

ECMWF Copernicus Procurement

Invitation to Tender



COPERNICUS PROJECT

VOLUME III B

ITT C3S_512
ISSUED BY: BSC Earth Sciences Department
Date: 1 March 2018
Version: Final

Table of Contents

1	Executive Summary.....	3
2	Track Record	4
2.1	Introduction	4
2.2	Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC).....	6
2.3	Deutscher Wetterdienst (DWD).....	8
2.4	Finnish Meteorological Institute (FMI)	10
2.5	Royal Netherlands Meteorological Institute (KNMI)	12
2.6	Federal Office of Meteorology and Climatology (MeteoSwiss).....	14
2.7	Predictia Intelligent Data Solutions S.L. (Predictia)	16
2.8	Freie Universität of Berlin (FUB)	17
2.9	Consiglio Nazionale delle Ricerche (CNR)	19
2.10	Stichting Wageningen Research, Wageningen Environmental Research (WENR)	21
3	Quality of Resources to be Deployed.....	23
3.1	Description of resources	23
3.2	CV's of key personnel.....	28
4	Technical Solution Proposed.....	30
4.1	Introduction	30
4.2	Quality assessment of climate data	30
4.3	Evaluating the CDS datasets	32
4.4	Evaluating the CDS toolbox.....	38
4.5	Overall service evaluation.....	42
4.6	User engagement.....	46
4.7	Summary of equipment	50
4.8	References	52
5	Management and implementation plan.....	53
5.1	Introduction	53
5.2	General organisation.....	53
5.3	Organigram	56
5.4	Gantt chart and PERT chart.....	56
5.5	Summary of work packages and deliverables.....	57
5.6	Work package description	62
5.7	Key performance indicators.....	80
5.8	Risk management.....	80
6	Annex I: Key personnel CVs.....	83

1 Executive Summary

The Evaluation and Quality Control (EQC) function of the Copernicus Climate Change Service (C3S) has a critical role to ensure that the service meets the needs of a range of users for high-quality data and information, and in proposing the necessary evolution of the service itself, while shaping the research agenda to attend the most important challenges detected.

The ITT that this offer addresses asks for the development and implementation of an EQC framework for climate projections, seasonal forecasts and in-situ observations, and the facilities available in the CDS to manipulate them, identifying the gaps that must be filled by the EQC to respond to identified user expectations. The offer described in this proposal aims at developing a solution for the EQC function to respond to the needs identified in previous contracts using a continuous user-engagement process. This offer will address the challenges posed by providing:

- an overarching EQC service for the whole CDS
- an independent quality assessment for a number products (seasonal forecasts, climate projections and in-situ observations)

The evaluation and quality assessment will put at work the best expertise available on the evaluation of the multi-faceted aspects of data and product quality based on the most complete set of standards accepted by the communities involved. Surveys and other user engagement techniques will be used and analysed to provide a detailed mapping of the users and their needs, identifying those that should be addressed with priority. The outcome will be employed to perform a gap analysis of the current capabilities of the CDS and formulate recommendations that support the evolution of the service.

The offer is structured into three technical work packages (WPs) and one for management, dissemination and coordination. The three technical WPs aim at:

- assessing the fitness for purpose of all the CDS datasets via a set of seamless quality assurance templates (QATs), setting the minimum requirements and baseline criteria for including new products in the catalogue and providing comprehensive quality assurance information and guidance for users of the datasets and products; vocabularies and common practices will be defined in coordination with WP2 to ensure consistency
- providing a set of tests and assessments of the CDS toolbox from multiple angles and considering the data model, the solution for data provenance and reproducibility, the quality of the code and the computational methods used; the assessments will be based upon parameters from standards such as ISO 9126; real-world tests cases will be also defined and performed to address complex assessments.
- measuring and reporting the quality of service provided by the CDS infrastructure using a set of key performance indicators (KPIs) to estimate the technical quality of the service, the result of which will be made available via a web-dashboard.

Close interaction with a range of other C3S contracts and tenders, as well as with C3S teams, is expected to take place to choose the most adequate options for the EQC function.

2 Track Record

2.1 Introduction

This offer involves nine institutions: the Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC), Deutscher Wetterdienst (DWD), Ilmatieteen Laitos (FMI), Koninklijk Nederlands Meteorologisch Instituut (KNMI), Federal Office of Meteorology and Climatology (MeteoSwiss) (CH), Predictia Intelligent Data Solutions S.L. (Predictia), Freie Universität Berlin (FUB), Consiglio nazionale delle Ricerche (CNR) and Wageningen Environmental Research (WENR). The consortium is led by the BSC.

The team has documented capabilities in all the scientific and technical aspects related to the evaluation and quality control of climate data and handling of large data volumes. Many of the partners participating in this offer have collaborated for a long time in Seventh Framework Programme and H2020 projects as well as in other Copernicus contracts.

Contractor	Legal details	Legal representative	Address	% of the contract value terms for which contractor will be responsible
BSC	Public Sector Organisation	Prof. Mateo Valero Cortés, Director of BSC	C/Jordi Girona 31, 08034 Barcelona Spain	18.2%
DWD	Public Sector Organisation	Prof. Dr. Gerhard Adrian, President of DWD	Frankfurter Straße 135, 63067 Offenbach, Germany	14.5%
FMI	Public Sector Organisation	Juhani DAMSKI, Director General	Erik Palmenin aukio 1, FI-00560 Helsinki, Finland	11.1%
KNMI	Public Sector Organisation	Prof. Dr. G. van der Steenhoven	Utrechtseweg 297 3731 GA De Bilt, the Netherlands	7.4%
MeteoSwiss	Public Sector Organisation	Dr. Peter Binder, Director MeteoSwiss	Operation Center 1 Postfach 257 CH-8058,Zürich-Flughafen	5.6%
Predictia	Private Sector Organisation	Daniel San Martín Segura, General Manager	Avda. los Castros s/n. I+D Building S345. 39005 Santander, Spain	10.9%
FUB	Public Sector Organisation	Ulrich Rössler Head of Research Division	Kaiserswerther Str. 16-18, 14199 Berlin, Germany	8.7%
CNR	Public Sector Organisation	Dr. Fabio Trincardi, Director of Earth and	Plazzale Aldo Moro 7, Roma, Italy	14.2%

Contractor	Legal details	Legal representative	Address	% of the contract value terms for which contractor will be responsible
		Environmental Sciences Dept.		
WENR	Private Sector Organisation	Dr. Bram de Vos, Director general Environmental Sciences Group. Wageningen University & Research	Droevendaalsesteeg 3, 6708 PD Wageningen, the Netherlands	9.4%

2.2 Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC)

The **Barcelona Supercomputing Center-Centro Nacional de Supercomputación** (BSC, <https://www.bsc.es>) is a research centre active at both national and international levels. The BSC combines unique high performance computing facilities and in-house top research departments on computer, life, and Earth sciences, and in computational applications in science and engineering. The BSC is the main provider of public supercomputing services in Spain, including not just the access to cutting-edge computers and technology, but also top-of-the-range training and education, the development of purpose-built applications for both public and private actors and first-class innovation. The BSC also coordinates the interests in supercomputing at the national level via the Red Española de Supercomputación and represents Spain in international initiatives such as PrACE, the Research Data Association and the Big Data Value Association. The BSC has a total staff of about 480 employees.

Established in 2006, the Earth Sciences Department of the BSC, hereafter BSC-ES, worked on atmospheric composition modelling. The designation of Professor Francisco J. Doblas-Reyes as Director of BSC-ES in 2014 initiated the merging of the Climate Forecast Unit of the Institut Català de Ciències del Clima (IC3-CFU), which he was leading and that in a short time became a main European actor in the development of climate services based on climate prediction, into the Department. This merging has created a more efficient and competitive Department that widens its previous scope and holds a sufficient critical mass to compete with the top international research groups in environmental forecasting and Earth system services. BSC-ES is structured around four groups (Climate Prediction, Atmospheric Composition, Computational Earth Sciences, and Earth System Services), with more than 70 employees, including technical and support staff. All the BSC infrastructure and support is available to the BSC-ES members: a 13 PFlop supercomputer, a long-term storage, commodity computational facilities with both physical and virtualised environments, a solid project management team, and the outstanding collaborations with researchers in computing sciences.

The BSC-ES international activity includes the coordination of the two World Meteorological Organisation (WMO) regional centres specialised in sand and dust warning and forecasting, as well as the participation in climate services initiatives like the Climate Services Partnership (CSP). The operational functioning of the WMO regional centres is ensured jointly with the Spanish weather service, AEMET, with whom the Department enjoys an excellent and long-term collaboration. Members of the BSC-ES participate in committees of the World Climate Research Programme (WCRP), such as CLIVAR, the Working Group on Seasonal-to-Interannual Prediction (WGSIP) and the WCRP Modelling Advisory Council, which is co-chaired by the Principal Investigator of this offer.

Three of the BSC-ES groups will be involved in this offer. 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. The Earth System Services group ensures that the outcomes of the department reach society, both in the public and private sectors, and continuously sample the needs of a range of users in the insurance, agriculture and renewable energy sectors. The Computational Earth Sciences group is a unique ensemble of physicists and computer engineers that develop computational and Big Data solutions for the weather, air quality and climate communities.

Over the past 5 years, the BSC members have participated in several projects and contracts relevant to this offer:

- The FP7 **EUPORIAS** (EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale) project (2012-2016) intended to improve our ability to maximise the societal benefit of seasonal forecasts by engaging with a range of users. Working in close relation with a number of European stakeholders, this project aimed to develop a few fully working prototypes of climate services addressing the need of specific users. The time horizon was set between a month and a year ahead with the aim of extending it towards the more challenging decadal scale. The main outcome of EUPORIAS will be the development and the delivery of robust and usable probabilistic predictions of the impact of high risk events.
- The **C3S_51 Lot 3 QA4Seas** (Quality Assurance for Multi-model Seasonal Forecast Products) contract (2016-2018), one of the precursors of the evaluation and quality control (EQC) function, develops a strategy for the EQC of the multi-model seasonal forecasts provided by the C3S. The assessment is user driven and, through surveys, provides a map of the user needs, identifying those features that should be prioritised. The outcome of the seasonal forecast quality assurance module is used to perform a gap analysis of the current information available to users and to develop a prototype of the EQC system that will illustrate the strategy proposed for the future development of the climate data store (CDS). The lead contractor is the BSC.
- The **C3S_34a lot 2 MAGIC** (2016-2018) contract The Copernicus Climate Change Service is developing solutions that will help users assess Global Climate Models (GCMs) projections using well-established metrics and manipulation tools and receive outputs tailored to their needs. In particular, the project aims to provide products that address the needs of the coastal, water, insurance and energy sectors. The system will allow users to access, visualize and manipulate the large data sets that are produced by climate models without having to download them to their own machine. It will combine software that have been developed by partners, either individually or within earlier European projects, into one single system. The software will contain modules to calculate standardized metrics and indices for each model, so that the models' performance can be assessed quickly. The lead contractor is the Royal Netherlands Meteorological Institute (KNMI).
- The **C3S_52 SECTEUR** (Evaluation and Quality Control Function for the Sectoral Information System) contract (2016-2017) brought together organisations with vast expertise in climate and business, to engage directly with end-users and analyse their requirements, identified gaps and delivered recommendations on future needs of C3S to better support decision-making. The sectors covered were agriculture and forestry, coastal areas, health, infrastructure, insurance and tourism. BSC was sector lead for the insurance sector.
- The H2020 **ERA4CS DustClim** (DUST storms assessment for the development of user-oriented CLIMate services in Northern Africa, Middle East and Europe) project (2017-2020) led by the BSC will provide a high-resolution baseline and trend information on sand and dust storms over Europe, Northern Africa, and the Middle East through an unprecedented reanalysis that assimilates dust aerosol data that have been quality controlled, and will develop dust-related climate services tailored to key socioeconomic sectors.

2.3 Deutscher Wetterdienst (DWD)

The **Deutscher Wetterdienst** (DWD) is the National Meteorological Service of Germany. Based on national law its core task is the provision of services for the protection of life and property in the form of weather and climate information. This includes the meteorological safeguarding of aviation and marine shipping and the warning of meteorological events that could endanger public safety and order. DWD has other important tasks such as the provision of weather and climate services to the government, the federal states, and the institutions administering justice. In addition, DWD is entrusted with the fulfilment of international commitments by the Federal Republic of Germany with respect to meteorological and climatological issues. The DWD thus coordinates the meteorological interests of Germany at a national level in close agreement with the German government and represents Germany in intergovernmental and international organisations such as, for example, the World Meteorological Organization (WMO). DWD's spectrum of activity is very wide and comprises of weather observation and forecasting, research and development, climate monitoring and modelling of projections as well as climate forecasts, development of precautionary measures to avoid weather-related disasters and to provide support for disaster risk reduction, advice, information and services on meteorology and climatology to commercial and non-commercial users, national and international cooperation in meteorological and climatological activities.

DWD is the national German user coordination institution for the Copernicus services on atmosphere (CAMS) and climate change (C3S). In this context it represents the German user interests in the EU Copernicus User Forum. At the national level DWD was and is involved in the national COPERNICUS programme with three projects, OCEAN-EVAL, NOCO, and GUAMO. While the first project developed an evaluation tool running operational for the German Climate Forecasting System (GCFS) with focus on oceanic parameters, the ongoing NOCO project supports the national coordinator of CAMS and C3S installed at DWD. In the scientific part of this project evaluation runs and sensitivity tests with the regional climate model COSMO-CLM coupled to the ocean model NEMO for the North and Baltic Sea are performed and analysed. The overall objective of the project GUAMO (Utilisation of GMES Urban Atlas for urban climate modelling) is to utilize Copernicus Land Monitoring Services data sets for urban climate simulations with MUKLIMO_3 model in Germany. The project supports the generation of urban climate services for climate resilient urban planning.

DWD is engaged in several standardization activities at the ISO level. DWD is a member of the working group developing ISO 14090 "Adaptation to climate change — Principles, requirements and Guidelines" including the integration of adaptation within or across organizations, understanding impacts and uncertainties and how these can be used to inform decisions. This International Standard will be applicable to any organization, regardless of size, type and nature e.g. local, regional, international, business units, conglomerates, industrial sectors, natural resource management units. ISO 14090 will be published in 2018.

Furthermore, the DWD is engaged in the expert team developing ISO14091 "Climate Change Adaptation - Guidance to Vulnerability Assessment", which will provide guidance for conducting a vulnerability assessment (VA) regarding the impacts of climate change. The document will give help to develop and implement a sound VA. This standard is targeted at all kinds of organizations, primarily to regional and local administrations as well as private and public businesses, to support their efforts in enhancing climate change adaptation planning and can be used by any planning entity. ISO 14091 will presumably be published in 2020.

Concerning the infrastructure/technical equipment relevant for the proposed work, the DWD maintains comprehensive technical infrastructure for the collection, analysis and archiving of meteorological data. High performance computing facilities are available for staff members for project related activities that require the handling and processing of high-volume data sets. As Member state of ECMWF, DWD has an appropriate account of computing and archiving resources at ECMWF HPC, which will partly be used for this service in order to optimise the fast data availability for the climate data shop.

In 2011, DWD, University of Hamburg (UHH) and Max Planck Institute for Meteorology (MPI-M) started to develop the German Climate Forecasting System (GCFS) for the provision of seasonal forecasts for German users. The first forecast products have been made available to the public in October 2016. As mentioned above, DWD together with UHH and MPI-M is appointed as additional provider of seasonal forecasts (project name: C3S_433) for the Copernicus climate change service (C3S) within the proof of concept phase. The negotiations for the second phase are currently ongoing (C3S_330). In addition, this group at DWD has been involved in other national and EU projects on decadal and seasonal-to-decadal climate predictions such as the ERA4CS research project CLIM2POWER and the national research project MiKlip.

2.4 Finnish Meteorological Institute (FMI)

The **Finnish Meteorological Institute** (FMI, en.ilmatieteenlaitos.fi) has the mandate of producing reliable scientific information on the state of the atmosphere, its characteristics and phenomena, with the aim of promoting safety and serving various needs of the public, industry and commerce, as well as contributing to multidisciplinary scientific ends. FMI has two Cray XT-5 supercomputers, and it employs about 700 people, about 350 of which are involved in research and development. FMI participates in many (inter)national collaborative projects, including around 40 EU-projects. The Weather and Climate Change Impact Research of FMI, currently employing approximately 40 people, offers climate services and examines weather and climate, their extremes, climate change and their socio-economic aspects. Furthermore, its aim is to diversify the range of customer-oriented climate change services and to provide reliable and high-quality information regarding climate change. FMI has cooperatively produced a web-portal Climateguide.fi in order to support society and citizens in mitigating climate change, and in adapting to it. FMI provides various data via the OpenData-catalogue according to the INSPIRE-directive. FMI is a member of the European HIRLAM-ALADIN NWP-consortium and is responsible for developing and maintaining numerical weather prediction systems and applications for operational weather forecasting.

FMI has been involved in several international and national climate related projects where tailor-made sectoral investigations have been done using multi-model climate projection products (MMPP). Each of these projects have dealt with post-processing of CMIP and/or CORDEX data according to the best scientific practices taken into consideration the user requirements. FMI has participated in climate data and service related projects such as FP6 ENSEMBLES, FP7 IS-ENES, FP7 FUME, FP7 EWENT, Life+ CCCRP, FP7 CORE-CLIMAX, FP7 RAIN, FP7 TopDad and FP7 EMBRACE. We have produced uncertainty estimates, evaluated model skill and/or sensitivity of the results depending on the choice of model and have expertise in quality controlling and fitting the distributions of the datasets (Millenium models runs, in situ, reanalyses, CMIP, CORDEX) (EXWE-SAFIR programme). Tailoring has been done according to the application requirements of the end users which vary much among the sectors like energy, forest, agriculture, water and traffic or decision makers (climateguide.fi). FMI has made the multi-model projection products together with University of Helsinki (UH). FMI has been jointly describing and surveying technical and practical providers, purveyors and user specific needs in CMIP and CORDEX data delivery and to define methodologies for key performance indicators needed in systematizing the processes for provision of the quality assured multi-model projection products.

FMI's relevant projects and contracts for this offer are:

- **EU-C3S Data Evaluation for Climate Models** (2016-2018). Activities in this project will address multi-model climate model products CMIP and CORDEX. Scientific robustness regarding climate model ensembles is in the heart of the project. Wide variety of current and potential new users of the multi-model climate data are surveyed and champion-users are invited to participate with tool development. With the support of users we will be able to co-design the best recommendations for multi-model climate model products for the EQC framework.
- **EU-C3S Clim4Energy** A service providing climate change indicators tailored for the energy sector, (2016-2018). The project brings together the complementary expertise of 7 climate research and service centres and 10 energy practitioners to demonstrate, from case studies, the value chain from ECVs to actionable information in the energy sector. It will deliver 9 energy-relevant pan-European indicators of climate trends and variability with a cross-sectoral consistency, appropriate documentation and guidance, estimation of uncertainties,

and a demonstration of use. It will contribute to other Copernicus services by sharing experience and tools on quality control, data access with distributed systems, visualization of complex multi-dimensional data and their uncertainties.

- **CLIPS** (CLimate services supporting Public activities and Safety, 2016-2018) aims at setting up the proof of concept for extended range (0-46 day long) seamless weather and climate services by developing novel climate impact outlooks (e.g. early warnings) for phenomena that pose risks and benefits to weather sensitive public activities in Finland.
- **EU-MACS** (EU MArket for Climate Services, 2016-2018). The project analyses the market structures and drivers, and obstacles and opportunities of climate services. Climate services cover the generation, provision, and contextualization of information and knowledge derived from climate research for decision-making.
- **MARCO** (MArket Research for Climate services Observatory, 2016-2018). This sister project of EU-MACS gathers market research firms, climate scientists, CS practitioners and innovation actors, in dialogue with stakeholders, to provide an enriched European CS market assessment up to 2030 with case studies, forecast future user needs, unveil opportunities, and promote market growth.
- **ERA4CS DustClim** (DUST storms assessment for the development of user-oriented CLIMate services in Northern Africa, Middle East and Europe) (2017-2020) will provide high-resolution baseline and trend information on sand and dust storms over Europe, Northern Africa, and the Middle East, and will develop dust-related climate services tailored to key socioeconomic sectors.
- **ERA4CS SERV_FORFIRE** (Integrated services and approaches for Assessing effects of climate change and extreme events for fire and post fire risk prevention, 2017-2020) will: (i) provide integrated services for forest fire assessment and mitigation strategies, from seasonal up to climatic time scales, (ii) create a bridge between observations, model development, operational products, information translation and user uptake.
- **ERA4CS URCLIM** (Urban climate services, 2017-2020) will combine high resolution urban climate modelling, with open source land use and urban morphology data, and with urban land use and morphology simulation modelling, so as to better explore alternative future urban climates in alternative future urban environments.
- **ERA4CS WINDSURFER** (Wind and wave scenarios, uncertainty and climate risk assessment for forestry, energy and reinsurance, 2017-2020). Extreme winds pose major risks to life, property and forestry, while extreme ocean waves can impact on offshore infrastructures and coastal communities.

2.5 Royal Netherlands Meteorological Institute (KNMI)

The **Royal Netherlands Meteorological Institute** (KNMI, <http://knmi.nl/home>) is the Dutch national weather service. It is an agency of the Ministry Infrastructure and Water management. Primary tasks are weather forecasting and the monitoring of weather, climate, air quality and seismic activity. KNMI is the national research and information centre for meteorology, climate, air quality, and seismology.

KNMI focuses on monitoring and warning for risks with an atmospheric or seismic origin. In addition, KNMI offers advice and strategy prospects for both acute and future dangers. We strive to make our high-quality knowledge and information in the area of weather, climate, and seismology operationally available 24 hours a day, seven days a week. In addition, we continuously extend and deepen this knowledge in cooperation with research institutes, universities and businesses. As a scientific institute, KNMI contributes to the international climate research and contributes to the process and reports of the Intergovernmental Panel on Climate Change (IPCC).

KNMI has a long record of activities related to climate services, both on the national as well as the European to global scale. It has been involved in several EU-funded projects, which provide users (policy makers, the scientific community, commercial partners) with tailored science-based assessments through our Climate Services activities as well as detailed state-of-the-art datasets. It provides these assessments and datasets using sustained and operational IT based services (ECA&D, Climate Explorer (climexp.knmi.nl), KNMI Data Center (data.knmi.nl), IS-ENES (climate4impact.eu)).

KNMI has a long tradition in climate modelling and providing access to climate model output and has been involved in several projects of some with directly relevance to C3S 512 such as the ones described below:

- **C3S 34a lot 2 (MAGIC)**, 2016-2018, which is developing solutions that will help users assess Global Climate Models (GCMs) projections using well-established metrics and manipulation tools and receive outputs tailored to their needs. In particular, the project aims to provide products that address the needs of the coastal, water, insurance and energy sectors. The system will allow users to access, visualize and manipulate the large data sets that are produced by climate models without having to download them to their own machine. It will combine software that have been developed by partners, either individually or within earlier European projects, into one single system. The software will contain modules to calculate standardized metrics and indices for each model, so that the models' performance can be assessed quickly. The lead contractor is the KNMI.
- **C3S SURF** Monitoring European climate using surface observations (<http://surfobs.climate.copernicus.eu>). This service provides climate monitoring products for Europe, based on surface in-situ observations. Data are collected by ground-based observation networks, owned and operated by the National Meteorological Services and others. Many thousands of historical observations are processed to prepare datasets, maps and graphs of basic variables like temperature and precipitation, as well as a large number of derived impact-oriented climate indicators. In monthly and annual State-of-the-European-climate reports, recent developments are presented and put in historical perspective. The lead contractor is the KNMI.
- **C3S_422 CRUCIAL** (WeR lead) The CRUCIAL proposal aims to address the crop-climate data needs of regional to global stakeholders in the agricultural and food sectors and related sectors such as agricultural insurance or commodity trading, water and irrigation management, and food systems research. The consortium will develop indicators primarily

for the globally most important staple crops, like wheat, maize, potatoes, rice and soybean, priorities to be set during the scoping phase. Some of the products that will be delivered, sometimes with slight modifications, are also relevant to sectors such as ecology and biodiversity and health. For example climate based indicators for crop development can be easily adapted for other natural species, and indicators for crop pests can also be very relevant for some transmissible or infectious diseases. Finally, the proposed forcing data stream (see below) will be useful for many types of climate impact models that require near surface climate data. During the scoping phase of the project the user needs will be assessed, by analysing existing literature on stakeholder data needs, including those of C3S projects SECTEUR/AGRICLASS and others, and through interactions with both end user and consultant communities through engagement of 3 user champions, covering the crop research, agribusiness and food policy and administration respectively. KNMI leads WP3, User guidance and documentation and develops the processing framework.

- **The H2020 DARE** (Delivering Agile Research Excellence on European e-Infrastructures, (<http://project-dare.eu/>) project aims to provide scientific communities with a unifying hyper-platform and development context to allow for user-friendly and reproducible carrying out of huge data-driven experiments, and rapid prototyping. DARE specifically addresses the requirements of innovating teams of research developers and scientists, who work on the intersection of software engineering and scientific domains, and on data, complexity and computing extremes. Building on extensive experience in research e-infrastructure, semantification and the handling of metadata, and on big-data technologies and domain applications, DARE will equip teams of innovators with meaningful abstractions and tools allowing for rapid prototyping of reproducible and efficient research solutions. DARE will improve further and integrate tried and tested programmatic dataflow specification APIs, big-data technologies and provenance/datalineage solutions to address the requirements of European RIs, initially of EPOS, on Earth science, and IS/ENES2, on climate. KNMI leads WP3 which will deliver solutions for “Large-scale Lineage and Process Management”.
- **The FP7 CLIPC** (www.clipc.eu) Climate Information Portal for Copernicus, precursor project for C3S, has been developed to provide data and information on climate change and climate impact to users. Main users in focus are the climate scientists, impact researchers and consultants. Important features of the portal are a solid list of climate impact indicators and tool (a toolkit) to work with these indicators and make assessments of climate impact in a certain region. KNMI has been responsible for the developments as part of the Architecture Team, as well as the main developer for processing, visualization discovery and download services (based on the climate4Impact platform).
- **FP7 EUPORIAS** (<http://www.euporias.eu/>) The FP7 project EUPORIAS aimed at improving the ability to maximize societal benefit from seasonal to decadal climate predictions. In close collaboration with stakeholders, a set of fully functioning prototypes of climate services were developed in the sectors of energy, agriculture, transport and water management. KNMI lead the Data Dissemination work package and supported the development of one of the showcases (Land Management Tool).

