PhD in atmospheric physics in 2004 at the Univ.Helsinki. Continued her post-doc in Australia before moving to work for international global change programmes. In 2011-2015, Dr Suni led the International Project Office for the iLEAPS core project of the International Geosphere-Biosphere Programme. Since 2014, she has been at the forefront of the developing new global change research programme Future Earth, led by ICSU, ISSC, the Belmont forum, three programmes of the UN, and WMO. In Future Earth, Dr Suni coordinates the European network of national FE platforms and the Finnish national committee for FE, FE-Finland. Her work concentrates on developing research culture to better answer the grand challenges of sustainability: solutions-oriented, interdisciplinary research on sustainability issues, stakeholder engagement, and transforming institutional structures such as funding and merit systems to help scientists contribute to societal challenges in full. Suni has extensive networks of scientists and stakeholders both in Finland and in Europe.

Publications, and/or products, services or other achievements

1. Coordination of the national doctoral programme “Atmospheric Composition and Climate Change: From Molecular Processes to Global Observations and Models” (ACCC).
2. Performing a state of the art field study on Biogenic Aerosols-Effects on Clouds and Climate (BAECC 2014) was conducted at the Station for Measuring Ecosystem Atmosphere Relations (SMEAR II) in Hyytiälä Finland. The experiment was funded by the U.S. Department of Energy. https://www.flickr.com/photos/armgov/sets/72157637889702933/
3. Development of the SMEAR concept & station network including data products and SMART-SMEAR dissemination interface (http://avaa.tdata.fi/web/smart) including instrument development and company spin off (AIRMODUS Ltd.)
4. Leadership in the European coordination together with CNRS and CNR for having the ARCTRIS RI in the ESFRI Roadmap, ACTRIS HQ established in Helsinki starting from 2016
5. Leadership in the European coordination for establishing the ICOS ERIC HQ in Helsinki starting from 2015 https://www.icos-ri.eu/head-office

Projects, and/or activities

1. Coordination of Finnish Center of Excellence “Centre of Excellence in Atmospheric Science – From Molecular and Biological processes to The Global Climate’ (ATM), https://www.atm.helsinki.fi/FCoE/
2. Coordination of Nordic Center of Excellence “Cryosphere-atmosphere interactions in a changing Arctic climate” (CRAICC) , https://www.atm.helsinki.fi/craicc/
3. Hosting the Future Earth Secretariat of the European Alliance at the University of Helsinki, http://ea-globalchange.org/
4. Coordination of a large scale multiscale, multi multidisciplinary Pan Eurasian Experiment PEEX Program (2012-) focused on Arctic-boreal regions and China https://www.atm.helsinki.fi/peex/
5. Global SMEAR Network approach, kick off in Paris COP21 in Dec 2015 by organizing a side event in the Nordic Pavilion

Significant infrastructure, and/or major items of technical equipment:

The infrastructure has the following main components: (i) field station network (ii) laboratories, (iii) modeling & super-computer capacity, also including remote sensing data and airborne measurements. We operate four field stations in Finland called the SMEAR (Station for Measuring Forest Ecosystem Atmosphere Relations) stations. The *SMEAR II* is the world leading station due to its comprehensive research program and due to its unique time series of aerosol formation and biogeochemical fluxes. For the Global coverage we analyze data from several field sites in “climate space” to identify and prioritize key gaps in understanding of global features in the climate change. We are intensively involved with a super-site concept development in Europe and outside Europe incl. in China (Nanjing), Estonia (Järvselja), South Africa (Welgegund), Italy (San Pietro Capofiume), India (Gual Pahari) and Saudi Arabia (Jeddah). Via PEEX program Univ.Helisnki provide a unique set of data to be utilized for the atmosphere -ecosystem research.

We have four laboratories in use: (i) Aerosol Particle Laboratory: mass spectrometers, particle generators, aerosol, cluster and ion spectrometers, and equipment for analyzing the hygroscopic properties and volatility of aerosol particles, characterization of novel instrumentation, calibration, optimization, (ii) Ecophysiological laboratory: growth chambers, mini-rhizotrons, physiological measurement systems with stable isotope equipment, (iii) Viikki Urban tree laboratory: continuous observations of tree growth, water relations and vitality in an urban setting and (iv) Laboratory of Analytical Chemistry : a suite of commercial and self-modified/self-constructed instruments, incl. aerosol mass spectrometry, portable gas chromatography-mass spectrometry, multidimensional chromatographic techniques, size-selective sampling, combination of mass spectrometry and chromatography.

The available models establish a hierarchy reaching across the scales of Univ.Helsinki research, e.g. ECHAM-HAM, SALSA, MALTE, JSBACH, GLOMAP, MPI-ESM. The model framework gives us an opportunity to develop and combine models operating at different spatial and temporal scales. IT Center for Science Ltd (CSC) as a workflow and computing infrastructure topics partner, has an active role in the ESM and Large Eddy Simulations.

30. German Research Centre for Geoscience / GFZ Potsdam (GFZ)

Expertise and experience of the organization

The GFZ German Research Centre for Geosciences is Germany's premier institute for the geosciences, with strong links to leading institutes across Europe. Its more than 1170 employees include almost 500 scientists and 120 PhD students working in seven departments on topics ranging across the full breadth of the Earth Sciences from global processes, plate boundary systems and georesources, to earth surface – climate interactions and natural hazards. GFZ has a strong tradition in the global monitoring of our planet with geophysical and remote sensing techniques but also operates major, multi-disciplinary regional observatories. All work at the GFZ benefits from generous technical support and a uniquely comprehensive range of state-of-the-art equipment. GFZ has formal collaborations with institutions from more than 60 countries and more than 40 joint appointments link it closely to the surrounding universities.

In recent years, a newly established surface-atmosphere interaction group has established leading expertise in regional airborne measurements of turbulent exchange of latent and sensible heat as well as greenhouse gases (CO2, CH4).

Role in the project

GFZ contributes existing regional-scale data and derived products (e.g. gridded high-resolution maps of regional sensible and latent heat exchange, carbon dioxide and methane flux) from airborne campaigns in Alaska, Canada, and Siberia and will prepare these data for integration in iAOS (WP2). New campaigns (WP3) geared towards the objectives of this proposal but funded externally will contribute additional data.

Key personnel CVs

Prof. Dr. Torsten Sachs (M) heads a Young Investigators Group focusing its research on the land-atmosphere exchange of heat, water vapor, and greenhouse gases such as CO2 and CH4 on scales ranging from experimental plots (1 m²) to regions (100.000 km²), both in re-wetted peatlands of NE Germany and pristine Arctic ecosystems. In recent years he has conducted several extensive aircraft and helicopter-based campaigns in the US, Canadian, and Siberian Arctic as well as northern Scandinavia and he will be responsible for organizing and executing the additional campaigns contributing to this proposal.

Dr. Andrei Serafimovich (M) has an extensive background in atmospheric physics and boundary layer processes and will be primarily responsible for regional simulations, aircraft data processing, quality control, and analysis.

Publications, and/or products, services or other achievements

1. Christensen, T; van Huissteden, K.; Sachs, T. (2015), Natural terrestrial methane sources in the Arctic. In: AMAP Assessment 2015: Methane as an Arctic climate forcer, Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway.
2. Petrescu, A.M.R.; Lohila, A.; Tuovinen, J.-P.; Baldocchi, D.; Desai, A.R.; Roulet, N.T.; Vesala, T.; Dolman, A.J.; Oechel, W.C.; Marcolla, B.; Friborg, T.; Rinne, J.; Hatala Matthes, J.; Merbold, L.; Meijide, A.; Kiely, G.; Sottocornola, M.; Sachs, T.; Zona, D.; Varlagin, A.; Lai, D.Y.F.; Veenendaal, E.; Parmentier, F.-J.W.; Skiba, U.; Lund, M.; Hensen, A.; van Huissteden, J.; Flanagan, L.B.; Shurpali, N.; Grünwald, T.; Humphreys, E.; Jackowicz-Korczynski, M.; Aurela, M.; Laurila, T.; Grüning, C.; Corradi, C.A.R.; Schrier-Uijl, A.P.; Christensen, T.R.; Tamstorf, M.P.; Mastepanov, M.; Martikainen, P.; Verma, S.B.; Bernhofer, C.; Cescatti, A. (2015). The uncertain climate footprint of wetlands under human pressure. Proc. Natl. Acad. Sci. U. S. A., 112(15), 4594–4599.

3. Kasurinen, V.; Alfredsen, K.; Kolari, P.; Mammarella, I.; Alekseychik, P.; Rinne, J.; Vesala, T.; Bernier, P.; Boike, J.; Langer, M.; Marchesini, L.B.; van Huissteden, K.; Dolman, H.; Sachs, T.; Ohta, T.; Varlagin, A.; Rocha, A.; Arain, A.; Oechel, W.; Lund, M.; Grelle, A.; Lindroth, A.; Black, A.; Aurela, M.; Laurila, T.; Lohila, A.; Berninger, F. (2014). Latent heat exchange in the boreal and arctic biomes. Global Change Biol., 20(11), 3439 – 3456.
4. Mbufong, H.N.; Lund, M.; Aurela, M.; Christensen, T.R.; Eugster, W.; Friborg, T.; Hansen, B.U.; Humphreys, E.; Jackowicz-Korczynski, M.; Kutzbach, L.; Lafleur, P.; Oechel, W.; Parmentier, F.-J.; Rasse, D.P.; Rocha, A.V.; Sachs, T.; van der Molen, M.; and Tamstorf, M.P. (2014). Assessing the spatial variability in peak season CO2 exchange characteristics across the Arctic tundra using a light response curve parameterization. Biogeosciences, 11, 4897-4912.
5. Watts, J.D.; Kimball, J.S.; Parmentier, F.J.; Sachs, T.; Rinne, J; Zona, D.; Oechel, W.; Tagesson, T. and M. Jackowicz-Korczyński (2014). A satellite data driven biophysical modeling approach for estimating northern peatland and tundra CO2 and CH4 fluxes. Biogeosciences, 11, 1961-1980.

Projects, and/or activities

1. Quantifying CO2 and CH4 Fluxes from Vulnerable Arctic-Boreal Ecosystems Across Spatial and Temporal Scales (NASA Terrestrial Ecology Program – Arctic Boreal Vulnerability Experiment (AboVE); Collaborator)
2. Trace Gas Exchange in the Earth – Atmosphere System on Multiple Scales (Helmholtz Young Investigators Group grant; Principal Investigator)
3. Airborne Measurements of Methane Flux (AIRMETH) (Institutional funding for circum-Arctic airborne eddy covariance flux measurements; Principal Investigator)
4. Characterization of CH4 emissions from high latitude lakes in North America using multi-scale remote sensing (NASA NNH10ZDA001N-CARBON: Carbon Cycle Science program; International Collaborator) – finished.

Significant infrastructure, and/or major items of technical equipment

The contribution to this proposal includes airborne measurements of meteorology and turbulent fluxes of energy, carbon dioxide, and methane. The funded campaign utilizes the converted DC-3 (now Basler BT 67) “Polar 5” owned by the Alfred Wegener Institute for Polar and Marine Research. All other contributions utilize the GFZ computer cluster for data processing.

31. ARMINES / Association pour la Recherche et le Developpement des Methodes et Prossesus Industriels (ARMINES)

Expertise and experience of the organization

MINES ParisTech with 2,000 students and 400 PhD students is part of the Paris Sciences Lettres (PSL) research university. MINES ParisTech has 14 research centers which operate in close cooperation with the industry and administration. The Centre de Géosciences, located in Fontainebleau, has a personel of 160 people, while the geostatistics group has presently 13 permanent scientists.

ARMINES was founded in 1967 by MINES ParisTech for the purpose of promoting industry-oriented research. ARMINES acts as an effective go-between linking research bodies and the world of industry. With an annual contract volume of 40 million Euro (2014) it is in the top rank of contract research organisations affiliated with academic institutions and together with MINES ParisTech it was awarded the Carnot Institute label of the French national research agency ANR. Setup in 1968 by Georges Matheron, the Geostatistics group of the Centre de Géosciences is a center-of-excellence in developping probabilistic and statistical methods for industrial applications in the environmental and earth sciences.

Role in the project

The Geostatistics group will be involved in WP5 to contribute with geostatistical methods to fill gaps and enhance the value of scattered and inhomogeneous data collected from various observing systems. We will also participate in WP6 with case studies in particular for the use fo acoustic data in constraining ocean models, performing model validation and offline state estimation.

Key personnel CVs

Dr Hans Wackernagel (M) is Research Director at MINES ParisTech within the Geostatistics group. He will take care of the geostatistical processing task within WP5. Geoscience Center of Ecole des Mines de Paris. He received his Doctoral degree in geostatistics from MINES ParisTech in 1985 and obtained a Habilitation à Diriger des Recherches diploma in 2004 from Université Pierre et Marie Curie, Paris. Dr Wackernagel, well-known by his book on Multivariate Geostatistics (3 editions, Japanese translation), has been involved in many multidisciplinary national and international projects on data assimilation and statistical modelling in such different fields like oceanography, climate, air pollution, radio-electric exposure estimation, epidemiology (non-contagious, contagious and vector-borne diseases), to mention but a few..

Didier Renard (M) graduated from Ecole des Mines de Saint-Etienne, France. He is presently a senior geostatistician and has been working within the Geostatistics group of MINES ParisTech for more than three decades. Leading the computer group, he actively contributes to the inception, development and testing of new models. He is one of the main authors of several well-known geostatistical packages such as BLUEPACK and more recently ISATIS. He also developed the geostatistical surface modeler ISATOIL dedicated to volumetric calculations in layer-cake environments. He is the main author of RGeostats which provides a complete toolbox of geostatistical methods available on the R platform.

He carries out consulting activities for petroleum industry and has worked for companies such as Shell, Statoil, ENI, Total, BHP. Finally he is involved in educational activities, teaching courses to students, giving lectures during geostatistical courses and training several hundreds of practitioners all over the world.

Dr Nicolas Desassis (M) is currently a research fellow in the Geostatistics group of MINES ParisTech. He received a master (2003) in biostatistics and a PhD (2007) in statistics from the University of Montpellier 2, France (partnership with the Biostatistics for Spatial Process laboratory, INRA, Avignon, France). He also worked at INRIA (National Institute of Research in Automatic and Informatics) (2008) on spatio-temporal simulation of forest dynamics. Dr. Desassis's research interests are in the area of geostatistics and spatial modelling more specifically in the inference of the spatial models (automatic variogram fitting, plurigaussian models…) and in conditional simulations. He also contributes to develop new Bayesian methods for inverse problems in geophysics.

Publications, and/or products, services or other achievements:

1. D Renard, N Bez, N Desassis, H Beucher, F Ors, F Laporte RGeostats: The Geostatistical package [v11.0.1]. MINES ParisTech. Free download from: http://rgeostats.free.fr.
2. V Zaytsev, P Biver, H Wackernagel, D Allard Change-of-support models on irregular grids for geostatistical simulation. Mathematical Geosciences, DOI 10.1007/s11004-015-9614-x, 2015.
3. A Gesret, N Desassis, M Noble, T Romary, C Maisons. Propagation of the velocity model uncertainties to the seismic event location. Geophysical Journal International, 200 (1), 52-56, 2015.
4. F Fouedjio, N Desassis, T Romary. Estimation of space deformation model for non-stationary random functions. Spatial Statistics, 13, 45-61, 2015.
5. F Fouedjio, N Desassis, J Rivoirard. A generalized convolution model and estimation for non-stationary random functions. Spatial Statistics, published online (in press), 2016.

Projects, and/or activities

1. H Wackernagel - Partner of the Scandinavian NordForsk NCoE project (2014-2018): Ensemble-based Methods for Environmental Monitoring and Prediction.
2. H Wackernagel - Partner of the Norwegian eVITA EnKF project (2007-2011): Forecasting non-linear systems using the ensemble Kalman filter and related methods.
3. H Wackernagel - Partner of the Franco-Norwegian project PRECOC (2006-2008): Ocean Forecasting in the North Sea and the Gulf of Lion: towards joint operational services.

32. Institute of Geophysics Polish Academy of Sciences / Instytut Geofizyki Polskiej Akademii Nauk (IGF PAN)

Expertise and experience of the organization

The Institute of Geophysics, Polish Academy of Sciences (IGFPAS) 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. The Institute's research broadly covers the following scientific fields: seismology, geomagnetism, earth's interior dynamics, physics of the atmosphere, hydrology and environmental hydraulics, polar and marine research. Now the Institute employed 179 persons (159 full-time and 20 part-time). The staff consisted of 69 scientists, including 13 professors and 19 associate professors. The rest of personnel included 58 engineers and technicians (mostly engaged in geophysical observations), clerks and service workers.

The Department of Polar and Marine Research conducts the Polish polar research using the Polish Polar Station located near the Hornsund Fjord at Svalbard. The Polar Research Department staff consists of 1 senior researcher, 5 doctors, 1 assistant, 5 PhD students, 1 technical worker and 3 logistic support staff.

Profile relating to the project: IGF is a multidisciplinary organization engaged in advanced research, teaching and service provision in cutting-edge geophysical sciences and is one of the largest research center in Poland working towards understanding and monitoring the environment. The Polish Polar Station at Svalbard is the oldest station, which performs monitoring in this part of Arctic. IGF PAS and Polish Polar Station at Svalbard has extensive experience (60 years) in operating an isolated self-sustained research station (Hornsund), whilst maintaining close cooperation with the Norwegian authorities.The Institute of Geophysics coordinates actions of Polish Roadmap for Infrastructure PolarPOL.

Role in the project

WP2: The Hornsund Polish Polar Station in Svalbard provides both direct on-line as well as post-processed data from a number of monitoring systems to international data bases. Our experience could be used to improve systems of collecting, processing and providing various types of data.

WP 7: The Institute of Geophysics, PAS has the experience (as a leader of already carried out educational projects for schools and other public information projects), so it could bring in such elements as:

Creating bigger interest in mathematical-natural science/informatics-technical science/ foreign languages thanks to diametrical change of previous teaching formulas. The rise of skills connected with identifying and defining research problems and using research methods in the range of science owing to pupils taking part in the real research process.

Key personnel CVs

Dr. Piotr Glowacki (M), Head of the Polar and Marine Research Department. *Education*: M.Sc, of Physics, Faculty of Mathematics, Physics and Chemistry, Wroclaw University, 1973; Ph.D of Chemistry, Faculty of Mathematics, Physics and Chemistry, University of Silesia, Katowice, 1984; Associate professor or Earth Sciences, Institute of Geophysics, Polish Academy of Sciences, Warsaw, 2008. 33 year experience in the Arctic, author and co-author of 3 monograph and 122 papers in Polish and foreign journals as well as 235 lectures, reports and scientific posters which were presented both in the country and abroad. Co-supervisor of the project entitled: "*Studies of the glaciers and snow covers dynamics in Arctic and in Russian mountain region*", which carried out in scientific co-operation between the Polish Academy of Sciences and the Russian Academy of Sciences for the years 1999-2013 and also a co-supervisor of the project entitled: "*Geophysical investigations of the glacier and snow structure in Spitsbergen at the Hornsund area*", which carried out in scientific co-operation between the Polish Academy of Sciences and the Finish Academy of Sciences for the years 2000-2005.