2.6 Federal Office of Meteorology and Climatology (MeteoSwiss)

The **Federal Office of Meteorology and Climatology** (MeteoSwiss) is by federal mandate the national provider for weather and climate services in Switzerland. In this role, it serves the general public, authorities, research and industry. MeteoSwiss operates the networks to observe the weather and climate in Switzerland, issues weather forecasts and warnings to the authorities and the general public and monitors the Swiss climate. The legal duties include the provision of climate information and climatological services for the benefit of the general public. MeteoSwiss provides generic and tailor-made datasets and services to customers, and conducts and supports research in applied weather and climate science. MeteoSwiss hosts the national GCOS office, is the official representative of Switzerland in various international organisations (WMO, ECMWF, EUMETSAT, EUMETNET etc.) and founding member of the Swiss Centre for Climate Systems Modelling (C2SM). Through a range of collaborations on national and international level, MeteoSwiss gained an in depth expertise in the fields of climate services, climate projections and monthly to seasonal forecasts. This especially concerns the following projects and contracts:

- **EURO-CORDEX** (<http://www.euro-cordex.net>) MeteoSwiss is actively involved in EURO-CORDEX, the European branch of the international WCRP CORDEX initiative. The aim of EURO-CORDEX is to provide state-of-the-art and user-tailored climate change projections for the European continent. By collaboration with ETH Zurich, staff at MeteoSwiss has contributed to the EURO-CORDEX experimental database and is currently engaged in the statistical downscaling and climate information distillation pillars. Furthermore, MeteoSwiss co-coordinates the assessment of existing EURO-CORDEX simulations in terms of serious simulation shortcomings and the setup of a dedicated errata database.
- **CH2018** (<http://www.ch2018.ch/en>) MeteoSwiss is co-coordinating and (co-)leads several working groups of the national CH2018 project which currently prepares the upcoming set of national Swiss reference climate scenarios to be released end of 2018. The consortium consists of several academic and governmental institutions. All activities are closely connected to the recently established National Center for Climate Services (NCCS). Among others, MeteoSwiss is responsible for the bias-correction and downscaling of raw EURO-CORDEX regional climate model output in order to produce user-tailored climate scenario products at local and regional scales.
- **COST VALUE** (ES1102; <http://www.value-cost.eu>) MeteoSwiss has been a management committee member of the COST-Action VALUE (Validating and Integrating Downscaling Methods for Climate Change Research) and, in collaboration with ETH Zurich, led the work package 2 on observational and climate model datasets. The aim of VALUE has been to evaluate a large set of statistical and dynamical downscaling methods on a European frame and in a well-defined statistical framework. In terms of downscaling methods, MeteoSwiss contributed with a multi-site multi-variable weather generator.
- **HEAT-SHIELD** (<https://www.heat-shield.eu>) MeteoSwiss is strongly involved in the ongoing Horizon2020 project HEAT-SHIELD which addresses the negative impact of increased workplace heat stress on the health and productivity of five strategic European industries. In this context and as part of the WP1 lead, MeteoSwiss developed long term climate change projections of a dedicated heat stress index for more than 1500 European sites based on the EURO-CORDEX data archive. Furthermore, MeteoSwiss has set up a European-scale early warning system for heat stress based on the ECMWF extended range forecast. Both activities rely on a dedicated multi-variate weather and climate model bias correction procedure.

- **National Center for Climate Services** (NCCS; www.nccs.ch/en) MeteoSwiss has recently installed the National Centre for Climate Services (NCCS) to coordinate climate services at a national level. The NCCS aims at bringing together producers and users of climate information and thereby fostering impact and uptake of climate information on a national level. It is the reference point for climate information ranging from the characterization of the current climate to the projections of future climate change. Through improved coordination among the participating federal offices and universities, NCCS aims at maximizing the impact of climate research and infrastructure such as the Copernicus services.
- **EUPORIAS** (<http://www.euporias.eu/>) The FP7 project EUPORIAS aimed at improving the ability to maximize societal benefit from seasonal to decadal climate predictions. In close collaboration with stakeholders, a set of fully functioning prototypes of climate services were developed in the sectors of energy, agriculture, transport and water management. MeteoSwiss led a work package on post-processing of seasonal forecasts to derive user-oriented climate information indicators. This included detailed verification activities and uncertainty assessments. MeteoSwiss further evaluated the added value through dynamical and statistical downscaling and contributed to the project through inquiring stakeholder needs.
- **C3S 51 Lot3** (QA4Seas) (<https://climate.copernicus.eu/quality-assurance-multi-model-seasonal-forecast-products>) In “QA4Seas - Quality Assessment Strategies for Multi-model Seasonal Forecasts”, MeteoSwiss leads work package 3 on scientific assessment and gap analysis. Specifically, MeteoSwiss is contributing a comprehensive verification of the C3S seasonal forecasting systems, user-oriented forecast verification of specific published products, analysis of multi-model methods, identification of scientific and technical gaps and recommendations on best practices. In addition, MeteoSwiss is involved in other project activities by inquiring stakeholder needs, by helping to develop metadata standards for forecast products and verification results, and by contributing to the design of the framework for evaluation and quality control of seasonal forecasts.
- **Copernicus C3Surf** MeteoSwiss participates in the C3Surf project (Copernicus Climate Change Service based on Surface in-situ Observations). C3Surf will deliver a climate monitoring service over Europe based on in-situ surface climate observations. New high-resolution gridded datasets will be generated building on the European Climate Assessment & Dataset (ECA&D) and E-OBS. In addition, two regional grids over the Alpine region and Fennoscandia will be developed. MeteoSwiss contributes to the project with expertise on spatial analysis and will develop, in collaboration with the Austrian weather service (ZAMG), a centennial monthly precipitation dataset over the Alps based on the HISTALP dataset. Moreover, MeteoSwiss will lead a comparison of products generated in the project with already existing gridded regional datasets in order to detect uncertainties and to communicate them to users.
- **CLIMANDES** In 2012, MeteoSwiss and the National Service for Meteorology and Hydrology (SENAMHI) of Peru initiated the project CLIMANDES (Servicios climáticos con énfasis en los Andes en apoyo a las decisiones). The project is funded by the Global Programme Climate Change of the Swiss Agency for Development and Cooperation (SDC) and is coordinated by the World Meteorological Organization (WMO) in the Global Framework for Climate Services (GFCS). The aims of CLIMANDES are to develop climate services for decision-makers in Peru, and to improve the training and education of meteorologists in the Andes region.

2.7 Predictia Intelligent Data Solutions S.L. (Predictia)

Predictia is an SME emerged in 2008 as a spin-off of the Santander Meteorology Group (CSIC-Universidad de Cantabria, Spain). Its mission is to offer data management and mining solutions for problems in scientific disciplines requiring specialized services for storage, access, visualization, and non-standard data mining techniques for extracting relevant information from data. Predictia offers custom software solutions based on web technologies, including the development of portals for data access, visualization and on-line data mining algorithms. Predictia maintains a core of R&D as a key driver of competitiveness of its products.

The company has participated in several national and international research projects, including:

- **EUPORIAS** Predictia participated in this FP7 project leading the stakeholder engagement work package, which aims to engage with EU citizens and businesses (including SMEs) about how seasonal-to-decadal information can be used in everyday decision-making, facilitate clear communication and information exchange with the stakeholders and demonstrate ways in which a climate service can be developed to address specific users' needs. Within EUPORIAS, Predictia is working on the development of web user interfaces for climate information.
- **MOSAICC** (MOdelling System for Agricultural Impacts of Climate Change). MOSAICC, funded by the FAO, is a system of models and utilities, developed by the FAO, designed to carry out inter-disciplinary climate-change impact assessment for agriculture through simulations. Predictia has integrated the Downscaling Portal into MOSAICC system in order to provide regional climate projections.
- **PRIMAVERA** (Process-based climate sIMulation: AdVances in high-resolution modelling and European climate Risk Assessment). The main objective of the H2020 PRIMAVERA project is to develop a new generation of advanced and well-evaluated high-resolution global climate models, capable of simulating and predicting regional climate with unprecedented fidelity, for the benefit of governments, business and society in general. Predictia participates in the user engagement and dissemination work package and its most relevant task is to create a web-based dissemination portal to maximize the dissemination of the project outcomes.
- **C3S 51 Lot3 QA4Seas** (Quality Assessment Strategies for Multi-model Seasonal Forecast) aims at developing a strategy for the evaluation and quality control (EQC) of the multi-model seasonal forecasts provided by the Copernicus Climate Change Service (C3S) to respond to the needs identified among a wide range of stakeholders. The participation of Predictia in this project is focused on two main aspects. First, the computational profiling and optimization of different climate forecast verification libraries. In addition, Predictia has contributed with a semantic metadata schema (METACLIP), envisaged as a solution for describing provenance of the seasonal forecast products and its understanding by users, to be deployed in the QA4Seas Prototype.
- **C3S 425** Migration of SIS demonstrators aims to re-implement five demonstrators (SWICCA, EDGE, CLIM4Energy, WISC and ECEM) developed within the C3S Sectoral Information System by using the CDS Toolbox.

2.8 Freie Universität of Berlin (FUB)

The **Freie Universität of Berlin (FUB)** is one of the largest universities in Germany, awarded the status of excellence by the German Research Funding organization, DFG. As part of the faculty of Geosciences, the main research areas of the Institute of Meteorology (IfM) are weather forecasting, climate research, environmental impacts, remote sensing and the stratosphere. The institute has been and is participating with several scientific projects on climate variability, anthropogenic climate change and extreme events, and leads a major interdisciplinary national project on communicating probabilistic aspects of weather warnings in close cooperation with social sciences. Within the German national initiative on decadal climate prediction (MiKlip), it is coordinating the modules of dealing with data and evaluation, and with process studies. It has developed a central evaluation system for the handling of different data streams in MiKlip, extending it for university education and for services to users within the climate community (CMIP) and hydrology research.

IfM has ample experience in the fields of global climate modelling (past climate, climate scenarios and decadal forecasting), dynamical and statistical downscaling, and forecast skill estimation. It is running and continuing to develop the evaluation system for the MiKlip decadal prediction project. This evaluation system is installed at the German Climate Computing Centre in Hamburg. Versions have been set up at other sites with specific tasks, for example serving university education, the output needs or specific data needs of partners in a research project coming from operational hydrology organizations. From the national German MiKlip initiative, IfM is also experienced in investigating decadal prediction ensembles, estimating skills and performing calibrations of the ensemble.

FUB/IfM's relevant projects and contracts for this offer are:

- **MiKlip and MiKlip II** (Decadal Climate Predictions), 1st Phase 9.2011-9.2015, 2nd Phase 11.2015-10.2019, funded by the German Research Ministry. MiKlip aims to the generation and evaluation of an operational decadal climate prediction system which includes an integrated database and evaluation system for decadal scale prediction (Sub-Project Integration). Other subprojects have a clear focus on the predictability of cyclones and windstorms (ENSDIVAL, VESPA), on the 2-way nesting of a regional model (MESOTEL), on analysing mechanisms leading to this skill in windstorm prediction (STOC). In ECO, the evaluation is Coordinated and a climate drift correction framework is implemented. The (re-)calibrating of the MiKlip decadal prediction ensemble is treated in the subproject CALIBRATION. The IfM is in MiKlip module leader and module coordinator as well as subproject leader; see the websites <https://www.fona-miklip.de> and <https://www-miklip.dkrz.de>.
- **WEXICOM** (Improving the process of weather warnings and extreme weather information in the chain from the meteorological forecasts to their communication for the Berlin conurbation), 9.2011-12.2018, funded by the German Weather Service. WEXICOM evaluates probabilistic aspects of weather forecasts with respect to windstorm and convective rainfall events. The project is a transdisciplinary work with the social sciences. The perception of users with respect to probabilistic information will be investigated and the also the damage due to such events will be modelled. The IfM is project leader, see the website <http://www.geo.fu-berlin.de/en/met/wexicom/Projektbeschreibung-WEXICOM-Phase-II/index.html>
- **BINGO** (Bringing INnovation to onGOing water management - A better future under climate change), 7.2015-6.2019, funded by the EU. The aim is the reduction of the

uncertainty of near-term climate predictions for key users from hydrology. Inside the project high resolution dynamical downscaling of decadal predictions and statistical downscaling and stochastic modelling of precipitation will be performed and analysed. The data preparation and its availability for users is a key task. The IfM is work package leader of WP2: Climate predictions and downscaling to extreme weather, see the website <http://www.projectbingo.eu/>.

- **CMIP6-DICAD** (Preparation of the German national contribution to the IPCC/AR6 initiative and support of CMIP6 activities in Germany), 12.2016-11.2018, funded by the German Research Ministry. The project aims to the national contribution of Germany for CMIP6. In general the model simulations for the CMIP6 initiative will be performed. One key task is the provision and guidance to CMIP6 data and evaluation results applying Freva. The IfM is work package leader of WP4 - Portal for providing evaluation results, see the website <http://cmip-eval.dkrz.de>.
- **EWIG** (Development of workflow components for long term archiving of science data in geosciences) 08.2011-07.2014, funded by German Science Foundation. The aim was the identification of remaining gaps and developments currently missing workflow components in the research data lifecycle. The development of digital preservation policies and a blueprint for long term archiving policies was combined with the design of a university lecture as proof of concept. IfM was project partner and worked on the educational related data management, see the website www.forschungsdaten.org/index.php/EWIG.

2.9 Consiglio Nazionale delle Ricerche (CNR)

The **Consiglio Nazionale delle Ricerche** (CNR, <http://www.cnr.it>) is the largest Italian research organization. CNR aims to promote, transfer and improve the knowledge in the main sectors of the scientific, technological, economic and social research activities. The climate, atmosphere, marine and earth observation activities are carried out by Department of Earth System Science and Environmental Technologies with aim to gather knowledge and predict the behaviour of the Earth system and its resources, so as to help a sustainable future for the planet and mankind.

CNR climate research includes: climate change and predictability, study of the basic processes of climate dynamics and variability, changes in the hydrological cycle and of climate-biosphere interactions, study of the interactions between climate and cryosphere, meteorology and its applications, atmospheric structure and composition, observations of the Earth.

CNR Institutes involved in the tender belong to the Earth and Environment department and has more than 20 years' experience on climate sciences including: study of the basic processes of climate dynamics and variability, atmospheric dynamics and composition, earth observations of the atmosphere and the ocean and ocean dynamics and successful experience in operational programs and project coordination. This results in a portfolio of around hundred active projects each year.

The Institute of Atmospheric Sciences and Climate (ISAC) is recognized internationally through its collaboration with a large number of European laboratories, and research centres worldwide. ISAC is bringing in the project the scientific knowledge and the operational expertise recognised at international level. The Institute for Advanced Atmospheric Methodologies (IMAA) has a proven track-record in the management of research projects and infrastructures and in the standardization of ground based measurement techniques and procedures for data quality assurance. IMAA is coordinating the ACTRIS Research Infrastructure.

The CNR team involved in the C3S_512 offer has a long experience on the implementation of other services related to climate and training. A non-exhaustive list includes:

Key European wide projects on Climate & Ocean: EU-FP7-MyOcean (2009-2012): & EU-FP7-MyOcean-2 & H2020 MyOcean FO (2012-2015), STRATOCLIM-FP7, PRIMAVERA-H2020 2015-2020, CRESCENDO-H2020 2015-2020, ACTRIS-2 H2020 2015-2109, GAIA-CLIM H2020, ENVRIPLUS 2015-2019, ACTRIS-PPP H2020-INFRADEV-2016-2017.

Data handling services: European Marine Observation and Data Network (EMODnet): the long term marine data initiative of DG MARE. CNR involved in: EMODNet Med-Check-Point, EMODNET Ingestion, EMODNet Physics., SeaDataCloud project H2020-INFRAIA-1-2016, EC H2020 Project CSA BLUEMED (lead by CNR), NEXTDATA-MIUR 2013-2015, I-AMICA-PON 2013-2015, Marine Strategy Framework Directive Implementation (2015-2017), EUMETSAT H-SAF (2012-2017), WITS and OCTAC Dissemination Units interfaced with the Mercator service desk, CMEMS Ocean Thematic Assembling Center (OCTAC) (main contractor).

Quality assurance programmes: in the framework of ground based networks like GRUAN (GCOS Research Upper-Air Network), EARLINET (European Aerosol Research Lidar NETwork), CLOUDNET (Continuous evaluation of cloud profiles in operational NWP models), GAW (GAW LIDAR Network).

And more specifically, the CNR team involved in this service has a consolidated experience in C3S services with a crucial role for the proposed service:

- **C3S_511 ECVs** scientific assessment service, prime contractor. C3S_511 implements the scientific assessment of the gridded observational ECVs in the CDS.

- **C3S_311a_Lot3** Lead contractor. The service provides reference and baseline network in-situ data for several essential climate variables.
- **C3S_422** Marine transport User service subcontractor and science advisor on the use of CDS data. The service has the aim to develop applications of CDS data (historical, forecasts and projections) for users of Maritime transport.
- **C3S MAGIC**, subcontractor. The service develops metrics for ESMs evaluation.

and a consolidated experience in implementing Copernicus services for the marine sector:

- **CMEMS** Ocean Colour Thematic Assembling Center service, contractor.
- **CMEMS WITS** Element (Wind, Ice and Temperature at the Ocean Surface), in charge of SST service and dissemination unit for all WITS products.
- **CMEMS-MultiOBS** provider of surface sea salinity products.
- **MAGICS C3S** subcontractor on metrics for ESMs evaluation.

2.10 Stichting Wageningen Research, Wageningen Environmental Research (WENR)

Wageningen Environmental Research (WENR, previous Alterra, <https://www.wur.nl/en/Expertise-Services/Research-Institutes/Environmental-Research.htm>) is a leading European research and development organisation offering a combination of practical, innovative and interdisciplinary scientific research across many disciplines related to the sustainable use of the living environment. WENR offers a combination of practical and scientific research in a multitude of disciplines related to the green world and the sustainable use of the living environment, and has a long-standing experience in climate change modelling (we have four Nobel prize laureates), sustainable agriculture, crop monitoring and the use of remote sensing and GIS. WENR has been involved in a large number of national and international projects directly relevant to user requirements in Copernicus Climate Services.

WENR has all facilities required to execute this work, in terms of software development environments; skilled software engineers with a wide range of experience in working in complex projects; professional support staff for project management, administrative accounting, and access and availability of relevant data sets and literature information through past projects in the region, knowledge of publicly available data sources and Wageningen UR Library. WENR is certified under ISO 9001:2008 for our Quality Management System as well as for our environmental management system conforming ISO 14001:2004. An internal auditing system is established to verify if applied quality activities comply with the agreed quality system and contribute to the quality objectives.

WENR's relevant projects and contracts for this offer are:

- **EUPORIAS** (2012-2017) develops end-to-end impact prediction services and demonstrates their value in informing decision making to stimulate a market for these new tools. A number of sectors have been addressed, water, energy, agriculture-food security, land management, etc. Both scientific assessments of predictive skill at seasonal time scales of climate and its sectorial impacts were part of the project, as well analysis and development of communication and visualisation strategies and of typical workflows and operational service prototypes. Leading the respective work packages WENR for seasonal impact prediction development for hydrology in Europe and for agriculture in E-Africa.
- **CLIP-C** (2013-2016) developed a pre-operational information portal for the Copernicus Climate Change Service. Led by STFC with scientific and technological coordination and support provided by WENR, CLIP-C provides access to climate information of direct relevance to a wide variety of users, from scientists to policy makers and private sector decision makers. The platform complements existing GMES/Copernicus pre-operational components and focuses on datasets which provide information on climate variability on decadal to centennial time scales from observed and projected climate change impacts in Europe. CLIP-C also provides a toolbox to generate, compare and rank key indicators.
- **C3S 411 Lot1** (Service for Water Indicators in Climate Change Adaptation), will bridge the gap between institutes who provide climate-impact data on one side, and water managers and policy makers on the other side. The project will add value to data and ensure that available information is useful for water management at local and regional scale across Europe. WENR lead the stakeholder engagement and training activities in addition to making available hydrological model based water indicators for various CMIP5 scenarios.
- **C3S 52 SECTEUR** (Evaluation and Quality Control Function for the Sectoral Information System) translating European User Requirements (2016-2017) also part of C3S, brings together organisations with vast expertise in climate and business, to engage directly with end-users and analyse their requirements, identify gaps and deliver recommendations on

future needs to support better decision-making. The Sectors covered are Agriculture & Forestry, Coastal areas, Health, Infrastructure, Insurance and Tourism. WENR was sector lead for the agriculture sector.

- **IS-ENES2** (2012-2015) InfraStructure for the European Network for Earth System Modelling. EU project where WENR was one of the partners responsible for Assessment of climate data needs in support of the EU Climate Adaptation Strategy; Design of user interface, guidance and documentation of the climate4impacts portal; and Dissemination to stakeholders, consultants in particular.
- **ClimInvest** (ERS4CS) (2017-2020) ClimINVEST aims to develop tailored information tools on physical climate risk for financial decision makers, in close cooperation between climate scientists and investors. The role of WENR: collaboration with Dutch institutional investors, WP3 lead on mapping and visualizing physical climate risk for investors.
- Support to the Uptake of the Copernicus Services by Users – Information Sessions, funded by the EC, DG Enterprise and Industry (2017-2021). This project promotes and encourages the use and uptake of data and information from the Copernicus program amongst a wide range of user communities, taking into account the distinctions between technical and non-technical, intermediate and end users, and making the most of the existing EU-funded activities and initiatives.
- **Copernicus Climate Indicators for Agriculture (C3S 422 Lot1)**, (2017-2019) The C3S 422 is a contract that develops a set of operational services with high-impact climate derived information aimed at the agricultural and food sector in order to enable them to make informed decisions. End-users from different market segments are involved to provide market information and address global aspects of food security. WENR is the lead contractor for this service.
- **ClimateAdapt**, funder EU DG Climate action (2010-2013) Climate-ADAPT is the European platform on Climate Change Adaptation. The platform supports in adapting to climate change. It is an initiative of the European Commission, implemented by a team led by WENR, and helps users to access and share data and information on expected climate change in Europe.
- **C3S Global impacts** (C3S 422 Lot1) (2017-2019) The project will demonstrate showcases on each populated continent for inspiration and provide data with guidance in best practices for climate-change adaptation. The aim is to ensure user uptake of relevant and high-impact climate information world-wide, addressing sectors such as health, safety, water-security, transport, biodiversity, tourism, agriculture and food production. The project will provide: easy access and user guidance to state-of-the-art scientific data on climate-change impact, tailoring of information based on user requests and co-design with climate experts, maps, graphs and downloads of readily available climate impact indicators world-wide, and showcases from site-specific indicator production, merging global data with local data/tools.

3 Quality of Resources to be Deployed

3.1 Description of resources

The offer will be implemented by an experienced team of researchers and software engineers from the Barcelona Supercomputing Center (BSC), Deutscher Wetterdienst (DWD), Ilmatieteen Laitos (FMI), Koninklijk Nederlands Meteorologisch Instituut (KNMI), MeteoSwiss, Predictia, Freie Universität Berlin (FUB), Consiglio nazionale delle Ricerche (CNR) and Wageningen Environmental Research (WENR), with a fairly long history of cooperation. The contractor and subcontractors are able to mobilise highly-qualified human resources and are well-placed to execute the tasks of the contract. The proposed team of researchers, software engineers and managers possess the range of required skills and considerable experience in the assessment of all types of climate simulations that are included in the CDS as well as in the assessment of in-situ observations, and a well-established history and reputation in climate services.

Many of the partners participating in this offer have collaborated in the last five years, either through their involvement in FP7 (SPECS and EUPORIAS) and H2020 (EUCP, PRIMAVERA) projects and a large number of C3S contracts. The team has documented capabilities in all the scientific and technical aspects related to the evaluation and the handling of large volumes of climate data. Some of them, like the BSC, Predictia and Meteoswiss have worked and published their results on evaluation and quality assessment together for at least one decade, while WENR, and FMI and CNR are European leaders in climate research communication and user engagement. The individuals involved are of the highest scientific and technical caliber.

The BSC has access to the infrastructure (including repositories with version control for the code development in the project) necessary to develop many of the tools planned, although for some specific aspects the access to virtual machines on public cloud systems will be considered. Many partners have to comprehensive climate model data repository in case the CDS is not available from the early stages of the contract.

The following table lists the skills of team members at the time of submitting the offer.

Title	Broad description of work in relation to Service	List of personnel who fit the profile and whose CVs are submitted with tender	Qualifications	Effort / engagement in months
Contract leader	Ensure the correct execution of the contract from both the technical, scientific and administrative point of view	Francisco Doblaz-Reyes (BSC)	PhD in atmospheric physics and department head	9.3
Project manager	Cover administrative and management requirements	Eugene Griffiths (BSC)	MPhil and head of project management group	2
Project manager	Cover administrative and management requirements	Dorota Chmielewska (BSC)	Project manager at Earth Science department	18
Research scientist	Contribute to seasonal forecast assessment	Pablo Ortega (BSC)	PhD in Physics and Climate prediction group leader	3
Communication	Contribute to user	Isadora Jiménez (BSC)	PhD in Biodiversity	11

Title	Broad description of work in relation to Service	List of personnel who fit the profile and whose CVs are submitted with tender	Qualifications	Effort / engagement in months
officer	engagement tasks		and Science Communication specialist	
Researcher in user engagement	Contribute to user engagement tasks	Dragana Bojovic (BSC)	PhD in Science and Management of Climate Change	11
Software engineer	Contribute to the CDS toolbox and overall service assessment	Nicolau Manubens (BSC)	Master in IT engineering	16.2
Software engineer	Contribute to the QAT design and preparation of a catalogue	Pierre-Antoine Bretonnière (BSC)	Master in IT engineering	10.5
Research engineer	Contribute to the CDS datasets and toolbox assessment	To be hired (BSC)	Master/PhD in physics or engineering	33
Research developer	Contribute to the CDS toolbox and overall service assessment	To be hired (BSC)	Master in IT engineering	34.5
Team leader	Contribute to framework development for data and toolbox, and coordination of WP1	Barbara Früh (DWD)	Dr in Science, team leader "Climate projections and climate predictions"	1.65 (-1.65 as in kind contribution)
Team leader	Contribute to user engagement tasks in WP1 and 2	Andreas Walter (DWD)	Dr in Science, team leader "Statistical Climatology"	1.65 (-1.65 as in kind contribution)
Senior scientist	Contribute to framework development and EQC of climate projections	Christian Steger (DWD)	Dr. in Science	4.95 (-4.95 as in kind contribution)
Project staff	Contribute to framework development and EQC of climate projections and framework development for toolbox	To be hired (DWD)	-	30
Project staff	Contribute to user engagement tasks in WP1 and 2	To be hired (DWD)	-	30
Team leader	Assessment of climate projections, fitness of service and user engagement	Hilppa Gregow (FMI)	PhD in forest sciences, Msc. in meteorology, executive education, experience in the field >20 yrs, head of Unit "Weather and Climate Impact Research"	1
Senior scientist	Assessment of climate	Joni Pekka Pietikäinen	PhD in	13

Title	Broad description of work in relation to Service	List of personnel who fit the profile and whose CVs are submitted with tender	Qualifications	Effort / engagement in months
	projections, fitness of CDS and toolbox	(FMI)	environmental physics, > 10 yrs experience in the field, head of Group "Seasonal and Climate Applications"	
Communication officer	User engagement and communication	Tiina Ervasti (FMI)	Research scientist/ science editor, MA in communication, 5 yrs experience in the field	12
Senior scientist	EQC of climate projections, service quality and KPIs, fitness of the service	Kirsti Jylhä (FMI)	Senior scientist, PhD in meteorology, > 30 yrs of experience in the field	5
Senior scientist	EQC of climate projections, fitness of toolbox	Antti Mäkelä (FMI)	PhD in meteorology 2011, > 10 yrs of experience in the field, head of Group "Climate Change and Extreme Weather"	8
Research scientist	User engagement and communication	Hadassa Hovestadt (FMI)	MSc in meteorology 2018	10
Research scientist	EQC of climate projections, fitness of CDS	Taru Olsson (FMI)	MSc in meteorology, > 5 yrs experience in the field	7
Senior scientist	Design and implementation of the mechanisms for provenance tracking	Alessandro Spinuso (KNMI)	MSc. in computer science	13
Senior scientist	Design and development of protocols and workflows for initiating, developing and updating quality assurance information and user guidance	Wim Som de Cerff (KNMI)	MSc. software engineering and theoretical informatics	14
Senior developer	Design and development of EQC of CDS infrastructure	Maarten Plieger (KNMI)	MSc. Earth sciences, natural hazards and Earth observation	16
Senior scientist	Coordinate and supervise setup of demonstration system to produce user-tailored scenario	Sven Kotlarski (MeteoSwiss)	PhD in meteorology	2

Title	Broad description of work in relation to Service	List of personnel who fit the profile and whose CVs are submitted with tender	Qualifications	Effort / engagement in months
	products based on CDS data and toolbox			
Team leader	Supervision and administrative support for demonstration system	Cornelia Schwierz (MeteoSwiss)	PhD in atmospheric dynamics, team leader "Climate monitoring and scenarios"	2
Project staff	Setup of demonstration system to produce user-tailored climate scenario products on national (Swiss) and European scale	To be hired (MeteoSwiss)	-	18
Senior scientist	Criteria for fitness of purpose of the toolbox	Jose Manuel Gutierrez (Predictia)	PhD in applied mathematics	13
Senior developer	Coordination, design and implementation of a mechanism for provenance tracking	Daniel San Martin (Predictia)	MSc. in applied mathematics and computer sciences	19
Senior scientist	Design and development of EQC of CDS Toolbox	Joaquin Bedia (Predictia)	PhD science, computing and technology	18
Senior developer	Design and development of EQC of CDS Infrastructure, CMS and web dashboard development	Fernando Martín (Predictia)	Software Engineer	36
Senior scientist	EQC on data and metadata standards definition for encoding climate products and services.	Antonio S. Cofiño (Predictia)	PhD in Applied Mathematics and Computational Sciences.	18
University professor	Coordination of EQC of CDS infrastructure	Uwe Ulbrich (FUB)	PhD and habilitation in meteorology, acting director of department, team leader	2
Senior scientist	Contribution to the development of the monitoring system	Ingo Kirchner (FUB)	PhD in Meteorology, software and web development	2
Research scientist	Consulting contribution to the web-dashboard development and technical interfaces	Christopher Kadow (FUB)	Diploma (eq. MSc) in meteorology, software and web development	0
Research scientist	Consulting contribution to the	Sebastian Illing (FUB)	Diploma (eq. MSc) in physics,	0

Title	Broad description of work in relation to Service	List of personnel who fit the profile and whose CVs are submitted with tender	Qualifications	Effort / engagement in months
	web-dashboard monitoring systems		software and web development	
Research scientist	Contribute to framework development and EQC of overall service as well as technical interfaces for data quality in the CDS, Web-dashboard development, monitoring system implementation and and KPI design	To be hired (FUB)	-	35.6
Senior scientist, professor	Coordinate the framework development for observational data, EQC of in-situ atmospheric data	Federico Fierli (CNR)	PhD in Meteorology, team leader, > 15 yrs of experience in the field	7
Senior scientist, professor	Coordinate the framework development for toolbox, EQC of toolbox, EQC of in-situ upper atmospheric data	Chiara Cagnazzo (CNR)	PhD in Physics, project leader, > 10 yrs of experience in the field	8
Research director	Support the framework development for data and toolbox, EQC of Oceanic in-situ data	Rosalia Santoleri (CNR)	Project leader, chair of IOC, manager of CMEMS services	10
Senior scientist	EQC of the upper atmospheric data	Paolo Cristofanelli (CNR)	PhD, project leader	8
Senior scientist	Support the framework development for data, EQC of surface in-situ data	Fabio Madonna (CNR)	PhD, project leader, manager of C3S_312 Lot 3 service	8
Service staff	Support EQC of surface in-situ data	To be hired (CNR)	Master/PhD in physics or engineering	26
Service staff	Support EQC of toolbox	To be hired (CNR)	Master in engineering	26
Senior scientist	Scientific quality output assurance	Annemarie Groot (WENR)	PhD on facilitation of multi-stakeholder learning processes	4.4
Senior scientist	Project coordination, contribute to user requirements tasks	Judith Klostermann (WENR)	PhD in Social Sciences, project leader on governance issues	18.6

Title	Broad description of work in relation to Service	List of personnel who fit the profile and whose CVs are submitted with tender	Qualifications	Effort / engagement in months
Scientist/Project manager	Project management, contribute to the user requirements tasks	Wilma Jans (WENR)	Diploma (eq. BSc) Earth Sciences, project manager of CLIPC/AMAZALERT	18.6
Senior scientist	Contribute to the user requirements tasks	Karianne de Bruin (WENR)	PhD in Environmental Economics, project coordination of C3S 422 Lot 1	0.3

3.2 CV's of key personnel

The following table lists the names of the key personnel involved in the project:

Organisation	Key personnel
BSC-CNS	Francisco Doblas-Reyes Eugene Griffiths Dorota Chmielewska Pablo Ortega Isadora Jimenez Dragana Bojovic Nicolau Manubens Pierre-Antoine Bretonnière
DWD	Barbara Früh Christian Steger Andreas Walter
FMI	Hilppa Gregow Joni Pekka Pietikainen Tinna Ervasti Kirsti Jylhä Antti Mäkelä Taru Olsson Hadassa Hovestadt
KNMI	Alessandro Spinuso Wim Som de Cerff Maarten Plieger
MeteoSwiss	Sven Kotlarski Cornelia Schwierz

Organisation	Key personnel
Predictia	Jose Manuel Gutierrez Daniel San Martin Joaquin Bedia Fernando Martín Antonio Cofiño
FUB	Christopher Kadow Uwe Ulbrich Ingo Kirchner Sebastian Illing
CNR	Federico Fierli Chiara Cagnazzo Rosalia Santoleri Paolo Cristofanelli Fabio Madonna
WENR	Annemarie Groot Judith Klostermann Wilma Jans Karianne de Bruin

All CVs are available in Annex I.

4 Technical Solution Proposed

4.1 Introduction

The C3S, operated by ECMWF, is a significant European investment, enhancing European capacity to adapt to climate change and reinforcing Europe's world-leading position on climate action and policy. The services will be based on a combination of world-class, authoritative data and tools following an advanced understanding of the public sector and market needs. The services will stimulate the market for climate services in Europe by overcoming the recognised barriers to entry, and hence will foster economic growth as well as societal benefits.

The C3S, through its Climate Data Store (CDS), will deliver a number of climate datasets of essential climate variables (ECVs) and climate impact indicators derived from these data blended with sector-specific information (relevant thresholds, socio-economic datasets), demonstration of use and guidance. These datasets and indicators should provide relevant information for the main actors in the EU-based industry and for policy development.

The Evaluation and Quality Control (EQC) function has a critical role in the C3S to ensure that the service meets the needs of a range of users for high-quality data and information, and in proposing the necessary evolution of the service itself, while shaping the research agenda to attend the most important challenges detected. To be successful, the C3S engages directly with a wide range of stakeholders, potential users of C3S services in a range of sectors: water, energy, agriculture and forestry, health, coastal areas, insurance, tourism and infrastructure. In each of these sectors there is a clear need for consistent, authoritative climate information to contribute to decision-making. However, previous experience has made clear that each user is likely to have distinct and specific needs, not just in terms of data but also in terms of the data quality information. For this reason, the C3S undertakes a comprehensive user requirement assessment, identifying where there is a need for not only climate data to support intelligent decision-making but also for the quality information that allows a best use of these data. It also aims at filling the gaps in its service rather than simply expecting users to take up products already on offer.

The ITT that this offer addresses asks for the development and implementation of an EQC framework for climate projections, seasonal forecasts and in-situ observations, and the facilities available in the CDS to manipulate them, identifying the gaps that must be filled by the EQC to respond to identified user expectations. The offer described in this proposal aims at developing a solution for the EQC function of the data and products provided by the C3S to respond to the needs identified in previous contracts using a continuous user engagement process.

4.2 Quality assessment of climate data

Knowledge of the climate system variability and change has proven to be a useful input to making resource management and planning decisions. This is one of the factors that determine the evolution of many climate-sensitive sectors.

However, the potential economic benefits of climate data are far from being fully realised. This is often linked to the aversion of a range of users to integrate climate information into their existing decision support systems without a clear assessment of how the data might affect their vulnerability, the satisfaction of a number of standards and an estimate of their quality, among other reasons. The socioeconomic application of climate information requires to either developing or improving the visualisation of the predictions, the public dissemination of the data and quality assessment information and to elaborate introductory, general-public information on the methodologies and the

regions, variables and times of the year where useful, traceable, and trustworthy information can be expected.

The World Meteorological Organization (WMO) has taken the initiative of developing the Global Framework for Climate Services ([GFCS](#)), which structures the efforts to express in clear terms the increasing need for robust climate information based on observations or covering future periods ranging from several months up to centuries for economic, industrial, and political planning. The GFCS has created a conceptual structure to close the gap in the provision of climate information and services between the information producers and its users, the latter ranging from policy makers to the industry. GFCS offers an umbrella for the development of climate services in the widest sense and has identified the quality assessment, along with its use in user guidance, as a key aspect of the service.

The implementation of the offer will be carried out taking into account the recommendations of the GFCS, and will be aligned with the strategy defined in the [European Research and Innovation Roadmap for Climate Services](#), published in March 2015, which summarises the strategy of the European Commission. It proposes a plan for action and a framework for discussion to the relevant actors and stakeholders. It paves the way to shared solutions and pathways facilitating the development of a market for climate services that provides benefits to society.

Besides the GFCS and the European Roadmap, the [EUPORIAS](#) project defined a set of principles for a successful climate service, which are particularly relevant for the design of an EQC framework (and also been used to prepare this offer) in a user-driven context and include:

- Understand the user chain
- Involve the appropriate actors, with the knowledge, experience and expertise required
- Listen to the users and take time to ensure you have a shared understanding
- Identify the potential tensions that could prevent the development of the service; build trust through transparency
- Agree the scope based on the expected added value
- Keep the service flexible through an iterative process
- Evaluate and monitor

A final set of principles that have been taken into account in this proposal is the [Ethical Framework for Climate Services](#). This framework is based on a set of reference points, two of which are central to the work that motivates the design of an EQC system:

- Climate service providers should consider the consequences of their actions for those who may use or be affected by the use of climate service products.
- Climate service products should be open to scrutiny and comparison.

The principles build on four core elements intrinsic to the production of climate services: integrity, transparency, responsiveness and collaboration, which the consortium plans to have present throughout its work. While describing the principles of practice and the principles of product development in this exercise is beyond the scope of this document, all individuals involved in the offer are strongly encouraged to carefully read the report and put the principles in practice.

The challenges of the quality assessment of the C3S data and products motivating this offer can be summarised as follows:

- Address adaptation: it must provide information for climate services together with short-term adaptation measures/plans because different users approach climate information and

many of them are already familiar with the climate-change problem and the subsequent adaptation issue.

- Provide consistency: it must provide information on which trust can be built, requiring a high degree of coherence across products, underlying data sets, processing methods, uncertainty communication, training and guidance, etc.
- Provide innovation: it should make operational recent developments from research, with innovative knowledge, methods and technologies to answer real-world issues, requiring stringent requirements in terms of standards and quality control.
- Address efficiency: the EQC information should be timely (e.g. available to respond to users' queries with a delay as short as possible), which imposes certain conditions on the approaches and algorithms considered to produce it.

This offer will address these challenges so that it provides:

- an overarching EQC service for the whole CDS
- an independent quality assessment for specific products (seasonal forecasts, climate projections and in-situ observations)

The evaluation and quality assessment, which will be user driven, will put at work the best expertise available on the evaluation of the multi-faceted aspects of data and product quality. Surveys and other user engagement techniques will be used and analysed to provide a detailed mapping of the users and user needs, identifying those needs that should be addressed with priority. Its outcome will be used to identify a set of the requirements for the CDS, to perform a gap analysis of the current information available to users, and to design an EQC solution that also supports the evolution of the service.

This offer cannot be considered in isolation; it builds on knowledge and expected outcomes generated by other C3S contracts. Figure 4.1 illustrates the links to some of these tenders and contracts.

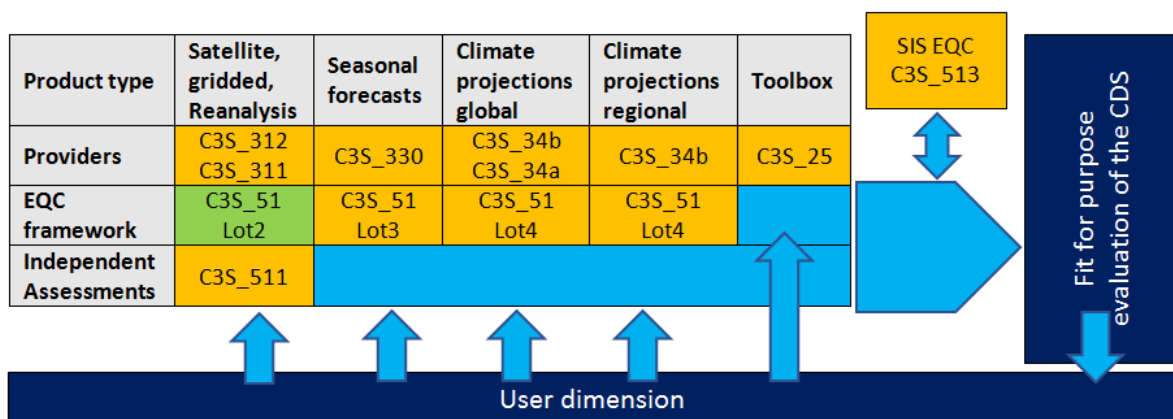


Figure 4.1: The role of the C3S_512 tender, in light blue, and the links to other C3S tenders and contracts. On-going contracts and tenders without an EQC framework yet established are in orange, while those with an EQC framework are in green. The user dimension is illustrated in dark blue.

4.3 Evaluating the CDS datasets

The type of data and the expected number of ECVs available in the CDS is reported in table 4.1. A wide range of datasets from the CDS catalogue will be considered in this offer:

- In-situ observations are provided by the suite of the three C3S_311a Lots that cover the coordination of data rescue activities, the access to observations from global climate data

archives, the access to observations from baseline and reference networks, and the climate monitoring products for Europe based on in-situ observations. The data category of in-situ observations covers a variety of different data sets: Lot 2 includes global in-situ data (i.e. ICOADS) of sea and air surface properties (temperature, precipitation, salinity) from buoys, land and ships, Lot 3 includes in-situ networks for surface temperature, profiles of temperature, humidity, wind, ozone (concentration, columns and profiles), CO, CO₂, CH₄ and integrated water vapour from reference networks (i.e GAW, GRUAN, etc.), and Lot 4 includes gridded regionals networks (E-OBS), which are assessed in the C3S_511 contract.

- Seasonal forecasts are provided by the C3S 433 and C3S 330 contracts. They include a large set of atmospheric variables, which will be enhanced with ocean variables in the future. Since DWD is involved in C3S 433 and submitted an offer to C3S 330, DWD will refrain from assessing the quality of the seasonal forecasts. This aspect will be covered by the contractor.
- Climate projections mainly come from simulations produced in the CMIP and CORDEX exercises. If data is provided by other sources than the ones mentioned above, all technical aspects of the data sets must meet the standards set by these contracts/projects.

Product type	Data Type	Datasets	# of QATs	# of reassessments
In-situ ECVs	Global climate data archives for land and ocean ECVs: Air temperature, wind speed, WV, P, Precipitation, Surface radiation, SST, Sea Ice, Clouds	Data archives as ICOADS	one per dataset	one per dataset version
	Baseline and reference networks, ECVs: Air Temperature, WV, Wind profiles, Ozone, CO, CO ₂ , CH ₄	Surface data: USCRN, RBSN, GSN, RBCN; Profiles from GRUAN, GUAN, RAOB; NDACC, SHADOZ, GAW TCCON Integrated water vapour IGS, EUREF, all international GNSS networks.	one per data set	one per data set version
Seasonal Forecast	Global ECVs formed by ensemble of forecasts with a forecast time horizon of several months	5 (MetOffice/MétéoFrance/CMCC/ECMWF/DWD)	Minimum of 5	One per new forecast system version
Regional Projections	Regional ECVs from regional climate projection ensemble	All CORDEX evaluation, historical and RCP simulations for EUR and MED domains as available via the CDS	Minimum of one per simulation	Each time a new version of the data set (which occurs after reruns or the identification of scientific problems in the data) is available

Product type	Data Type	Datasets	# of QATs	# of reassessments
				in the CDS; revision of ensemble products after withdrawal of a data set
Global Projections	Global ECVs from long simulations, some of them with ensembles	All the multi-model CMIP5 historical simulations and projections and the DECK and SCENARIOMIP simulations from CMIP6	Minimum of one per CMIP simulation (at least three per exercise, one historical and two projections) and per model	Each time a new version of the data set (which occurs after reruns or the identification of scientific problems in the data) is available in the CDS; revision of ensemble products after withdrawal of a data set

Table 4.1: List of the products and datasets subject to evaluation in this offer. QAT stands for quality assurance template.

The general strategy to assess the climate data set is to provide quality assurance templates (QATs) for all the CDS datasets with the best possible uniformity to reduce redundancy and duplication. The proposed approach for producing QATs is to define a two-step EQC framework based on:

- Collect the documentation of single data sets. The template to collect the documentation will be based on the efforts of the C3S 51 Lots 2-4 to prepare an encompassing, uniform framework containing the key information for the different types of data (Figure 4.2).
- Elaborate user guidance providing results from product Maturity and Fitness for Purpose (F4P) independent assessment (Bates and Privette 2012). Maturity metrics measure the freedom of the software system from failures caused by bugs in the system itself, while F4P refers to the functional quality of the data or software instead of to its structural quality. The definitions implemented in this contract will be based on the concepts developed in the data quality control community, such as for instance the definition of the Maturity Matrix and F4P structure in [CORDEX](#). The assessment will be implemented using standard tools such as [ESMValTool](#), the C3S quality checker or R-based packages. This requires the coordination with the C3S 511 contract to provide a uniform framework for user guidance (Figures 4.3, 4.4).

In addition to the requirements formulated by the [Global Climate Observing System](#) (GCOS) and the [Committee on Earth Observation Satellites](#) (CEOS) for in-situ observations, C3S for seasonal forecasts, and the [Coupled Model Intercomparison project](#) (CMIP) and CORDEX for projections, as well as inspired by projects like [Core Climax](#) and [QA4ECV](#), which include accuracy, temporal stability, spatial and temporal resolution, among many others, this offer will perform an assessment for specific use cases that will be defined in an initial discussion with C3S, and later identified from the user engagement.

The proposed approach is inspired by the approach used in the C3S 511 framework developed for observational and reanalysis ECVs. The evaluation will take the form of a product maturity and fitness for purpose matrix filled in from the result of use cases. The information will be summarised in a performance matrix (Figure 4.3).

In-situ data	Seasonal Forecasts	Climate Models
Product description		
Name		
DOI		
Organisation & contact		
Description		
Versioning		
Coverage		Horizontal Vertical Temporal
Coordinates		i.e lon/lat/z
Data format		i.e. NetCDF4
User Forum		i.e. website
Physical Quantities		i.e. Ozone, Temperature
Resolution		Horizontal Vertical Temporal
Product Generation		
Documentation	reference to ATBD / production documentation	
<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>
Quality control		
<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>
Uncertainty Characterization		
<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>
Product validation		
<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>	<i>Fields specific to each data type</i>
Independent assessment		

Figure 4.2: Structure of the proposed quality assurance template (QAT) for the independent assessment of the CDS data, where QATs shall contain the key information from data providers to be exposed to CDS Users. The QATs will share a common format and vocabularies.

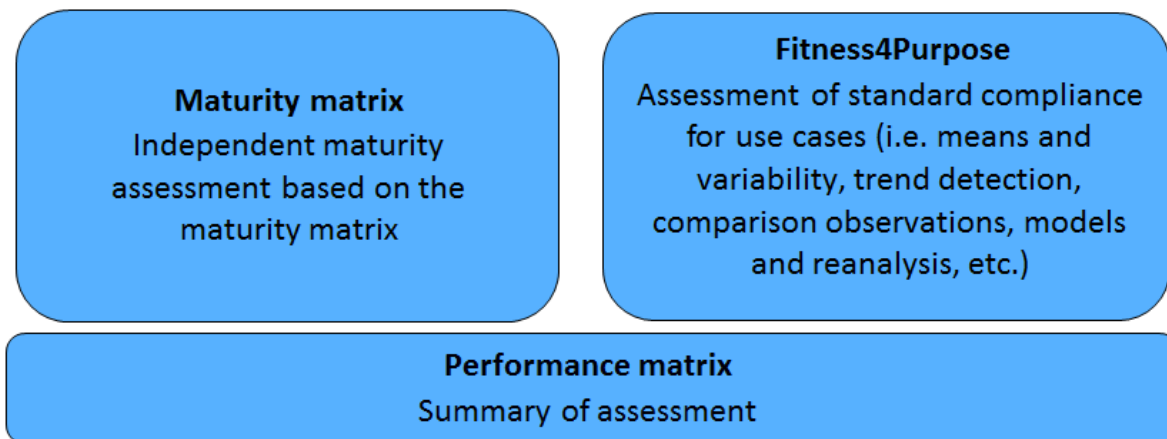


Figure 4.3: The proposed initial independent assessment framework that will be implemented via an automated system like ESMValTool or an R-based suite of functions.

The workflow to complete the QATs will follow these steps:

- For a new product
 - evaluate a CDS product
 - check the documentation based on the product type
 - provide an independent assessment on its maturity
 - provide an independent assessment on fitness for purpose
- For a reassessment
 - re-evaluate a product that has changed because a new version is available, the period has been updated, an error has been corrected, etc.
 - provide an updated independent assessment as above

For new products, the publication is decided based on the workflow described limited to the first three evaluation points.

Quality aspects of in-situ measurements depend on measurement techniques, data processing and site specific information. Therefore, the quality assessment of the in-situ observations will focus on the assessment of the technical quality of the data, which are aspects that include the correct and complete description of the dataset and its generation, the availability of a documentation of the generation process, the use of correct metadata standards and file format and the completeness of the metadata, and pointers to any external source of information relevant to the specific dataset.

For both seasonal forecasts and projections (both global and regional), similar aspects to those mentioned for the in-situ data will be assessed, in addition to a minimum set of metrics measuring the data quality. For both seasonal forecasts and the projections a dataset is defined as the ensemble simulation (one model, one start date, all variables). Standards for products derived from climate projections have been developed in the FP7 [CLIPC](#) project and applied and slightly adjusted in the German project [ReKliEs-De](#) to generate a standardised set of climate indices, while for seasonal forecasts the FP7 [SPECS](#) project formulated many of the standards that will be followed in this offer.

INDEPENDENT EVALUATION	
Spatial and temporal completeness of data product	
Spatial and temporal consistency of data product	
Any other issues to note	
MATURITY MATRIX	
Maturity of the product	Provide a maturity matrix (i.e Bates and Privette, EOS 2012) adapted for each category of data. Matrix is filled following specific guidance provided in this service
INDEPENDENT VALIDATION / COMPARISONS	
ASSESSMENT OF UNCERTAINTIES	Based on pre-existing documentation and/or independent analyses
Compliance with Climate targets and requirements of international and reference standards	Based on pre-existing documentation and/or independent analyses
GUIDANCE TO USERS	
FITNESS FOR PURPOSE ASSESSMENT	General strengths, weaknesses and limitations of the specific product in 1-page text derived from pre-existing information (Scientific literature, Reports, Assessments) Based on pre-defined use-cases
USE CASE 1-n	Provide synthetic results oriented to the applicability of the product to the use-case

Figure 4.4: Structure of the independent assessment report proposed for the CDS datasets. The independent assessment will share a common format and vocabularies for the different datasets.

A two-step procedure is proposed for the data quality assessment of the model datasets. In the first step the datasets are checked for physical plausibility and internal consistency, for which the C3S quality checker will be a key element. Plausibility and consistency mean, for example, that the values are in a (physically) reasonable range, the time series do not show gaps or jumps and the spatial and temporal variability is within reasonable limits. In the second step, those variables for which gridded robust observations are available (e.g. mean/minimum/maximum near surface temperature, precipitation, sea level pressure) will be analysed over a common period between the observations and the simulations with regard to their scientific quality. Since there are many different aspects of quality in a climate simulation data set (e.g. bias, spatial correlation, ability to reproduce spatial patterns, ability to reproduce large scale circulation patterns, ability to produce frequency of extreme events and distribution of weather types, forecast quality, etc.), the analysis will be prioritised according to the user needs identified.

A content management system (CMS) will be set up to ease the collaborative development of the QAT content. The CMS will enable the collaborative definition of the QAT structure for the different data types. Once the QAT structure has been defined, the CMS will be used to manage the creation of the QAT content. The CMS will be based on [Drupal](#), a widely used open-source solution with a highly modular architecture and a huge community of users and developers. In order to ease the collaborative creation of the QAT content, the CMS will include the following characteristics:

- A multi-role schema, recognising the existence of different type of users; for instance, the definition of “authors”, “editors” and “publishers” will enable a content moderation mechanism
- Content versioning
- Content change notification through subscriptions
- Discussion board
- Contributions to periodic reporting and possibility of data export

A technical interface will be developed to ensure that each QAT within the CMS can be displayed as web content alongside the descriptive metadata of the corresponding dataset in the CDS. A strategy for the best web-interface tables (e.g. XML, JSON, etc.) of the QAT content will be developed in cooperation with the C3S team. Given a direct visualisation of the embedded quality information for the users of the portal, this will improve the feedback mechanisms and enhance the CDS capabilities.

The framework updates will be carried out using a backward compatibility formulation and ensuring that the baseline criteria for publication are among the information stored by the CMS, maximising the consistency of the approach, the vocabulary used, the impact of the visualisation and the user experience. The experience and knowledge gained will be used to formulate recommendations for each dataset and, whenever relevant, for more than one data type.

4.4 Evaluating the CDS toolbox

The CDS toolbox includes a set of interactive processing software, workflows and Open Geospatial Consortium- (OGC) compliant web-based services to a) access data remotely through dedicated adaptors, b) manipulate, explore and transform data (sub-setting, aggregation etc.), c) build new apps and workflows, and d) visualise multivariate data in context (e.g. the Climate Monitoring Facility). In addition to these capabilities, adaptors (e.g. REST API, OpenDAP adaptor for ESGF, OGC-compliant web services) will provide the interoperability between the centralised part of the CDS, and the various distributed data repositories. The CDS broker forwards data retrieval and computation requests to the relevant data repository via the adaptors.