Publications, and/or products, services or other achievements

1. Głowacki P., 2004: Research Operations in Remote Arctic Islands – The model of the Polish Polar Station Hornsund in Spitsbergen. In: S Skreslet (ed.), Jan Mayen Island in Scientific Focus. Kluwer Academic Publishers. Printed in the Nedtherlands, 2004: 249-259.
2. Greuell W., Kohler J., Obleitner F., Głowacki P., Melvold K., Bernsen E. and Oerlemans J., 2007: Assessment of interannual variations in the surface mass balance of 18 Svalbard glaciers from the Moderate Resolution Imaging Spectroradiometer/Terra albedo product. —Journal of Geophysical Research, Vol. 112, D07105, doi:10.1029/2006JD007245.
3. Hole L.R., Christensen J. H., Ruoho-Airola T., Tørseth K., Ginzburg V., Głowacki P., 2009: Past and future trends in concentration of sulphur and nitrogen compounds in the Arctic. Atmospheric Environment, 43: 928-939

4. Lapazaran. J., Petlicki M., Navarro F., Machío F., Puczko D., Głowacki P., Nawrot A., 2013: Ice volume http://www.polarresearch.net/index.php/polar/article/view/11068
5. Mansutti D., Bucchignani E., Otero J., Glowacki P., 2015: Modeling and numerical sensitivity study on the conjecture of a subglacial lake at Amundsenisen, Svalbard. ―Applied Mathematical Modelling, 39(15): 4266-4284 http://dx.doi.org/10.1016/j.apm.2014.12.043

Projects, and/or activities

1. Strategic Coordination and Networking of European Polar RTD Programmes. (Europolar ERA-NET) FP 6. (2006-2009)
2. FP7-INFRASTRUCTURES-2010-1 Svalbard Integrated Arctic Earth Observing System (SIOS). (2009-2014)
3. Horizon 2020 BG-15-2014 European polar research cooperation). (2014-2019)
4. Centre for Polar Studies – Leading National Research Centre (2014-2018)
5. Horizon 2020 European Plate Observing System Implementation Phase. (2015-2019)

Significant infrastructure, and/or major items of technical equipment

The Polish Polar Station carries out variety of continuous observations of geophysical fields in the Arctic and it is also a basis for data collection in other scientific branches like biology. The Station cooperates with 25 scientific institutions in Poland and 35 institutions from other countries. The station's significance and international status as well as possibilities of development are due to its: unique location, long-running history (since 1957), constant year-round activity (since 1978) and thus long-term observations, modern laboratories and equipment, logistic possibilities for field work in summer and winter times, scientific achievements of teams using the station.

Polish Multidisciplinary Laboratory for Polar Research (PolarPOL)

A goal for creating the PolarPOL Laboratory is to combine technical and organizational ability for running inter-disciplinary research and observations within natural phenomena taking place in Arctic environment. The Laboratory is going to strengthen the Polish contribution to creating worldwide network for research and monitoring of land and marine environments in polar zones which are crucial for understanding the dynamics of environmental changes all over the globe (global warming and raising sea levels especially). It will also consolidate dispersed scientific potential of Polish polar researchers. PolarPOL is going to secure participation of Poland in both international competition and collaboration by co-participation in the global research of polar areas, which is fundamental importance for the position of Poland both in the scientific research of polar areas and in the field of foreign policy of the State

33. University of Silesia, Centre for Polar Studies / Uniwersytet Slaski (U Slaski)

Expertise and experience of the organization

The University of Silesia (US) is the one of the largest institutions of higher education in Europe. US has 12 faculties, *i.a.* the Faculty of Earth Science, where has been conducting Earth science research in the field of polar science for a few decades. The overall aim of research polar programme of the US is identification and understanding of changes in the Arctic cryosphere system as indicators of climate warming. The Faculty of Earth Sciences US is also the leader of the Centre for Polar Studies with status of Leading National Research Centre in Earth Sciences (2014-2018). Centre conducts advanced research aimed at improving the understanding of polar environments and their transformation related to climate change and educational centre for specialized polar studies (Interdisciplinary Polar Studies). Moreover, the US heads the Polish Polar Consortium – cooperation between **18 Polish scientific institutions**. The mission of Consortium is to build a framework for an effective cooperation of the Polish polar research community.

Role in the project

US contributes **WP2** in acquiring, processing and delivery of variety of high quality ground-based as well as remote sensing data related to Svalbard glaciation. Long term series of glaciers' front positions on southern Spitsbergen and glaciers' velocity are available thanks to the combined analysis of satellite/airborne images with results of terrestrial investigations. Based on the data, the calving rate and ice supply from reference tidewater glaciers to the ocean will be estimated. Glaciers' mass balance calculations and numerical modelling will exploit the meteorological inputs (c. 10 years series from AWSs dispersed on glaciers around

Hornsund), whereas ground truth results will be used to calibration and validation. The data pointed out above allow to investigate the evolution of glacial systems under recent environmental changes, to define couplings between different polar components and are valuable sources for calibration/validation of numerical modeling. Archival and ongoing results, processed and provided with appropriate comments, are input to the WP5.

Key personnel CVs

Dr. Mariusz Grabiec (M) Assistant Professor at Faculty of Earth Sciences University of Silesia and Centre for Polar Studies. Ph.D. of Geography (2004). Moore than 15 years of experience in polar and high-mountains studies, mainly in Svalbard, Northern Scandinavia and the Tatra Mountains. Research focus on thickness and internal structure of glaciers using radio-echo soundings; the snow cover physical features; mass balance and geometry changes of Svalbard glaciers. Author and co-author of several dozens of scientific papers including few in prestigious journals (e.g. Journal of Glaciology, Annals of Glaciology, The Cryosphere and others). Partner in several scientific projects granted among others by the European Science Foundation (SvalGlac Project), Polish-Norwegian Research Fund (AWAKE and AWAKE2), EU Seventh Framework Programme (ICE2SEA). Delegate of University of Silesia to the board of the Polish Polar Consortium and the National Representative to the Network on Arctic Glaciology (IASC). Co-coordinator of the Polish Snow Research Programme on Svalbard.

Prof. Jacek Adam Jania (M) Head of the Department of Geomorphology at Faculty of Earth Sciences University of Silesia and Executive Chairperson of the Centre for Polar Studies in Poland, as also President of the Committee on Polar Research, Polish Academy of Science and Council Member of the International Arctic Science Committee (IASC). The active member of the IASC Cryology Working Group & IASC Network on Arctic Glaciology. Research activity on: response of glaciers to climate change, dynamics of tidewater glaciers, remote sensing. Periglacial, glaciological and geomorphological studies in Spitsbergen (since 1972 - continued), on Iceland (2002), on Alaska (2010), in the Tatra Mountains and in Northern Poland. Member and leader of more than 30 expeditions to Svalbard. The Coordinator of several projects (e.g. AWAKE, SvalGlac) and author or co-author of more than 60 papers and 3 books. Supervisor of 15 completed PhD dissertations (in glaciology, geomorphology and remote sensing). Currently, supervision of 6 PhD candidates.

Publications, and/or products, services or other achievements

1. Navarro F.J., Martin-Espanol A., Lapazaran J.J., Grabiec M., Otero J., Vasilenko E.V., Puczko D. 2014: Ice volume estimates from ground-penetrating radar surveys, Wedel Jarlsberg Land glaciers, Svalbard. Arctic Antarctic and Alpine Research 46(2), 394-406.
2. Sauter, T., Möller, M., Finkelnburg, R., Grabiec, M., Scherer, D., and Schneider, C. 2013: Snowdrift modelling for Vestfonna ice cap, north-eastern Svalbard, The Cryosphere, 7, 709-741.
3. Gulley, J. D., Grabiec M., Martin J. B., Jania J., Catania G., and Glowacki P. 2012: The effect of discrete recharge by moulins and heterogeneity in flow-path efficiency at glacier beds on subglacial hydrology. Journal of Glaciology 58(211), 926-940.
4. Oerlemans J., Jania J., Kolondra L., 2011, Application of a minimal glacier model to Hansbreen, Svalbard, The Cryosphere, 5(1), 1-11.
5. Błaszczyk M., Jania J., Hagen J.O., 2009, Tidewater glaciers of Svalbard: Recent changes and estimates of calving fluxes. Polish Polar Research, 30(2), 85-142.

Projects, and/or activities

1. Ice2se - Estimating the future contribution of continental ice to sea-level rise. EC Large-scale integrating project No. 226375, FP 7. [2009-2013].
2. AWAKE – Arctic Climate and Environment of the Nordic Seas and the Svalbard – Greenland Area, The Polish-Norwegian Research Fund, project [2009-2012] - Coordinator of the WP 6 & AWAKE 2 - Arctic Climate system study of ocean, sea ice and glacier interaction in Svalbard area with focus on Hornsund, The Polish-Norwegian Research Fund project [2014-2016] – PI.
3. SvalGlac - Sensitivity of Svalbard glaciers to climate change, European Science. Foundation, PolarCLIMATE, ERANET EUROPOLAR [2010-2013].
4. Organization of the Arctic Science Summit Week (ASSW) 2013 in Poland as the leader of the Polish Polar Consortium.

5. The leader of the Centre for Polar Studies with status of Leading National Research Centre in Earth Sciences, Poland [2014-2018].

Significant infrastructure, and/or major items of technical equipment

The latest technological equipment such as a laser scanner, UAVs, thermal imaging camera, GPS, GPR, laser rangefinder, meteorological stations etc. are research potential of the University of Silesia. The US cooperates closely with the Institute of Geophysics, Polish Academy of Sciences – operator of Polish Polar Station in Hornsund, Spitsbergen and with the Institute of Oceanology, Polish Academy of Sciences – owner of the research vessel s/y 'Oceania'. Research activity of US drives multidisciplinary academic education at the PhD Interdisciplinary Polar Studies and at the MSc level.

34. Barcelona Supercomputing Center (BSC)

Expertise and experience of the organization

The **Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS)** combines unique high performance computing facilities and in-house research departments on computer, life, and Earth sciences, and computational applications, counting more than 350 researchers and students. The Earth Sciences Department (ESD) focuses on atmospheric emissions, air quality, mineral dust transport, and global and regional climate modelling and prediction. It is structured around four groups with more than 50 employees, including technical and support staff. It is a highly productive scientific entity that has published more than 300 research articles in peer-reviewed journals over the last 5 years, many in prestigious high-impact journals. The climate prediction group aims at developing a climate forecast system based on the EC-Earth model and performs regular assessments of the characteristics of this forecast system compared to all other operational and quasi-operational systems available in the world. It participates in six European projects and two national projects.

Role in the project

The climate prediction group from BSC will be involved in WP6.1 where its expertise in generating, calibrating and verifying climate predictions will be exploited to assess the benefits from the INTAROS observations to initialize seasonal to decadal climate predictions. BSC will ensure liaison with the APPLICATE project if funded under the H2020- BG-10-2016 call.

Key personnel CVs Key personnel CVs

Prof. Francisco Doblas Reyez (M) is the head of the Earth Sciences department of BSC. He is a worldwide expert in the development of seasonal-to-decadal climate prediction systems and has more than 20 years of experience in weather and climate modeling, climate prediction, as well as the development of climate services. He serves in several panels of the World Climate Research Programme (WCRP) and the World Weather Research Programme (WWRP) under the UN WMO (among them the steering group of the Polar Prediction Project), is a member of the European Network for Earth System modelling HPC Task Force.. Currently, Prof. Doblas-Reyes is the principal investigator (PI) or co-investigator in 6 FP7 and H2020 European projects, is coordinator of the FP7 collaborative SPECS project. Overall, Prof. Doblas-Reyes has authored and co-authored more than 100 peer-reviewed papers on climate modeling and prediction, as well as climate services, and currently has a total of 6103 citations with a h-index of 39.

Dr. Virginie Guemas (F) is the head of the climate prediction group within the Earth Sciences department of BSC. She is an expert on seasonal to decadal climate prediction, with a particular emphasis on polar climate predictability and its linkages with the mid-latitudes. She is member of the WCRP (World Climate Research Program) CLIVAR (Climate and Ocean Variability, Predictability, and Change) SSG (Scientific Steering Group). Currently, she is Principal Investigator (PI) or co-investigator of six European projects and the PICA-ICE national project focused on Arctic climate predictions. She is author of 33 articles on climate modelling and predictions in international peer-reviewed journals, among which six in high-impact journals.

Publications, and/or products, services or other achievements

1. Guemas V, E. Blanchard-Wrigglesworth, M. Chevallier, J.J. Day, M. Déqué, F. J. Doblas-Reyes, N. Fučkar, A. Germe, E. Hawkins, S. Keeley, T. Koenigk, D. Salas y Mélia, S. Tietsche, 2015: A review on Arctic sea ice predictability and prediction on seasonal-to-decadal timescales, Quarterly Journal of the Royal Meteorology Society, doi:10.1002/qj.2401.

2. Guemas V., F. J. Doblas-Reyes, A. Germe, M. Chevallier, D. Salas y Mélia, 2013: September 2012 Arctic sea ice minimum : Discriminating between sea ice memory, the August 2012 extreme storm and prevailing warm conditions [in "Explaining Extreme Events of 2012 from a Climate Perspective"], Bull. Amer. Meteor. Soc., 94 (9), S20-S22.
3. Doblas-Reyes, F.J., J. García-Serrano, F. Lienert, A. Pintó Biescas and L.R.L. Rodrigues, 2013: Seasonal climate predictability and forecasting: status and prospects. WIREs Climate Change, 4, 245-268, doi:10.1002/WCC.217
4. Guemas V., F. J. Doblas-Reyes, I. Andreu-Burillo, M. Asif M., 2013: Retrospective prediction of the global warming slowdown in the past decade. Nature Climate Change, 3, 649-653, doi : 10.1038/nclimate1863.
5. Doblas-Reyes F.J., I. Andreu-Burillo, Y. Chikamoto, J. García-Serrano, V. Guemas, M. Kimoto, T. Mochizuki, L. R. Rodrigues and G. J. van Oldenborgh, 2013: Initialized near-term regional climate change prediction. Nature Communications, 4, 1715, doi:10.1038/ncomms2704.

Projects, and/or activities

1. SPECS is an EU FP7 project coordinated by ES-BSC. Its main scientific objective is to deliver a new generation of European climate forecast systems and efficient regionalization tools.
2. PRIMAVERA is an EU H2020 project which aims to deliver novel and well-evaluated high-resolution global climate models capable of simulating and predicting regional climate with unprecedented fidelity, out to 2050.
3. EUCLEIA is an EU FP7 project which aims to provide well verified assessments of the extent to which weather-related risks have changed due to human influences on climate, as well as to identify those types of weather events where the science is still too uncertain to make a robust assessment of attributable risk.
4. IMPREX is an EU FP7 project which aims to improve forecast skill of meteorological and hydrological extremes in Europe and their socio-economic and public impacts.
5. CMUG2 is funded by the European Space Agency. It aims at exploiting high-resolution high-quality satellite date for model development and validation.

Significant infrastructure, and/or major items of technical equipment

BSC-CNS is the National Supercomputing Facility of Spain and hosts a range of high-performance computing (HPC) systems, including MareNostrum III, one of the most powerful supercomputers in Europe with 48,128 cores and 1.1 Pflops capacity. The BSC-CNS is a key element of and coordinates the Spanish Supercomputing Network, which is the main framework for granting competitive HPC time to Spanish research institutions. Furthermore, BSC-CNS is one of six hosting nodes in France, Germany, Italy and Spain that form the core of the Partnership for Advanced Computing in Europe (PRACE) network. PRACE provides competitive computing time on world-class supercomputers to researchers in the 25 European member countries.

35. DNV GL AS (DNV GL)

Expertise and experience of the organization

Det Norske Veritas (DNV) is an independent, autonomous Foundation working to safeguard life, property and the environment. DNV comprises 300 offices in 100 countries, with some 8522 employees. DNV develops rules and establishes requirements regarding how ships and mobile offshore units are to be constructed. DNV shapes the requirements to ensure that quality of the vessels is retained throughout its lifetime. Surveyors ensure that the requirements are met. DNV helps customers to increase their client's trust and confidence in them and reduce their business risks by offering management systems, product and personnel certification, verification and business-improvement training services. DNV assists in ensuring that the right technology solution for a particular application is found and applied, and also that the technical condition of existing structures and facilities is such that operations are safe and reliable. It helps clients to safely improve their business performance seeking to manage risks within and to those businesses. DNV provides its customers in the shipping, offshore and process industries with life-cycle-focused solutions aimed at design, strength assessment, and risk/knowledge management.

DNV Research & Innovation promotes and facilitates DNV's interdisciplinary knowledge, expertise and technological leadership, secure knowledge sharing across business units, and focus on potential rather than well defined needs. DNV Research & Innovation has throughout the years been successful in creating a wealth of knowledge, extreme expertise, grand ideas, and innovative solutions to significant problems for DNV and its customers. DNV has long traditions in continually reviewing knowledge, ability and technology through R&D activities.

Role in project

DNV GL will in WP6 define end user requirements and ensure that the output from the project has a good understanding and sharp focus for the end users in oil and gas and maritime. Furthermore, novel visualization methods will be developed for the various types of ice-metocean data (WP2), and the DNV GL's Arctic Risk Map will be employed as the platform for dissemination of project results to relevant stakeholders, in particular those with interests in risk analysis in the Arctic region.

Key personnel CVs

Dr. Øyvind Endresen (M), the Program Director for the research program, Maritime Transport, has more than ten years experience in maritime research and development. He holds a Ph.D. in geophysics and a B. Sc. In technical engineering, and has experience from both research and consulting projects. He has co-ordinated a number of Norwegian research projects, as well as been involved in several EU¬ research projects. His research experiences cover mainly environmental aspects related to shipping, with particular focus on quantifying ship emissions and impacts and how to reduce these impacts.

Dr. Gus Cammaert (M) joined DNV's Enterprise Risk Management group in December, 2001, and moved to Technology Services in January 2005. Since January 2007 he has been the Programme Director, Arctic Technology, for DNV Research and Innovation. He leads a multi-discipline group of researchers working in the areas of ice mechanics, Arctic metocean, and advanced computational mechanics. Prior to joining DNV he had his own consultancy in Canada, while he was also a Professor of Ocean Engineering at the Memorial University of Newfoundland. From 1976 to 1988 he was employed by Acres International Limited, of Toronto, where he worked on specialist risk assessment studies in offshore, marine and civil engineering applications. He has more than 30 conference papers and journal articles on cold regions engineering and project risk management.