Taking into account the characteristics of the CDS toolbox, this offer will consider the following objectives for its evaluation:

- A continuous testing and assessment of fitness for purpose, including several real-world test cases will be undertaken. Aspects of efficiency and correct functioning, taking into account user feedback, will be central elements. A number of unit tests (either automated or manual/supervised) will be designed for testing purposes. A CDS toolbox test plan document will be prepared to help the CDS team to validate the acceptability of the toolbox software and to define the process of software validation. A draft of this plan is available as Appendix A. The test plan document will describe three testing categories conducted on the toolbox: for CDS service, for the integration of new tools and for user applications. The assessments will be addressed in a form similar to CDS dataset evaluation in WP1, taking into account the maturity and fitness for purpose criteria (Figure 4.3). Test results, applied to the main toolbox components will be carried out at various levels (Test cases/User assessment/User feedback), and a final grading will be assigned according to an assessment matrix (Figure

4.5). The assessment results will be presented in a form suitable for publication on the CDS in a “seamless” way with other evaluation information. The preferred format consists in tables summarising the test evaluation and the fitness for purpose (Figure 4.5).

Real-world test cases will be used at a later stage to evaluate the integration of external applications. Three of these cases have been already defined prior to the start of the contract (described below), and more will be added as the contract progresses. They will test the tools, workflows and the application editor and score them in terms of parameters gathered from ISO9126 (functionality, reliability, performance, changeability, transferability, usability, integration, and documentation). The criteria developed in this objective will enable the validation of the computational methods of the toolbox, and the reproducibility and traceability of the results, taking into account the application domain and the metadata profiles defined. The fitness for purpose of the CDS toolbox will be evaluated through these cases, along with the simpler unit tests mentioned above in order to cover a broad range from basic to complex toolbox applications.

- Defining a set of minimum requirements for including new tools in the CDS toolbox. These requirements will be based on the parameters illustrated in Figure 4.5, which should provide an acceptable final grading. A set of shared vocabularies and common practices will be defined in coordination with the WP1 activities to ensure the consistency of the quality assurance information and user guidance information for all the CDS toolbox components.
- Quality assurance information and guidance will be provided to users of the CDS toolbox. The overall fitness for purpose results will be the basis of the guidance to users that will be a living, evolving document. A preliminary list of the applications for which guidance will be offered is
 - basic climate operations on CDS data
 - data interoperability
 - specific statistical scientific functions such as interpolation, downscaling, or evaluation of regional trends
 - variability and selected climate extreme events
 - applications for sectorial services
- C3S will be regularly informed on gaps, shortcomings and limitations, as well as opportunities for the improvement of the CDS Toolbox based on the information collected in the previous objectives.

The assessment of the common data model (CDM) is a key step in the process of evaluating the toolbox. A data model is an abstract model that organises elements of data and standardises how they relate to one another and to properties of the real world entities. The purpose of the CDM is to provide a uniformed description (conventions, structures, formats etc.) of all data and products in the CDS, so that they can be combined and processed by the toolbox in a consistent fashion. This aspect will be addressed through an empirical EQC of the existing CDM product. The quality factors to be assessed by the CDM EQC framework will be correctness, completeness, integrity, simplicity, flexibility, integration, understandability and implementability. The CDM EQC framework will consider upstream users, who provide input to the CDS, and downstream users, who use the CDS. The key stakeholders will be dataset providers and consumers, CDM developers, datasets administrators and toolbox application developers.

A whole provenance model will be carefully addressed in this offer. Data provenance explains how a particular data product was generated, by detailing the steps in the computational process producing it. The current provenance model used in the CDS toolbox will be thoroughly evaluated, considering aspects such as coverage, standard compliance (for instance, the Climate Conventions, INSPIRE, etc.) and extensibility. The toolbox should enable mechanisms to explore and validate the

results obtained by their computations by means of lineage information represented in a comprehensive provenance data model. Here the relationships between the input data used by the functions adopted by the user-defined methods (or workflows) and the produced output, including the applied parameterisation, should be described with substantial metadata. To guarantee coverage, consistency and interoperability of the collected provenance data, this offer will assess the compliance of the toolbox to a common standard model of provenance, such as [PROV-DM](#).

Define: Tools/Workflow/Editor	Functionality	Reliability	Efficiency	Maintainability	Portability	Usability
Test case 1-N	Green	Green	Green	White	White	Green
Expert assessment	White	White	White	Green	Green	White
Users feedback	White	Green	Green	White	White	Green
Final grading	Orange	Orange	Orange	Orange	Orange	Orange

Resource accessibility status	Colour
Test not applicable	White
Test failed	Red
Test partially failed (add details)	Orange
Test partially succeed (add details)	Yellow
Succeed	Green

Figure 4.5: Assessment matrix of test items for toolbox users. The test is applied to the main toolbox components (tools/workflow/application editor) and may be done at various levels (test cases/user assessment/user feedback) with a final grading. Green corresponds to a test succeeded, white to a non-applicable test and orange to a test partially failed.

Depending on the results of the above evaluation, an extension of the current solution or the elaboration of a new one will be discussed with C3S. To achieve a satisfactory coverage we will analyse the computational model that characterises the toolbox and the adopted data formats. The team will initially rely on existing extensions of the common model for processes and workflow provenance representation, for instance such as [ProvONE](#). These baselines will be further elaborated to reach a satisfactory level of granularity of the lineage information, with respect to users and system requirements. Eventually the task will deliver a provenance profile that will include quality indicators, domain specific semantics and metadata describing the functions and the data products. These will be chosen from existing and emerging controlled vocabularies and ontologies ([IRI Ontologies](#), [META CLIP](#)). The team will evaluate the inclusion of vocabularies and terminology for the characterization of the large range of uncertainties associated with the products generated in a holistic way.

The engineering of the mechanisms enabling provenance aware execution of the toolbox will be also evaluated to identify the points of integration of the mechanisms for capturing the lineage effectively and at a manageable overhead. Moreover, the goal will be to evaluate and suggest a solution for the storage and dissemination of the provenance information.

Common provenance exploitation, querying and visualisation use cases will be examined taking into account all the feedback collected from a heterogeneous user community. A technical solution will

be drafted relying on existing systems and experience. This solution should be as coherent with what is already being implemented in other communities as possible, potentially converging into new system fit for the specific purpose (Metaclip, [S-ProvFlow](#)). Approaches pursued in projects such as the [Human Brain Project](#), [DataONE](#), and ongoing initiatives where the team already shares knowledge and expertise ([Solid Earth Science EPOS](#), [DARE](#)) will also be examined. The investigation will take into account also security, anonymisation and privacy aspects, provided the sensible informative payload carried by the lineage traces. The task will deliver a prototypical provenance management system prioritising the aspects just mentioned to achieve a workable solution.

Common provenance exploitation use cases will be discussed with C3S, taking into account all the user requirements identified. Any refinements will be implemented iteratively in coordination with C3S and representatives of the user community.

Three real-world applications will be used to test thoroughly the toolbox and its extensions. They will focus on the continuous identification of (and the feedback on) weaknesses, bottlenecks, missing elements, hurdles of access and potential improvements. The test cases, which will interact for the whole duration of the contract to fine tune their approaches, are:

- **Case 1, setup and evaluation of automated systems for producing user-tailored climate scenarios based on the CDS at national and European scales:** MeteoSwiss will exploit the CDS datasets and toolbox functionalities to set up a prototype of a full (semi-)automated processing chain made of a) the identification of existing and/or newly added regional climate projections available in the CDS, b) the quality assessment of climate projection datasets employing the CDS toolbox functionalities, c) the data download, d) the local data processing and further bias adjustment and downscaling and, finally, e) the creation of readily available and user-tailored regional and local climate scenario products for Switzerland. Among others, this prototype will ultimately facilitate an automated update of existing national reference climate scenario products. Particular attention will be given to the specific challenges related to high altitudes and complex topography like the Alps. The evaluation exercise of step b) will integrate a multitude of relevant climate data records available through the CDS, i.e. the driving global climate scenarios, regional climate scenarios themselves as well as gridded and station-based observational datasets that could serve as evaluation reference and/or bias adjustment and downscaling target. Observational uncertainty will be explicitly taken into account and assessed. Post-processing steps d) and e) will involve existing setups of the quantile mapping technique (currently available via several public and owned R packages; e.g. the [downscaleR](#) package). For European-wide applications that rely less on national/regional data sources, the feasibility of changing the sequence of steps c) and d) (and eventually step e)) will be exploited, i.e. the functionality of the CDS toolbox itself in terms of post-processing and downscaling of regional climate scenarios (and eventually of scenario product generation) will be assessed. Such setups would have the advantage of being independent of user-specific technical resources to a large extent and, hence, would have a broader range of application. Step e) will ultimately result in a range of climate scenario products that are, for instance, readily usable in typical climate impact applications. These include transient future time series of meteorological variables at local and regional scales but also change signals of impact-relevant climate indices. Related projection uncertainties will be attached to all products.
- **Case 2, provision of user-tailored seasonal forecast information for the renewable energy and agriculture sectors:** BSC will undertake a complementary exercise to provide climate information for identified users in the renewable-energy and agriculture sectors from multi-

model seasonal forecasts. Multi-model forecasts will be built from the C3S operational seasonal forecast systems available in the CDS, the best multi-model combination being selected based on hindcast performance. The individual forecasts will be bias adjusted using either in-situ data for location specific problems (e.g. for wind energy power plants) or reanalyses and gridded data for the global-scale illustrations (e.g. for crop-yield estimates at continental scales). Aspects like the adequacy of the metadata, availability of documentation and provenance will be assessed at all the stages of the process. Forecasts for simple indices selected previously in an interaction with a small number of users will be formulated in a similar way and simplified impact models run with this climatological forcing to illustrate the full value chain. The forecast quality of the final combination will be assessed using [s2dverification](#), paying special attention to the wallclock time to obtain a comprehensive view of the data quality.

- **Case 3, integration of the VALUE downscaling validation framework into the CDS Toolbox:** Predictia will test the integration of new tools in the CDS toolbox considering the validation framework for downscaling methods developed in the COST-action [VALUE](#) (now continued in EURO-CORDEX, Maraun et al. 2015). This validation tool (which is already implemented using the R language and integrated within the [climate4R](#) framework) consists of a cross-validation protocol and a set of validation measures to assess several key aspects for users: temporal variability, extreme events, spatial coherence and variability, and inter-variable consistency. The implementation of this framework (workflow) in the CDS Toolbox will allow testing the integration of new tools in the toolbox and the integration of new components (index calculation, bias correction, etc.) with the existing ones (e.g. for data collocation) in the toolbox and will develop user guidance and recommendations for improvement.

4.5 Overall service evaluation

The overall service evaluation will be implemented guided by a set of key performance indicators (KPIs) that evaluate the degree to which the CDS fulfil the user requirements in terms of the quality of the service and products provided. A preliminary list of KPIs proposed to evaluate and quantify the quality of the CDS service by measuring its ability to provide the ECVs requested by the users and the ability to offer a timely and user-oriented processing capability of the CDS dataset are listed in Table 4.2. The first six of them target the evaluation of the CDS, the next seven the assessment of the toolbox, and the final two the quality of the products provided. The KPIs will be applied periodically using an automatic procedure.

KPI	Description
store coverage	availability of the data in the CDS
store throughput	average Mbps in a transfer of a fixed set of files
store interface performance: throughput	actual data provision capacity of the CDS when queried through its interface
store interface performance: efficiency	data provision efficiency of the CDS interface), store availability-service (availability of the CDS service
store availability: data sources	effective availability of selected ECVs for a case study in the CDS
toolbox functionality	completeness of the functionality
toolbox product quality: plots	dissemination quality of the graphical products offered by the software

KPI	Description
toolbox performance: data query throughput	actual data provision capacity of the data query functionality of the CDS toolbox when querying through its interface
toolbox performance: parallelisation ability	data provision efficiency of the CDS toolbox interface
toolbox performance: computation time	performance of the software in terms of computation time
toolbox performance: parallelisation ability	performance of the software in terms of its ability to parallelize calculations where appropriate
toolbox performance: memory footprint	performance of the software in terms of its ability to manipulate large data arrays
toolbox product quality: data	quality of the data files produced/provided by the software in terms of coherence and correctness of the data values
product quality: reproducibility and traceability	degree of reproducibility and traceability of the products produced/provided by the software

Table 4.2: Preliminary list of KPIs to measure the overall quality of service of the CDS.



Figure 4.6: Design prototype of a general web-dashboard giving an overview of KPIs evaluating the overall service of the CDS.

Information derived from user requirements needs to be integrated continuously during the contract. An initial way of surveying the users is providing them with a comprehensive list of the service functional requirements, which are established by C3S, the types of graphical and numerical products they expect, and that should all be appropriately defined and documented before the user engagement. A constant reassessment of the KPI set will further help optimising some of the

suggested indicators to better accomplish their monitoring functionality and adding those that are found to be most relevant to the users.

A common web-dashboard will be developed hosting different and customised monitoring results based on the KPIs designed. The web-dashboard could give a distinct overview (charts, statistics, etc.) of the CDS system in real time (Fig4.6). It also gives access to the hosted technologies and specialised dashboards with detailed information of, for instance, the hardware or user monitoring system aspects. The web-dashboard will be developed according to the consortium experience in software frameworks and web-applications (e.g. [Freva](#), [Climate4Impact](#), [Predictia's software](#)). To decide the solution to implement the web-dashboards existing approaches in use by other climate service centres or commercial monitoring tool providers, as well as open source solution will be evaluated based on the defined list of KPIs.

Table 4.3 shows the different possible implementation strategies and the challenges associated with each one. The suggested technical solutions will be discussed with C3S and decisions on implementation will be made accordingly. The two columns suggest either an open source solution or a commercial off-the-shelf (COTS) solution, but, of course, the solution can be a mixture of both. For potential service activities of open source and COTS or potential web services, a subcontracting budget has been allocated, an estimate of 7,200 € for service activities in 2019 and 2020. As there is a decision to be made in the first three months of the project, this estimate is based on a service fee of a potential open source candidate [Zabbix](#) (40 h consulting service).

Requested in the tender	Technical solution 1 Using open source solutions	Technical solution 2 Using commercial off-the-shelf (COTS) solutions
<p>Introduce a set of key performance indicators (KPIs) measuring technical quality of service, such as system availability, response time, capacity, speed, effectiveness of search, usability, INSPIRE compliance, etc., using proven methods, metrics and techniques</p>	<p>For implementation of performance type indicators open source tools are available. Besides the more traditional Nagios and Zabbix solutions, more modern full-stack solutions are also available (Sensu, Prometheus, Bucky). The consortium has experience in using and setting up Zabbix-based solutions.</p> <p>Pros: open source, able to measure most of the requested KPI's, knowledge base in the consortium Cons: additional programming is required, not a SaaS solution provider available.</p> <p>It is possible that for newly defined KPIs (e.g. aggregation of all downloads through OpenDAP per client IP) a more in-depth analysis is needed. Common approach</p>	<p>For measuring the listed KPIs existing off-the-shelf solutions are available. Pingdom and NewRelic are examples of such a commercial SaaS providers.</p> <p>Pros: Able to measure most of the requested KPIs out of the box, thus providing a quick start, includes a dashboard, Cloud based SaaS Cons: Payed for service, not INSPIRE compliance checking integrated but should be possible to add this, less flexibility for adding specific monitoring</p>
<p>In task 3.1 the (initial) KPI list will be defined. Based on this list the best</p>		

Requested in the tender	Technical solution 1 Using open source solutions	Technical solution 2 Using commercial off-the-shelf (COTS) solutions
	solution will be chosen from the five proposed solutions together with C3S.	
Newly defined KPI's	<p>It is possible that newly defined KPIs (e.g. aggregation of all downloads through OpenDAP per client IP per month) require more in-depth analysis. A common approach is to collect logfiles from all involved services in one database. For such approaches both open source and COTS solutions are available.</p> <p>Elastic Stack (The ELK stack) is Elasticsearch, Logstash and Kibana, together they provide a fully working real-time data analytics tool.</p> <p>Pros: open source, fully tailorable, very flexible, knowledge available in the consortium Cons: not a SaaS solution</p>	<p>SPLUNK</p> <p>Pros: easy to learn, well defined search syntax, knowledge available in the consortium Cons: less flexible</p>
Ensure that the set of KPIs spans a wide range of system performance aspects and user perspectives, e.g. related to user type (background, objectives, etc.) and access method (web, API)	<p>For monitoring system usage by users the Matomo platform can be used.</p> <p>Pros: Free open-source software 100% data ownership User privacy protection User-centric insights Customisable and extensible also available as SaaS. Cons: Additional programming required</p>	<p>Google analytics is a widely used SaaS application for analysing users perspectives.</p> <p>Pros: Many in depth analysis options possible, constantly growing set of possibilities, SaaS solution</p> <p>Cons: Additional programming required to enable specific usage monitoring although also with simple options available, data is stored and shared with Google</p>
Ensure that each KPI is defined in such a way that can be interpreted consistently over time (i.e. unaffected by specific hardware configurations or changes in technology)	This will be covered in task 3.1 where the specific KPIs will be defined.	
Continuously test, probe and measure CDS system performance	For both proposed technical solutions an online dashboard will be developed/configured that is able to show (near) real time CDS system performance. First versions will consist of collections of 'out of the box' KPI dashboards as provided by the different tools. The custom CDS dashboard will iteratively be developed and will grow during the	

Requested in the tender	Technical solution 1 Using open source solutions	Technical solution 2 Using commercial off-the-shelf (COTS) solutions
	project when more KPIs are available and can be integrated. The dashboards will be the basis for the periodic reporting of the KPIs to C3S.	

Table 4.3: Possible implementation strategies for suggested technical solutions using either an open source solution or a commercial off-the-shelf (COTS) solution.

4.6 User engagement

As explained in previous sections, further development of the C3S and its components, including the CDS, should be user-driven. This offer considers users' appreciation of the CDS content quality and completeness to measure user satisfaction and to develop recommendations for improvement and expansion of the CDS datasets and products based on user feedback as central elements of its strategy. Here, best practices from the previous C3S projects are the starting point, where users are explicitly engaged and a feedback system is developed; especially, the practices used in C3S 51 Lot 4 (DECM) will be used and further elaborated. The feedback system will include functionalities such as issue tracking for measuring the amount and status of user-relevant issues (with status posted/open/answered/resolved). The user feedback system is proposed to be developed in close cooperation with the C3S user support experts for enabling as much portability and compatibility with the C3S user engagement strategy and technical detail as possible.

Diverse user groups will be enabled to provide feedback on the use and fitness of the CDS in terms of strengths, challenges, difficulties and suggestions for improvement. The internal C3S tools to tackle this aim are the User Requirement Data Base (URDB) and the User Requirement Analysis Document (URAD). The project will periodically contribute to the URDB (which will be managed and maintained by the C3S 513 contract) with the user engagement information collected (organised following a set of criteria that will be negotiated with C3S). The contractor will also develop and maintain a URAD prioritising and categorising all URDB entries using both the information collected through the user engagement activities and the URDB. This will result in new entries into the URDB and also in further developments in the existing CDS structure. User engagement is needed to keep track of such developments and to create and manage an active community around the services offered by C3S. An approach that supports new users, but that also addresses the evolving needs of existing users, is required.

The user engagement activities are spread across several work packages (WPs) in the implementation plan. They are described in tasks 1.3, 2.3 and 3.3, which show substantial commonalities between them. For instance, those tasks will have overlapping set of users, although with slightly different interests and objectives (some are interested in accessing the datasets, while others will aim at manipulating the data before downloading it). For this reason a coordination task 0.7 has been created that will guide, coordinate and optimise the user-related activities. This task streamlines the simultaneous reporting requirements and provides a common user engagement approach that will differ only when the specific focus (datasets and products, toolbox or overall service) requires it.

C3S users include scientists, consultants, knowledge purveyors, planners and policy makers, the media and the general public. The need for reliable, quality controlled and up-to-date climate data and products is also formulated by international (e.g. ISO, CEN) and national standardisation bodies. These bodies might become intensive users of climate data in the near future. The approach in this

offer will also need to map out further user characteristics: their location, the sectors they are active in, the governance scale, and their main objectives. While the information from C3S should eventually benefit all of these users, earlier climate services projects with a quality control aspect (CORE CLIMAX, C3S 51 Lot 4, CLIPC) suggest that the majority of direct users of the CDS are climate scientists, climate impact scientists and knowledge brokers with appropriate technical skills and available time and resources, rather than governments, business users, the media and the general public. These groups will not be excluded, but they will not be the contract’s main focus as they might be handled indirectly through knowledge purveyors. Technical staff in governments and businesses is not actively excluded. They will be invited to participate in user engagement activities, for example, when they visit the conferences we target with dedicated events to collect user feedback, and their views and background will be registered in the URDB.

While it is expected that a large group of users will be relevant for all three WPs, there will also be differences between those of higher relevance for each WP, an aspect that requires some flexibility and differences between approaches in WPs as noted in the respective task descriptions. For efficiency and consistency, the a general approach and time schedule will be designed in task 0.7 and used in a coordinated way by WPs 1 to 3. The activities will be coordinated around the bi-annual reporting scheduled.

The C3S 51 Lot 4 contract has distinguished between “data users” and “product users”, which will be associated with the user engagement work in WPs 1 (data) and 2 (toolbox), respectively. A topological illustration of the complexity of the user ecosystem is illustrated in Figure 4.7. The offer will also improve the overview of who the real users are. The WP3 service component is relevant to both data and product users, which provides a broader base to sample.

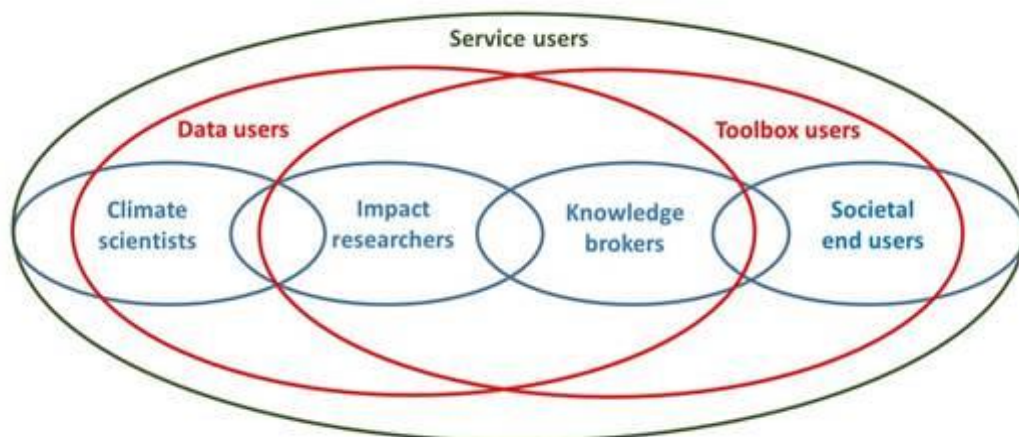


Figure 4.7: Topology of C3S user categories. The diagram illustrates the different kinds of users, with no sharp boundaries between user groups.

To capture the requirements of such a varied set of users during the course of the contract, two avenues will be followed:

- Digital means (surveys, virtual workshops, webinars) and face-to-face events will be combined to collect user feedback. The work will start with ~100 champion users that are already involved in various C3S contracts identified by the contractors. The strategy will aim to gradually expand the C3S audience to several hundreds. The information currently available in the URDB will also be an essential element in the design of this strategy. In WP1 (datasets) the emphasis will be on digital means, while for WP2 (toolbox) also face-to-face

events and interviews are considered appropriate. Many potential users will have limited opportunities or interest to travel just for the sake of providing specific feedback to the C3S CDS. Therefore, the face-to-face events will mainly be sessions or back-to-back meetings at conferences and professional meetings in which potential users participate. Table 4.4 provides a non-exhaustive list of relevant meetings and conferences that can be targeted for workshops and side events.

- To ensure direct interactions with users, a focus group of data and product users (up to 20 users) will be established and maintained during the contract activity as a second avenue. This focus group, which will be stratified in categories depending on the special interest in datasets, tools or the whole service, will be regularly consulted for feedback in workshops to discuss subsequent CDS releases. This continuous interaction will be required by the planned growth of the CDS datasets from 20-40 in early 2018 to 250-400 data sets by 2020, and the corresponding growth of the toolbox. To save on costs, about half of this focus group would be users from the subcontractors that are not directly involved in the contract execution and selected from a number of related research projects and operational activities. They will be complemented by new, external users covering key user areas. For these external users an option will be created to refund travel costs if needed.

Conference	Web site
EGU General Assembly 7-12 April 2019 in Vienna (annual event)	https://www.egu2019.eu (14,000 participants in 2017)
ECCA 28-31 May 2019 in Lisbon (event happening every second year)	http://ecca2019.eu/ (850 participants in 2017)
Climateurope festivals (one in 2018 and another one in 2020)	https://www.climateurope.eu/
ECMWF/C3S general events, e.g. C3S General Assembly 24-28 sept 2018 in Berlin	https://climate.copernicus.eu/events
C3S EQC workshop based on the 2017 EQC framework event in Barcelona	https://climate.copernicus.eu/events/evaluation-and-quality-control-workshop
Adaptation Futures 18-21 June 2018 in Cape Town (event happening every second year)	http://adaptationfutures2018.capetown/
International Conference Energy and Meteorology (ICEM) (annual event)	http://www.wemcouncil.org/wp/icem2018/

Table 4.4: Potentially relevant conferences and meetings to involve users.

All project partners involved in the user engagement have worked with (potential) users in business routine and/or in many earlier or ongoing C3S, FP7, H2020 and other climate services projects. In the first stage of the project, an inventory will be made of such users from earlier and parallel C3S projects that will be part of the strategy for user engagement to be delivered in the early stages of the contract. Table 4.5 offers an overview of relevant projects that, subject to C3S' agreement, will be contacted. This list will be expanded during the project as more initiatives are identified. Because there is a lot of information already available on user requirements, the contract will start with a

solid knowledge base. The user engagement strategy will try to avoid repetition of general, broad questions from these earlier exercises. Instead, both the digital surveys and the focus group meetings are planned to select urgent topics based on the results of previous user engagement activities. Examples include obtaining information about how users deal with model and observation uncertainty estimates, criteria for adequate tutorials for data/product use, requirements of the level of metadata information, perception of the need for reproducibility, strategies for the selection of preferred datasets or fit-for-purpose temporal and spatial resolution.

Project acronym	Website or brief contract information	Involvement of project partners
CLIPC	http://www.clipc.eu/	WENR
C3S 52 Lot 2	http://climate.copernicus.eu/secteur	WENR
C3S 441 Lot 1 SWICCA	http://swicca.eu/	WENR
EDgE	http://edge.climate.copernicus.eu/	
ECEM	http://ecem.climate.copernicus.eu/	
C3S 441 Lot 2 Clim4Energy	http://clim4energy.climate.copernicus.eu/	BSC
Urban SIS	http://urbansis.climate.copernicus.eu/	
AgriCLASS	https://agriclass.climate.copernicus.eu/	
WISC	http://climate.copernicus.eu/wisc-windstorm-information-service	
ERA4CS Clim2Power	https://clim2power.com/	DWD
C3S 513	Under evaluation	
COP 10	Under evaluation https://climate.copernicus.eu/tenders/cop010-user-learning-services	CNR, WENR
COP 20	Under evaluation http://ted.europa.eu/TED/notice/udl?uri=TED:NOTICE:038310-2018:TEXT:EN:HTML	
C3S 34a Lot 2 Magic	http://portal.c3s-magic.eu/#/	BSC, CNR, KNMI
C3S 312b Lot 4	https://climate.copernicus.eu/tenders/c3s312b-essential-climate-variable-products-derived-observations	CNR
C3S 311a Lot 3	https://climate.copernicus.eu/tenders/copernicus-c3s311a-collection-and-processing-situ-observations-deadline-has-	CNR

Project acronym	Website or brief contract information	Involvement of project partners
	been-extended-4	
C3S 422	https://climate.copernicus.eu/tenders/copernicus-c3s422-global-and-european-services-extended-deadline	CNR
C3S 25	https://climate.copernicus.eu/tenders/c3s25-software-development-climate-data-store-cds-toolbox	CNR
C3S 511	https://climate.copernicus.eu/tenders/copernicus-c3s511-quality-assessment-ecv-products-extended-deadline	CNR
C3S 51 Lot 3	https://climate.copernicus.eu/quality-assurance-multi-model-seasonal-forecast-products	BSC, Predictia
C3S 51 Lot 4	http://decn.climete.copernicus.eu/	FMI

Table 4.5: Relevant projects and programmes to involve C3S users.

4.7 Summary of equipment

Equipment	Describe Relevant Function	List each work package for which equipment will be used	Owned / To be Purchased / To be Leased
S2dverification (software), cran.r-project.org/web/packages/s2dverification	R package with functions to perform an analysis of the climate characteristics and estimate the forecast quality of seasonal-to-decadal predictions. Developed by BSC.	WP2, WP3	Owned (GPL-3 license)
ESMValTool	The Earth System Model eValuation Tool (ESMValTool) is a community diagnostics and performance metrics tool for the evaluation of Earth System Models (ESMs) that allows for routine comparison of single or multiple models, either against predecessor versions or against observations. BSC is a core developer.	WP1, WP2, WP3	Owned (Apache 2.0 license)
Virtual machines including web hosting	Linux based virtual machine (VM) including apache for website hosting is necessary for the local hosting of the web-dashboard and its implemented monitoring systems including the KPIs. The VM would be also the common development environment until C3S gives access to the CDS.	WP3	Provided by ECMWF or, alternatively, to be contracted externally
Free and open source software for monitoring aspects	A web-dashboard will host several and customised monitoring tools. Depending on the strategy to be	WP3	Free if using open source software To be leased if

Equipment	Describe Relevant Function	List each work package for which equipment will be used	Owned / To be Purchased / To be Leased
	assessed the software packages (licenses) will be selected from: Zabbix (GPL), Nagios (GPL), Sensu Core (MIT), Prometheus (APACHE), Bucky (MIT) , Matamo (GPL), ELK (Apache)		commercial expert service or support is required
Commercial off-the-shelf software for monitoring aspects	A web-dashboard will host several and customised monitoring tools. Depending on to be assessed strategy (see 1.X) the software packages (licenses) could include: Pingdom (SaaS), NewRelic (SaaS), Splunk (SaaS), GoogleAnalytics (SaaS)	WP3	To be Leased: Commercial Service, but with potential to be customized
Freva	The Freie Universität Evaluation System (Freva) is a software framework for scientific IT infrastructures on HPCs. The technology starts, monitors, combines scientific applications and data retrievals including customized KPIs in web and shell for research projects.	WP3, WP1	Owned (Free BSD license)
Drupal	Drupal is a free and open source content management system distributed under the GNU General Public License. Drupal is widely used (at least 2.3% of all web sites worldwide), it has a highly modular architecture and has a huge community of users and developers.	WP1	Free open source software
Quantile Mapping (QM)	Several R public (e.g. CRAN) and owned (e.g. MeteoSwiss) packages for employing the QM methodology for bias-adjustment and downscaling are currently available. The QM implementation used within the proposed project will build upon these sources.	WP2	Public and owned
S-ProvFlow	A set of tools and components to store, query and explore provenance and lineage information for runtime monitoring and validation of data-intensive methods.	WP2	Owned (Apache 2.0 license)
Metaclip visualizer	A web tool for Metaclip RDF metadata exploration.	WP2	Owned (GPLv3 license)
R Value	An R package implementing a number	WP2	Owned (GPLv3)

Equipment	Describe Relevant Function	List each work package for which equipment will be used	Owned / To be Purchased / To be Leased
	of indices and measures for the validation of statistical downscaling methods. These indices and measures were defined in the VALUE COST action.		license)

Table 4.6: Equipment to be used for the provision of the service.

4.8 References

Bates, J. J. and J. L. Privette (2012). A maturity model for assessing the completeness of climate data records. EOS, 93, 441, doi:10.1029/2012EO440006.

Maraun, D., M. Widmann, J.M. Gutiérrez, S. Kotlarski, R.E. Chandler, E. Hertig, J. Wibig, R. Huth and R.A.I. Wilcke (2015). VALUE: A framework to validate downscaling approaches for climate change studies. Earth's Future, 3, 2014EF000259.

5 Management and implementation plan

5.1 Introduction

BSC will coordinate this offer and subcontract eight other institutions with experience in climate services quality control, user engagement and the development of technical solutions. They have expertise in the provision of multi-sectoral climate information complementary to BSC, while there is also an important overlapping of expertise to ensure that sufficient backup exists to cover the project objectives and deliverables in case of problems. These partners have often worked together in previous projects and collaborations.

5.2 General organisation

The coordination will be achieved by Francisco Doblas-Reyes, head of the BSC Earth Sciences Department (BSC-ES), a research unit with dedicated services and technical groups that aims at responding to the growing needs expressed by a variety of stakeholders and public institutions. Beyond coordination, BSC will a) maintain an interface with ECMWF, b) ensure that the contractors have access to all the necessary information, c) collect information that allows the standardisation of the project outcomes, and d) participate directly in most of the contract technical and user engagement activities.

Francisco Doblas-Reyes is a senior scientist, director of the Earth Sciences Department at the BSC-CNS leading a team of 70 people. He has a vast scientific coordination experience, having coordinated to this date the FP7 SPECS project and the C3S_51 Lot 3 contract, been involved with management responsibility in collaborative European projects and acting as co-chair of the World Climate Research Programme (WCRP) Modelling Advisory Council (WMAC). The coordination will be supported by a project management team led by Eugene Griffiths.

Two subcontractors of the BSC (DWD and Predictia) will lead a thematic work package (WP) each aiming at distributing the tasks according to the main expertise of each relevant subcontractor and achieving a maximum efficiency. The other subcontractors (FMI, KNMI, Meteoswiss, FUB, CNR, and WENR) will contribute to the development of the tasks and the accomplishment of the deliverables with their well-recognised expertise in quality control, provenance, technical developments and user engagement. The entire group will bring their expertise and experience together to elaborate science-based qualitative and quantitative assessment of and recommendations for the CDS and its content. As a basis, all of them will provide the software and analyses to the BSC that will lead to the creation of a quality assurance template for all the CDS datasets, evaluations of the CDS toolbox and the whole service, and recommendations for the improvement and expansion of the service.

The project is structured in three technical and one management and communication work packages (WPs). The technical WPs are linked to a number of other C3S contracts and tenders, as explained in the previous section, and in particular with the contract C3S 511 (Figure 4.1).

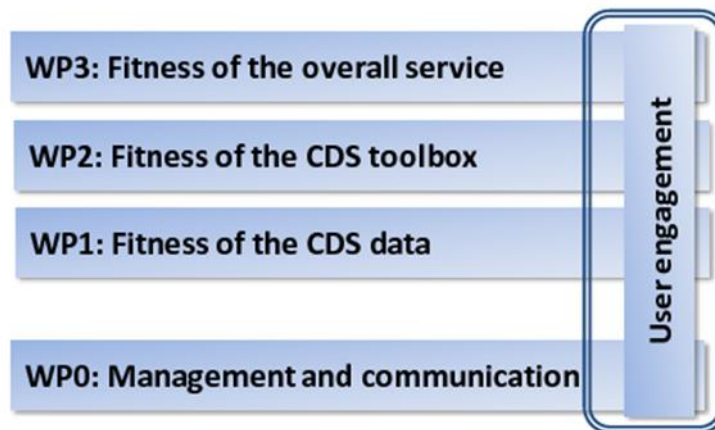


Figure 5.1: Work packages (WP) and the role of user engagement.

WP1 will assess the fitness for purpose of the CDS datasets, setting the minimum requirements and baseline criteria for including new products in the catalogue and providing comprehensive quality assurance information via a set of seamless quality assurance templates (QATs) and guidance for users of the datasets and products. WP2 will provide a set of tests and assessments of the CDS toolbox to evaluate the toolbox from multiple angles including the data model, the possibility to provide data provenance and reproducibility, the quality of the code and the computational methods. These activities will gather parameters from standards as ISO 9126, while vocabularies and common practices will be defined, if required, to ensure consistency. WP3 will measure and report the quality of service provided by the CDS infrastructure, with the work structured around a set of key performance indicators (KPIs) measuring technical quality of service and the result made available via a dashboard. In all cases user requirements will be identified to define the most relevant aspects expected from the QATs and a protocol to inform C3S with recommendations to avoid gaps, address drawbacks and shortcomings and identify limitations will be established.

WP0 will ensure the a) management of the project, including reporting and links to ECMWF, the partners and other relevant C3S contractors, and the communication and b) the coordination of the user engagement component to ensure a coherent approach across the other WPs.

The detailed WP descriptions provide full information on the nature of the work that will lead to the development of the evaluation and quality control solution. However, the consortium remains flexible to include additional features and modify those already planned to accommodate the feedback from both the user group and C3S.

Given the key role of project management in the success of this kind of projects, Mr Griffiths will be backed up by another project manager, Ms Dorota Chmielewska, who will follow closely the project activities and will be available to take over the project management at any time should a problem occur or additional human resources be needed at some specific point to manage the project. This offer follows the strategy of having two project managers familiar with the activities and progress to ensure the administrative and organisation supervision of the project under any circumstance, although only one will be charged to the contract at a time. The acting project manager will conduct all management tasks: administrative, contracting and financial matters, all stages of progress reporting, links with the subcontractors and C3S, teleconference minutes and meeting organisations, and assist in progress reporting. The managers have vast experience in international business, European projects and, especially, Copernicus contracts.

A communication officer based at the BSC, Dr Isadora Jiménez, will also be involved to implement the communication and documentation strategy. She will ensure the link with the technical and scientific development of the contractor and subcontractors and be involved in the user engagement, prepare all sorts of information material required (videos, fact sheets) based on both the project and other information sources, develop the project web site (and its link to social media if sufficient relevant activity is detected) and contribute to the organisation of events.

In the event that any issue arises that requires resolution, the first point of contact will be the project manager. The project manager will be responsible for working with C3S to agree an action plan to resolve the issue, informing the steering committee of the progress through to satisfactory resolution. In the event that escalation is required, C3S will contact the project leader.

As each stage needs interactions between a large number of actors, the progress of the tasks will be fully documented for traceability and efficiently informing all actors. This will be particularly the case with the definition of task owners and the interaction with the users to offer a coordinated view of the contract to the outside world. The whole process will be documented in the contract internal wiki. For this methodology to work efficiently, the following rules have been set among the subcontractors:

- Addressing adaptation: the contract outcome must provide information for climate services and short-term adaptation together because different users approach climate information, where many (although not all) of them are already familiar with the climate-change and variability problem.
- Monthly teleconferences with subcontractors will be scheduled to document progress. Some teleconferences may include the stakeholder panel and, if considered relevant, members of the SIS user group. Four physical meetings will also take place, gathering subcontractors and, if relevant, a subset of users.
- A first version of each quarterly activity report will be asked to each subcontractor two weeks before the deadline of the quarterly activity report to be delivered to C3S. This will allow performing at least one iteration of each document before submission.
- The subcontractor deadline for the completion of the deliverables will be one month before the report being delivered to C3S, allowing an internal review by all participants (including the advisory panel).

Most of the activity of the project will be coordinated through the project web area, which will consist in two spaces: a website hosted by C3S that will give the contract visibility and favour the interaction with the users, and a wiki associated with a gitlab facility where all subcontractors can find the contract documentation and progress and share the feedback, exchange experiences, engage in scientific or technical discussions, etc. The BSC Twitter account will be used to announce all public reports of interest to the users and developments that C3S might agree with disseminating. These activities will be carried out by the project manager, Eugene Griffiths, and the BSC-ES communication expert, Isadora Jiménez.

There are no plans to collect personal information (the user engagement and user feedback information will be anonymised, unless C3S requires otherwise). However, it is noted that the BSC adheres to the EC legislation and organisational guidelines with regard to the protection of any personal data (including EU Directive 95/46/EC).

5.3 Organigram

Figure 5.2 illustrates how the BSC will work together with the eight subcontractors to deliver the objectives requested in this offer. While the BSC will ensure the management of the contract and the communication with C3S and other institutions with the personnel mentioned in the previous subsection plus the contract leader, it also participates along with the eight subcontractors in the scientific and technical activities. All subcontractors will report technically, financially and from an administrative point of view to the BSC. The only link with C3S will be done via the management office, unless C3S wishes to implement a different solution, which could be applicable in specific cases.

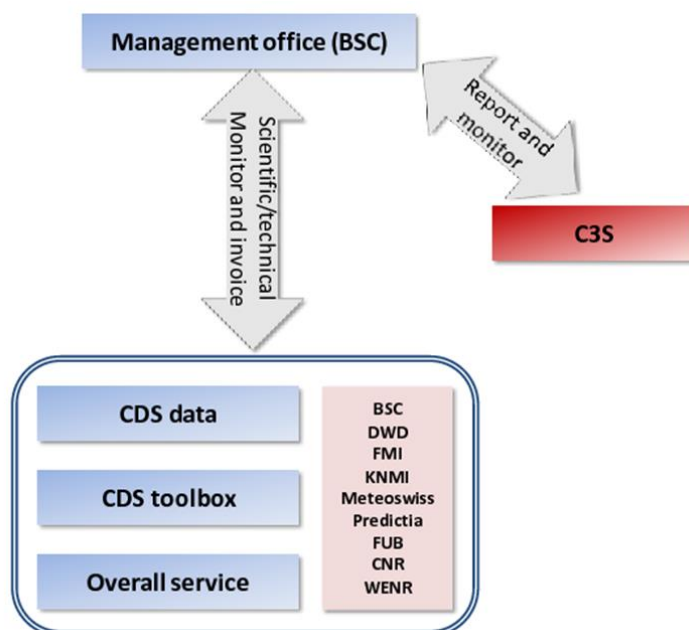


Figure 5.2: Organigram with the links between the main actors of this offer

5.4 Gantt chart and PERT chart

Table 5.1 shows the schedule of the different tasks and the deliverables at the time they are expected to be handled to C3S. The service will be offered for 36 months, with an estimated start date of July 2018. The table is split in two, one for each half of the contract, for better visualisation.

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
T0.1																		
T0.2																		
T0.3																		
T0.4				0.4.1			0.4.2	0.4.3							0.4.4			
T0.5																		
T0.6			0.6.1			0.6.2												
T0.7						0.7.1												0.7.2
T1.1			D1.1.1 D1.1.2 D1.1.3			D1.1.4												D1.1.5 D1.1.6
T1.2						D1.2.1			D1.2.2			D1.2.3			D1.2.4			D1.2.5 D1.2.6
T1.3						D1.3.1 D1.3.2						D1.3.3						D1.3.4 D1.3.5
T2.1						D2.1.1						D2.1.2						
T2.2												D2.2.1 D2.2.2 D2.2.3						
T2.3						D2.3.1 D2.3.2						D2.3.3						D2.3.4 D2.3.5
T3.1			D3.1.1															
T3.2						D3.2.1			D3.2.2			D3.2.3 D3.2.4			D3.2.5			D3.2.6
T3.3						D3.3.1 D3.3.2						D3.3.3						D3.3.4 D3.3.5

Month	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Task																		
T0.1																		
T0.2																		
T0.3																		
T0.4	0.4.5	0.4.6								0.4.7			0.4.8	0.4.9				
T0.5																		
T0.6																		
T0.7																		
T1.1												D1.1.7						
T1.2			D1.2.7			D1.2.8			D1.2.9			D1.2.10	D1.2.11		D1.2.12			D1.2.13
T1.3						D1.3.6						D1.3.7	D1.3.8					D1.3.9
T2.1						D2.1.3	D2.1.4					D2.1.5	D2.1.6	D2.1.7				
T2.2						D2.2.4	D2.2.5											D2.2.6
T2.3						D2.3.6						D2.3.7	D2.3.8					D2.2.7
T3.1																		D2.2.8
T3.2			D3.2.7			D3.2.8			D3.2.9			D3.2.10			D3.2.11			D3.2.12
T3.3						D3.3.6						D3.3.7	D3.3.8					D3.3.9

Table 5.1: Schedule of the activities described in this offer (with the period during which the task is active being coloured, with a different colour per WP) and of the deliverables planned (where the deliverable is named using the code workpackagenumber.tasknumber.deliverablenumber) to reach the objectives.

5.5 Summary of work packages and deliverables

The following table displays a summary of WPs, the deliverables and their effort in person months.

Work package	Deliverable Reference	Effort in person-months
WP0 Management, communication and coordination of user engagement	D0.4.1 Implementation plan 2019	2
	D0.4.2 Preliminary financial information	2
	D0.4.3 Annual report	3
	D0.4.4 Implementation plan 2020	2
	D0.4.5 Preliminary financial information	2
	D0.4.6 Annual report	3
	D0.4.7 Implementation plan 2021	2
	D0.4.8 Preliminary financial information	2
	D0.4.9 Annual report	3
	D0.4.10 Final report	3
	D0.6.1 Wiki and gitlab for contractor collaboration	6
	D0.6.2 Contract website	5
	D0.7.Strategy for user engagement	3.53
	D0.7.2 Mid-term evaluation of the user engagement strategy	4
Total WP0 Effort		42.53
WP1 Fitness of the CDS data	D1.1.1 Consistent set of QAT designs for all dataset categories supported by the CDS	8.56
	D1.1.2 Protocols and workflows for initiating, developing and updating QATs, including definitions of minimum requirements and procedures for publication of new datasets in the CDS catalogue	8

Work package	Deliverable Reference	Effort in person-months
	D1.1.3 Definition of shared vocabularies and common practices to ensure consistency of QATs across the CDS	8
	D1.1.4 Report on relevant international standards and best practices related to quality control and/or quality assessment of scientific data, including an assessment of their applicability in the context of this tender	6
	D1.1.5 Content Management System for managing collaborative development of QAT content	8
	D1.1.6 Update of the framework deliverables	8
	D1.1.7 Update of the framework deliverables	8
	D1.2.1 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.3 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.4 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.5 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.6 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.7 Update of the QATs	8
	D1.2.8 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.9 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.10 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.11 Update of the QATs	8
	D1.2.12 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.13 Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	6
	D1.2.14 A QAT for each dataset in the CDS catalogue	8
	D1.3.1 Bi-annual report on user	6

Work package	Deliverable Reference	Effort in person-months
	engagement activities, URAD updates and recommendations on evolution of the CDS data	
	D1.3.2 Contribution of user requirements for CDS data to the URDB	8
	D1.3.3 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	6
	D1.3.4 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	6
	D1.3.5 Contribution of user requirements for CDS data to the URDB	8
	1.3.6 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	6
	1.3.7 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	6
	1.3.8 Contribution of user requirements for CDS data to the URDB	8
	1.3.9 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	7
Total WP1 Effort		205.56
WP2 Fitness of the CDS Toolbox	D2.1.1 Definition of a quality assurance framework for the CDS toolbox and all its components	10
	D2.1.2 Assessment of the current toolbox tracking system and design of the required extensions	10
	D2.1.3 Definition of shared vocabularies and common practices to ensure consistency of quality assurance information and user guidance for all elements of the CDS toolbox	10
	D.2.14 Specification of provenance exploitation use cases and technical solutions	10
	D2.1.5 Test Implementation Plan	12
	D2.1.6 Prototypical provenance tracking and management system	13
	D2.1.7 Finalised list of protocols and quality assurance requirements for the inclusion of new tools in the CDS Toolbox	12
	D2.2.1 Toolbox EQC test and assessment	14.05
	D2.2.2 User guidance on quality and applicability based on F4P outcomes	12

Work package	Deliverable Reference	Effort in person-months
	D2.2.3 Definition of the real-world test cases	12
	D2.2.4 Toolbox EQC test and assessment	12
	D2.2.5 User guidance on quality and applicability based on F4P outcomes	12
	D2.2.6 Toolbox EQC test and assessment	12
	D2.2.7 User guidance on quality and applicability based on F4P outcomes	12
	D2.2.8 Prototype with the implementation of the real-world test cases	13
	D2.3.1 Contribution of user requirements for CDS data to the URDB Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	11
	D2.3.2 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	10
	D2.3.4 Contribution of user requirements for CDS data to the URDB	8
	D2.3.5 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	10
	D2.3.6 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	10
	D2.3.7 Contribution of user requirements for CDS data to the URDB	8
	D2.3.8 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	10
	D2.3.9 Bi-annual report on user engagement activities, URAD updates and recommendation on evolution of the CDS data	10
Total WP2 Effort		253.05
WP3 Fitness of overall service	D3.1.1 Definition of KPIs on service quality	6.96
	D3.2.1 Quarterly report on service quality KPIs	4
	D3.2.2 Quarterly report on service quality KPIs	4
	D3.2.3 Quarterly report on service quality KPIs	4
	D3.2.4 Web dashboard and user feedback system	6
	D3.2.5 Quarterly report on service quality KPIs	4
	D3.2.6 Quarterly report on service quality	4

Work package	Deliverable Reference	Effort in person-months
	KPIs	
	D3.2.7 Quarterly report on service quality KPIs	4
	D3.2.8 Quarterly report on service quality KPIs	4
	D3.2.9 Quarterly report on service quality KPIs	4
	D3.2.10 Quarterly report on service quality KPIs	4
	D3.2.11 Quarterly report on service quality KPIs	4
	D3.2.12 Quarterly report on service quality KPIs	4
	D3.3.1 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	5
	D3.3.2 Contribution of user requirements for CDS infrastructure to the URDB	6
	D3.3.3 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	5
	D3.3.4 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	5
	D3.3.5 Contribution of user requirements for CDS infrastructure to the URDB	6
	D3.3.6 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	5
	D3.3.7 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	5
	D3.3.8 Contribution of user requirements for CDS infrastructure to the URDB	6
	D3.3.9 Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	5
Total WP3 Effort		104.96
TOTAL		606.10

Table 5.2: Summary of WPs and deliverables.

5.6 Work package description

Work package #	WPO	Start/End date	M1/M36
Work package title	Management, communication and coordination of user engagement		
Participants (person months)	BSC (30), FMI (5), WENR (7.53)		
Other main direct cost elements	Organisation of four project meetings and one workshop		

Main objectives

This work package will ensure the a) management of the project, including reporting and links to ECMWF, the partners and other relevant C3S contractors, and the communication (via a web site, social media, participation in conferences and workshops) and b) the coordination of the user engagement component to ensure a coherent approach across the other WPs.

Description of activities

Task 0.1 (**BSC**; M1-M3) Description of the service: The description will include the management plan, the strategy for the interaction with the subcontractors and C3S, a procedure to deal with the data collected and the maintenance of a risk registry. The management plan will contain a description of how C3S recommends to engage with other relevant C3S contracts.

Task 0.2 (**BSC**; M1-M36) Contract management: The contract will require a solid management to ensure that the adequate level of reporting reaches C3S. Aspects like ensuring that all the human resources are in place at the right time and that new hiring is communicated to C3S, a periodic assessment of the risks to proceed with the contract as planned, and the measure and communication of the contract key performance indicators (e.g. to assess the deliverable quality) will also be dealt with. Monthly teleconferences will be organised with both the subcontractors and C3S to ensure an appropriate monitoring of the contract takes place. The monthly partner teleconferences will precede a similar teleconference with C3S where progress and issues will be discussed.

Task 0.3 (**BSC**; M1-M36) Project meetings: Four main meetings will be organised, a kick-off meeting (M1), two annual meetings (M12 and M24) and a final meeting (M36), to allow for the interaction between the contractors and to keep ECMWF and other relevant C3S projects informed. In addition, the subcontractors and the contractor will communicate via the monthly progress teleconferences and through the preparation of the brief quarterly progress reports to be sent to C3S.

Task 0.4 (**BSC**; M1-M36) Reporting: A series of reports will be provided to C3S. Feedback to those reports will be sought from C3S to take preventive measures. Quarterly reports will be delivered at least 20 days following the closing of the previous quarter. With the contract starting on the 1st of July 2018, they are due before the 20th of October, 20th of January, 20th of April, and 20th of July. It is planned to include the last one in the final report. Preliminary financial information due annually on the 15th of January is scheduled as a periodic deliverable. The first one is expected on the 15th of January 2019. Annual reports, due annually, will be sent on or before the 28th of February. The final report will be delivered 60 days after the end of the contract. A draft implementation plan for the year 2019 will be submitted during Q1 of the contract, while the finalised implementation plan will be submitted in October 2018. Similarly, draft implementation plans for 2020 and 2021 will be sent in February 2019 and 2020, with finalised implementation plans submitted in October 2019 and 2020, respectively.

Task 0.5 (**BSC**; M15-M19) Workshop: A mid-term meeting involving representative users and worldwide EQC experts will be organised to collect additional feedback in an intense manner and discuss open issues that might have been addressed in different ways by the relevant communities.

Task 0.6 (**BSC**; M1-M36) Website and dissemination: A website will be developed and maintained collecting the main outputs of the contract (quality assessment and visualization examples, documentation, reporting,

events, communication strategy, software developed, links to social media). The website will follow the templates and branding provided by C3S. A wiki and a gitlab facility with restricted access will also be created to favour the interaction between the contractors and keep track of the progress and issues addressed. The BSC Twitter account (@BSC_CNS), which has more than 4,500 followers, will announce any public reports and developments of the contract.

Task 0.7 (BSC, **WENR**; M1-M36) Coordination of user engagement: This task, which is closely linked to tasks 1.3, 2.3 and 3.3, will coordinate the way the contractors assess users' requirements and their experience of the CDS content quality and completeness. The aim is to measure user satisfaction to develop recommendations for the improvements of the CDS datasets, capabilities, products and overall service. As tasks 1.3, 2.3 and 3.3 will deal with overlapping sets of users, this task streamlines the simultaneous reporting requirements and provides a common user engagement approach that will be adapted to the specific needs of the user engagement tasks. In the first stage of the contract an inventory of users will be made from earlier or ongoing C3S, FP7, H2020 and other climate services project. Support to identify new users and to address the evolving needs of existing users will also be coordinated in this task. After about one year of contract, experiences with users in the three work packages will be evaluated and modifications to the plan provided for the remainder of the project lifetime. A focus group of data and product users (up to 20 users) will be established and maintained during the contract activity as a second approach. This focus group will be regularly consulted for feedback in workshops to discuss subsequent CDS releases. The common interaction with the internal C3S tools to store and monitor user requirements, the User Requirement Data Base (URDB) and the User Requirement Analysis Document (URAD), will be outlined in this task to avoid duplication of efforts. The user engagement information will be collected, filtered and stratified, the most relevant pieces feeding the URDB every twelve months. The URDB will be consulted regularly to extract, prioritise and categorise valuable information collected by other C3S contracts. The URAD will be updated every six months on the basis of the information available in the URDB and collected from the used engagement. Biannual reports on the new outcome from the user engagement activities will be produced in each WP to ensure that the preliminary conclusions reached are valid as more users become familiar with the use of the CDS service.