Knut Espen Solberg (M) Senior Researcher in DNV R&I Arctic Programme working with the effects from climate change on Arctic shipping. Knut Espen Solberg has earlier worked for Center for International Climate and Environmental Research with vulnerability and adaption to climate change in the Arctic region. Previously Knut Espen Solberg has been employed as a technical superintendent with in the shipping sector.

Publications, and/or products, services or other achievements

1. A.B. Cammaert and D.B. Muggeridge, "Ice Interaction with Offshore Structures", Van Nostrand Reinhold, New York, 1988 (431p).
2. Eide, M., Endresen, Ø., Skjong, R., Longva, T. and Alvik, S. (2009). Cost-effectiveness assessment of CO2 reducing measures in shipping. Submitted to Maritime Policy & Management, December 2008.
3. Endresen, Ø., et al. (2008), The environmental impacts of increased international maritime shipping - Past trends and future perspectives, study made for OECD.
4. Eide M.S., Endresen Ø., Brude O.W., Brett P.O., Ellingsen I.H., Røang K., Hauge J., Prevention of oil spill from shipping by modelling of dynamic risk, The Marine Pollution Bulletin, 2007, London, UK. In press, 2007.
5. Dalsøren, S. B., Endresen Ø., Gravir G., Sørgård E., and Isaksen I. S. A., Environmental impacts of the expected increase in sea transportation, with particular focus on oil and gas scenarios for Norway and for Northwest Russian,112, Journal of Geophysical Research, D02310, doi: 10.1029/2005JD006927, 2006.

Projects, and/or activities

1. **Risk reduction and oil spill response** – Greenland. Customer: Defense Command Denmark. 2015. The project covered topics such as; a response gap analysis (RGA) for the whole Greenland area, an oil spill contingency analysis (OSCA), an assessment of the applicability of different oil spill response strategies for Greenland, an assessment of risk reducing measures (RRM) for ship traffic accidents, an assessment of the shipping risk associated with icebergs.

2. **Environmental mapping and Oil Spill Response Planning for Bjørnøya and the Ice Edge** along the Barents Sea. As a part of preparation for exploration and appraisal drilling operations in the Wisting License in the Barents Sea OMV (Norge) AS engaged DNV GL to conduct complete environmental risk and oil spill contingency analysis and response planning. The work included a Field Survey to Bear Island, use of updated methodology for calculations of environmental risk for the MIZ and development of ice maps with monthly mean ice concentration and geographical distribution of monthly maximum sea ice extent Customer: OMV. 2014.
3. **Development of methodology for calculations of environmental risk for the marginal ice zone**. A joint development project between Akvaplan-Niva and DNV GL. Customer: NOROG, Statoil, RWE, DEA Total E&P, GDF Suez E&P. 2013-2014.
4. **SHINE (Ship, Ice, Navigation, Environment).** Project, which produced the currently most detailed emission inventory for Arctic ship emissions to the atmosphere. Results included more accurate quantification of current impacts of Arctic ship emissions on climate and air pollution, in particular for short-lived climate forcers like black carbon. Joint DNV GL project with CICIRO. 2014.
5. **BaSEC. Environmental Risk Analysis of oil spill in Marginal Ice Zone**. Customer: 16 operators active on the Norwegian Continental Shelf. 2015 – ongoing.

Significant infrastructure, and/or major items of technical equipment

Arctic Risk Map: Development of an interactive Arctic Risk Map to present the risks associated with offshore and maritime activities in the Arctic, which provides stakeholders with a comprehensive tool for decision-making and transparent communications. It presents multiple dimensions, such as the seasonal distribution of ice, metocean conditions, sea-ice concentrations, biological assets, shipping traffic and oil and gas resources, in a user-friendly, single layout. It also includes a Safety and Operability Index, showing the variation in different factors that impact the risk level depending on the season and their location in the Arctic. DNV GL tool. Internal DNV GL project. 2014.

36. Seascape Consultants Ltd. (Seascape)

Expertise and experience of the organization

Seascape Consultants Ltd was established in 2010 to provide solutions and high-level advice to the marine sector, with expertise in the fields of seafloor geological processes, marine biodiversity, ecosystems and habitat mapping, marine data, governance and legislative advice. Seascape Consultants specialise in marine research programme and data network management and currently coordinate the international Global Ocean Biodiversity Initiative (GOBI; www.gobi.org), the FP7 MIDAS project (www.eu-midas.net), and provides the Secretariat for the **European Marine Observation and Data Network** (EMODnet; www.emodnet.eu).

Key personnel CVs

Calewaert J.B (Head of the EMODnet Secretariat) and Prof. **Philip Weaver** (Chair of the EMODnet Steering Committee) are central in providing support and coordination to the European Marine Observation and Data Network (EMODnet) which consists of more than 120 European partner organisations working together to observe the seas and assembling data from regional, national and European databases. Access to data, metadata and products is organised using 7 thematic data portals (Bathymetry, Geology, Seabed habitats, Chemistry, Biology, Physics and Human activities).

Jan-Bart Calewaert trained as a bio-engineer in cellular and genetic biotechnology, and later in Marine Environment Management. Jan-Bart has been involved in a range of multidisciplinary research projects and science policy advisory bodies in support of marine research, sustainable management of marine and coastal environments and related policy frameworks. He has experience working at the interface between science and policy, combining his broad expertise in marine sciences with knowledge of the marine and maritime policy landscape in Europe. Jan-Bart is currently **Head of the Secretariat for the European Marine Observation and Data Network** (EMODnet).

Prof. Philip Weaver has over 35 years' experience as a marine scientist and has written over 60 peer reviewed publications. He has coordinated 4 successive EC-funded marine science research projects (FP5 EUROSTRATAFORM/ FP6 HERMES/ FP7 HERMIONE/ FP7 MIDAS) that have collected vast amounts of biological, geological and environmental data and have contributed greatly to our knowledge of the oceans. Prof. Weaver is the Managing Director of Seascape Consultants Ltd, and oversees the management of the EMODnet Secretariat, which was contracted to Seascape in 2013. **Prof. Weaver chairs the EMODnet Steering Committee**.

Publications, and/or products, services or other achievements

1. **Calewaert J.B.** and Niamh C. (Eds.) (2008). Remote Sensing of Shelf Sea Ecosystems, State of the Art and Perspectives. Marine Board Position Paper 12. European Science Foundation - Marine Board, Strasbourg, France.
2. Heip H., Barange M., Danovaro R., Gehlen M., Grehan A., Meysman F., Oguz T., Papathanassiou T., Philippart C., She J., Tréguer P., Warren R., Wassmann P., **Weaver P.P.E.**, Yu R., Beusekom J., Boyd P., Cooper A., De Baar H., De Haas H., Janssen F., Ludwig W., Pedersen L.T., Tsimplis M., Von Storch H., Mcdonough N. & **Calewaert J.B.** (2011). Climate Change and Marine Ecosystem Research: Synthesis of European Research on the Effects of Climate Change on Marine Environments. CLAMER Marine Board Special Report. Strasbourg, Marine Board-ESF.
3. Pauly D., Watson R., Eller D., Philippart C., Heip C., **Calewaert J.B.**, McDonough N., Moore C., de Boer J., van Leeuwen S., Wilkinson C., Salvat B., Sneddon L., Wolfenden D., Swabe J., Watts S., Aiking H., Yimin Y., Ouwehand E. (2012). Sea the truth. Assays on Overfishing, Pollution and Climate Change. Nicolaas G. Pierson Foundation. Amsterdam, The Netherlands.
4. **Weaver, P.P.E.**, D.S.M. Billett, A. Boetius, R. Danovaro, A. Freiwald, and M. Sibuet (2004) Hotspot Ecosystem Research on Europe's Deep-Ocean Margins. Oceanography Special Issue Vol. 17 No 4. pp 132-143.
5. **Weaver, P.P.E.** and Johnson, D., (2012) Think big for marine conservation. Nature v483, p399.

Projects, and/or activities

1. **EMODnet Secretariat (2013-2017):** contracted by DG MARE. The European Marine Observation and Data Network (EMODnet) is a network of organisations working together to observe the sea, process the data according to international standards and make that information freely available as interoperable data layers, metadata and data products. The Secretariat coordinates the efforts of the thematic and regional EMODnet projects, monitors their progress and collects user feedback to improve the data portals and the products and services they provide.
2. **Global Ocean Biodiversity Initiative (GOBI) Secretariat (2013-2016):** contracted by the German Federal Agency for Nature Conservation. GOBI is an international partnership advancing the scientific basis for conserving biological diversity in the deep seas and open oceans. It aims to help countries, regional and global organisations, to use and develop data, tools and methodologies to identify ecologically or biologically significant areas of the ocean beyond national jurisdiction.
3. **AtlantOS (2015 - 2019):** Funded under the EC's Horizon 2020 programme, the overarching objective of AtlantOS is to achieve a transition from a loosely-coordinated set of existing ocean observing activities producing fragmented, often monodisciplinary data, to a sustainable, efficient, and fit-for-purpose Integrated Atlantic Ocean Observing System (IAOOS). Within this project, Seascape provides an essential link between the EMODnet community and the scientists in AtlantOS. This is essential in order to strengthen the dissemination and exploitation of data and information from observatories and to help streamline the interactions between AtlantOS, the main observing communities and their multiple stakeholders and users.
4. **Managing Impacts of Deep Sea Resource Exploitation (MIDAS; 2013-2016):** FP7 RTD project (contract no. 603418). P. Weaver is the Coordinator of this project, which is investigating the environmental impacts of extracting mineral and energy resources from the deep sea. This includes the exploitation of materials such as polymetallic sulphides, manganese nodules, cobalt-rich ferromanganese crusts, methane hydrates and the potential mining of rare earth elements.
5. **Hotspot Ecosystem Research and Man's Impact on European Seas (HERMIONE; 2009-2012):** FP7 Collaborative Project (contract no. 226354). P. Weaver was the Coordinator of this project, which investigated the natural dynamics, distribution, and interconnection of deep-sea ecosystems and how they are affected by human activities. A major aim was to use this knowledge to contribute to EU environmental policies and in developing effective management.

Participants not eligible for EU funding

37. Nansen International Environmental and Remote Sensing Centre (NIERSC)

The Nansen International Environmental and Remote Sensing Center (NIERSC) was established in St. Petersburg, Russia in 1992 as a non-profit joint venture and reorganized as a Scientific Foundation in 2001. NIERSC is co-founded by NERSC and the University of Bergen, Norway, two Russian Academy of Sciences institutes, St. Petersburg State University and Max Planck Society in Germany. The vision of NIERSC is to understand, monitor and predict climate and environmental changes in the high northern latitudes for serving the society with a special focus on the Russian High North. Together with its two of its co-founders NIERSC was elected the 2005 EU Descartes Laureate in Earth Sciences for the attainments achieved during more than 10 years of joint climate research activities under the project "*Climate and Environmental Change in the Arctic – CECA*". NIERSC is a member of the European Climate Forum (ECF) and the Arctic Regional Ocean Observing System (Arctic ROOS). The NIERSC expertise covers climate change in the Arctic, including sea ice and surface air temperature, satellite remote sensing of atmosphere, ocean and sea ice and some other areas. NIERSC has coordinated the FP7 Inco-lab project *European-Russian Centre for cooperation in the Arctic and Sub-Arctic environmental and climate research - EuRuCAS* (2012-2015) with 12 European partners. Apart from research, NIERSC is also involved in educational activities at postgraduate level performed under the NANSEN Fellowship Program.

NIERSC will contribute with Russian snow and ice data and air temperature from Russian areas. In collaboration with RIHMI (All Russian Research Institute for Hydro-meteorological Information) it will also provide hydrological data. The work will be lead by Dr. **Leonid Bobylev**, Managing Director of NIERSC. NIERSC and RIHMI will contribute to WP2.

Key personnel CV

Dr. Leonid P. Bobylev, Director of NIERSC, received his PhD in atmospheric remote sensing at Voeikov Main Geophysical Observatory, St. Petersburg, Russia in 1980. His major research interests are: global climate change in the Arctic, passive and active microwave remote sensing of sea ice and atmosphere-ocean system. Dr. Bobylev is a co-author of 4 monographs published by Springer-Praxis and of a number of papers in refereed journals. Dr. Bobylev was awarded by the EU Descartes Prize in 2005. He is a member of Norwegian Scientific Academy for Polar Research.

All Russian Research Institute for Hydro-meteorological Information (RIHMI-WDC).

RIHMI-WDC has a long-standing experience in marine data management and analysis of climate variabilityof marine processes occurring both off shore and in the coastal area. The Web site of RIHMI-WDC is http://www.meteo.ru/. RIHMI-WDC collects, accumulates, processes and provides long-term storage of data coming from the Roshydromet (Federal Service for Hydrometeorology and Environmental Monitoring) network of hydro-meteorological and oceanographic observations (research vessels, coastal and island stations, buoys, satellites), including Russian Arctic are available. RIHMI-WDC is a coordinator of Subprogramme "The Unified State System of Information on the Global Ocean" (ESIMO) implemented under the Federal Targeted Programme "The World Ocean" involving a more 30 institutions of major marine-related Ministries and Agencies of the Russian Federation. These developments are based on modern web-oriented information technologies (service-oriented architecture and web-services, web-GIS, etc.) including interoperability tools (ISO/OGC standards). ESIMO addresses the whole of the global ocean including Arctic regions (http://data.oceaninfo.ru/).

Key personnel CV

Dr. Mikhaylov Nikolay. Head, Oceanographic Data Centre. Education: 1974 – Hydro-Meteorological Institute, St-Petersburg. Degree in Oceanography 1987 – State Oceanographic Institute, Moscow. PhD in Oceanography. Current research activities is design and coordination of "The Unified System of Information on the Global Ocean" (ESIMO) and international projects. He is Vise-Chair of IOC of UNESCO.

38. Woods Hole Oceanographic Institution (WHOI)

Woods Hole Oceanographic Institution

Andrey Proshutinsky, *Sr. Scientist*
MS #29, 266 Woods Hole Road, Woods Hole, MA 02543
Office: 508 289-2796
aproshutinsky@whoi.edu

To: H2020 February 8, 2016
From: Andrey Proshutinsky

Subject: Expression of support for, and interest in collaborating with the INTAROS project

This letter has been prepared on behalf of participants in two projects, namely: The Beaufort Gyre Exploration Project (BGEP) and Forum for Arctic Modeling and Observing Synthesis (FAMOS) project at the Woods Hole Oceanographic Institution (WHOI) to express support for, and interest in collaborating with the INTAROS project being proposed to the Horizon 2020 program. Both projects goals and objectives (see details below) are in close agreement with the Horizon 2020 activities associated with the development of an integrated Arctic observational system which will close critical observational gaps with innovative solutions, as well as improve the integration and inter-operability of existing observational systems based on cooperation between the existing European and international infrastructures and the modelling communities.

The Beaufort Gyre system is a unique circulation component within the Arctic physical environmental system that reflects a set of specific atmospheric, sea-ice, and oceanic conditions having significant interrelationships with the Arctic-wide as well as global climate systems. Observations spanning 2003-2015 reveal that the Beaufort Gyre region accumulated more than 5000 km^3 of liquid freshwater relative to the climatology of the 1970s. Recent results suggest that the Beaufort Gyre system may be entering a period of freshwater release which has the potential to cause another Great Salinity Anomaly in the subpolar North Atlantic. Since 2003, fourteen years of observations (see Figure), supported by NSF, WHOI, the Department of Fisheries and Oceans, Canada, and different institutions of Japan have been conducted in the Beaufort Gyre region of the Arctic Ocean as part of the BGEP project based on the Beaufort Gyre Observing System (BGOS) activities. To date, the BGOS program has sequentially deployed and recovered 36 moorings at 3-4 fixed locations that measured water temperature and salinity (T&S), ocean currents, sea ice drafts, bottom pressure, and collected sediment samples; and amassed hydrographic data from more than 400 CTD (T&S, biogeochemistry) and more than 600 XCTD (T&S)

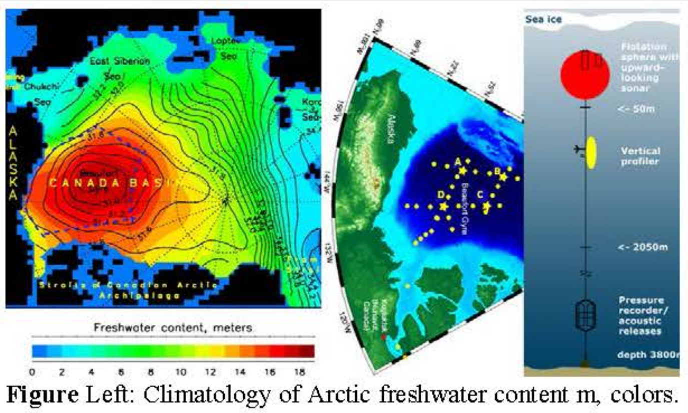

Figure Left: Climatology of Arctic freshwater content m, colors. Solid lines depict summer mean salinity at 50 m. The BG region is bounded by thick dashed blue lines; Middle: BGOS field program region with locations of A,B,C, and D moorings (stars) and sites of CTD casts (circles); Right: BGOS mooring diagram with: (a) floatation-mounted Upward Looking Sonar (ULS), and ADCP; (b) McLane Moored Profiler (MMP) measuring T, S and currents between 50 and 2050m, (c) anchor, (d) acoustic releases and (e) anchor-mounted Bottom Pressure Recorder (BPR).

casts along standard sections in fall during each year of the program. BGOS has had strong ties through logistics and data sharing with at least ten other AON projects (including ITP, IMB, AOFB, O-Buoy, UpTempO, IABP) and looser associations with many others. Over 100 peer-reviewed publications by authors from different countries and institutions have utilized BGOS data. In 2014, we were given support to continue the BGOS measurements ($5,816,831) throughout the time span of 2014-2017 to investigate the fate of BG changes under a rapidly changing climate. The BGOS configuration (mooring locations and hydrographic sites, see Figure) has been maintained and will be maintained in the future (we will submit a new proposal later this year to continue observations in 2017-2021) to better understand how the Beaufort Gyre system works.