Deliverables				
<i>#</i>	<i>Responsible</i>	<i>Nature</i>	<i>Title</i>	<i>Due</i>
D0.4.1	BSC	Report	Implementation plan 2019	M4
D0.4.2	BSC	Report	Preliminary financial information	M7
D0.4.3	BSC	Report	Annual report	M8
D0.4.4	BSC	Report	Implementation plan 2020	M16
D0.4.5	BSC	Report	Preliminary financial information	M19
D0.4.6	BSC	Report	Annual report	M20
D0.4.7	BSC	Report	Implementation plan 2021	M28
D0.4.8	BSC	Report	Preliminary financial information	M31
D0.4.9	BSC	Report	Annual report	M32
D0.4.10	BSC	Report	Final report	M38
D0.6.1	BSC	Website	Wiki and gitlab for contractor collaboration	M3
D0.6.2	BSC	Website	Contract website	M6

D0.7.1	WENR	Report	Strategy for user engagement	M6
D0.7.2	WENR	Report	Mid-term evaluation of the user engagement strategy	M18

Milestones				
<i>#</i>	<i>Responsible</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M0.1.1	BSC	Description of the service	Report available to C3S	M3
M0.2.1	BSC	Hiring new staff	Report available to C3S	M3
M0.2.2	BSC	Hiring new staff	Report available to C3S	M21
M0.3.1	BSC	Project meeting summary	Meeting report available from the website	M2
M0.3.2	BSC	Project meeting summary	Meeting report available from the website	M13
M0.3.3	BSC	Project meeting summary	Meeting report available from the website	M25
M0.3.4	BSC	Project meeting summary	Meeting report available from the website	M36
M0.4.1	BSC	Draft implementation plan for 2019	Report available to C3S	M3
M0.4.2	BSC	Quarterly report	Report available to C3S	M4
M0.4.3	BSC	Quarterly report	Report available to C3S	M7
M0.4.4	BSC	Draft implementation plan for 2020	Report available to C3S	M8
M0.4.5	BSC	Quarterly report	Report available to C3S	M10
M0.4.6	BSC	Quarterly report	Report available to C3S	M13
M0.4.7	BSC	Quarterly report	Report available to C3S	M16
M0.4.8	BSC	Quarterly report	Report available to C3S	M19
M0.4.9	BSC	Draft implementation plan for 2021	Report available to C3S	M20
M0.4.10	BSC	Quarterly report	Report available to C3S	M22
M0.4.11	BSC	Quarterly report	Report available to C3S	M25

M0.4.12	BSC	Quarterly report	Report available to C3S	M28
M0.4.13	BSC	Quarterly report	Report available to C3S	M31
M0.4.14	BSC	Quarterly report	Report available to C3S	M34
M0.5.1	BSC	Workshop meeting summary	Meeting report available from the website	M19
M0.7.1	WENR	Draft user engagement strategy	Report available from the website	M3
M0.7.2	BSC	Report from the first focus group meeting	Focus group established	M8
M0.7.3	WENR	Internal evaluation of user engagement experience	Meeting of the partners working on user engagement to exchange experience and align the strategy accordingly	M15
M0.7.4	WENR	Workflow user feedback	The workflow to incorporate the user feedback in the reports and deliverables is fully established	M18

Work package #	WP1	Start/End date¹	M1/M36
Work package title	Fitness of the CDS data		
Participants (person months)	BSC (55.5), DWD (42), FMI (21), Meteoswiss (1), Predictia (20), FUB (8.6), CNR (46), WENR (11.46)		
Other main direct cost elements	Travel costs: C3S 512 meetings and WP meetings		

Main objectives

This work package will assess the fitness for purpose of the CDS datasets, setting the minimum requirements and baseline criteria for including new products in the catalogue and providing comprehensive quality assurance information and guidance for users of the datasets and products. Vocabularies and common practices will be defined, together with WP2, in order to ensure consistency. The quality assurance information will be provided for each dataset via a set of seamless quality assurance templates (QATs) based on the experience from previous contracts and managed centrally through appropriate criteria that also favour their display as an integral part of the CDS. The QATs will be filled in and updated including the most recent information available about the applicability, documentation, limitations and uncertainties of the dataset. User requirements will be identified to define the most relevant aspects expected from the QATs. A protocol to inform C3S with recommendations to avoid gaps, address drawbacks and shortcomings and identify limitations will be established.

Description of activities

Task 1.1 (BSC, DWD, FMI, KNMI, Predictia, **CNR**; M1-M30) Framework Development: This task will define the framework for the assessment of the quality and fitness for purpose of the data in the CDS. The general strategy is to provide a data-type seamless (homogenous across all data categories) QAT and evaluation approach based on the pre-existing EQC activities ongoing in C3S. The approach that will be developed in this task is a two-level EQC framework based on the QATs for each data set and a seamless framework for maturity and fitness for purpose gathering from the C3S_511 contract framework. The design of the QATs will be based on the templates developed in C3S_51 Lots 2, 3 and 4 for satellite data and products, seasonal forecasts and climate projections, respectively. To ease the collaborative development of the QATs a Drupal based Content Management System will be set up. The templates will

- be adjusted for the needs of this contract as needed
- address the technical information and data-provider quality of each dataset made available through the CDS including information on: description, availability of an appropriate documentation of the generation process and associated uncertainties, file formats and adequacy and completeness of the metadata and, whenever possible, also the quality of the data itself using standard metrics and diagnostics
- be revised in the context of similar approaches in use by other climate service centres (NOAA, ESGF, ESIP Information Quality Cluster, etc.)
- be compared with frameworks from the meteorological services and the private sector

The framework will allow setting the minimum requirements for including new products in the CDS catalogue.

Task 1.2 (BSC, CNR, **DWD**, FMI, FUB, KNMI, MeteoSwiss, Predictia; M4-M36) EQC of CDS datasets: QATs meeting the requirements defined in task 1.1 will be produced for each dataset in the CDS catalogue that is targeted by this tender (see Table 4.1). The protocols and workflows for initiating, developing and updating

¹ For this Tender, dates shall be indicated in months starting from M1.

QATs, including an independent assessment via maturity and fitness for purpose matrices, will also be defined in task 1.1. The exact steps to produce a QAT for a dataset depend on the design of the QAT used for the respective data type. QATs will be produced along with adequate user guidance consisting in documentation and tutorials for users to identify and correctly interpret the most relevant information of the data. The most important user guidance information will be incorporated in the QATs to prevent misuse of the data. In-depth information for inexperienced users or users looking for data for well-identified, specific applications will be made available via the independent assessment reports for the datasets/products of the CDS. The process will be automatized as much as possible to ensure a fast and effective workflow. To ease the collaborative development of the QATs a Drupal-based content management system will be set up. The QATs, once completed, will be made available through the CDS along with the datasets using an approach that depends largely of the CDS technology. The framework definition will also benefit from the user feedback system planned in task 3.2. Quarterly reports will be prepared for C3S to be regularly informed on overall quality of the CDS datasets, content, and most relevant quality shortcomings and to provide recommendations.

Task 1.3 (BSC, DWD, FMI, KNMI, FUB, **WENR**; M1-M36) User requirements: Users will be consulted and surveyed to help assessing the fitness for purpose of all CDS data products and to provide appropriate quality assurance information and guidance to users of the products. Contractors will engage with the pool of users identified using the approaches defined in task 0.7. The objective is to collect information about the datasets and products the users access as well as the most relevant aspects of the data quality. Information about the support and guidance the users expect will also be collected.

User engagement activities will consist of online training sessions and workshops during conferences. The information will be collected, filtered and stratified. It will feed the four sets of deliverables expected: reports on user engagement activities, contributions of the user requirements to the User Requirement Database (URDB), updates of the User Requirements Analysis Document (URAD), sets of periodic recommendations on the evolution of the CDS datasets. The URDB will be consulted regularly to extract valuable information collected by other C3S contracts. This workflow ensures that the information gathered is fed back to tasks 1.1 and 1.2 to improve the framework, the adequacy of the QATs and the data quality information collected. A user feedback system is put in place in task 3.3.

Deliverables				
<i>#</i>	<i>Responsible</i>	<i>Nature</i>	<i>Title</i>	<i>Due</i>
D1.1.1	CNR	Report	Consistent set of QAT designs for all dataset categories supported by the CDS	M3
D1.1.2	CNR	Report	Protocols and workflows for initiating, developing and updating QATs, including definitions of minimum requirements and procedures for publication of new datasets in the CDS catalogue	M3
D1.1.3	CNR	Report	Definition of shared vocabularies and common practices to ensure consistency of QATs across the CDS	M3
D1.1.4	CNR	Report	Report on relevant international standards and best practices related to quality control and/or quality	M6

			assessment of scientific data, including an assessment of their applicability in the context of this tender	
D1.1.5	Predictia	Software	Content Management System for managing collaborative development of QAT content	M18
D1.1.6	BSC	Report	Update of the framework deliverables	M18
D1.1.7	BSC	Report	Update of the framework deliverables	M30
D1.2.1	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M6
D1.2.2	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M9
D1.2.3	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M12
D1.2.4	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M15
D1.2.5	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M18
D1.2.6	DWD	Report	Update of the QATs	M18
D1.2.7	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M21
D1.2.8	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M24
D1.2.9	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M27
D1.2.10	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M30
D1.2.11	DWD	Report	Update of the QATs	M30
D1.2.12	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M33

D1.2.13	DWD	Report	Quarterly report on overall quality of the CDS datasets and content, quality shortcomings and recommendations	M36
D1.2.14	DWD	Dataset	A QAT for each dataset in the CDS catalogue	M36
D1.3.1	WENR	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M6
D1.3.2	WENR	Entries in database	Contribution of user requirements for CDS data to the URDB	M6
D1.3.3	BSC	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M12
D1.3.4	BSC	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M18
D1.3.5	DWD	Entries in database	Contribution of user requirements for CDS data to the URDB	M18
D1.3.6	DWD	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M24
D1.3.7	DWD	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M30
D1.3.8	BSC	Entries in database	Contribution of user requirements for CDS data to the URDB	M30
D1.3.9	FMI	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M36

Milestones				
<i>#</i>	<i>Responsible</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M1.1.1	Predictia	Initial version of content manage	URL shared with partners and ECMWF	M6

		ment system		
M1.2.1	DWD	Preliminary QATs with minimum requirements	QATs available in the initial version of the content management system	M6
M1.2.2	DWD	Workflow for QAT production	Report available on internal website	M18

Work package #	WP2	Start/End date	M1/M36
Work package title	Fitness of the CDS toolbox		
Participants (person months)	BSC (36), DWD (18), FMI (18), KNMI (36.6), Meteoswiss (21), Predictia (71), CNR (41), WENR (11.45)		
Other main direct cost elements	Travel costs: C3S 512 meetings, WP meetings; publications		

Main objectives

This work package will provide a set of tests and assessments of the CDS toolbox. The assessment methods and criteria will be user-oriented and comprehensive, and will evaluate the CDS toolbox from multiple angles, from the data model, the data provenance and reproducibility, the quality of the code and the computational methods. Whenever possible, the assessments will gather parameters from standards as ISO 9126. Vocabularies and common practices will be defined, together with WP1, in order to ensure consistency. Fitness of Purpose tests will be defined and performed, and their results will be made easily accessible to the users of the toolbox. Finally, complete real-world tests cases will be also be defined and performed. Users will be engaged to gather their feedback on the use and fitness of the toolbox.

Description of activities

Task 2.1 (**Predictia**, DWD, FMI, BSC, KNMI, MeteoSwiss, CNR; M1-M30) Framework development: A set of user-oriented quality criteria and assessment methods for different categories and different components of the CDS toolbox will be developed. These will be gathered in an implementation plan delivered within the first semester of the contract. The components include tools, common data model, application editor, provenance tracking mechanism and all the associated documentation. The criteria developed in the framework will enable the validation of the computational methods of the toolbox, and the reproducibility and traceability of the results, taking into account the application domain and the metadata profiles defined. The assessment will consider the international recognised standards for software (ISO9126) from the outset and will be extended to the wider range of applications of specific scientific software such as the CDS toolbox. The assessment will be reported in a similar form as the outcome of the CDS dataset assessment in task 1.1. This implies the use of a software maturity assessment and a fitness for purpose (F4P). Specific use cases will be defined to contextualise the tests and to score them in terms of parameters gathered from ISO9126 (functionality, reliability, performance, changeability, transferability, usability, integration, documentation). The following activities will be part of the framework:

- The set of shared vocabularies (including standard names and other types of metadata) and common practices will be defined in coordination with WP1 to ensure consistency of the quality assurance information and user guidance for all elements of the CDS toolbox. For instance, the assessment will check the consistency of the data description and the data model that document the processed products from seasonal forecasts, in-situ observations and climate projections.
- The provenance model for the CDS toolbox will receive special attention considering aspects such as coverage, standard compliance and extensibility. Common provenance exploitation use cases will be reported, taking into account the user requirements identified in task 2.3 and the provenance refinement will be the result of iterations with the user community and C3S.
- The engineering of the mechanisms enabling provenance-dependent execution of the applications developed with the toolbox will be outlined. The current software architecture of the toolbox will be reviewed to identify the points of integration of the mechanisms for capturing the lineage effectively and at a controllable overhead.

Task 2.2 (**Predictia**, FMI, BSC, KNMI, MeteoSwiss, **CNR**; M1-M36) EQC of CDS toolbox: A battery of tests following the framework defined in task 2.1 will be performed on the toolbox and presented in a form suitable for publication in the CDS in a seamless way with respect to the other components. The format will consist in

tables summarising the test evaluation and the fitness for purpose (examples are available in the technical solution section), which will be made accessible to new users of the toolbox following the feedback collected in task 2.3. The result of the assessment will be regularly updated with the F4P outcomes, which will be source for the guidance for users.

The evaluation of the CDS toolbox will be completed by performing real-world test cases. Three of these cases have been already defined, and more will be added as the contract progresses. A first case will consist of the setup and evaluation of automated systems for producing user-tailored climate scenarios based on the C3S CDS on national and European scale. The second test case will be an exercise to provide climate information for identified users in the renewable-energy and agriculture sectors from multi-model seasonal forecasts. The forecasts will be bias-adjusted using either in-situ data for location specific problems or reanalyses and gridded data for the global-scale illustrations. The third test case will test the integration of new tools in the CDS toolbox considering the validation framework for downscaling methods developed in the COST-action VALUE using a set of validation measures to assess several key aspects for users: temporal variability, extreme events, spatial coherence and variability, and inter-variable consistency. These cases will be used to illustrate the problems identified and make recommendations.

Task 2.3 (**DWD**, FMI, BSC, KNMI, MeteoSwiss, CNR; M1-M36) User requirements: In this task users will analyse the adequacy of the CDS toolbox performance to their needs. Team members will engage with the pool of users identified and users consulted using the approaches defined in task 0.7 to identify user requirements for toolbox content quality and completeness and how they are presented, to measure user satisfaction and to develop recommendations for improvements and expansion of the toolbox by building new applications that make use of climate data. A special focus of the work will be on the feedback on the user guidance for quality and applicability (fitness-for-purpose) of all elements of the CDS toolbox, including visualisation, interpolation, downscaling, statistical analysis, and for specific components like the Common Data Model and the Application Editor. The interaction strategy specific to this WP includes organise demonstrations on the basis of user's cases (online sessions, focus group meetings, workshops in conferences), analyse specific cases (for what purposes have users used the CDS tools, what questions did they try to answer and what tools did they use) and identify suggestions (including contributing software) for improvement. The user feedback system developed in task 3.3 will also be used to collect information. The information collected will feed the four sets of deliverables expected: reports on user engagement activities, contributions of the user requirements to the User Requirement Database (URDB), updates of the User Requirements Analysis Document (URAD), sets of periodic recommendations on the evolution of the CDS infrastructure.

Deliverables				
<i>#</i>	<i>Responsible</i>	<i>Nature</i>	<i>Title</i>	<i>Due</i>
D2.1.1	CNR	Report	Definition of a quality assurance framework for the CDS toolbox and all its components	M6
D2.1.2	KNMI	Report	Assessment of the current toolbox tracking system and design of the required extensions	M12
D2.1.3	Predictia	Report	Definition of shared vocabularies and common practices to ensure consistency of quality assurance information and user guidance for all elements of the CDS toolbox	M24
D2.1.4	KNMI	Report	Specification of provenance exploitation use cases and	M24

			technical solutions	
D2.1.5	Predictia	Report	Test Implementation Plan	M30
D2.1.6	Predictia	Report + source code	Prototypical provenance tracking and management system	M30
D2.1.7	KNMI	Report	Finalised list of protocols and quality assurance requirements for the inclusion of new tools in the CDS toolbox	M30
D2.2.1	BSC	Report	Toolbox EQC test and assessment	M12
D2.2.2	CNR	Report	User guidance on quality and applicability based on F4P outcomes	M12
D2.2.3	MeteoSwiss	Report	Definition of the real-world test cases	M12
D2.2.4	CNR	Report	Toolbox EQC test and assessment	M24
D2.2.5	Predictia	Report	User guidance on quality and applicability based on F4P outcomes	M24
D2.2.6	KNMI	Report	Toolbox EQC test and assessment	M36
D2.2.7	Predictia	Report	User guidance on quality and applicability based on F4P outcomes	M36
D2.2.8	MeteoSwiss	Report + source code	Prototype with the implementation of the real-world test cases	M36
D2.3.1	WENR	Entries in database	Contribution of user requirements for CDS data to the URDB	M6
D2.3.2	WENR	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M6
D2.3.3	DWD	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M12
D2.3.4	FMI	Entries in database	Contribution of user requirements for CDS data to the URDB	M18
D2.3.5	DWD	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on	M18

			evolution of the CDS data	
D2.3.6	BSC	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M24
D2.3.7	DWD	Entries in database	Contribution of user requirements for CDS data to the URDB	M30
D2.3.8	CNR	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS data	M30
D2.3.9	DWD	Report	Bi-annual report on user engagement activities, URAD updates and recommendation on evolution of the CDS data	M36

Milestones				
<i>#</i>	<i>Responsible</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M2.1.1	KNMI	Preliminary list of protocols and quality assurance requirements for the inclusion of new tools in the CDS toolbox	Report available on internal web site	M6
M2.1.2	CNR	Preliminary version of the test implementation plan	Report available on internal web site	M6
M2.1.3	KNMI	Assessment of the toolbox software architecture for the integration of the lineage capturing mechanisms.	Report available on internal web site	M12
M2.1.4	KNMI	Assessment of the current toolbox tracking system and design of the required extensions	Report available on internal web site	M12
M2.1.5	BSC	Update of test implementation plan	Report available on internal web site	M18
M2.2.1	Predictia	Preliminary definition of shared	Report available on internal web site	M6

		vocabularies and common practices to ensure consistency of quality assurance information and user guidance for all elements of the CDS toolbox		
M2.2.2	Predictia	Report on deliverable updates affecting the framework definition	Report available on internal web site	M12
M2.2.3	Predictia	Second report on deliverable updates affecting the framework definition	Report available on internal web site	M24

Work package #	WP3	Start/End date	M1/M36
Work package title	Fitness of overall service		
Participants (person months)	BSC (27), FMI (12), KNMI (6.5), Predictia (11), FUB (31), CNR (6), WENR (11.46)		
Other main direct cost elements	Test and acceptance environment (virtual machines for shared development, deployment and testing on e.g. Amazon Web Services, potential outsourced expert software or service); travel costs to WP meetings		

Main objectives

This work package will measure and report the quality of service provided by the CDS infrastructure and will inform C3S on user requirements, gaps, shortcomings and limitations, and opportunities for improvement of the CDS infrastructure. The work will be structured around a set of key performance indicators (KPIs) measuring technical quality of service that will be monitored and the result is made available via a dashboard. The set of KPIs will be revised during the contract according to the experience gained and the user requirements identified.

Description of activities

Task 3.1 (**BSC**, **FMI**, **Predictia**, **FUB**, **KNMI**; M1-M30) Framework development: A set of KPIs will be defined measuring technical quality of service, such as system availability, response time, capacity, speed, effectiveness of search for data and tools, usability, and compliance with INSPIRE and other standards using metrics and techniques that can be applied automatically. To ensure that the set of KPIs tests the overall service quality spanning a wide range of system performance aspects, user perspectives and access methods the set will be built through the following activities:

- Definition of a minimum set of requirements for the efficient access to the CDS datasets and the toolbox, its web interfaces and the API considering the feedback from a range of user types
- Evaluation and inclusion of KPIs already formulated for the CDS such as the list developed by predecessor contracts
- Summary of similar approaches in use by other climate service centres (NOAA, ESGF, ESIP Information Quality Cluster, etc.) and of approaches used in agronomy, ecology, forestry, hydrology, etc.
- Comparison of the framework proposed with solutions available from the meteorological services and the private sector

The suggested technical solution will be discussed with C3S and decisions on implementation will be made accordingly. The KPI framework will be updated regularly according to the experience gained in task 3.2 and the user requirements identified in task 3.3.

Task 3.2 (**BSC**, **FMI**, **Predictia**, **FUB**, **KNMI**, **CNR**; M4-M36) EQC of CDS infrastructure: The CDS service performance will be continuously tested according to the framework developed in task 3.1. The KPIs will collect information from the platform hosting the CDS at ECMWF, provided that access is granted, as well as from client side from outside ECMWF. This approach ensures that a wide range of system performance aspects and user perspectives can be considered. The list of KPIs will be discussed with annual frequency using the feedback provided in task 3.1, so that each KPI can be interpreted consistently over time (in case hardware and software configuration changes occur), to introduce newly identified KPIs and to address the user requirements from task 3.3.

An automated system will be developed so that its regular application measures performance over time. The retrievable statistics will be used to prepare quarterly reports for C3S summarising the overall system performance. In this context, task 3.2 depends on the access to the CDS system, its software and hardware components, although preliminary work can be developed on virtualised external platforms as described in the risk assessment of this offer.

A web-dashboard will be developed hosting statistics for the selected KPIs. The web-dashboard will be a software framework giving an overview of the status and performance of the CDS and toolbox. Modern applications for system performance and monitoring (e.g. zabbix, nagios, pingdom, newrelic) will be applied and customised to the CDS system according to strategies made in task 3.1. KPI interfaces or plugins will fulfill a variety of basic tests on the service, perform new tests developed for the CDS web and API application, always examining the compliance with the INSPIRE directive. While the WP1 content management system (CMS) will collect documents about the quality assurance templates, which will be also referred to in the KPIs, the web-dashboard will display the KPIs. The solution proposed for the web-dashboard could host or frame the CMS to give one common access point for both developers and users.

Task 3.3 (BSC, FMI, FUB, **WENR**; M1-M36) User requirements: Users will be consulted and surveyed to help assess the adequacy of the CDS service. Team members will engage with the pool of users identified and users consulted using the approaches defined in task 0.7. The objective is to collect user requirements regarding quality of service and to measure user satisfaction. Information will be collected to describe different user types. The focus will be on the KPIs that measure the technical quality of service (system availability, response time, capacity, speed, effectiveness of search, usability, INSPIRE compliance, guidance, and other aspects proposed by the users).

The user engagement will be made through a user feedback system that includes functionalities such as issue tracking for measuring the amount and status of user-relevant issues (with status posted/open/answered/resolved). It is suggested for this solution to be discussed in synergy with C3S' [User Service Desk](#) to promote compatibility. Also, best practices from other contracts could be exploited (e.g. from the C3S_51 Lot4 prototype piloting a user feedback system in 2018). The outcome will inform the revision of the set of KPIs and be used to provide recommendations for improvements and expansion of the CDS Infrastructure. The information collected will feed the four sets of deliverables expected: reports on user engagement activities, contributions of the user requirements to the User Requirement Database (URDB), updates of the User Requirements Analysis Document (URAD), sets of periodic recommendations on the evolution of the CDS infrastructure.

Deliverables				
<i>#</i>	<i>Responsible</i>	<i>Nature</i>	<i>Title</i>	<i>Due</i>
D3.1.1	BSC	Report	Definition of KPIs on service quality	M3
D3.2.1	FUB	Report	Quarterly report on service quality KPIs	M6
D3.2.2	FUB	Report	Quarterly report on service quality KPIs	M9
D3.2.3	BSC	Report	Quarterly report on service quality KPIs	M12
D3.2.4	FUB	Website	Web dashboard and user feedback system	M12
D3.2.5	Predictia	Report	Quarterly report on service quality KPIs	M15
D3.2.6	KNMI	Report	Quarterly report on service quality KPIs	M18
D3.2.7	Predictia	Report	Quarterly report on service quality KPIs	M21
D3.2.8	FUB	Report	Quarterly report on service quality KPIs	M24
D3.2.9	FMI	Report	Quarterly report on service quality KPIs	M27
D3.2.10	KNMI	Report	Quarterly report on service quality KPIs	M30
D3.2.11	FUB	Report	Quarterly report on service quality KPIs	M33

D3.2.12	FUB	Report	Quarterly report on service quality KPIs	M36
D3.3.1	WENR	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	M6
D3.3.2	FMI	Entries in database	Contribution of user requirements for CDS infrastructure to the URDB	M6
D3.3.3	FMI	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	M12
D3.3.4	BSC	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	M18
D3.3.5	FMI	Entries in database	Contribution of user requirements for CDS infrastructure to the URDB	M18
D3.3.6	BSC	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	M24
D3.3.7	WENR	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	M30
D3.3.8	FMI	Entries in database	Contribution of user requirements for CDS infrastructure to the URDB	M30
D3.3.9	WENR	Report	Bi-annual report on user engagement activities, URAD updates and recommendations on evolution of the CDS infrastructure	M36

Milestones				
#	<i>Responsible</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M3.1.1	BSC	Revision of KPIs on service quality	Report available on internal web site	M12
M3.1.2	BSC	Revision of KPIs on service quality	Report available on internal web site	M30
M3.2.1	FUB	Strategy for the implementation of the web dashboard	Report available on internal web site	M6

M3.2.2	FMI	Strategy for the implementation of the user feedback system	Report available on internal web site	M6
--------	-----	---	---------------------------------------	----

5.7 Key performance indicators

Table 5.3 lists the Key Performance Indicators that are proposed for an appropriate monitoring of the contract's implementation.

KPI #	KPI Title	Performance Target and Unit of Measure	Frequency of Delivery	Explanations / Comments
1	Contract management	Percentage of deliverables submitted on time: target 95%	Annually	To be included in the annual report
2	QATs completed	Number of QATs completed: target total 100 QATs	Quarterly	To be included in the quarterly reports
3	User engagement intensity	Number of entries to the URDB: target total 150 entries	Biannually	To be included in the corresponding deliverable
4	Toolbox assessment	Number of toolbox independent assessments: target total 25 tools	Annually	To be included in the corresponding deliverable
5	Service quality KPIs	Number of KPIs tested: target total 25	Quarterly	To be included in the quarterly reports

Table 5.3: Key performance indicators.

5.8 Risk management

Table 5.4 summarises the different risks that in our opinion might lead to delays in the contract implementation.

Work package: All					
Risk Name	Description	Likelihood	Impact	Response Strategy	Period
R1: Subcontractor not signing contract	The committed subcontractors might encounter problems (administrative or technical) that prevent them from signing the contracts with BSC	1	4	The task will be achieved by another subcontractor, or a new subcontractor be found.	M1-M3
R2: Staff availability and disruption	Risk of key staff assigned to the service not being available (at the start of their work or being unavailable), resulting in the objectives of the service not being delivered, or delivered late	2	2	Reliance on single points of expertise will be reduced at all times by making sure that multiple team members are able to work on the service, by documenting task progress and by identifying redundancies.	M1-M36
R3: Delay on hiring non-permanent staff	Several positions will have to be filled with non-permanent staff, which requires announcing the	2	2	Announce the positions as soon as news from the reviews are available and rely on the backup offered by other subcontractors	M1-M24

	positions and going through a selection process			until the position is filled.	
Work package: WPs 1-3					
R4: Low or slow response from users	Possibility of having a lower response rate or slow feedback collection from the users consulted	3	2	The contractors and subcontractors will gather as many contacts as possible from their own organisations for the user engagement to create a solid base. Intense work will be performed to take advantage of the information available in the URDB. The announcement of the user engagement tools will be enhanced to reach a wider user spectrum.	M1-M36
R5: Access to ECMWF platforms not available	No immediate access is given to the platform hosting the CDS at ECMWF	4	2	Contractor and subcontractors will provide a virtualised common developer environment for the dashboard, content management system and automatic feedback collection. Once the ECMWF platform is made available, the developments could be transferred to the dedicated machine.	M1-M36
R6: Number of high-quality datasets found to be low or late	A too small number of high quality datasets complicates the tests of the CDS components	3	2	Test datasets available and inform C3S	M1-M36
Work package: WP2					
R7: Real-world test cases not the most relevant to C3S and users	The three real-world test cases do not fit the priorities defined by C3S and the users consulted in task 2.3	3	1	New test cases will be discussed with the focus user group and C3S and negotiated with the contractor; as new test cases are expected to be defined as users and contractors gain experience, there is a solution already foreseen in the offer	M1-M18
Work package: WP3					
R8: Free or open software not adequate for dashboard implementation	Both free and proprietary solutions are considered for the dashboard implementation, a selection to be made following a discussion with C3S	2	1	A small budget has been foreseen to cover the cost of the proprietary solutions	M1-M12

Table 5.4: Risk register for each work package.

<i>Entry</i>	<i>Guidance</i>
Risk Name	Title to identify the risk
Risk Description	High level description of the risk scenario and consequences Please use the following structure: Risk of [event]...due to [cause]...that may result in [consequence]
Risk Likelihood	A numeric value denoting the estimate of the probability that the residual risk will occur. The possible values are: 5 – very likely (> 70% prob of occurrence) 4 – likely (between 50% and 70% prob of occurrence) 3 – possible (between 20% and 50% prob of occurrence) 2 – unlikely (between 5% and 20% prob of occurrence) 1 – remote (< 5% prob of occurrence)
Risk Impact	A numeric value denoting the severity of the impact of the residual risk (should it occur). The possible values are: 5 – catastrophic (Critical impact impeding the achievement of the strategic objectives) 4 – damaging (Damaging impact impeding the achievement of the strategic objectives) 3 – significant (Significant impact affecting achievement of operational objectives) 2 – moderate (Moderate impact on the achievement of an operational objective) 1 – low (Minor impact on the global performance)
Risk Response Strategy	The available strategies to deal with the identified risks are: Avoid: risk avoidance, working around those conditions or activities which introduce the risks; Reduce: risk mitigation or reduction through the proactive implementation of risk reduction activities; Accept: acceptance of the risk; in these cases, contingency plans can also be defined in case the risk occurs; Transfer/share: transfer or share a risk with other entities e.g. through subcontracting, insurances etc.

Table 5.5: Guidance table for risk register.

6 Annex I: Key personnel CVs

PERSONAL INFORMATION

Francisco J. Doblas-Reyes



Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC-CNS),
Jordi Girona 29, 08034 Barcelona, Spain

+34 93 413 77 19 NA

francisco.doblas-reyes@bsc.es

<http://www.icrea.cat/Web/ScientificStaff/Francisco-Javier-Doblas-Reyes-499>

Sex Male | Date of birth 07/06/1968 | Nationality Spanish

WORK EXPERIENCE

OCTOBER 2014 - PRESENT

ICREA research professor working as director of the Earth Sciences Department

Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC-CNS, Barcelona, Spain)

- Management of one of the four scientific departments of the BSC-CNS
- Gaining competitive funds and computing resources
- Research in climate modelling, efficient computing and Big Data, and atmospheric chemistry

DECEMBER 2009 – PRESENT

ICREA research professor working as senior scientist and head of the Climate Forecasting Unit

Institut Català de Ciències del Clima (IC3, Barcelona, Spain)

- Development of a seasonal and interannual climate prediction capability
- Illustration of the application of climate information in energy production
- Gaining competitive funding and computing resources
- Management of a research group of around 25 people

MARCH 2000 - NOVEMBER
2009**Research scientist**

European Centre for Medium-Range Weather Forecasts (ECMWF, Reading, UK)

- Execution of the tasks of several European projects
- Contribution to the development of the operational multi-model seasonal climate forecast system

Research institute and a 24/7 operational service, producing and disseminating numerical weather predictions to its Member States

FEBRUARY 1999 - FEBRUARY
2000**Post-doctoral scientist**

Centro de Astrobiología, Instituto Nacional de Técnicas Aeroespaciales (Madrid, Spain)

- Research on modelling of planetary atmospheres

Public research body specialized in aerospace research and technological development

JANUARY 1997- FEBRUARY
1999**Post-doctoral scientist**

Centre National de Recherches Météorologiques, Météo-France (Toulouse, France)

- Execution of the tasks of several European projects

Public research body specialized in weather and climate forecasting

OCTOBER 1992 - SEPTEMBER
1996**PhD student**

Department of Earth Physics, Astronomy and Astrophysics II (Universidad Complutense, Madrid, Spain)

- PhD thesis on atmospheric physics
- Public university

EDUCATION AND TRAINING

JUNE 1997

BSc degree in Mathematics

Universidad Complutense of Madrid (Spain)

SEPTEMBER 1992-MAY 1996

PhD in Physics

Universidad Complutense of Madrid (Spain)

Thesis entitled "Atmospheric blocking: GCM simulation and associated precipitation patterns"

OCTOBER 1986-JUNE 1991

MSc degree in Physics

Universidad Complutense of Madrid (Spain)

PERSONAL SKILLS

MOTHER TONGUE(S)

Spanish

OTHER LANGUAGE(S)

	UNDERSTANDING		SPEAKING		WRITING
	LISTENING	READING	SPOKEN INTERACTION	SPOKEN PRODUCTION	
English	C2	C2	C2	C2	C2
Replace with name of language certificate. Enter level if known.					
French	C2	C2	C2	C2	C1
Replace with name of language certificate. Enter level if known.					

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

**ORGANISATIONAL /
MANAGERIAL SKILLS**

- Leadership (currently responsible for a team of 70 people)
- Proven ability to obtain competitive resources (both financial and computing time)
- Experience in preparing strategic plans and periodic reports, as well as in representing the department in public and private fora

**PUBLICATIONS
PRESENTATIONS**

PUBLICATIONS, SELECTED PEER-REVIEWED PUBLICATIONS (OUT OF MORE THAN 140)

**PROJECTS
CONFERENCES
SEMINARS
HONOURS AND AWARDS
MEMBERSHIPS
REFERENCES**

- Massonnet, F., O. Bellprat, V. Guemas and F. J. Doblas-Reyes (2016). Using climate models to estimate the quality of global observational data sets. *Science*, **6311**, 452-455, doi:10.1126/science.aaf6369.
- Kirtman, B., S. Power, J.A. Adedoyin, G.J. Boer, R. Bojariu, I. Camilloni, F.J. Doblas-Reyes, A.M. Fiore, M. Kimoto, G.A. Meehl, M. Prather, A. Sarr, C. Schär, R. Sutton, G.J. van Oldenborgh, G. Vecchi and H.J. Wang (2013)*. Near-term climate change: Projections and predictability. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (Eds), 953-1028, Cambridge University Press.
- Doblas-Reyes, F.J., I. Andreu-Burillo, Y. Chikamoto, J. García-Serrano, V. Guemas, M. Kimoto, T. Mochizuki, L.R.L. Rodrigues and G.J. van Oldenborgh (2013). Initialized near-term regional climate change prediction. *Nature Communications*, **4**, 1715, doi:10.1038/ncomms2704.
- 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.
- Thomson, M.C., F.J. Doblas-Reyes, S.J. Mason, R. Hagedorn, S.J. Connor, T. Phindela, A.P. Morse and T.N. Palmer (2006). Malaria early warnings based on seasonal climate forecasts from multi-model ensembles. *Nature*, **439**, 576-579.

PROJECTS, AS PI (SELECTION OF PROJECTS, TOTAL COMPETITIVE FINANCIAL RESOURCES OBTAINED FROM 2010 OVER FIVE MILLION EUROS)

- European Climate Prediction system (EUCP), PI, European Commission H2020, 2017-2022, contract 776613, 1,026,493 euros.
- QA4Seas (Quality Assessment Strategies for Multi-model Seasonal Forecasts), Copernicus Climate Change Service, coordinator, 2016-2018, 731,214 euros.
- PRIMAVERA (PRocess-based climate sIMulation: AdVances in high resolution modelling and European climate Risk Assessment), PI, European Commission H2020, 2015-2019, contract 641727, 1,277,425 euros
- SPECS (Seasonal-to-decadal climate Prediction for the improvement of European Climate Services), coordinator, European Commission FP7, 2012-2017, contract 3038378, 1,615,305 euros.

HONOURS AND AWARDS

- Recipient of the Mumm-Gerbier Prize in 2006
http://www.wmo.int/pages/about/awards/winners_mumm_en.html

PERSONAL INFORMATION


Eugene Griffiths



 Nexus II Building, C. Jordi Girona 29, Barcelona, 08034

 +34 93 413 7190  +34 629 324 140

 eugene.griffiths@bsc.es

 Skype [eugene.griffiths](#)

Sex Male | Date of birth 18/02/1971 | Nationality British

POSITION

Head of Research Support, Transfer and Dissemination

WORK EXPERIENCE

OCT 2010 - PRESENT

Head of Research Support, Transfer and Dissemination

Barcelona Supercomputing Center, Spain

- Reporting to the centre's director, in charge of a team of professionals responsible for: finding and communicating funding opportunities, preparing project proposals, contract negotiation and management, financial legal and administration of research projects (BSC currently has over 90 H2020 projects running or in negotiation); in charge of communication unit responsible for project dissemination, corporate image, digital communication, internal communication, events and visits; also responsible for Technology Transfer Office and Strategy Support (including strategic e-infrastructure projects and European Technology Platform). Personally responsible for negotiation and management of BSC's industrial contracts with companies such as Intel, Microsoft, Cisco, Repsol, Samsung and Qualcomm.

[Business or sector](#) Research

APRIL 2009 - OCT 2010

Finance Programme Manager

CETaqua Water Technology Centre, Barcelona, Spain

- Reporting to the CEO, and leading a team responsible for detecting, monitoring and communicating R&D financing opportunities; coordinating the presentation of project proposals; legal, administrative and financial management of the centre's portfolio of projects (over 50 projects including Life+, FP7, and various with national funding)

[Business or sector](#) Research

MARCH 2008 - APRIL 2009

PRACE Project Work Package Leader

Barcelona Supercomputing Center, Spain

- Coordination of tasks of more than 40 people in 14 countries in order to assure that the signature-ready contact was available for the new European Research Infrastructure. Work Package responsibilities included: choice of the best legal form; design of governance structure, definition of funding and usage model, peer review process and operating model.

[Business or sector](#) Research

NOV 2005 - MARCH 2008

Project Manager, International Projects Department

CTM Centre Tecnològic, Manresa, Spain

- Reporting to business development manager, responsible for promoting the centre's involvement in international projects, particularly under the Framework Programme of the EC through the detection and exploitation of opportunities.

[Business or sector](#) Research

JAN 2003 – OCT 2005

Claims senior agent and key user

HP Direct

[Business or sector](#) IT

SEP 1999 – JAN 2003 **Research Project Manager**
 Litexco Group
 Business or sector Consulting

EDUCATION AND TRAINING

2000-2001 **Master's in Business Communication and Digital Technology**

Universidad Pompeu Fabra (IDEC), Barcelona

1993-1994 **M.Phil. with distinction in Philosophical Inquiry.**

University of Glasgow

2000-2001 **BA Honours joint in Politics and Philosophy**

University of Strathclyde

PERSONAL SKILLS

MOTHER TONGUE(S) English

OTHER LANGUAGE(S)

	UNDERSTANDING		SPEAKING		WRITING
	LISTENING	READING	SPOKEN INTERACTION	SPOKEN PRODUCTION	
Spanish	C1/2	C1/2	C1/2	C1/2	C1/2

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
 Common European Framework of Reference for Languages

COMMUNICATION SKILLS

- Good communication skills gained through years of experience interfacing with wide variety of professional profiles including researchers, managers, lawyers, project officers, finance staff etc.

**ORGANISATIONAL /
MANAGERIAL SKILLS**

- Leadership. Currently responsible for a team of 17 people, setting and reviewing annual objectives. Responsible for restructuring communication department and creating technology transfer office at BSC. Experience managing wide variety of international projects in the research field, ranging from R&D projects, coordination and support actions and creation of new research infrastructures.

COMPUTER SKILLS

- good command of Microsoft Office™ tools; SAP business one database, advanced user and responsible for definition of projects module

DRIVING LICENCE

- B

ADDITIONAL INFORMATION

**PROJECTS, CONFERENCES,
COURSES AND
MEMBERSHIPS**

Participation in numerous EC Framework programme projects including PRACE, Mont-Blanc, EUDAT, Rethink Big, Hipeac, RDA Europe, RISC, EXDCI and Eurolab4HPC among others.

Regular attendance of courses on areas ranging from project management (including PRINCE2), funding programmes, impact and exploitation, IPR management, consortium agreements, EU policy etc.

Member of the Steering Board of the European Technology Platform for High Performance Computing, Member of the European Association of Research Managers and Administrators (EARMA).

Regular attendance of conferences including EARTO (European Association of Research and Technology Organizations) and EARMA.

PERSONAL INFORMATION

Dorota CHMIELEWSKA



 NEXUS II building, Jordi Girona 29, 08034, Barcelona, Spain

 +34 934134082

 dorota.chmielewska@bsc.es

Sex Female | Date of birth 27/09/1988 | Nationality Polish

JOB APPLIED FOR
POSITION
PREFERRED JOB
STUDIES APPLIED FOR
PERSONAL STATEMENT

Research Project Manager at Barcelona Supercomputing Center, Barcelona

Working with researchers and professional services staff in the development of bids for external research funding. Monitoring, analysing and reporting on data related to Copernicus contracts and Horizon 2020 projects activities. Preparing and submitting summary reports, Quarterly Reports, Annual Reports and Implementation Plans. Controlling the financial aspects of Copernicus contracts ensuring that the invoices are correct and submitted to the ECMWF/ Contract coordinator.

WORK EXPERIENCE

2016 to present

Research Project Manager

Barcelona Supercomputing Center, Barcelona, Spain

International and European projects management: Horizon 2020 and COPERNICUS programmes

2013-2016

European Contracts Administrator

European Research & Innovation Office, University College London, London, United Kingdom

International and European project management

2012-2013

European Union Project Specialist

The International University of Logistics and Transport C.L Consulting & Logistics, Wroclaw, Poland

Management of projects co-funded by European Social Funds and International funding.

2012

Parliamentary Office. Project assistant

Polish Parliament, Wroclaw, Poland

EDUCATION AND TRAINING

2010-2012

Master Degree in European Studies

Institute of Political Science at University of Wroclaw, Poland.

2011

Economy and Political Science.

Universidad Carlos III de Madrid, Spain.

2007-2010

Bachelor degree in European Studies

Institute of Political Science, University of Wroclaw.

Specialization: Foreign Policy of the European Union

PERSONAL SKILLS

Mother tongue(s) Polish

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	Advanced (C1)	Advanced (C1)	Advanced (C1)	Advanced (C1)	Advanced (C1)
Spanish	Intermediate (B1)	Intermediate (B1)	Intermediate (B1)	Intermediate (B1)	Intermediate (B1)

Communication skills Good communication skills gained through my experience as parliamentary assistant and research project manager

Organisational / managerial skills Good command of management processes (currently responsible for project management and audits related to projects). Experience in organising people and team building

Digital skills Good command of Microsoft Office™ tools, wiki development. Outlook, Prezi.

ADDITIONAL INFORMATION


- Courses
- European Union Funds – Horizon 2020.
 - New European Liaison Officers: Getting the most out of European Funding, November 2014, Brussels, Event organized by UK Research Organization.
 - Marie Skłodowska-Curie Actions Individual Fellowships – Information and Proposal Writing Event organized by UK Research Organization, June 2014.
 - Marie Skłodowska-Curie Actions RISE - Information and Proposal Writing Event organized by UK Research Organization, January 2015.
 - European Research Council Starting and Consolidator Grants – Information and Proposal Writing Event– November 2014.
 - Other trainings at University College London.
 - Pronunciation and Public Speaking English Course: October – December 2014.
 - MyFinance Training

PERSONAL INFORMATION

Pablo Ortega



 Barcelona Supercomputing Center, C/ Jordi Girona 29, 08005 Barcelona (Spain)

 934137679

 pablo.ortega@bsc.es

 <https://www.bsc.es/ortega-montilla-pablo>

Date of birth 04/03/1982 | Nationality Spanish

WORK EXPERIENCE

12/09/2017–Present

Co-leader of the Climate Prediction Group

Barcelona Supercomputing Center (BSC), Barcelona (Spain)

- Supervision of 7 postdocs and 1 PhD student
- Coordination of the participation of the group to 4 european and 3 spanish national projects.
- Coordination of the group contribution to the EC-Earth climate model Consortium

01/02/2015–Present

Postdoctoral Researcher

NCAS Climate, University of Reading, Reading (United Kingdom)

- Analysing the role of ocean circulation on climate variability and its potential for decadal prediction.
- Undertaking lecturing activities (Master Degree: 40 hours)
- Supervision of a master thesis and a graduate student summer research stay

16/11/2013–15/01/2015

Postdoctoral Researcher

LOCEAN-IPSL/CNRS, Paris (France)

- Analysis of the mechanisms of decadal variability in the ISPL model
- Development of a novel nudging technique better initialise the ocean circulation
- Undertaking lecturing activities (Master Degree: 24 hours)

16/01/2012–15/11/2013

Postdoctoral Researcher

LSCE-ISPL/CNRS, Gif sur Yvette (France)

- Compilation of a comprehensive database of annually resolved ice-core records for Greenland
- Analysis of the atmospheric signals recorded in paleoclimate archives across the North Atlantic
- Supervision of an undergraduate student

EDUCATION AND TRAINING

02/06/2007–03/12/2011

PhD in Physics

EQF level 8

Universidad Complutense de Madrid, Madrid (Spain)

PhD Thesis: Ocean circulation and heat content variability from 1000 to 2100 AD

01/09/2006–01/06/2007

Master of Science in Geophysics and Meteorology

EQF level 7

Universidad Complutense de Madrid, Madrid (Spain)

Master thesis: Variability of the large-scale circulation in the Atlantic Ocean

30/09/2005–01/06/2006 **Master in Climate Risks and Environmental Impacts**
 Universidad Complutense de Madrid/AEMET, Madrid (Spain)

30/09/2000–31/06/2005 **Degree in Physics (Specialization in meteorology and climate)**
 Universidad de Salamanca, Salamanca (Spain)

EQF level 6

PERSONAL SKILLS

Mother tongue(s) Spanish

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C1	C1	C2
French	C1	C1	B2	B2	C1

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
 Common European Framework of Reference for Languages

Job-related skills

- Proven communication skill acquired after numerous presentations in scientific meetings, conferences, workshops, lectures, invited seminars
- Leadership and management (currently in charge of a team of 15 postdocs and 3 Phd Students)
- Mentoring skills (from undergraduate, to master students, PhDs and postdoctoral researchers)

ADDITIONAL INFORMATION

Selected Publications (out of more than 20)

Swingedouw D., P. Ortega, & Coauthors, “Bidecadal North Atlantic ocean circulation variability controlled by timing of volcanic eruptions”. *Nature Communications* 6, 6545, 2015.

Ortega P., & Coauthors, “A multi-proxy model-tested North Atlantic Oscillation reconstruction for the last millennium”. *Nature* 523, 71-74, 2015.

Robson J., P. Ortega and R. Sutton, “A reversal of climatic trends in the North Atlantic since 2005”, *Nature Geoscience* 9, 513-517, 2016.

Guillet S., C. Corona, M. Stoffel, M. Khodri, F. Lavigne, P. Ortega & Coauthors “Climate response to the 1257 Samalas eruption revealed by proxy records”, *Nature Geoscience* 10, 123-128, 2017.

Hawkins E., P. Ortega, and Coauthors “Estimating changes in global temperature since the pre-industrial period”, *BAMS* 98, 1841-1856, 2017

Selected Projects (From more than 15)

- SPECS:** FP7 project on seasonal-to-decadal climate Prediction. Period: 2013/2015 Role: Postdoctoral Researcher.
- DYNAMOC:** NERC-funded project to determine the variability and predictability of the AMOC. Period: 2015/2018 Role: Postdoctoral Researcher.
- PREFACE:** FP7 project to improve the representation of climate processes in the Tropical Atlantic. Period: 2017/2018 Role: PI at the BSC.
- INTAROS:** H2020 project to compile and exploit a new observational system in the Arctic region. Period: 2017/2018 Role: PI at the BSC.
- APPLICATE:** H2020 project to better understand the linkages between polar and non-polar climate. Period: 2017/2018 Role: PI at the BSC.
- HIATUS:** Spanish MINECO project to explore the recent HIATUS period in global temperatures. Period: 2017/2018 Role: PI at the BSC.

PERSONAL INFORMATION



Isadora Christel Jiménez García

📍 29, Jordi Girona, Nexus II 1st floor. Barcelona 08034 Spain

☎ (+34) 934 134 076 📠 (+34) 675 509 764

✉ Isadora.jimenez@bsc.es

💬 Skype Isadora.jimenez

Sex Woman | Date of birth 15/08/1981 | Nationality Spanish

PERSONAL STATEMENT

I have a Master's degree in Science communication and a Ph.D in offshore wind energy Impact assessment. Five years of science communication experience overlapped with ten years of research experience in direct contact with energy stakeholders. As a science communication specialist I give support to the Earth System Services Group of BSC (Barcelona Supercomputing Center) to stimulate interest and interaction with industrial stakeholders in energy, agriculture, insurance and water management. I coordinate a multidisciplinary team of five people specialised in Knowledge and Technology transfer. As part of National and European Funded projects such as EUPORIAS, SPECS, IMPREX, RESILIENCE or Clim4Energy I am involved in work packages of user engagement and dissemination. I am the communication manager of the COST action InDust and work package leader in EUPORIAS, PRIMAVERA and APPLICATE. I work in the scientific management team of S2S4E (H2020 project coordinated by our group at BSC).

WORK EXPERIENCE

November 2015 – Present

Science communication specialist

Barcelona Supercomputing Center – Earth Sciences Department

Team coordinator, coordination of the development of visual operational services (e.g.

<http://www.bsc.es/seasonalhurricanepredictions/>), WP and Deliverables coordination, organisation of user engagement initiatives, preparation of specialised dissemination materials.

April 2015 – October 2015

Communication and Project manager

Catalan Institute of Climate Sciences (IC3) - Climate Forecasting Unit. Barcelona

October 2013 – May 2015

Communication manager

Barcelona Alzheimer Treatment & Research Center (Fundació ACE). Barcelona

March 2012 – May 2015

Freelance communication consultant

 Validated ID s. l. (www.validatedid.com). Barcelona

December 2012 – May 2013

Communication project manager

University of Barcelona (UB). Barcelona

June 2008 – December 2012

Researcher, PhD Student

University of Barcelona (UB). Barcelona

August 2004 – May 2008

Research assistant

Capital Energy Offshore s.l. & Fundació Bosch & Gimpera

EDUCATION AND TRAINING

2008-2012

Doctor of Philosophy, Biodiversity

University of Barcelona (UB)

2011

Master's degree in Scientific, Medical and Environmental Communication

University Pompeu Fabra's Institute of Continuing Education (UPF-IDEC). Barcelona

2004

Bachelor's degree in Biology

University of Barcelona (UB)

PERSONAL SKILLS

Mother tongue(s) Other language(s)	SPANISH		FRENCH		WRITING
	UNDERSTANDING		SPEAKING		
	Listening	Reading	Spoken interaction	Spoken production	
ENGLISH	C1	C1	C1	C1	C1
FRENCH	A2	B1	A1	A1	A1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Communication skills

- Advanced graphic design skills (Illustrator, InDesign, Photoshop) and Intermediate user of video editing software (Premiere)
- Good oral communication and writing skills adapted to different target audiences.
- Press officer and community manager experience.

Organisational / managerial skills

- Experience in organization of scientific conferences (9th Barcelona-Pittsburgh Biennial conference), workshops and Open House activities.

Computer skills

- Advanced user of ArcGIS for spatial data visualization, R for statistics and ACCESS for Data Bases.

ADDITIONAL INFORMATION

Publications

- Christel, I.**, D. Hemment, D. Bojovic, F. Cucchiattia, L. Calvoa, M. Stefaner and C. Buontempo (2017). Introducing design in the development of effective climate services. *Climate Services*, doi:10.1016/j.cliser.2017.06.002.
- Buontempo C., H. M. Hanlon, M. Bruno Soares, **I. Christel**, J-M Soubeyroux, C. Viel, S. Calmanti, L. Bosi, P. Falloon, E. J. Palin, E. Vanvyve, V. Torralba, N. Gonzalez-Reviriego, F.J. Doblás-Reyes, E. Pope, P. Newton and F. Liggins (2017). What have we learnt from EUPORIAS climate service prototypes?. *Climate Services*, doi:10.1016/j.cliser.2017.06.003
- Torralba, V., F.J. Doblás-Reyes, D. MacLeod, **I. Christel** and M. Davis (2017). Seasonal climate prediction: a new source of information for the management of wind energy resources. *Journal of Applied Meteorology and Climatology*, doi:10.1175/JAMC-D-16-0204.1.