The overall goal of the FAMOS project is a better understanding of the Arctic climate system through the use of improving numerical models and observational tactics and strategies. The FAMOS project is focused on enhancing collaboration and coordination among arctic marine modelers, theoreticians, and observationalists. The International teams of FAMOS scientists (USA, Canada, UK, France, Germany, Sweden, Poland, China, Japan, Korea, Russia, Norway, Belgium) are represented at all levels of project activities starting from generating hypotheses, to planning numerical and field experiments, and to finalizing analyses. The key scientists and students from all teams usually receive some financial support from FAMOS to sponsor their participation in FAMOS activities including annual meetings at WHOI. FAMOS supports synthesis across the suite of Arctic models and observations by:

- Holding scientific workshops and schools for new investigators including virtual teleconferences;
- Creating teams of modelers, theoreticians, and observationalists to work on topical issues of Arctic sea ice and oceanic dynamics and thermodynamics;
- Conducting collaboration with other similar projects focused on other aspects of arctic/global climate (atmospheric, terrestrial, cryospheric);
- Disseminating findings to broader communities and involving the larger community in discussions, coordinated modeling and observational field experiments;
- Training a new generation of ocean and sea-ice observationalists and modelers.

In this sense, collaborating with the INTAROS project is a natural functionality of FAMOS to enhance quality of scientific results and to reduce uncertainties in model predictions.

At present, our FAMOS-related activities are being funded by grants from the U.S. National Science Foundation (under their Arctic System Science program). Our current NSF grant (2013-2016; $511K) is supporting initiation and coordination of numerical experiments via coordinated studies to better understand Pacific and Atlantic water circulation, freshwater changes in the Arctic Ocean, pack ice drift, ice ridging, and changing ice-related processes, landfast generation and break-up, and changes in Arctic ecosystems. More than 50 peer-reviewed papers have been published in peer-reviewed journals based on these studies (www.whoi.edu/project/famos). In 2015 (October), we submitted a new proposal to continue FAMOS studies (2016-2019). This new FAMOS, phase-2 project will focus on high and very high resolution ocean and sea ice modeling and observing. If funded (a decision is expected to be made in May of 2016) this project will collaborate with the INTAROS project supporting such objectives as improving of data assimilation techniques, planning and recommending the most effective and reduced cost oceanic and sea ice observational systems able to provide observational data for improved predictions of environmental conditions at different spatial and temporal scales for the Arctic region.

In addition to me, the BGEP and FAMOS projects at WHOI involve Richard Krishfield and John Toole. Mary-Louise Timmermans at Yale University is a close collaborator.

We will contribute to the INTAROS program modeling and observational activities by participating in INTAROS projects and expeditions and providing our resources and intellectual property to fulfill major goals and objectives of the INTAROS program which are in our project major interests listed above. We confirm that we intend to develop a partnership agreement with the INTAROS project if the program is funded.

Sincerely,
Andrey Proshutinsky

Andrey Proshutinsky

Digitally signed by Andrey Proshutinsky
DN: cn=Andrey Proshutinsky, o=Woods Hole Oceanographic Institution, ou=Physical Oceanography Department, email=aproshutinsky@whoi.edu, c=US
Date: 2016.02.11 09:49:06 -05'00'

Senior Scientist,
BGEP and FAMOS project Principal investigator

WOODS HOLE OCEANOGRAPHIC INSTITUTION

John M. Toole, *Senior Scientist, Department of Physical Oceanography*

February 5, 2016

To: H2020

From: John Toole

Subject: WHOI Ice-Tethered Profiler program

This memo has been drafted on behalf of the participants in the Ice-Tethered Profiler (ITP) program based at the Woods Hole Oceanographic Institution (WHOI) to express support for, and interest in collaborating with the Integrated Arctic Observation System (INTAROS) project being proposed to the Horizon 2020 activity. I personally have 40 years of experience working with data from oceanographic instruments and have initiated and led a variety of observational programs, including a sustained measurement effort in the Arctic. That latter effort is built on an instrument system developed here at WHOI under my supervision: the Ice-Tethered Profiler (ITP).

The ITP is an autonomous instrument system designed to collect observations of upper ocean water properties and related parameters while drifting with a supporting ice floe. Details about the instrument may be found at the program website: www.whoi.edu/itp. The underwater instrument component of the ITP system is commercially available from McLane Research Laboratories, Inc. while the surface electronics module and tether are constructed in house here at WHOI.

Begun in summer 2004, the ITP program over the last 11.5 years has fielded a total of 88 ITP systems in the Arctic that have collectively returned more than 70,000 vertical profiles of ocean data and nearly 100 combined years of ice drift information. A majority of the ITP underwater observations span the depth interval from just below the ice-ocean interface to several hundred meters depth. All ITPs sample the ocean temperature and salinity: subsets have additionally observed dissolved oxygen concentration, chlorophyll fluorescence, optical backscatter, CDOM, PAR and ocean currents. These data are publicly available from the program website in near real time as well as distributed over the Global Telecommunications System (GTS) for integration into operational modeling activities. Once a given ITP system has been judged to have terminated, careful editing and calibration work is carried out to produce research quality data. These final data products are available from national data archives as well as accessible from the program website.

Importantly, a large fraction of the ITPs that have been deployed to date have been funded through collaborations with colleagues outside of the U.S. The WHOI ITP program provides this instrumentation to our collaborators "at cost" and we host the data telemetry from these systems and data processing in identical fashion to U.S.-funded systems. As well, ITP systems have been deployed from both U.S. and overseas platforms by our teams as well as by collaborating team members we have trained. We very much appreciate these contributions to the ITP array and hope such collaborations can continue into the future, including via Horizon 2020.

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At present, our ITP-related activities in the Arctic are being funded by grants from the U.S. National Science Foundation (under their Arctic Observing Network program) and from the Office of Naval Research. Our current NSF grant ($3.6M) is supporting construction and deployment of 5 ITP systems per year (total of 20 systems) over the period Oct 1, 2013 to Sep 30, 2018. We are currently deciding when to submit a follow-on proposal to NSF to continue the program (fall 2016 or wait until fall 2017). ONR is presently supporting one operational ITP system (grant of $309k for the period Mar 1, 2015 to Feb 28, 2017); they previously funded construction and deployment of 5 systems as a contribution to the Marginal Ice Zone study. Three new ITP systems funded by ONR will be fielded as part of the Stratified Ocean Dynamics in the Arctic (SODA) program. The proposal for that activity requested $1.7M for the period Oct 1, 2015 to Sep 30, 2020. All of these ITP systems may be considered contributions to international Arctic observing efforts.

In addition to me, the ITP program at WHOI involves Richard Krishfield, Andrey Proshutinsky and Sylvia Cole. Mary-Louise Timmermans at Yale University is a close collaborator. We are all keen to collaborate with INTAROS to continue and expand the program of sustained Arctic observing.

39. Scripps institution of Oceanography - University of California, San Diego (SIO)

Expertise and experience of the organization

Scripps Institution of Oceanography **(https://scripps.ucsd.edu)** is one of the oldest, largest, and most important centers for marine and earth science research, graduate training, and public service in the world. It was founded in 1903. Research at Scripps now encompasses physical, chemical, biological, geological, and geophysical studies of the oceans. Scripps staff numbers approximately 1,300. More than 300 research programs may be under way at any time, including studies of air-sea interactions, climate prediction, earthquakes, biodiversity in marine ecosystems, marine chemistry, beach erosion, the marine food chain, marine genomics, the geological evolution of the ocean basins, and the multidisciplinary aspects of global change and the environment. In its most recent survey of U.S. graduate schools, the U.S. National Research Council ranked Scripps the number one oceanographic program in faculty quality, distinction, and scholarly publications. Scripps operates a fleet of four ships and the platform FLIP for oceanographic research. Cruises range from local, limited-objective trips to far-reaching expeditions in the world's oceans.

The scientists and technical staff within the Acoustical Oceanography Group at SIO have played a leading role in the development of ocean acoustic tomography, including the development and deployment of the required instrumentation, since the method was introduced by W. Munk and C. Wunsch in the late 1970s. The Acoustical Oceanography Group has conducted numerous experiments applying the technique to oceanographic and acoustic problems in the North Pacific, North Atlantic, and Arctic Oceans. It has been involved in the tomographic work in Fram Strait, including the DAMOCLES, ACOBAR, and UNDER-ICE projects. SIO brings first class expertise in tomographic technology and methodology that they have built up over many years.

Role in the project

SIO will participate in WP2 in all aspects of the analysis of the active and passive acoustic data collected in various recent and ongoing experiments in the Arctic, including the experiments in Fram Strait led by NERSC (DAMOCLES, ACOBAR, UNDER-ICE) and the experiments led by SIO in the central Arctic (THAAW) and the Canada Basin (CANAPE). SIO anticipates contributing to the initial processing of the acoustic data (signal processing, mooring motion and clock corrections, ray and mode beamforming), to the subsequent inversion of the data to obtain ocean temperatures, and to the use of the data to test and constrain high-resolution ice-ocean models.

Key personnel CVs

Dr. Peter F. Worcester (M) (Ph.D., SIO-UCSD, 1977). Worcester is a Research Oceanographer Emeritus at SIO. His primary research interests are in acoustical oceanography and underwater acoustics. His work has focused on the application of acoustic remote sensing techniques to the study of ocean structure and circulation. He received the 2006 Walter Munk Award in Recognition of Distinguished Research in Oceanography Related to Sound and the Sea (granted by the U. S. Navy and The Oceanography Society).

Dr. Bruce D. Cornuelle (M) (Ph.D., MIT-WHOI Joint Program, 1983). Cornuelle is a Research Oceanographer and Senior Lecturer at SIO. His primary research interests are in the application of inverse methods and data assimilation using acoustic and other data to the study of ocean structure and circulation, He was awarded the 2002 Acoustical Society of America Medwin Prize for Acoustical Oceanography.

Dr. Matthew A. Dzieciuch (M) (Ph.D., Univ. Michigan, 1990), Dzieciuch is a Project Scientist at SIO. His primary research interests are in acoustical oceanography and underwater acoustics, with special emphasis on acoustic signal processing. He is part of the Acoustical Oceanography Group and has participated in many ocean acoustic tomography/thermometry experiments.

Publications, and/or products, services or other achievements

1. Dzieciuch, M. A. (2014), Signal processing and tracking of arrivals in ocean acoustic tomography, J. Acoust. Soc. Am., 136(5), 2512–2522.
2. Dzieciuch, M. A., B. D. Cornuelle, and E. K. Skarsoulis (2013), Structure and stability of wave-theoretic kernels in the ocean, J. Acoust. Soc. Am., 134(4), 3318–3331.
3. Morawitz, W. M. L., B. D. Cornuelle, and P. F. Worcester (1996), A case study in three-dimensional inverse methods: Combining hydrographic, acoustic, and moored thermistor data in the Greenland Sea, J. Atmos. Oceanic Tech., 13, 659–679.
4. Munk, W. H., P. F. Worcester, and C. Wunsch (1995), Ocean Acoustic Tomography, Cambridge University Press, Cambridge, England, 433 pp.,
5. Send, U., P. F. Worcester, B. D. Cornuelle, C. O. Tiemann, and B. Baschek (2002), Integral measurements of mass transport and heat content in the Strait of Gibraltar from acoustic transmissions, Deep-Sea Res. Part II, 49, 4069–4095.

Projects, and/or activities:

CANAPE (Canada Basin Acoustic Propagation Experiment). CANAPE consists of a yearlong experiment in the Canada Basin of the Arctic Ocean to be conducted during 2016–2017, preceded by a short Pilot Study that was performed during July-August 2015. The goals include (1) understanding the impacts of changing sea ice and oceanographic conditions on acoustic propagation and fluctuations; (2) characterizing the depth dependence and temporal variability of the ambient noise field; and (3) measuring the spatial and temporal variability in the upper ocean throughout the annual cycle by combining acoustic and other data with ocean models.

THAAW (THin-ice Arctic Acoustic Window). Ambient noise data were collected as a Distributed Vertical Line Array (DVLA) receiver deployed by SIO and WHOI near the North Pole in April 2013 drifted south toward Fram Strait. The goas are to characterize the ambient noise and assess its relationship to the ice cover, atmospheric and other forcing, and to the ocean sound-speed field.

OBSANP (Ocean Bottom Seismometer Augmentation in the North Pacific). The 2013 OBSANP experiment was conducted to study (1) the relationship between the acoustic field in the water column and the seismic field in the seafloor for both ambient noise and signals transmitted by a J15-3 source and (2) the relationship between deep ocean ambient noise and sea surface processes that generate sound

NPAL Philippine Sea Experiments. During 2009–2011 three experiments were conducted to study deep-water acoustic propagation and ambient noise in the oceanographically and geologically complex northern Philippine Sea. The goals included (i) understanding the impacts of fronts, eddies, and internal tides on acoustic propagation, and (ii) determining whether acoustic methods, together with other measurements and ocean modeling, can yield estimates of the time-evolving ocean state useful for making improved acoustic predictions and for understanding the local ocean dynamics.

Significant infrastructure, and/or major items of technical equipment

SIO has an extensive inventory of the acoustic sources and receivers needed to conduct ocean acoustic tomography experiments, together with the requisite mooring and other supporting equipment.

40. University of Alaska Fairbanks International Arctic Research Center (UAF)

Expertise and experience of the organization

International Arctic Research Center (IARC) at the University of Alaska Fairbanks (UAF) was established in 1999 as a cooperative research institute supported by both the U.S. and Japanese governments. IARC researchers and collaboration teams are funded through a variety of grants from U.S., Japanese and Korean funding agencies. More than 20 international groups and more than 60 scientists are collaborating with IARC, allowing the institute to meet our mission and goals through shared understanding and cooperation. Understanding, observing and responding to rapid Arctic change cannot be addressed by any single institution or nation in isolation. IARC strives to play a pivotal role in facilitating international collaboration in Arctic environmental change studies. IARC conducts outreach to Alaska communities and those in more temperate regions on all aspects of physical, biological and social sciences in the circumpolar north. It serves as a synthesis and coordination center for Arctic research programs, particularly within the UA system, but also as a leader in Arctic research among the international community. Examples of this leadership include IARC's role as the lead organizer of the Arctic Science Summit Week and the Arctic Observing Summit in March 2016 in Fairbanks in conjunction with an Arctic Council Senior Arctic Officials meeting. IARC also conducts an internationally popular summer school for young researchers and holds workshops on the integration and synthesis of research. IARC also supports several K-12 outreach projects.

Role in the project

IARC will link to the NABOS program led by Dr. Igor Polyakov, as well as the SIZONet project co-led by Dr. Hajo Eicken (WP2&WP3). IARC will also serve as a hub for project meetings and other activities linking experts and stakeholders from the Pacific Arctic sector into the project (WP1).

Key personnel CVs

Dr. Hajo Eicken (M) is director of IARC and has studied the role of sea ice in the context of Arctic social-environmental systems for the past two decades. He is leading an effort on community-based observations in Alaska focusing on coastal sea ice and its uses by people and ecosystems that will contribute to this proposed project. He is currently serving as immediate past chair of the U.S. Study of Environmental Arctic Change (SEARCH), with IARC serving as the home for the SEARCH Executive Director and a U.S. CLIVAR-SEARCH working group co-lead.

Dr. Igor Polyakov (M) is professor with joint appointment at IARC and College of Natural Science and Mathematics. His studies are focused on Arctic and North Atlantic climate changes, and processes driving these changes. He is the leader of NABOS, an observational program which overarching goal of the proposed study as an element of the Arctic Observing Network is to compile a cohesive picture of the climatic changes in the Eurasian and Makarov basins of the Arctic Ocean. High-latitude cruises is the vehicle for achieving the goal.

Publications, and/or products, services or other achievements

1. Carmack E., I. Polyakov, L. Padman, I. Fer, E. Hunke, J. Hutchings, J. Jackson, D. Kelley, R. Kwok, C. Layton, D. Perovich, O. Persson, B. Ruddick, M.-L. Timmermans, J. Toole, T. Ross, S. Vavrus, P. Winsor (2015) The new Arctic: Towards quantifying the increasing role of oceanic heat in sea ice loss, BAMS, 10.1175/BAMS-D-13-00177.1.
2. Polyakov, I. V., U. S. Bhatt, J. E. Walsh, E. P. Abrahamsen, A. V. Pnyushkov and P. F. Wassmann (2013) Recent oceanic changes in the Arctic in the context of long-term observations, Ecological Applications, 23(8), 1745-1764.
3. Polyakov, I. V., L. A. Timokhov, V. A. Alexeev, S. Bacon, I. A. Dmitrenko, L. Fortier, I. E. Frolov, J.-C. Gascard, E. Hansen, V. V. Ivanov, S. Laxon, C. Mauritzen, D. Perovich, K. Shimada, H. L. Simmons, V. T. Sokolov, M. Steele, and J. Toole (2010) Arctic Ocean warming reduces polar ice cap, J. Phys. Oceanogr., DOI: 10.1175/2010JPO4339.1, 40, 2743–2756.
4. Eicken, H., M. Kaufman, I. Krupnik, P. Pulsifer, L. Apangalook, P. Apangalook, W. Weyapuk, Jr., J. Leavitt (2014): A framework and database for community sea ice observations in a changing Arctic: An Alaskan prototype for multiple users. Polar Geogr. 37(1), 5-27
5. Lovecraft, A. L., and H. Eicken (eds., 2011) North by 2020: Perspectives on Alaska's Changing Social-Ecological Systems. University of Alaska Press, Fairbanks, AK, 736pp

Projects, and/or activities

1. Seasonal Ice Zone Observing Network (SIZONet) collects data on the state and dynamics of the seasonal ice zone across the Arctic with a focus on Alaska coastal environments, including a database of >5000 community-based ice observations.

2. Nansen and Amundsen Basins Observational System (NABOS) provides multidisciplinary observations from the eastern Arctic Ocean, a remote and logistically challenging area of the polar region.
3. IARC houses the SEARCH Executive Director and his office, as well as co-lead of a U.S. CLIVAR-SEARCH working group.
4. IARC leads organization of the 2016 Arctic Science Summit Week and Arctic Observing Summit in Fairbanks (assw2016.org; arcticobservingsummit.org).
5. North by 2020 is a forum housed at IARC to explore, discuss, plan and prepare opportunities for sustainable development in a North experiencing rapid transformation. North by 2020 facilitates research and education across disciplinary boundaries to address the real world concerns surrounding Northern futures and engages public, private, and government stakeholders (http://www.iarc.uaf.edu/NX2020).

Significant infrastructure, and/or major items of technical equipment

IARC has meeting and conference rooms and other facilities for coordination, workshops and project meetings in support of project goals.

The NABOS program possesses an extensive pool of scientific equipment. Oceanographic equipment is sufficient to deploy up to 10 deep-water moorings equipped with McLane mooring profilers or Acoustic Doppler Current Meters with Conductivity-Temperature-Pressure loggers. Logistics is supported by several deep-water winches and A-frame.

41. Jet Propulsion Laboratory, California Institute of Technology (JPL)

Expertise and experience of the organization

JPL is a US Federally-funded Research and Development Center managed by the California Institute of Technology. Organizational expertise includes the development, flight, operation, and scientific analysis of remote sensing systems for use in Earth Science.

Role in the project

Provide satellite-derived products related to Arctic sea ice in WP2.

Key personnel CVs

Mr. Benjamin Holt (M) is a research scientist in the Ocean Circulation and Air-Sea Interaction Group within the Earth Science Section at JPL. His research interests include using multi-sensor remote sensing data to examine the geophysical state of polar sea ice and snow, coastal oceanography circulation, and the detection of marine pollutants. In addition, he is also involved with new instrument development and techniques for microwave measurement of sea ice thickness and the development of sea ice thickness archive based on in-situ surface measurements. He is a currently on the Science Definition Team of the NISAR mission.

Dr. Ron Kwok (M) is a Senior Research Scientist at the Jet Propulsion Laboratory, California Institute of Technology. His research interests include the mass and energy balance of the Arctic and Southern Ocean ice cover and the role of the sea ice in global climate. His current focus is on the analysis of thickness, small-scale sea ice kinematics, time varying gravity from various spaceborne and airborne remote sensing instruments. He is a currently a member of NASA's ICESat-1&2 science teams, SWOT science definition team and ESA's CryoSat-2 Calibration/Validation team

Publications, and/or products, services or other achievements

1. Wang, Y., B. Holt, W. E. Rogers, J. Thomson, and H. H. Shen, Wind and wave influences on sea ice floe size and leads in the Beaufort and Chukchi Seas during the summer-fall transition 2014, J. Geophysical Res. Oceans, 121, doi:10.1002/2015JC011349, 2016.
2. Holt, B., M. P. Johnson, D. Perkovic-Martin, B. Panzer, Snow depth on Arctic sea ice derived from radar: In situ comparisons and time series analysis, J. Geophysical Res. Oceans, 120, 4260-4287, doi:10.1002/2015JC010815, 2015.
3. Brekke, C., B. Holt, C. Jones, and S.Skrunes, Discrimination of oil spills from newly formed sea ice by synthetic aperture radar, Remote Sensing of the Environment, 145, 1-14, 2014.

4. Kwok, R., and J. Morison (2015), Sea surface height and dynamic topography of the ice-covered oceans from CryoSat-2: 2011–2014, J. Geophys. Res. Oceans, 121, doi:10.1002/2015JC011357.
5. Kwok, R., (2015), Sea ice convergence along the Arctic coasts of Greenland and the Canadian Arctic Archipelago: Variability and extremes (1992-2014), Geophys. Res. Lett., 42, 7598–7605, doi:10.1002/2015GL065462.

Projects, and/or activities

1. Current member of the Science Definition Team for the NISAR mission, a planned joint NASA-ISRO SAR mission scheduled to be launched in 2020.
2. Current member of the Science Definition Team for the ICESat-2 mission scheduled to be launched in October 2017.
3. Current member of the Science Definition Team for the SWOT mission scheduled to be launched in October 2020.

42. Université Laval (UL)

ArcticNet
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Prof. Stein Sandven
Research Director
Nansen Environmental and Remote Sensing Centre
Thormøhlens gate 47
NO-5006 Bergen
Norway

Québec, 05 February 2016

Subject: ArcticNet's support for the Integrated Arctic Observing System (INTAROS) proposal

Dear Professor Sandven,

ArcticNet is a Network of Centres of Excellence of Canada that brings together scientists in the natural, human health and social sciences with their partners in Inuit organizations, northern communities, government and industry to help Canadians face the impacts and opportunities of climate change and globalization in the Arctic. In Canada, the Network involves over 140 researchers and 1000 graduate students, post-doctoral fellows, research associates and technicians from 30 Canadian universities and several federal departments. ArcticNet researchers use the Canadian Research icebreaker CCGS *Amundsen* as their primary infrastructure to access and monitor the coastal Canadian Arctic and adjacent seas. In particular, in cooperation with other Canadian Research Networks, we are in the process of deploying new low-power cabled observatories and telemetry systems in Hudson Bay (funded) and Baffin Bay (proposal stage).

Hence, the INTAROS project shares several research objectives with the scientific program of ArcticNet including to (1) close critical gaps in the Arctic Observing System with innovative solutions; (2) improve the integration and inter-operability of existing observation systems in the Arctic; (3) ensure the interoperability, archiving and assimilation of data; (4) involve stakeholders in the design of the research; (5) help implement the Transatlantic Ocean Research Alliance and the Sustaining Arctic Observation Networks (SAON); (6) promote the integrated use of Arctic land, ocean, ice and atmosphere *in-situ* and space-based observations from Europe, the USA, Canada and other international partners; and (7) encourage community-based observation programs, the inclusion of indigenous and local knowledge, and capacity-building in Arctic communities.

ArcticNet strongly supports the INTAROS proposal in which we are a partner. Once INTAROS approved, we look forward to further discuss how the two programs can cooperate in developing a fully integrated Arctic observation system.

Sincerely,

Prof. Louis Fortier O.C., O.Q.
Scientific Director - ArcticNet
Scientific Leader - Canadian research icebreaker CCGS *Amundsen*
Canada Research Chair on the response of Arctic marine ecosystems to climate warming

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arcticnet@arcticnet.ulaval.ca • www.arcticnet.ulaval.ca

43. University of Victoria (UVIC)

oceannetworks.ca

OCEAN NETWORKS CANADA

15 February 2016

Dr. Hanne Sagen
Group Leader/Scientist
Nansen Environmental and Remote Sensing Centre
Thormøhlens gate 47, NO-5006 Bergen, NORWAY
transmitted via email

Subject: Support and Collaboration with INTAROS

Dear Dr. Sagen:

This letter expresses Ocean Networks Canada's support for, and interest in collaborating with the INTAROS project. Ocean Networks Canada has been in discussion with various members of the INTAROS working groups, which has resulted in very positive ways that we can work together.

Ocean Networks Canada operates the world-leading NEPTUNE and VENUS cabled observatories as well as community observatories in the Arctic Ocean and other coastal areas in Canada that collect data on physical, chemical, biological, and geological aspects over long time periods. The NEPTUNE and VENUS observatories, which have been operating for ten years, provide unique scientific and technical capabilities that permit researchers to operate instruments remotely and receive data at their home laboratories anywhere on the globe in real-time. These facilities extend and complement other research platforms and programs, whether currently operating or planned for future deployment.

We see that there are several areas of support and collaboration that span work packages 1, 2, 4, and 5. In the attached, we outline the details of this support and collaborations.

We look forward to supporting and working with INTAROS.

Sincerely,

Kate Moran, PhD
President & CEO

Attachment (1)

PO Box 1700 STN CSC 2300 McKenzie Avenue Victoria BC V8W 2Y2 | T 250.472.5400 | F 250.472.5370

AN INITIATIVE OF University of Victoria

Ocean Networks Canada's Contribution to INTAROS

WP1 – International Collaboration

1. ArcticNet

   ArcticNet is a Network of Centres of Excellence of Canada that brings together scientists and managers in the natural, human health and social sciences with their partners from Inuit organizations, northern communities, federal and provincial agencies and the private sector. The objective of ArcticNet is to study the impacts of climate change and modernization in the coastal Canadian Arctic. Over 150 ArcticNet researchers and 1000 graduate students, postdoctoral fellows, research associates, technicians and other specialists from 34 Canadian universities, and 20 federal and provincial agencies and departments collaborate with more than 150 partner organizations in 14 countries. ONC works with ArcticNet scientists who use the ONC community observatory data in Cambridge Bay. These data will similarly be shared with the INTAROS science teams.

2. Polar Knowledge Canada

   Polar Knowledge Canada (POLAR), established as a new Canadian federal agency on 1 June 2015, is responsible for advancing Canada's knowledge of the Arctic and strengthening Canadian leadership in polar science and technology. As a key component of Canada's Northern Strategy, it comprises a pan-northern science and technology program (the Canadian High Arctic Research Station in Cambridge Bay, Nunavut, which will be operational in 2017) and a knowledge management and mobilization function.

   POLAR provides a hub for science and technology research in Cambridge Bay, Nunavut called the Canadian High Arctic Research Station. ONC is currently funded by POLAR to combine sea-ice thickness data with models to predict sea-ice concentration in Dease Strait. ONC will provide the data, model results, and future model developments to INTAROS.

3. Alaska Ocean Observing System and Coastal Community Ocean Observers (C2O2)

   Ocean Networks Canada is partnering on a proposal with the Alaska Ocean Observing System and Coastal Community Ocean Observers, an initiative of the University of Alaska Fairbanks. The proposal would support a community observatory in an Alaskan community, or a Community Fishers program in three Alaskan coastal communities (Kaktovik, St. Paul and Old Harbor). Both of these initiatives would bridge science and community-based learning and knowledge. Further details on Community observatories and Community Fishers are discussed below. Should this be funded, ONC will share the data and the know-how for installing community observatories with INTAROS.

WP2 – Existing Systems

1. Churchill Observatory

The University of Victoria's Ocean Networks Canada is partnering with the University of Manitoba to develop, install and maintain the cabled estuary observatory component of a new marine observatory in Hudson Bay. The Churchill Marine Observatory, formally announced by the Canadian federal government on 6 July 2015 in Churchill, Manitoba—Canada's only Arctic deep-water port—will be a multidisciplinary facility where researchers will study the impact of oil spills on sea ice and investigate issues related to marine transportation and resource development in the Arctic.

The facility, led by the University of Manitoba, is funded by the Canada Foundation for Innovation and the Province of Manitoba. These contributions will fund a cabled observatory to be built in the mouth of the Churchill estuary along the main shipping channel across Hudson Bay and the Strait, providing a state-of-the-art monitoring system designed to strengthen Canada's ability to protect the Arctic environment.

Information from Ocean Networks Canada's observatories, which will be shared with INTAROS, is being used for research, forecasting and monitoring the health of the ocean environment. High-quality scientific data will be critical to understanding these changes and mitigating their impacts on ocean ecosystems and coastal communities.

2. Cambridge Bay Observatory

Ocean Networks Canada was granted a research license from the Nunavut Research Institute, with approval from the Nunavut Impact Review Board, to install and maintain a small, cabled seafloor observatory in Cambridge Bay, Nunavut. Installation was completed in September 2012. This community-based observatory is the first location in Canada's Arctic for year-round, continuous undersea monitoring of the northern environment. Its purpose is to offer science-based support for greater understanding and protection of fragile arctic marine ecosystems. Data streaming from the instruments support cutting-edge research as well as educational and community purposes. This site was chosen because of: the existing community and infrastructure (power, airstrip and accessible wharf); the protected location in the bay; the opportunity for science education at the local school; and the outreach potential both to the local community and seasonal visitors.

The underwater instrument platform is located on the ocean floor at a depth of approximately six metres, and linked by cable to a wharf connection. The instrument platform hosts a high-definition underwater video camera and underwater microphone, a suite of sensors to measure seawater properties, plus an instrument to measure ice thickness. On the wharf, a second camera monitors surface ice formation, and a small weather station provides information on current atmospheric conditions. From the wharf, data is transmitted over a wireless link to the local school. A satellite-based Internet connection is used to make data available beyond Cambridge Bay.

This community observatory is now supporting a growing suite of research activities, including benthic ecology, marine chemistry, and sea-ice thermodynamics. By the spring of 2014, the dataset included two complete freeze-up and melt seasons, and the creation of a thermodynamic sea-ice model supported by the direct measurements of seawater properties and atmospheric forcing, as recorded by the observatory. Model predictions and observed sea-ice thickness are leading to refinements in model formulations, additional new measurements associated with coastal sea-ice growth and melt, and have been leveraged as a cornerstone for a newly funded Polar Knowledge Canada research project on sea-ice in the Canadian Arctic Archipelago. Benthic surveys and new sensors are also supporting research into under-ice spring plankton blooms, Arctic marine geochemistry (pCO_2 and pH), and temporal variations in Arctic marine fauna. The Cambridge Bay observatory has also spawned an expanded Arctic research program that now includes research activity in Hudson Strait and Churchill, Manitoba.

3. Baffin Bay Observatories

Ocean Networks Canada, with Laval, Dalhousie, Memorial Universities, the University of Manitoba, and partners from Greenland, submitted a proposal concept to install observing systems in Baffin Bay. The concept was submitted to the Canada Foundation for Innovation in 2016. See map below. Once installed, these data will be available to INTAROS yearly.

WP4 – Community Involvement

1. Community Fishers Application

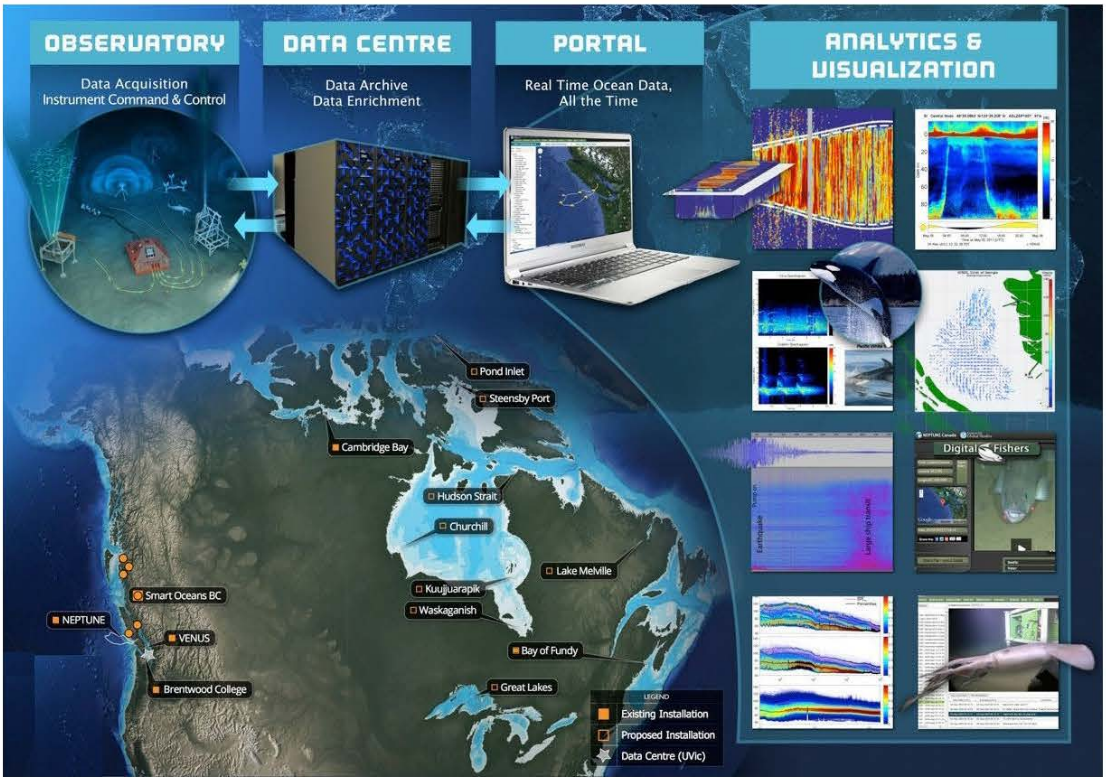
Ocean Networks Canada partners with the Pacific Salmon Foundation to deliver an ocean observing program called Community Fishers. Community Fishers combines a practical, easy-to-use mobile tablet application with ships of opportunity operated by local fishermen who are funded to travel to a pre-set location and conduct oceanographic profiles of conductivity (salinity), temperature, depth, dissolved oxygen, and turbidity. The app allows for automatic upload of data from the profiling instrument to Ocean Networks Canada's advanced data management system, Oceans 2.0. Once the instrument is retrieved, the collected data are seamlessly transferred to the smart device (tablet or smart phone) and stored. Once a connection (cellular or wireless Internet) is established, the data collected from one or more casts are automatically transferred to Oceans 2.0. After transfer to Oceans 2.0, QA/QC processes are automatically executed to rapidly and accurately assess the quality of the data prior to running other automatic processes, such as derived calculations. In addition to the automatic QA/QC routines, Ocean Networks Canada staff implements a suite of manual QA/QC processes to further validate archived data. The data are made openly available via the Oceans 2.0 data portal very quickly after the transfer, allowing users to freely access, download, and visualize the data via an extensive library of available data products. ONC can provide a full system for implementation in the Arctic to INTAROS at cost.

Image: Citizen Fishers collecting oceanographic data off their vessel. Once collected, the data are automatically uploaded to their tablet and then transferred to the Oceans 2.0 data management system (after the tablet is connected to the Internet).

WP5 – Data

1. Oceans 2.0

Long-term, continuous scientific data from the ocean environment are gathered by Ocean Networks Canada and made available through Oceans 2.0, a powerful online data management system. Oceans 2.0, combined with high-performance computing, allows Ocean Networks Canada to manage, mine, analyze, and visualize these data to provide ocean analytics for researchers, communities, industry, and policy-makers to make evidence-based decisions in Canada and globally. Oceans 2.0 provides users with open access to real-time and archived data, and supports a collaborative work environment. The University of Saskatchewan hosts the observatories' data backup. This system is unique on the global stage, enabling international access to the observatory sensors, robots, and cameras and delivering data and information produced by ONC, its scientific community, and its partners. This powerful data management system was accepted as a member the World Data System in 2015. The World Data System is an Interdisciplinary Body of the International Council for Science created by its 29th General Assembly in Maputo, Mozambique in 2008. See figure below for visual outline of Oceans 2.0. ONC currently provides existing data freely over the Internet. ONC could provide an Oceans 2.0 system to INTAROS at fair cost.



44. National Marine Environmental Forecasting Center (NMEFC)

国家海洋环境预报中心

National Marine Environmental Forecasting Center

Letter of support

13/1/2016

The National Marine Environmental Forecasting Center (NMEFC) is pleased to make contributions to "INTegrated ARctic Observing System (INTAROS)" proposal coordinated by Research Director and Prof. Stein Sandven, of the Nansen Environmental and Remote Sensing Center (NERSC), Norway. The NMEFC is aware that INTAROS is part of EC H2020 Framework (BG-9-2016: An Integrated Arctic Observing System) call.

The NMEFC carries out the operational sea ice forecasts for the Arctic Ocean upon requests from CHInese National Arctic Research Expedition (CHINARE) program. NMEFC is also responsible for meteorological observation and operational weather service along the CHINARE expedition trajectories. Additionally, NMEFC provide Arctic marine and meteorological service for the stakeholders, e.g. China Ocean Shipping (Group) Company (COSCO). COSCO intended to carry out commercial transit of Arctic waters. The MV YongSheng affiliated with COSCO has been explored Northern Sea Route in recent years with help of NMEFC services.

The Polar Research and Forecasting Department (Contact person: Dr. Qinghua Yang) associated with the Marine Meteorological Forecasting Department (Contact person: Dr. Lixin Wei) will represent NMEFC to collaborate with INTAROS.

The NMEFC will support INTAROS in terms of Arctic marine and meteorological modelling and observations. The PRFD/NMEFC will closely collaborate with INTAROS partner, the Finnish Meteorological Institute (FMI) to deploy Sea-Ice Mass Balance Array (SIMBA) in the Arctic Ocean. The MMFD/NMEFC will collaborate with INTAROS partners on atmospheric in situ observations and modelling research.

Sincerely

On behalf of the NMEFC
Qinghua Yang Qinghua Yang

Research Professor, Deputy Head of Polar Research and Forecasting Department
NMEFC, Beijing, 100081, P.R. China
Email: yqh@nmefc.gov.cn
Phone: 8610-62173595
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中国・北京海淀区大慧寺路8号 邮政编码：100081 8 Dahuisi，Haidian District，Beijing 100081，China
电话（Tel）：86-010-62173598 传真（Fax）：86-010-62173620； 86-010-62173612

45. Polar research institute of China (PRIC)

Polar Research Institute of China

Address: 451 Jinqiao Road, Pudong, Shanghai Tel: +86(21) 58711401 Postcode: 200136

Letter of support

11/1/2016

The Polar Research Institute of China (PRIC) is willing to take part in EC H2020 Framework (BG-9-2016: An Integrated Arctic Observing System) proposal entitled "INTegrated ARctic Observing System (INTAROS) coordinated by Prof. Stein Sandven, research director of the Nansen Environmental and Remote Sensing Center, Norway.

PRIC is responsible to implement CHInese National Arctic Research Expedition (CHINARE) program. The Division of Polar Oceanography Division (DPO) of PRIC is selected as official partner from PRIC to join this proposal. The DPO is a part of State Oceanic Administration Key Laboratory for Polar Science and in charge of Polar oceanography, remote sensing, sea ice and climate research at PRIC and has duties to carry out field work, data analysis and numerical model development. The group scientists have participated several times CHINARE program and also been worked as team numbers of a key Chinese Research project on polar science "Chinese Polar Environment Comprehensive Investigation and Assessment Programs". The division leader is Dr. Jianfeng He. The division proposes scientists Dr. Ruibo Lei and Dr. Qun Li to contribute INTAROS. Ruibo Lei is a sea ice physicist. He plays four times leading role with respect to sea ice observations during CHINARE between 2008-2014 and currently worked with the sea ice data analysis and remote sensing. Dr. Qun Li is working on sea ice field data analyses and climate modeling.

The DPO/PRIC will support INTAROS in terms of marine cryosphere *in situ* observations in Chukchi Sea and Canada Basin. The PRIC 1) welcome INTAROS partners to join CHINARE field work; 2) can provide relevant logistical support; 3) participate the data analysis and numerical modeling work; 4) support data sharing within collaboration partners and duty of the authorships of joint publications; 5) The scientific visits/research mobility/joint workshops between PRIC and INTAROS are expected. By implementations of these activities, PRIC expects to provide significant contributions to INTAROS proposal. We may also expect INTAROS could strengthen PRIC international position on Arctic cryosphere monitoring and research.

Sincerely

Huigen Yang

H. Yang

General Director
Polar Research Institute of China, Shanghai, 200136, P.R. China
Email: yanghuigen@pric.org.cn
Phone: 8621-58713004
Fax: 8621-58711663

46. Institute of Remote Sensing and Digital Earth – Chinese Academy of Science (RADI CAS)

RADI (http://english.radi.cas.cn/) is a comprehensive research institute under the Chinese Academy of Sciences (CAS). It was established in 2012 as a major initiative of CAS's Innovation 2020 Program through the merger of two CAS institutes: the Institute of Remote Sensing Applications (IRSA) and the Center for Earth Observation and Digital Earth (CEODE).

The mission of RADI is to explore leading technologies in Earth observation, geospatial information science and mechanisms for acquiring and distributing remote sensing information. It aims to construct and operate spaceborne, airborne and ground-based Earth observation systems that can provide resource-environmental spatial information at the regional and global level, forming a Digital Earth science platform.

RADI is home to many cutting-edge research resources, including the State Key Laboratory of Remote Sensing Science, the CAS Laboratory of Digital Earth Science, the Center for Applied Technologies of Earth Observation, and the National Engineering Center for Geoinformatics.

RADI operates two national key S&T infrastructures: the China Remote Sensing Satellite Ground Station and the Airborne Remote Sensing Aircraft. The China Remote Sensing Satellite Ground Station boasts one of the world's highest capacities for receiving, processing, and distributing satellite data, while the Airborne Remote Sensing Center, equipped with two Citation S/II high-altitude remote sensing aircraft, can conduct all-weather flight operations with different remote sensors.

RADI has developed several international S&T platforms and serve as the national international collaboration platform, including the International Society for Digital Earth (ISDE), International Centre on Space Technologies for Natural and Cultural Heritage under the auspices of UNESCO (HIST) and etc. These platforms enable RADI to carry out high-level research and international collaboration within the framework of international organizations such as UNESCO, ICSU, and TWAS.

The State Key Laboratory of Remote Sensing Science and the CAS Laboratory of Digital Earth Science are two main research units under RADI, whose duties include providing the remote sensing product of snow, ice, and physical status of Tibetan Plateau and Polar areas. Dr Yubao Qiu is the main research who works on the snow, lake ice, and sea ice remote sensing, and with a strong experience on the Earth cold regions research.

Key personnel

Yubao Qiu, associate professor/researcher at the Institute of Remote Sensing and Digital Earth (RADI), he is the youth core member for the CODATA/ICSU, and the onboard the expert list of the China National GEOSS. He was with the Helsinki University of Technology and the Arctic Research Center of FMI for the passive microwave remote sensing modeling of snow and field experiment from 2007 to 2008, and he finished his doctor degree research in end of 2008. He was also with the board of SOAN for two years, and was invited to be the panel list of Arctic Observation Summit (AOS 2014).

Yubao had three years of working experience in secretariat to Group on Earth Observations (GEO), mainly worked to the establishment of the GEO Cold Regions initiative (GEOCRI), and now her serves as the Point of Contact (PoC) for GEOCRI with his status in RADI, China. He also works on two projects in Polar remote sensing, thaw-refreezing and sea ice monitoring through the passive microwave remote sensing, and he registered one software for the remote sensing thaw-refreezing over Antarctic. He is now the member of the Arctic Data Committee (ADC) of SAON.

Jiancheng Shi, researcher, the director of State Key Laboratory of Remote Sensing Science, developing the WCOM mission in China, which is the first science satellite with passive and active remote sensing payload.

Publications, and/or products, services or other achievements

Yubao Qiu, Huadong Guo, Xiao Cheng, etc. Comparison to the thaw-refereeing detection algorithms over polar region using microwave scatterometer measurement, metrological conference, 2011.

Yubao Qiu, Huadong Guo, Chanjia Bin, et al. SNOW DEPTH ALGORITHMS COMPARATIVE STUDY USING AMSR-E PASSIVE MICROWAVE REMOTE SENSING IN CHINA, IEEE International Geoscience and Remote Sensing Symposium/ 35th Canadian Remote Sensing Society, 2014, Canada

Bin Chanjia, Qiu Yubao, Shi Lijuan, et al. Comparative validation of snow depth algorithms using AMSR-E passive microwave data in China[J].Journal of Glaciology and Geocryology, 2013, 35（4）: 801-813

Kun Wang, Li Zhang, Yubao Qiu, et al. Snow effects on alpine vegetation in the Qinghai- Tibetan Plateau. International Journal of Digital Earth. 2013, DOI: 10.1080/17538947. 2013.848946

Requirement from iAOS

RADI would be very relevant as partner by contribution with Chinese satellite remote sensing data for the Arctic regions. In particular some description of how satellite data management, archiving and distribution is done in RADI, because this will a central topic in the proposal.

RADI has core competences in four major areas: remote sensing data acquisition and processing based on the spaceborn-airborne-ground Earth observation system; basic research into remote sensing and geospatial information science; information analysis on the global environment and resources based on the Digital Earth Science Platform; and research covering a broad spectrum of academic disciplines and international S&T collaborations.

The China Remote Sensing Satellite Ground Station, with over 3.3 million scenes of satellite data accumulated on file since 1986, is regarded as the largest Earth observation satellite data archive in China.

At present, the nationwide ground station network for land observing satellite data is taking shape. Its three stations at Miyun, Kashi, and Sanya can receive data simultaneously from satellites covering the whole territory of China and 70% of Asia. At the same time, efforts have been made to construct stations in China’s southwest and northeast, and in Polar Regions.

The station has become one of China’s key infrastructures for Earth observation through coordinated operation of various subsystems ranging from data receiving, data transmission, data processing, to data management, data retrieval and technical service.

China’s RS Satellites and Data Archive

Satellite	Height (km) Inclination (degree)	Period (min)	Launch date	Payload	Resolution (m)
CBERS-1/2	780 98.2	100	1999.10.14 2003.10.21	CCD CAM	19.5
				WFICAM	258
				IRMSS	78 or 156
CBERS-2B	760 98.2	100	2007.9.19	CCD CAM	20
				HRC	2.36
				WFICAM	258
CBERS-4	780 98.55	100	2014.12.7	MUXCAM	20
				PANMUX	5 or 10
				IRSCAM	40 or 80

				WFICAM	64
ZY III - 01	508 97.4	95	2012.1.9	Camera Normal	2.1
				Camera Forward	3.5
				Camera Afterward	3.5
				Multispectral Spectrometer	6

Satellite	Height(km) Inclination(degree)	Period (min)	Launch date	Payload	Resolution (m)
HJ-1A	650 97.95	97.5	2008.9.6	CCD CAM	30
				Hyperspectral Imager	100
HJ-1B				CCD CAM	30
				Infrared Multispectral Camera	150 or 300
GF-1	630 98.05	97.5	2013.4.26	PANMUX	2 or 8
				MUXCAM	16
GF-2	630 98	97.5	2014.8.19	PANMUX	1
				MUXCAM	4

Data Policy

At this moment, the original satellite data could be used in the project of RADI or RADI's collaboration for free, except the ZY III dataset (table above). The add-value products from the Chinese satellite can be freely released and open for the specific topics, such as the Polar application and global change research, and other projects.

Another opportunities for this iAOS collaboration could be the satellite that not fully managed by RADI, but could be used through the National policy that RADI partner can access freely, there are Chinese Metrological Satellite (Geostationary, Polar Orbit) data, like FY series satellite, which can be used in the special sea ice, thawing, refreezing, snow cover retrieval actives over Polar area.

One possible way is to organize a RADI's Polar satellite data center interoperated with iAOS

47. National Institute of Polar research (NIPR)

Expertise and experience of the organization

The National Institute of Polar Research (NIPR) maintains monitoring stations in Antarctica and the Arctic, and conducts comprehensive polar research based on observations. As an inter-university research institute, NIPR provides researchers throughout Japan with the necessary infrastructure for North and South Pole monitoring and observation, and works for the advancement of polar science by soliciting proposals for collaboration projects and furnishing researchers with materials and information.

Arctic monitoring is carried out from observation bases in Svalbard, Greenland, northern Scandinavia, Iceland and elsewhere, and entails observation of the atmosphere, ice sheets, the ecosystem, the upper atmosphere, the aurora, the earth's magnetic field and so on. In marine areas, observations of the marine ecosystem and atmosphere are carried out as well. In addition, the Institute has promoted the Green Network of Excellence (GRENE) Arctic Climate Change Project.

The Arctic Environment Research Center (AERC) was established in June 1990 at the National Institute of Polar Research (NIPR) to promote the study of sea ice, oceanography, marine ecology, terrestrial ecology, atmospheric sciences, glaciology, and upper atmospheric sciences. Since April 2015, AERC has started enhancements of international research planning and cooperative works. AERC is gathering and providing information on Arctic observations and arranging a cooperative use of Arctic observation facilities. AERC manages and supports the use of an Arctic observatory in Ny-Ålesund, and an office at the University Centre in Svalbard (UNIS) in Longyearbyen, Spitsbergen Island. It assists researchers by supporting registration, providing base information, and implementing safety measures. AERC assists in the international cooperation for polar observations, such as the Antarctic-Arctic aurora conjugate observation point in Iceland and the EISCAT (European non-interference scattering) radar project.

NIPR will contribute to INTAROS by coordinating development Arctic Observing System (WP1) and integration of databases (WP5). NIPR is developing the Arctic Data archiving System (ADS) which will be an important part of a Pan-Arctic system of distributed databases (https://ads.nipr.ac.jp). NIPR is also partner in SIOS and contributes to the development of the SIOS Knowledge Centre in UNIS, which will be a node in a Pan-Arctic integrated observing system.

Key personnel

Hiroshi MIYAOKA, Deputy Director & Professor of,

Arctic Environment Research Center

National Institute of Polar Research (NIPR)

10-3 Midori-cho, Tachikawa-shi, Tokyo, 190-8518 Japan

Phone: +81-42-512-0662 Fax: +81-42-528-3195

Email: miyaoka@nipr.ac.jp

48. Korean Polar Research Institute, Korean Ocean Reseach and Development Institute (KOPRI)

Expertise and experience of the organization

KOPRI (www.kopri.re.kr) is a rapidly growing polar research institute of the Republic of Korea, being responsible for the national polar program and international cooperation. KOPRI is actively working in many fields of polar science including Arctic environmental changes and recent development of Northern Sea Route. Under strong government support KOPRI is involved in developing and operating polar infrastructures such as the research icebreaker *ARAON*, the two Antarctic research stations King Sejong and Jang Bogo and the Arctic Dasan station with various projects. Since the construction of icebreaker ARAON in 2009, KOPRI conducted joint scientific cruise with international partners in the Pacific sector of the Arctic Ocean every year. As a national operator for polar research in Korea, KOPRI participates many international organizations (Arctic Council, IASC, FARO, PAG and other)

Role in the project

KOPRI will primarily contribute to WP1. KOPRI has conducted studies to accurately examine the rapid changes in the Arctic climate and ecosystem. KOPRI conducted the CAPEC project to set up an observational node in the permafrost region at five different Arctic coastal countries in order to predict and examine the future environmental changes through interdisciplinary studies (atmosphere, soil, life science, modeling, data acquisition and transmission). The "Environmental changes studies based on the Arctic Dasan Staion" project was launched in 2014 to activate Arctic research in Svalbard. This project aims to understand the changes in the atmosphere, pedosphere, and biosphere along a glacial chrono-sequence and micro-topography in a glacier foreland and conduct paleo-environmental, mineralogical, and geochemical researches in Spitsbergen.

Key personnel CVs

Dr. Yeadong KIM (M) is the Director/President of KOPRI and also an expert in Geophysics.

Dr. Sung Ho KANG (M) is the Head of the Polar Ocean Environment Division and is an expert in Oceanography.

Dr. Hyun-cheol KIM (M) is the Head of the Polar Remote Sensing Laboratory, expert of remote sensing.

Dr. Seong-Joong KIM (M) is the Head of the Polar Climate Change Division, expert in Atmospheric Modeling.

Dr. Jong-Kuk HONG (M) is the Head of the Polar Earth-System Sciences Division and is an expert in geophysics.

Dr. Yoo Kyung LEE (F) is the Head of the Arctic Research Center and is an expert in the field of Biology.

Dr. Hyoung Chul SHIN (M) is the Head of the International Cooperation Department, is an expert in Marine Ecology.

Publications, and/or products, services or other achievements

1. S-H. Kang et al., Cruise Report: IBRV Araon ARA05B, July 30 - August 25, 2014, Bering Sea US EEZ, Chukchi/Beaufort/East Siberian Seas, MIZ Ice Camp, Report of Korea Polar Research Institute (online fromhttp://www.arctic.or.kr/download.php?bo_table=main4&file_name=file1_1428650509.pdf&filename=2014_ara05b_cruise_report.pdf), 2014.
2. S-W. Han et al., A masterplan to vitalize Arctic R&D activities, Report of Korea Polar Research Institute (BSPE13280-055-11), 2013
3. B.-M. Kim et al., A planning for developing a hi-resolution Arctic climate simulation, Report of Korea Polar Research Institute (BSPE14370-065-12), 2015.
4. H.-C. Kim et al., Svalbard Integrated Arctic Earth Observing System – Preparatory Phase (SIOS-PP), Report of Korea Polar Research Institute (BSPI13010-144-12), 2014.
5. B.-Y. Lee et al., Establishment of Circum Arctic Permafrost Environment Change Monitoring Network and Future Prediction Techniques : CAPEC Project, Report of Korea Polar Research Institute (BSPE13140-048-12), 2013

Significant infrastructure, and/or major items of technical equipment

Korea Polar Research Institute (KOPRI) manage and operates one research icebreaker, two Antarctic research stations and one Arctic station. The icebreaker ARAON is equipped with state-of-the art research equipment to conduct multidisciplinary scientific research in the polar region and also support logistics to the research stations. The Arctic Dasan station is located in Ny-Alesund and supports environmental/ecological research, glacial/periglacial geomorphology, hydrology and atmospheric chemistry. The station provides laboratory space with limited equipment: glacier and boating equipment, radios, firearms (training provided) computers, telephone, fax and e-mail.

Korea Polar Research Institute (KOPRI)
26 Songdomirae-ro, Yeonsu-gu, Incheon, 21990
Republic of Korea
Tel: +82-(0)32-770-8400 / Website: www.kopri.re.kr

Stein SANDVEN
Director
Nansen Environmental and
Remote Sensing Center
Thormohlensgate 47
N-5006 Bergen, Norway
Tel: +47 55 20 58 00

December 10, 2015

Dear Director Stein SANDVEN,

On behalf of the Korea Polar Research Institute, I would like to express our sincere appreciation toward your invitation to be a partner in the EU Arctic observing system.

KOPRI has been expanding efforts to strengthen research and monitoring in the Arctic. I believe that joining the Arctic observation system project will increase and strengthen collaboration between the Arctic research institutes in data collection and other various research topics in the Arctic areas.

KOPRI is pleased to accept the invitation and as the collaboration progresses, I will give full consideration and provide other supports. I hope that more deliberate and practical discussions on the collaborative project will continue between KOPRI and the Nansen Environmental and Remote Sensing Center, along with other Arctic research institutions.

Sincerely Yours,

Yeadong KIM
President
Korea Polar Research Institute (KOPRI)

4.2. Third parties involved in the project (including use of third party resources)

For the partners except those listed below, there are no third parties involved.

Participant 1. (NERSC)

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	**Y**

If yes, please describe and justify the tasks to be subcontracted

Pole Position Logistics AS.

Pole Position Logistics AS is a company located in Longyearbyen. Its main activity is logistical services for shiptraffic, handling about 200 portcalls per year. The company was formed in 2005 and is growing as a result of increasing ship traffic to Svalbard. The company will be involved as stakeholder in INTAROS, and will work together with NERSC and NORDECO in Task 6.6. The topic for the task is to demonstrate the importance of observing systems in the Arctic for a local community where climate change and extreme weather have severe impact on the community. The company is represented in the municipality and is the contact point to the Governor in Svalbard.

Does the participant envisage that part of its work is performed by linked third parties	**N**
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	**Y**

If yes, please describe the third party and their contributions

European Commission – Joint Research Centre (JRC)

JRC will collaborate with INTAROS exploit the results of the project since it is a contributor to EU's policy development in the Arctic. JRC is interested to use the integrated data provided by the iAOS platform in studies of human activities in the Arctic. JRC works specifically with ship traffic in the Arctic and use of satellite ocean colour data in studies of marine productivity. JRC have also expressed interest to be a contributor of data to the Arctic Observing System. JRC will be invited to the Stakeholder workshops.

European Commission – Joint Research Centre (JRC)

The Joint Research Centre (JRC) is the European Commission's in-house science service. Its mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle. While primarily serving the policy makers of the European Commission, the JRC addresses key societal challenges while stimulating innovation and developing new methods, tools and standards. The JRC shares know-how with the Member States, the scientific community and international partners, and collaborates with over a thousand organisations worldwide. The JRC contributes to the overall objective of Horizon 2020 with its long-standing scientific expertise, modelling capacity, foresight studies, work on standards, infrastructure and e-infrastructures.

One of the JRC's seven institutes is the **Institute for the Protection and Security of the Citizen (IPSC), working** to enhance safety and stability of European society on the basis of an agreed EU agenda. The institute provides scientific and technological support to European Union policies such as global stability and security, crisis management, maritime and fisheries policies, maritime security and the protection of critical infrastructures. JRC-IPSC's core competencies are in the field of engineering and information technologies, satellite image processing and analysis, big data and open source information analysis, and risk assessment. Since 2011, the IPSC works under a certified Quality Management System that is based on the requirements of the ISO 9001 standard.

Within the JRC-IPSC is the Maritime Affairs Unit, where EU efforts to expand maritime safety and security are supported by developing new concepts and systems to improve maritime surveillance capabilities and to collect information about shipping. Maritime surveillance is essential for creating maritime awareness ('knowing what is happening at sea'). With its competences in space technologies and data fusion, the Unit contributes to the development of the European Border Surveillance System (EUROSUR) and the Common Information Sharing Environment (CISE) for the EU maritime domain, and investigates maritime surveillance solutions e.g. in the fight against piracy off Africa. The Unit has two relevant facilities: One is SUMO, a state-of-the-art software for automatic ship detection in satellite SAR images. The other is the "Blue Hub", a platform for the fusion of disparate data streams with maritime surveillance relevance to produce real-time ship traffic pictures, and to analyse ship behaviour for anomaly flagging and for historic ship traffic and route patterns.

Another JRC institute involved is the Institute for Environment and Sustainability (IES). Its mission is to provide scientific and technical support to EU policies for the protection of the environment, and the more efficient and sustainable management of natural resources at global and continental scales. Within IES, the Water Resources Unit includes activities focusing on marine and coastal waters, with a large use of Earth observation data. Particularly, JRC has built a long and solid expertise in terms of development, assessment and applications of ocean colour derived products to characterise the marine ecosystems at European and global scales. Activities on optical remote sensing have been accompanied by field measurements that support calibration/validation activities, the development of bio-optical algorithms and the definition of measurement protocols and methods. These will support the assessment of the Sentinel-3 OLCI data products in the context of the Copernicus program. JRC has been a member of the International Ocean Colour Coordinating Group (IOCCG) since its creation in 1996, and has had an active role in IOCCG reports and working groups. The increasing relevance of the Arctic and EU interest is leading the JRC to devote more attention to this area.

Key personnel CVs

Dr Michele Vespe (M): Degree in telecommunications engineering University of Florence (2003) and PhD in signal processing University College London (2006). Project engineer in industry in the fields of remote sensing, small and medium area surveillance and data fusion (2007-2008). Postdoc at JRC developing pre-operational applications in the maritime domain (2009-2011). Senior Scientist at the NATO Centre for Maritime Research and Experimentation (CMRE, formerly NURC), working on anomaly detection and networked radar systems (2011-2013). Since 2013, scientific officer at the JRC, coordinating the activities of a team of researchers and developers in the fields of maritime surveillance, data fusion and maritime knowledge discovery (the "Blue Hub").

Dr Harm Greidanus (M): PhD in Astrophysics at Leiden University, 1989. Researcher in remote sensing at the Netherlands Organization for Applied Scientific Research (TNO) during 1990-2003, with an emphasis on sea surface observation with radar. Researcher at the European Commission's Joint Research Centre from 2003 to today, working on ship detection from satellite Synthetic Aperture Radar, on maritime surveillance systems and concepts for EU-level issues, and on ship traffic analysis with ship reporting systems (AIS and LRIT) and fusion with satellite observations. More than 150 publications.

Dr Frédéric Mélin: He graduated at the French National School for Aeronautics and Space, and received a PhD in Earth sciences at the University Paul-Sabatier (Toulouse, France, 2003). At the Jet Propulsion Laboratory (NASA, Caltech, 1995-1997) he studied the physical variability of the equatorial Pacific and Indian oceans. At JRC IES since 1998, he is responsible for the activities related to ocean remote sensing products (mainly from optical sensors). His research interests include the development, validation and analysis of optical remote sensing products, the creation of ocean colour climate data records, and the modelling of primary productivity for the study of marine ecosystems. At JRC he will be co-responsible for the Sentinel-3 ocean colour data assessment. He is currently a member of the International Ocean Colour Coordinating Group working group on climate data records and co-chairman of the working group on uncertainties. He has co-authored ~80 peer-reviewed articles.

Participant 12. NORDECO

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	**Y**
If yes, please describe and justify the tasks to be subcontracted **Exchange for Local Observations and Knowledge of the Arctic (ELOKA)** **Yukon River Inter-Tribal Watershed Council (YRITWC)** **Center for Support of Indigenous Peoples of the North** (**CSIPN**, Russia). The involvement of these three organisations will: (i) facilitate outreach to indigenous and civil society organisations engaged in community-based observing, advance tools for cross-fertilizing indigenous and local knowledge with scientific knowledge, and facilitate making community-based observations accessible for iAOS (WP4), and (ii) facilitate competence-building and experience-exchange among civil society organisations (WP7). The hiring of all three organisations will ensure that the substantial experiences of the constituents of these organisations in community-based observing in the Arctic contribute to the development of the iAOS. Broad involvement of community monitors, civil society organisations, government staff and scientists in the development and establishment of the iAOS help create 'ownership' and thus contribute to the long-term financial and institutional sustainability of iAOS.	
Does the participant envisage that part of its work is performed by linked third parties	**N**
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	**N**

Participant 28. CNRS

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	**Y**
If yes, please describe and justify the tasks to be subcontracted **TBM environment** is an engineering consulting firm specialized in ecosystem management and cartographic and fauna-flora inventories In INTAROS, TBM will be in charge of the technical analysis of the responses of the polar benthic communities using passive acoustic monitoring and explanatory data acquired from accelerometers. **SOMME - Société d'Observation Multi-Modale des Environnements** main objective is the development of new methodologies for operational observation of the environment and marine organisms. In INTAROS, SOMME will adapt the passive acoustics algorithm and perform the data processing and coupling with accelerometer data.	
Does the participant envisage that part of its work is performed by linked third parties[1]	**N**
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	**N**

[1] 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).

4.3. Letters of Support

Support letter from AMAP (Arctic Monitoring and Assessment Program)

Arctic Monitoring and Assessment Programme
Gaustadalléen 21, N - 0349 Oslo. Norway, Phone 47 – 21 08 04 80, Fax 47 – 21 08 04 85
e-mail: amap@amap.no, http://www.amap.no

Prof. Stein Sandven

Research Director

Nansen Environmental and Remote Sensing Center

Thormøhlens gate 47

NO-5006 Bergen

Norway

Your ref.	Our ref.	Date
		12 Febr., 2016

Subject: Letter of Support for the Integrated Arctic Observing System (INTAROS)

Dear Professor Stein Sandven,

The Arctic Monitoring and Assessment Programme (AMAP) of the Arctic Council is pleased to support the proposal "Integrated Arctic Observing System (INTAROS)". The proposal will be submitted to the Horizon 2020 call 'BG-09-2016: An integrated Arctic observation system'.

AMAP research and monitoring activities is focusing on persistent organic pollutants (POPs), mercury and other environmental contaminants; human health effects in Arctic populations resulting from exposure to environmental contaminants; combined effects of multiple stressors on human (and ecosystem) health; and effects of climate change, including short-lived climate forcers and ocean acidification.

INTAROS will

- assess strengths and weaknesses of existing observing systems and offer solutions to fill some of the gaps in the in situ observing network;
- have a multidisciplinary focus, with tools for integration of data from atmosphere, ocean, cryosphere and terrestrial sciences, provided by institutions in Europe, North America and Asia;
- include development of community-based observing systems.

INTAROS will be an important contribution to the AMAP research and monitoring activities, but will also be a valuable input to the Sustaining Arctic Observing Networks (SAON).

AMAP
Arctic Monitoring and Assessment Programme

Arctic Monitoring and Assessment Programme
Gaustadalléen 21, N - 0349 Oslo. Norway, Phone 47 – 21 08 04 80, Fax 47 – 21 08 04 85
e-mail: amap@amap.no, http://www.amap.no

If the INTAROS proposal is approved, AMAP will look forward to discussing how cooperation between the consortium and AMAP could be organised. AMAP would be interested in monitoring the progress and outcomes of the work and would be ready to share experiences and offer recommendations.

Yours sincerely,

Lars-Otto Reiersen
Executive Secretary

Support letter from Association of Arctic Expeition Cruise Operators

Association of Arctic Expedition Cruise Operators AECO

To Prof. Stein Sandven
NERSC
Thormøhlensgate 47
N-5006 Bergen
Norway

Your ref: Our ref: Longyearbyen, 01.02.2016

Letter of support

I hereby confirm that AECO – the Association of Arctic Expedition Cruise Operators, will support the proposal INTAROS (Integrated Arctic Observing System) to the H2020 framework programme for Research and Innovation. INTAROS is coordinated by Nansen Environmental and Remote Sensing Center and will be submitted.

AECO is an international association for Arctic expedition cruise operators and related stakeholder, with approximately 50 members. Half of our members are operators conduction cruises in high Artic areas with a little more than 30 vessels, carrying between 10 and 480 passengers. AECO's members carries approximately 15 000 passengers to the Arctic annually. The associations main objectives are to ensure environmentally-friendly, safe and considerate Arctic cruise tourism. More information on www.aeco.no.

The objective of INTAROS is to build an interdisciplinary Pan-Arctic Observation System (iAOS) by connecting existing systems and new emerging technologies for observing atmosphere, ocean, cryosphere and terrestrial data and demonstrate the benefit to Arctic science and stakeholders.

INTAROS will contribute to improved monitoring and forecasting services weather and sea ice in the Arctic, which is important for safe and cost-effective operations.

Kind regards,

Frigg Jørgensen

Frigg Jørgensen
Executive director

Association of Arctic Expedition Cruise Operators
P.O. Box 103
N-9171 Longyearbyen - Norway
Phone +47 79 02 63 50 Fax +47 79 02 61 01 Cellphone +47 913 90 554
www.aeco.no frigg@aeco.no Org. no. 986 361 901

Support letter from EPOS (European Plate Observing System)

To whom it may concern

14 February 2016

Re: Support letter for INTAROS application

The European Plate Observing System (EPOS – www.epos-eu-org) is a pan-European initiative aiming at integrating multidisciplinary data sets, data products, services and software that are used in monitoring and understanding the natural processes that occur both at the surface and in the interior of the Earth. The goal of EPOS is to offer tools and data to promote and facilitate innovative approaches for a better understanding of the physical processes controlling earthquakes, volcanic eruptions, unrest episodes, and tsunamis as well as those driving tectonics and Earth surface dynamics. This overarching goal will be achieved throughout the integration of existing and newly developed national and trans-national Research Infrastructures that provide multidisciplinary data recorded by monitoring networks, acquired in laboratory experiments, and produced by computational simulations. EPOS is included in the Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) in December 2008 and has recently (October 2015) started its implementation phase.

The main vision of the Norwegian component of the EPOS, EPOS-Norway (www.epos-no.org), is to address the three basic challenges in Earth Sciences:

- Unravelling the Earth's deformational processes which are part of the Earth system evolution in time
- Understanding the geohazards and their implications to society
- Contributing to the safe and sustainable use of georesources

While the solid Earth monitoring networks have a reasonable coverage in mainland Norway, there are significant gaps in the monitoring capacity in the Arctic areas. In order to achieve a better monitoring capacity, EPOS-Norway will install new seismograph and GPS stations as well as corner reflectors for improved satellite coverage in the Arctic.

The main objectives of the INTAROS and EPOS-Norway projects are similar as both projects aim to improve the monitoring capacity in the Arctic. EPOS-Norway with installations mainly on land in the Arctic islands are complementary for the planned INTAROS installations offshore. As such, significant synergy effects are expected. EPOS-Norway project therefore strongly supports the INTAROS application.

Sincerely yours,

K. Atakan.

Prof. Dr. Kuvvet Atakan
EPOS-Norway Project Coordinator

Support letter from Group on Earth Observations

GROUP ON
EARTH OBSERVATIONS

Our Ref: 2016-10/GEO/INTAROS
ct

Prof. Stein Sandven
Research Director
Nansen Environmental and Remote Sensing Center
Thormøhlens gate 47
NO-5006 Bergen
Norway

Geneva, 14 January 2016

Subject: Letter of Support for the INTAROS proposal

Dear Prof. Sandven,

The Group on Earth Observations (GEO) is pleased to support the proposal "INTegrated ARctic Observing System – INTAROS" which will be submitted to the Horizon 2020 call "BG-9-2016: An Integrated Arctic Observing System".

As GEO is active in Earth observations for Cold regions, including the Arctic, we are interested in following the INTAROS project, which aims include to:

- contribute to long-term improvement of Arctic observation systems and related services for different sectors (e.g. shipping, tourism, fishing);
- increase temporal and geographic coverage of observational data in the Arctic, and improve their inter-operability;
- improve the integration of space-based and in-situ Arctic observations into models and forecast systems showing benefit to the Copernicus monitoring services;
- support international assessments of global challenges such as climate change, scarceness of natural resources and global scale hazards.

This Project will contribute to the GEO Cold Region Initiative and leverage the Global Earth Observation System of Systems (GEOSS) and particularly the capabilities of the GEOSS Common Infrastructure (GCI).

We look forward to a fruitful collaboration. If the INTAROS proposal is approved, we will be pleased to discuss the appropriate mechanisms for GEO to help monitor the progress and outcomes of the proposed activities, share our relevant experiences, and provide input and recommendations.

Yours sincerely,

Barbara J. Ryan

Barbara J. Ryan
Secretariat Director

GEO Secretariat: 7 bis, avenue de la Paix • Case postale 2300 • CH-1211 Geneva 2 • Switzerland
Tel: + 41 (0) 22 730 85 05 • Fax: +41 (0)22 730 85 20 • secretariat@geosec.org • www.earthobservations.org

Support letter from ICOS (Integrated Carbon Observation System)

ICOS INTEGRATED CARBON OBSERVATION SYSTEM

Prof. Stein Sandven
Research Director
Nansen Environmental and Remote Sensing Centre
Thormøhlensgate 47
NO 5006 Bergen
Norway

Dr. habil. Werner Leo Kutsch
Director General
Integrated Carbon Observation System
(ICOS ERIC)
Email: werner.kutsch@icos-ri.eu
Web: www.icos-ri.eu

Erik Palménin aukio 1,
FI-00560 Helsinki

Helsinki, 12 February 2016

Dear Prof. Sandven,

in my role as Director General of the Integrated Carbon Observation System, European Research Infrastructure Consortium (ICOS ERIC) and as coordinator of the H2020 project Environmental Research Infrastructures providing shared solutions for science and society (ENVRIplus) I herewith express my support for your proposal INTAROS. I have read an advanced draft of the proposal and discussed with key persons of the INTAROS community about possible synergies with ICOS. ICOS and INTAROS share manifold research objectives and interests. Furthermore, ICOS will provide important data to your observation system.

I am particularly supporting your approach to build your data procedures on existing concepts and ongoing work from the ENVRI and ENVRIplus projects. This ensures the inter-operability among different observational systems and infrastructures and makes data access very easy for users.

Summarizing I see many fields of cooperation between INTAROS and ICOS RI but also many other environmental research infrastructures and I am looking forward to close cooperation in case the proposal will be accepted.

Sincerely,

Werner Kutsch

Dr. habil. Werner L. Kutsch

Support letter from International Glaciological Society

International Glaciological Society

Scott Polar Research Institute,
Lensfield Road,
Cambridge, CB2 1ER, UK
Tel: +44 (0)1223 355 974
Fax: +44 (0)1223 354 931
E-mail: igsoc@igsoc.org
Web: http://www.igsoc.org

IGS

Dr Stein Sandven
Research Director
Nansen Environmental and Remote
Sensing Center
Thormøhlens gate 47
N-5006, Bergen
NORWAY

6 February 2016

Dear Dr Sandven

The International Glaciological Society (IGS) hereby states its full support to the INTAROS proposal to the H2020 call under BG-9-2016: An Integrated Arctic Observation System, coordinated by the Nansen Environmental and Remote Sensing Center, Bergen, Norway.

The IGS is willing to be a member of the Stakeholder Group of the proposal, which is planned for five years (2016-2020).

Yours sincerely.

Douglas R. MacAyeal

Prof Douglas R. MacAyeal
President

Magnús Már Magnússon.
Secretary General

Registered Charity 231043

Support letter from UNIS (University Center in Svalbard)

UNIS
The University Centre in Svalbard

Professor Stein Sandven
NERSC
Thormøhlensgt. 47
N-5006 Bergen
Norway

Your ref. Our ref. Date: 18-01-2015

Letter of Support

We hereby state our support towards the INTAROS (integrated Arctic Observing System) proposal to H2020 Framework Programme for Research and Innovation 2015-2021 (BG-9-2016).

UNIS is the world's northernmost institution for higher education and research, located in Longyearbyen, Svalbard at 78°N. The unique location and facilities at UNIS makes it particular advantageous for researchers and students to conduct field and laboratory studies here at all times of the year.

UNIS is the project owner of the the Svalbard Integrated Arctic Earth Observing System (SIOS) interim phase project. SIOS is a distributed world-class research infrastructure that will establish a regional observational system in and around Svalbard to address Earth System Science questions related to Global Change. SIOS is offering a single-point access to infrastructure, tools and services as well as providing a continuous development of methods, ground-based observations and a substantial capability for utilising remote sensing resources. SIOS will link with other observational infrastructures across the Arctic to share data and best practice, contributing to a pan-Arctic observational structure that facilitates better regional modelling and understanding of the role of the Arctic in the Earth System.

After entering the ESFRI Roadmap in 2008, SIOS is a priority for the international scientific communities working with long-term observations in and around Svalbard. The interim phase of SIOS is since June 2015 funded by the Norwegian Research Council in a three-year project, with commitments provided by 10 international partners.

The Nansen Environmental and Remote Sensing Center is one of the founding members of the SIOS interim project and the ambitions of the INTAROS proposal is to a large extent overlapping with the goals of SIOS. In particular we find it important that data management and dissemination is developed to benefit the future operational SIOS. The INTAROS project will, by linking other arctic databases also promote the role of SIOS in a Pan Arctic perspective.

Address: P.O.Box. 156, N-9171 Longyearbyen | Phone: (47) 79 02 33 00 | Fax: (47) 79 02 33 01
E-mail: post@unis.no | Web: www.unis.no | Organisation number: 985 204 454

UNIS is also, together with other SIOS members, partners in the INTAROS application.The application falls well within the strategies and goals of SIOS , and we regard SIOS as a major stakeholder in this initiative.

We hereby confirm that UNIS on behalf of the SIOS project, support the above mentioned initiative. The application falls well within the strategies and goals of SIOS.

Ole J. Lønne
Director
SIOS interim phase project

Ole Arve Misund
Managing Director
UNIS

Address: P.O.Box. 156, N-9171 Longyearbyen | Phone: (47) 79 02 33 00 | Fax: (47) 79 02 33 01
E-mail: post@unis.no | Web: www.unis.no | Organisation number: 985 204 454

Support letter from World Glacier Monitorin Service

University of Zurich[UZH]

ICSU (WDS)
IUGG (IACS)
UNEP
UNESCO
WMO

wgms
World Glacier Monitoring Service

Department of Geography
University of Zurich
Winterthurerstrasse 190
SWITZERLAND - 8057 Zurich

www.wgms.ch

Michael Zemp
Director WGMS, PD Dr. sc. nat.

Phone: +41 44 635 51 39
email: michael.zemp@geo.uzh.ch

Stein Sandven
INTAROS Proposal Coordinator
Nansen Environmental and Remote Sensing Center
Thormøhlens gate 47
N-5006, Bergen
NORWAY

E-mail: stein.sandven@nersc.no

Zurich, 1st February 2016

Letter of support for INTAROS proposal

Dear Stein Sandven,

The Work Glacier Monitoring Service (WGMS) hereby states its full support to the INTAROS proposal to the H2020 call under BG-9-2016: An Integrated Arctic Observation System, coordinated by the Nansen Environmental and Remote Sensing Center, Bergen, Norway.

The WGMS is willing to be member of the Stakeholder Group of the proposal, which is planned for five years (2016-2020).

Sincerely

Michael Zemp
Director WGMS

5. Ethic and security

Ethic

All activities in the proposal meet the national legal and ethical requirements of the 8 Arctic countries. Specifically, with regard to the community-based observing activities, the involved members at community level will approve of the use of the data they have collected.

For the field piloting of community-based observing approaches in Svalbard in WP4, research permission is required from the local authorities

Security[2]

Please indicate if your project will involve:

- activities or results raising security issues: NO
- 'EU-classified information' as background or results: NO

[2] Article 37.1 of the Model Grant Agreement: *Before disclosing results of activities raising security issues to a third party (including affiliated entities), a beneficiary must inform the coordinator — which must request written approval from the Commission/Agency*. Article 37.2: *Activities related to 'classified deliverables' must comply with the 'security requirements' until they are declassified. Action tasks related to classified deliverables may not be subcontracted without prior explicit written approval from the Commission/Agency. The beneficiaries must inform the coordinator — which must immediately inform the Commission/Agency — of any changes in the security context and — if necessary — request for Annex 1 to be amended (see Article 55*

6. Appendices

Appendix 1. List of akronyms

Table 1. Organizations, Infrastructures, Programs, and Projects

Acronym	Explanation
ACCESS	Arctic Climate Change, Economy and Society (**FP7**)
ACOBAR	Aerosols, Clouds, and Trace gases Research InfraStructure (**H2020**)
ACTRIS-2	Acoustic Technology for Observing the interior of the Arctic Ocean (**FP7**)
ADC	Arctic Data Committee (**under International Arctic Science Committee and SAON)**
ADS	Arctic Data archiving System **(Infrastructure, Japan)**
AERONET	Aerosol Robotic Network (**Program**)
AGU	American Geophysical Union **(Organization)**
AMAP	Arctic Monitoring and Assessment Program (**Program**)
AMSA	Arctic Marine Shipping Assessment **(Project of the Arctic Council working group "Protection of the Arctic Marine Environment")**
ANAEE	Analysis and Experimentation on Ecosystems (**EU Infrastructure**)
AON	Arctic Observing Network (component of the Study of Environmental Arctic Change (SEARCH) **program**)
AOOS	Arctic Ocean Observing System **(Infrastructure, US)**
ARCPATH	Arctic Climate Predictions: Pathways to Resilient, Sustainable Societies **(Project of the Nordic Centre of Excellence)**
Arctic ROOS	Arctic Regional Ocean Observing System (**Organization**)
Arctic-Hycos	Arctic Hydrological Cycle Observing system (**WMO project**)
ARCUS	Arctic Research Consortium of the United States (**Organization**)
ARM	Atmospheric Radiation Measurement Program (**Program**)
ARTIST	Arctic Radiation and Turbulence Interaction Study (**FP5 project**)
AtlantOS	Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems (**H2020 project**)
A-TWAIN	Long-term variability and trends in the Atlantic Water inflow region **(Fram Centre project)**
BRIDGES	Bringing together Research and Industry for the Development of Glider Environmental Services (**H2020 project**)
CAFF	Conservation of Arctic Flora and Fauna (**biodiversity working group under Arctic Council)**
CANAPE	Canada Basin Acoustic Propagation Experiment **(US project)**
CCI	Climate Change Initiative of the European Space Agency (**Program**)
CERSAT	Centre ERS d'Archivage et de Traitement (Laboratory of Oceanography From Space, **IFREMER)**
CMEMS	Copernicus Marine Environment Monitoring Service **(EU Program)**
CM-SAF	The Satellite Application Facility on Climate Monitoring (**EU Infrastructure and Program**)
CNSA	China National Space Administration **(Organization)**
COOP+	Cooperation of research infrastructures to address global challenges in the environmental field (**H2020 project**)
COOPEUS	Strengthening the cooperation between the US and the EU in the field of Environmental Research Infrastructures (**FP7 project**)
CRI	Cold Region Initiative **(Program)**
CryoVex	Cryosat Validation Experiment **(project of ESA)**
CSA	Canadian Space Agency **(Organization)**
DAMOCLES	Developing Arctic Modeling and Observing Capabilities for Long-term Environmental Studies
DCPP	Decadal Climate Prediction Project **(WMO Project)**
ECMWF	European Centre for Medium-Range Weather Forecasts (**EU Institution**)
EEA	European Environment Agency **(Organization)**
EGU	European Geosciences Union **(Organization)**
ELOKA	Exchange for Local Observations and Knowledge of the Arctic **(Organization)**

EMODnet	European Marine Observation and Data Network (**Organization**)
EMSA	European Maritime Safety Agency **(Organization)**
ENVIRIplus	Environmental Research Infrastructures Providing Shared Solutions for Science and Society (**EU Infrastructure**)
EPOS	European Plate Observing System (**EU Infrastructure**)
ESA	European Space Agency (**Organization**)
ESFRI	European Strategy Forum on Research Infrastructures **(EU infrastructure)**
ESSAS	Eccosystem Studies of Subarctic and Arctic Seas **(reseach program of Integration of Marine Biogeochemistry and Ecosystem Research)**
EUAIC	European Arctic Information Centre (**EU Institution**)
EUMETNET	European Meteorological Service Network (**Organization**)
EU-PolarNet	Connecting Science with Society **(H2020 project)**
EUPORIAS	European Provision Of Regional Impacts Assessments on Seasonal and Decadal Timescales **(FP7 Project)**
EURO-ARGO	Global ocean observing infrastructure (**EU Infrastructure**)
FLEXSEM	Software package for simulation of biogeochemical processes in coastal zone ecosystems
FSFP	First San Francisco Partners **(IT company)**
GAIA-CLIM	Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring (**H2020 project**)
GAW	Global Atmosphere Watch (**WMO Program**)
GCE Subsea	Global Centres of Expertise Subsea **(Organization)**
GCME	Global Change Metadata Directory
GC-Net	Greenland Climate Network **(Infrastructure)**
GCOS	Global Climate Observing System (**Program**)
GCW	Global Cryosphere Watch (**Program**)
GEO	Group on Earth Observations (**Organization**)
GEOSS	Global Earth Observation System of Systems (**Infrastructure**)
GEOCRI	GEO Cold Region Initiative **(under GEO)**
GEO-CRI	GEO Cold Region Initiative **(under GEO)**
GLISN	Greenland Ice Sheet Monitoring Network **(Infrastructure/ collaborative project)**
GNET	Greenland GPS Network (**Infrastructure**)
GOOS	The Global Ocean Observing System **(Infrastructure)**
GRUAN	Global Climate Observing System Reference Upper Air Network (**Infrastructure**)
GTN-P	Global Terrestrial Network for Permafrost **(International research program)**
GUAN	Global Climate Observing System Upper-Air Network **(Infrastructure)**
IASOA	International Arctic Systems for Observing the Atmosphere (**Infrastructure and Organization**)
ICE-ARC	Ice, Climate, Economics – Arctic Research on Change (**FP7 project**)
ICES	International Council for the Exploration of the Sea **(Organization)**
ICOS	Integrated Carbon Observation System (**EU Infrastructure**)
ICSU-WDS	World Data System (WDS) of the International Council for Science (ICSU) (**Organization**)
IGBP	International Geosphere-Biosphere Programme (**Organization**)
iLEAPS	Integrated Land Ecosystem Atmosphere Process Study **(Project)**
IMO	International Maritime Organization **(Organization)**
INSPIRE	Infrastructure for Spatial Information in the European Community (**EU Infrastructure**)
INTERACT	International Network for Terrestrial Research and Monitoring in the Arctic (**FP7 project**)
IOC	Intergovernmental Oceanic Commission **(UNESCO infrastructure)**
IPCC	Intergovernmental Panel on Climate Change **(Organization)**
ISAC	International Study of Arctic Change Science (**research program)**
JPI	Jet Propulsion Lab **(Institution, US)**
LoVE	Lofoten-Vesterålen Cabled Ocean Observatory **(Infrastructure)**
LTER Hausgarten	Long-Term Ecological Research in the deep Arctic Ocean (**AWI measurement infrastructure)**
MSFD	Marine Strategy Framework Directive **(EU directive)**
NABOS	Nansen and Amundsen Basins Observational System **(Project)**
NACLIM	North Atlantic Climate (**FP7 project**)

NASA	National Aeronautics and Space Administration (**Organization**)
NDAAC	Network for the Detection of Atmospheric Composition Change **(Infrastructure)**
NEXOS	Next generation Low-Cost Multifunctional Web Enabled Ocean Sensor Systems Empowering Marine, Maritime and Fisheries Management **(FP7 project)**
NGEE Arctic	Next-Generation Ecosystem Experiments (**US project**)
NOAA CMDL	National Oceanic and Atmospheric Administration (NOAA) Climate Monitoring and Diagnostics Laboratory (**Organization**)
NORMAP	Norwegian Satellite Earth Observation Database for Marine and Polar Research **(Norwegian Research Council Project)**
NORWECOM	Norwegian Ecological Model system **(software)**
NSIDC	National Snow and Ice Data Centre **(US)**
OECD	Organization for Economic Co-operation and Development **(Organization)**
ONC	Ocean Networks Canada **(Infastructure)**
OSISAF	Ocean and Sea Ice Satellite Application Facility (**project, Europe**)
PAGE21	Changing Permafrost in the Arctic and its Global and its Global effectsin the 21st Century **(FP7 Project)**
PDC	Polar Data Catalogue **(Data base, Canada)**
PEEX	Pan-Eurasian Experiment (**Program**)
POLAR	Polar Knowledge Canada (**Canadian Institution**)
PPP	Polar Prediction Project (**WMO project**)
PROMICE	Programme for Monitoring of the Greenland Ice Sheet (**Programme and Infrastructure**)
ROSCOSMOS	Russian Federal Space Agency **(Organization)**
RTD	Research and Technology Development
SAON	Sustaining Arctic Observation Network (**Organization**)
SeaDataNet	Pan-European Infrastructure for Ocean and Marine Data Management (**Infrastructure**)
SEARCH	Study of Environmental Arctic Change (**US program**)
SEN3APP	Processing Lines and operational Services Combining Sentiel and in-situ data for terrestrial cryosphere and boreal forest zone (**FP7**)
SIOS-KC	Svalbard Integrated Observing System Knowledge Centre (**Infrastructure and Organization**)
SnowPex	Satellite Snow Product Intercomparison and Evaluation Experiment (**ESA project**)
SPECS	Seasonal-to-decadal climate Prediction for the improvement of European Climate Services **(FP7 Project)**
STSE	Science Technology Society Environment **(education concept)**
SWARP	Ships and Waves Reaching Polar regions (**Copernicus project**)
THAAW	THin-ice Arctic Acoustic Window **(US Project)**
TORA	Transatlantic Ocean Research Alliance **(research agreement)**
UNDER-ICE	Arctic ocean under melting ice (**International project**)
UNESCO	United Nations Educational, Scientific and Cultural Organization **(Organization)**
WCRP	World Climate Research Program (**Program**)
WHOI	Woods Hole Oceanographic Institution **(US)**
WMO	World Meteorological Organization (**Organization**)
WOC	World Ocean Council **(Organization)**
YOPP	Year of Polar Prediction **(WMO project)**

Table 2. Other acronyms

Acronym	Explanation
ADCP	Acoustic Doppler Current Profiler (**In situ instrument**)
AIRS	Atmospheric Infrared Sounder (**Satellite mission**)
AOS	Arctic Observing Summit
ARAON	Research Vessel operated by the Government of South Korea
arcFOCE	Arctic Free Ocean Carbon Enrichment (**Experimental technology**)
AROME	Application of Research to Operations at Mesoscale model
AWIPEV	Joint French-German Arctic Research base in Ny-Ålesund, German Alfred Wegener Institute for Polar and Marine Research (AWI) and the French Polar Institute Paul Emile Victor (IPEV)
AWS	Automatic Weather Station
CBM	Community-Based Monitoring
CERSAT	Remote-Sensing data Archiving and Processing Centre of IFREMER (**National Data Centre**)
CHINARE	Chinese National Arctic Research Expedition
CMDL	Climate Monitoring and Diagnostics Laboratory
COHERENS	COupled Hydrodynamical Ecological model for REgioNal Shelf seas
COSMOS-SkyMed	COnstellation of small Satellites for the Mediterranean basin Observation **(Satellite mission)**
CPU	Central Processing Unit
CrIS	Cross-track Infrared Sounder **(Satellite instrument)**
DESCA	Development of a Simplified Consortium Agreement
DIC	Dissolved Inorganic Carbonate
DMP	Data Management Plan
DOI	Digital Object Identifier
DOM	Dissolved Organic Matter
EAV	Essential Arctic Variable
EB	Executive Board
EC-Earth	European Earth System Model
EEN	Enterprise Europe Network
EMODnet	European Marine Observation and Data Network (**Database**)
ENVISAT	Environmental Satellite
EO	Earth Observation
ERGOM	Ecological Regional Ocean Model
ERS	European Remote Sensing Satellite
ESAS	East Siberian Arctic Shelf
ESP@CENET	A European patent system
FLEXSEM	FLEXible Simulation and Ecological Modelling
FRRF	Fast Repetition Rate Fluorometry
GA	General Assembly
GECCO	German contribution to Estimating the Circulation and Climate of the Ocean **(Global model)**
GEOSLIB	Converting library for GEOS (Geometry Engine - Open Source) files
GHG	Greenhouse Gas
GIM	Geostatistical Inverse Modelling
GIS	Geographical Information System
GlobSnow	Dataset on satellite-retrieved information on snow extent
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRACE	Gravity Recovery and Climate Experiment **(Satellite mission)**
HYCOM	Hybrid Coordinate Ocean Model
iAOS	integrated Arctic Observing System
IASI	Infrared Atmospheric Sounding Interferometer **(Satellite instrument)**
ICESat	Ice, Cloud,and land Elevation Satellite
ICT	Information and Communications Technology

IGRA	Integrated Global Radiosonde Archive **(International Database)**
IPR	Intellectual Property Rights
IR	Infra-Red
ITP	Ice-Tethered Platform
KPI	Key Performance Indicator
LIDAR	Light Detection and Ranging
MODIS	Moderate Resolution Imaging Spectroradiometer **(Satellite instrument)**
NAO	North Atlantic Oscillation
NCP	National Contact Point
NGO	Non-Governmental Organization
NMDC	Norwegian Marine Data Centre **(National Data Centre)**
NorCPM	Norwegian Climate Prediction Model
NorESM	Norwegian Earth System Model
NORWECOM	NORWegian ECOlogical Model system
NP	North Pole
NRT	Near Real Time
NSDC	Finnish National Satellite Data Centre (**National Data Centre**)
NSIDC	National Snow and Ice Data Center (**International Data Centre**)
NWP	Numerical Weather Prediction
OBS	Ocean Bottom Seismometer
OpenAIRE	Open Access Infrastructure for Research in Europe
OPeNDAP	Open-source Project for a Network Data Access Protocol
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSSE	Observing System Simulation Experiment
PANGAEA	Data Publisher for Earth and Environmental Science (**National Data Centre**)
PM	Project Manager
PM-team	Project Management Team
QA/QC	Quality Assurance / Quality Control
RAFOS	SOund Fixing And Ranging (spelled backward)
RGeostats	Geostatistical Package under R platform
RI	Research Infrastructure
SAOS	Sustainable Arctic Observing System
SAR	Synthetic Aperture Radar (**Satellite instrument**)
SC	Steering Committee
SDI	Spatial Data Infrastructure
SHEBA	Surface Heat Budget of the Arctic Ocean (**Arctic drifting station**)
SIAP	Stakeholder and Innovation Advisory Panel
SIMBA	Sea Ice Mass Balance Array
SMAP	Soil Moisture Active Passive (**Satellite mission**)
SME	Small Medium Enterprise
SMOS	Soil Moisture Ocean Salinity (**Satellite mission**)
STAP	Scientific and Technical Advisory Panel
SWE	Snow Water Equivalent
TARA	Drifting station in the FP7 DAMOCLES project
TEP	Thematic Exploitation Platform
TRL	Technology Readiness Level
UAV	Unmanned Aerial Vehicle
VNA	Vector Network Analyzer
WP	Work Package

Appendix 2. References in Section 1-3

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