+ 9 publications from 2010 to 2016

Conferences

- D. Bojovic, M. Terrado, **I. Christel**, F. Doblás-Reyes, H. Jóhannsson, G. Fugmann, L. Cristini. From twitting to training: a communication approach to adapt to a changing Arctic climate. *European Meteorological Society (EMS)*. Dublin, Ireland. 2017
- D. Bojovic, E. van der Linden, **I. Christel**, E. Palin. Co-designing the next generation of climate models for a better informed society. 3rd European Climate Change Adaptation Conference. Galsgow, UK. 2017
- M. Terrado, D.Bojovic, **I.Christel**, L.I.Lledó, V.Torralba, N.González-Reviriego, A.Soret, F.Cucchiatti, L.Calvo, F.Doblás-Reyes. RESILIENCE - Climate predictions for the wind energy sector. Climateurope Festival. Valencia, Spain. 2017

+ 20 conferences contributions from 2008 to 2016

Presentations & Seminars

- Presentation of “CALIOPE: air quality forecast service” at the Smart City Expo World Congress. Barcelona, Spain. 2017
- Climate services: The added value of communication and social science. International Conference on climate science and climate services. Exeter, UK. 2016
- Presentation of “Project Ukko: seasonal wind speed predictions” at the Project Expo at Adaptation Futures. Rotterdam, Netherlands. 2016
- Moderator of the Working Group on Seasonal Predictions for Wind (SP4Wind). París, France. 2015

Memberships

- Member of ACCC (Catalan Association for Science communicationAssociació Catalana de Comunicació Científica)
- Member of INORE (International Network on Offshore Renewable Energy)



PERSONAL INFORMATION

Dragana Bojović

Address BSC-CNS, 1C Jordi Girona 29, 08034 Barcelona, Spain
 Phone +34 934134076; +34 633 080 778
 Email dragana.bojovic@bsc.es; dragunlija@gmail.com
 Sex Female
 Date of birth 13/03/1979
 Nationality Serbian

WORK EXPERIENCE

09/2016 – Present position

Researcher

Barcelona Supercomputing Center (BSC-CNS), Spain

- Project: Process-based climate simulation: Advances in high-resolution modelling and European climate risk assessment (PRIMAVERA)
 Main duties: Coordination of user engagement and dissemination related activities
- Project: C3S - Metrics and Access to Global Indices for Climate Projections
 Main duties: Coordination of project products tailoring through user consultation
- Project: Quality assurance for multi-model seasonal forecast products (QA4Seas)
 Main duties: Assessing user requirements for the evaluation and quality control of climate data
- Project: Advanced prediction in Polar regions and beyond (APPLICATE)
 Main duties: coordination of user engagement and the work of the project user group.
- Project: European climate prediction system (EUCP)
 Main duties: User engagement, validation of the project products and mapping knowledge gaps.

2010 – 2016

Researcher

Euro-Mediterranean Centre on Climate Change (CMCC), Venice, Italy

- Project: Platform for Climate Adaptation and Risk Reduction (PLACARD)
 Main duties: Social network analysis of the main actors in the climate change adaptation and disaster risk reduction communities.
- Project: Integrated water resource management at Dojran lake, Macedonia
 Main duties: Proposing the best practice for the development of the integrated water resource management and payment for ecosystem services scheme at Dojran lake.
- Project: Capitalising Climate Change Knowledge for Adaptation in the Alpine Space (C3Alps)
 Main duties: Development of an interactive, multi-lingual decision support platform for involvement of the public and experts in climate change adaptation in the Alpine space.

09/2014 – 08/2015

Network Specialist

Management Systems International, US

- Project: Performance evaluation of NASA/USAID Regional Visualisation and Monitoring System (SERVIR)
 Main duties: development of evaluation methodology and applying it to case studies in Central America, East Africa, and the Himalayan region; stakeholders focus group coordination, interviews; social network analysis.

04/2014 – 04/2015

Research Fellow

Ca'Foscari University, Venice, Italy

Main duties: Integrating computational social science with stakeholder participation, particularly in the field of climate change decision-support.

01/2009 – 08/2009

Research Associate

Institute for Multidisciplinary Research, Belgrade, Serbia

- Project: The South Eastern European Wind Energy (SEEWIND)
 Main duties: developing a study on socio-economic impact of the first wind farm in Serbia:

09/2008 – 12/2008

Research Assistant

Environmental Change Institute, Oxford University, Oxford, UK

- Project: Assessment of strategic future policy pathways to reduce carbon from the UK transport
 Main duties: Developing policy briefs of transport policies and measures.

EDUCATION AND TRAINING

- 09/2009 – 01/2014 **PhD**
Ca'Foscari University, Venice, Italy
 Science and Management of Climate Change
 Dissertation Title: Public participation in climate change adaptation using Information and communication technologies
- 09/2007 – 09/2008 **MSc**
Environmental Change Institute, University of Oxford, UK
 Environmental Change and Management
- 09/2010 – 02/2011 **10 ECTS**
The Autonomous University of Barcelona (UAB – ICTA), Spain
 Foundations of Ecological Economics
- 06//2006 – 08/2006 **15 ECTS**
University of Oslo, Norway
 Post-Graduate Course: Energy, Environment and Sustainable Development
- 1998 – 2004 **BCs**
Faculty of Biology, University of Belgrade, Serbia
 Ecology and Environmental Protection

PERSONAL SKILLS

Mother tongue(s)	Serbian					
	UNDERSTANDING		SPEAKING		WRITING	
	Listening	Reading	Spoken interaction	Spoken production		
Other language(s)						
English	C2	C2	C2	C2	C2	C2
Spanish	C1	C1	B2	B2	B2	B2
French	B1	B2	B1	B1	B1	B1
Italian	C1	C1	B2	B1	B1	B1

Communication skills ■ Excellent communication skills gained through my research experience and the work on user engagement and science communication;
 ■ Networking, stakeholder coordination and work with local communities.

Organisational / managerial skills ■ Organisation of focus groups, round tables, workshops;
 ■ Team member experience in multi-sectoral and multi-national environments.


Key publications ■ Terrado, M, Christel, I., **Bojovic, D.** et al. (2018) Climate Change Communication and User Engagement: A Tool to Anticipate Climate Change. Handbook of Climate Change Communication: Vol. 3
 ■ Christel, I., Hemment, D., **Bojovic, D.** et al. (2017) Introducing design in the development of effective climate services. Climate Services
 ■ **Bojovic, D.** et al. (2017) An online platform supporting the analysis of water adaptation measures in the Alps. Journal of Environmental Planning and Management 61(2): 214-229
 ■ **Bojovic, D.** et al. (2017) Social Network Analysis of the PLACARD Project Stakeholders. <http://www.placard-network.eu/visuals/cca-drr-network-analysis/>
 ■ **Bojovic, D.** et al. (2016) Framework for development of integrated water resource management plan at Dojran Lake. Report – the CEPF funded project: IWRM at Dojran Lake.
 ■ **Bojovic, D.** et al. (2015) Online participation in climate change adaptation: a case study of agricultural adaptation measures in Northern Italy. Journal of Environmental Management, 157:8-19.
 ■ Bonzanigo, L., **Bojovic, D.** et al. (2015) Agricultural policy informed by farmers' adaptation experience to climate change in Veneto, Italy, Regional Environmental Change 16(1): 245-258

PERSONAL INFORMATION



Nicolau Manubens Gil

 C/ Convent 35, 08251 Santpedor (Spain)

 (+34) 686279138

 nicolau.manubens@gmail.com

Sex Male | Date of birth 1991 | Nationality Spanish

PERSONAL STATEMENT

Computer scientist, with experience in software development and management, visualisation and analysis of voluminous data on high performance computing platforms, with good communication and teamwork skills, interested in working with Big Data technologies.

WORK EXPERIENCE

01/01/2016–Present

Research Support Engineer

Barcelona Supercomputing Center-Centro Nacional de Supercomputacion
Torre Girona, 31, C/ Jordi Girona, 08034 Barcelona (Spain)
www.bsc.es/earth-sciences

- Management, maintenance and development of tools for quality controlling, analysis and visualisation of large climate data sets on High Performance Computing platforms.

- Research support.

- Involvement in European projects.

Business or sector Professional, scientific and technical activities

10/10/2014–01/01/2016

Software Engineer

Institut de Ciències del Clima de Catalunya (IC3)
Doctor Trueta, 203, 08005 Barcelona (Spain)
www.ic3.cat

10/10/2012–10/10/2014

Internship

Institut de Ciències del Clima de Catalunya (IC3), Barcelona (Spain)

01/05/2012–01/10/2012

Web developer

Quark Informàtica, Santpedor (Spain)

- Design and development of a web application and its associated database for decision making and cost estimation in industrial design projects.

EDUCATION AND TRAINING

09/2009–08/2014

Computer Science Degree

EQF level 7

Universitat Autònoma de Barcelona (UAB), Escola d'Enginyeria (EE), Bellaterra (Spain)

Grade Point Average: 8.15 out of 10, first in the class.

Main skills covered: Databases, Computer architecture, Operating systems and networks, Software engineering, Artificial intelligence and computer vision, Computer graphics, Basis of mathematics, electronics, law and enterprise project management, Web development

PERSONAL SKILLS

Mother tongue(s) Catalan/Valencian, Spanish

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
English C1 (MECR)					

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
 Common European Framework of Reference for Languages

Communication skills - Excellent communication and teamwork skills developed during 5 years of experience in a large research team.

Organisational / managerial skills - Experience in task planning for small groups (up to 5 people).
 - Experience in European projects.

Digital skills - R programming language expertise.
 - Acquainted with Git software version control system.
 - Experience in bash, python, C, C++ and Unix systems.

Driving licence B

ADDITIONAL INFORMATION

Publications Manubens N. et al., 2018, "An R Package for Climate Forecast Verification", Environmental Modelling and Software 103C (2018) pp. 29-42

Conferences Manubens N. et al., 2017, "Evaluation and Quality Control for the Copernicus Seasonal Forecast Systems", IN33D Quality Control and Provenance of Scientific Data: Data Producers and Consumer Perspectives II, AGU Fall Meeting 2017

Poster presentations Manubens N. et al., 2017, "s2dverification: an R package for climate forecast verification", 7th International Verification Methods Workshop


Manubens N. et al., 2017, "startR: retrieval of multidimensional distributed data sets", useR! 2017 conference



R packages s2dverification v2.8.0, 2017, CRAN
 easyNCDF v0.0.4, 2017, CRAN
 startR v0.0.1, 2017, CRAN
 multiApply v1.0.0, 2018, CRAN

PERSONAL INFORMATION



Pierre-Antoine Bretonnière

 Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC-CNS), Jordi Girona 29, 08034 Barcelona, Spain

 +34 93 413 77 19  NA

 Pierre-antoine.bretonniere@bsc.es



Sex Male | Date of birth 01/10/1986 | Nationality French

WORK EXPERIENCE

September 2015 – present

Software Engineer in the “Computational Earth Sciences” team

Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC-CNS, Barcelona, Spain)

- Data and diagnostics team leader
- Big Data management projects
- Development of post-processing tools for general circulation models (GCM) outputs

Business or sector Computational applications in science and engineering

November 2012 – September 2015

Software Engineer – Data manager of SPECS European project in the Climate Forecast Unit

Institut Català de Ciències del Clima (IC3, Barcelona, Spain)

- Definition of data policy of the project (format, variables, conventions,...)
- Development of post-processing tools for general circulation models (GCM) outputs

Business or sector Research institute

February 2011 – August 2012

Research engineer in the “Climate modelling and Global change” team

Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (CERFACS, Toulouse, France)

- Parallelization of Arpege/Nemo/Oasis GCM on High Performance Computer Jade

Business or sector Research institute

EDUCATION AND TRAINING

February 2009- August 2009

Master Internship

Arianet SA, Milano, (Italy)

- Modelling of dense gas spread with lagrangian and eulerian models

2006-2009

Master degree in mathematical and mechanical modelling with distinction

Matmeca, engineer school, Bordeaux (France)

June 2008- August 2008

Master Internship

Bedford Institute of Oceanography, Halifax (Canada)

- Modelling of tides in Hudson Bay

PERSONAL SKILLS

Mother tongue(s) French

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
First Certificate of English, TOEIC.					
Spanish	C2	C2	C2	C2	C2

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Communication skills

- Mathematics and physics particular teacher during 3 years (2009-2011)

Computer skills

UNIX/LINUX and FORTRAN programming, knowledge of GRIB and NetCDF data formats, CDO, NCO, Ferret, Big Data technologies, OpenDAP/THREDDS

Driving licence

- B

ADDITIONAL INFORMATION

- Publications
- Presentations
- Projects
- Conferences
- Seminars
- Honours and awards
- Memberships
- References

Publications

Modulation of the climate response to a volcanic eruption by the Atlantic Multidecadal Variability, Martin Ménégoz; Christophe Cassou; Didier Swingedouw; Pierre-Antoine Bretonnière; Francisco Doblas-Reyes, Climate Dynamics
 RDA Interest Group on Weather and air quality, PA Bretonnière, F Benincasa, Geophysical Research Abstracts, Vol. 18, EGU2016-5994, 2016
 European wintertime influence of Lamb Weather Types on Temperature, Precipitation and Wind Speed, Cortesi N., V. Torralba, P. A. Bretonnière, N. Gonzalez-Reviriego, D. Peña-Angulo and F. J. Doblas-Reyes. Geophysical Research Abstracts. Vol. 18, EGU2016-14185, 2016. Geophysical Research Abstracts, Vol. 18, EGU2016-14185, 2016
 Weather regimes as a tool to validate seasonal forecasts. 16th EMS Annual Meeting & 11th European Conference on Applied Climatology (ECAC), Trieste, Italy, Cortesi N., D.Y. Lee, V. Torralba, N. Gonzalez-Reviriego, A. Soret, L. Lledó, P. A. Bretonnière and F. J. Doblas-Reyes.

References

- Dr. Francisco Doblas-Reyes
Barcelona Supercomputing Center, Barcelona, Spain
francisco.doblas-reyes@bsc.es
- Eric Maisonnave
CERFACS, Toulouse, France
Eric.maisonnave@cerfacs.fr

PERSONAL INFORMATION

Dr. Barbara Früh

 Gießener Str. 15, 63128 Dietzenbach, Germany

 +49 (0)69 8062-2968

 Barbara.Frueh@dwd.de

Sex female | Date of birth 05/12/1966 | Nationality German

WORK EXPERIENCE

- 08/2013 - present **Head of “Climate Projections and Climate Forecasts” unit**
Deutscher Wetterdienst (DWD), Frankfurter Str. 135, 63067 Offenbach, Germany, www.dwd.de
- Responsible for the climate modelling development and application activities at DWD
 - Supervision of projects in the fields of seasonal forecasts, decadal forecasts, evaluation of climate forecasts, analysis of regional climate projections, coupling of marginal seas to the regional climate model COSMO-CLM.
 - Coordination of the [CLM-Community](#) (Climate Limited-area Modelling-Community) which is an open, international network of scientists, who are employing and developing the regional climate model COSMO-CLM with more than 250 members at 68 institutions worldwide.
- Business or sector** National Meteorological Service
- 06/2008 – 08/2013 **Senior Scientist**
Deutscher Wetterdienst (DWD), Frankfurter Str. 135, 63067 Offenbach, Germany, www.dwd.de
- Model development of the regional climate model COSMO-CLM
- Business or sector** National Meteorological Service
- 01/2007 – 06/2008 **Senior Scientist**
Karlsruhe Institute for Technology (KIT, formerly University of Karlsruhe), Kaiserstraße 12, 76131 Karlsruhe, Germany, www.kit.edu
- Statistical analysis of the occurrence and strength of extreme precipitation events
- Business or sector** Research Institution
- 01/2001 – 11/2007 **Postdoctoral Studies**
Johannes-Gutenberg University Mainz, Institute for Atmospheric Physics, Becherweg 21, 55099 Mainz, Germany, <https://www.blogs.uni-mainz.de/fb08-ipa/>
- interdisciplinary project developing a decision support system for the hydrological cycle
- Business or sector** University
- 01/1997 – 12/2000 **Doctoral Studies**
Johannes-Gutenberg University Mainz, Institute for Atmospheric Physics, Becherweg 21, 55099 Mainz, Germany, <https://www.blogs.uni-mainz.de/fb08-ipa/>
- Modelling radiative transfer in cloudy and aerosol loaded atmosphere.
- Business or sector** University

EDUCATION AND TRAINING

- 01/1997 - 12/2000 **Doktor der Naturwissenschaften (PhD)**
Johannes-Gutenberg University Mainz, Institute for Atmospheric Physics, Becherweg 21, 55099 Mainz, Germany

- Thesis title: Development and evaluation of a model hierarchy for the simulation of actinic radiation in aerosol-loaded and cloudy atmosphere

10/1990 - 10/1996

Diploma in Meteorology

Johannes-Gutenberg University Mainz, Institute for Atmospheric Physics, Becherweg 21, 55099 Mainz, Germany

- Thesis title: Investigations on the nesting of meso- and microscale climate models

PERSONAL SKILLS

Mother tongue(s) German

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
French	A2	A2	A1	A1	A1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

ADDITIONAL INFORMATION

Selected Publications

- Dalelane, C., B. Früh, C. Steger, A. Walter, 2018: A pragmatic approach to build a reduced regional climate projection ensemble for Germany using the EURO-CORDEX 8.5 Ensemble. *Journal of Applied Meteorology and Climatology*, Early online release <http://journals.ametsoc.org/doi/abs/10.1175/JAMC-D-17-0141.1>.
- Kreienkamp F., A. Paxian, B. Früh, 2018: Evaluation of the Empirical-Statistical Downscaling method EPISODES, *Climate Dynamics*, in Review.
- Nikulin, G., R. Manzanos, J. Bhend, S. Herrera García, R.M. Cardoso, B. Früh, R. Tome, M. Dolores Frias, M.A. Liniger, K. Wyser, K. Fröhlich, S. Calmanti, J. Fernández, S. Asharaf, P.M.M. Soares, J.M. Gutiérrez, U. Hansson, M.E. Magariño, C. Spirig, M. Kolax, 2017: Dynamical and statistical downscaling of a global seasonal hindcast in eastern Africa. *Climate Services*, doi: <https://doi.org/10.1016/j.cliser.2017.11.003>
- Pham T.V., J. Brauch, B. Früh, B. Ahrens, 2016: Simulation of snow bands on the Baltic Sea with coupled model COSMO-CLM/NEMO. *Meteorologische Zeitschrift*, in Review.
- Reyers, M., H. Feldmann, S. Mieruch, J.G. Pinto, M. Uhlig, B. Ahrens, B. Früh, M. Kameshvar, N. Laube, J. Mömken, W. Müller, G. Schädler, C. Kottmeier, 2017: Development and prospects of the regional MiKlip decadal prediction system over Europe: Predictive skill, added value of regionalization and ensemble size dependency. *Earth System Dynamics*, in review.
- Pham T.V., J. Brauch, C. Dieterich, B. Früh, B. Ahrens, 2014: New coupled atmosphere-ocean-ice system COSMO-CLM/NEMO: On the air temperature sensitivity on the North and Baltic Seas. *Oceanologia*, **56**(2), 167-189, doi:10.5697/oc.56-2.167 ([online access](#)).
- Früh B. et al., 2011: Estimation of Climate-Change Impacts on the Urban Heat Load Using an Urban Climate Model and Regional Climate Projections. *Journal Applied Meteorology and Climatology*, **50**, 167 - 184.
- Früh B., H. Feldmann, G. Schädler, H.-J. Panitz, K. Keuler, D. Jacob, P. Lorenz, 2010: Determination of precipitation return values in complex terrain and their evaluation. *Journal of Climate*, **23**, 2257 - 2274.
- Früh B., J. W. Schipper, A. Pfeiffer, V. Wirth, 2006: A pragmatic approach for downscaling precipitation in alpine scale complex terrain. *Meteorologische Zeitschrift*, **15**, 631-646.
- Früh B., T. Trautmann, M. Wendisch, A. Keil, 2000: Comparison of observed and simulated NO₂ photodissociation frequencies in a cloudless atmosphere and in continental boundary layer clouds. *Journal of Geophysical Research*, **105**, 9843 - 9857.

PERSONAL INFORMATION

Dr. Christian Steger

📍 Hofstettener Str. 51, 97816 Lohr am Main, Germany

☎ +49 (0)69 8062-2908

✉ Christian.Steger@dwd.de

Sex male | Date of birth 17/01/1982 | Nationality German

WORK EXPERIENCE

01/2017 – present

Senior Scientist

Deutscher Wetterdienst (DWD), Frankfurter Str. 135, 63067 Offenbach, Germany, www.dwd.de

- production of global climate projections for CMIP6
- development of modelling framework ICON, which can be used for global and regional applications
- Support of the Coordination of the CLM-Community (Climate Limited-area Modelling-Community) which is an open, international network of scientists, who are employing and developing the regional climate model COSMO-CLM with more than 250 members at 68 institutions worldwide.

Business or sector National Meteorological Service

02/2015 – 12/2016

Scientist

Deutscher Wetterdienst (DWD), Frankfurter Str. 135, 63067 Offenbach, Germany, www.dwd.de

- Participation in the german project ReKliEs-De (Regional Climate projection Ensemble for Germany, funded by the Federal Ministry of Education and Research) <http://reklies.hlnug.de/startseite/>
- Production of regional climate projections for the EURO-CORDEX domain with the regional climate model COSMO-CLM
- Analysis of the ensemble with regard to the needs of the user
- Standardization of the model output and the derived climate variables

Business or sector National Meteorological Service

10/2011 – 12/2014

Doctoral Studies

Julius-Maximilians University Würzburg, Institute for Geography and Geology, Am Hubland, 97074 Würzburg, Germany, <https://www.geographie.uni-wuerzburg.de/startseite/>

- Participation in the DFG (Deutsche Forschungsgemeinschaft) priority program TIP (Tibetan Plateau : Formation – Climate – Ecosystems). Simulation of the paleoclimate in Asia with a high-resolution regional climate model.

Business or sector University

EDUCATION AND TRAINING

10/2011 - 12/2014

Doktor der Naturwissenschaften (PhD)

Julius-Maximilians University Würzburg, Institute for Geography and Geology, Am Hubland, 97074 Würzburg, Germany

- Thesis title: Simulation of selected timeslices of the paleoclimate in Asia with a high-resolution regional climate model

10/2003 - 12/2010

State examination Physics and Geography

Julius-Maximilians University Würzburg, Institute for Geography and Geology, Am Hubland, 97074 Würzburg, Germany

▪ Thesis title: Zukünftige Veränderung von Wahrscheinlichkeitsdichtefunktionen thermischer und hygischer Variablen aus Klimamodellen

PERSONAL SKILLS

Mother tongue(s) German

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
French	A2	A2	A1	A1	A1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

ADDITIONAL INFORMATION

Selected Publications

- Dalelane, C., B. Früh, C. Steger, A. Walter, 2017: A pragmatic approach to build a reduced regional climate projection ensemble for Germany using the EURO-CORDEX 8.5 Ensemble. *Journal of Applied Meteorology and Climatology*, Early online release <http://journals.ametsoc.org/doi/abs/10.1175/JAMC-D-17-0141.1>.
- Huebener, H., P. Hoffmann, K. Keuler, S. Pfeifer, H. Ramthun, A. Spekat, C. Steger, K. Warrach-Sagi, 2017: Deriving user-informed climate information from climate model ensemble results. *Advances in Science and Research*, **14**, doi: 10.5194/asr-14-261-2017
- Huebener, H. K. Bülow, C. Fooker, B. Früh, P. Hoffmann, S. Höpp, K. Keuler, C. Menz, V. Mohr, K. Radtke, H. Ramthun, A. Spekat, C. Steger, F. Toussaint, K. Warrach-Sagi, M. Woldt, 2017: ReKliEs-De Ergebnisbericht. Available Online <http://reklies.hlnug.de/startseite/>.
- Li, J., T.A. Ehlers, S.G. Mutz, C. Steger, H. Paeth, M. Werner, C.J. Poulsen, R. Feng, 2016: Modern precipitation O-18 and trajectory analysis over the Himalaya-Tibet Orogen from ECHAM5-wiso simulations. *Journal of Geophysical Research – Atmospheres*, **121** (18), doi: 10.1002/2016JD024818
- Mutz, S.G., T.A. Ehlers, J. Li, C. Steger, H. Paeth, M. Werner, C.J. Poulsen, 2016: Precipitation delta O-18 over the Himalaya-Tibet orogen from ECHAM5-wiso simulations: Statistical analysis of temperature, topography and precipitation. *Journal of Geophysical Research – Atmospheres*, **121** (16), doi: 10.1002/2016JD024856
- Steger, C., 2015: Simulation of selected timeslices of the paleoclimate in Asia with a high-resolution regional climate model. PhD Thesis, University of Würzburg
- Paeth, H., C. Steger, C. Merckenschlager, 2013: Climate Change – It's all about probability. *Erdkunde* **67** (3), doi: 10.3112/erdkunde.2013.03.01.

PERSONAL INFORMATION

Dr. Andreas Walter

📍 Nordring 101, 60388 Frankfurt am Main, Germany

☎ +49 (0)69 8062-2668

✉ Andreas.Walter3@dwd.de

Sex male | Date of birth 30/12/1964 | Nationality German

WORK EXPERIENCE

- 10/2009 – present **Head of Climate Consultancy Unit**
Deutscher Wetterdienst (DWD), Frankfurter Str. 135, 63067 Offenbach, Germany, www.dwd.de
- Support Policy Makers with relevant information regarding adaptation measures to climate change
 - Member of national and international standardization expert teams related to adaptation issues
 - Coordination of projects in the field of adaptation to climate change and renewable energy
- Business or sector** National Meteorological Service
- 03/2008 – 9/2009 **Scientist**
Deutscher Wetterdienst (DWD), Frankfurter Str. 135, 63067 Offenbach, Germany, www.dwd.de
- Improving and running the DWD MOS System
 - Implementation of new algorithms into the DWD postprocessing chain
- Business or sector** National Meteorological Service
- 02/2006 – 2/2008 **Scientist**
Johannes-Gutenberg University Mainz, Institute for Atmospheric Physics, Becherweg 21, 55099 Mainz, Germany
- Running the operational forecast model of DWD under conditions of the last Glacial Maximum (LGM)
 - Excellence Cluster "GEOCYCLES"
- Business or sector** University
- 02/2002 – 12/2005 **Scientist**
Deutscher Wetterdienst (DWD), Frankfurter Str. 135, 63067 Offenbach, Germany, www.dwd.de
- Project QUIRCS (Quantification of Uncertainties in Regional Climate Projections)
 - Preparation of observed two dimensional fields and statistical comparison with model output
- 10/2011 – 12/2014 **Doctoral Studies**
Johann Wolfgang Goethe University Frankfurt, Institute for Atmospheric and Environmental Sciences, Altenhöferallee 1, 60438 Frankfurt/Main, Germany, <http://www.uni-frankfurt.de/41121398/IAU?>
- Business or sector** University

EDUCATION AND TRAINING

- 1996 - 1/2001 **Doktor der Naturwissenschaften (PhD)**
 Johann Wolfgang Goethe University Frankfurt, Institute for Atmospheric and Environmental Sciences, Altenhöferallee 1, 60438 Frankfurt/Main, Germany
 ▪ Thesis title: The use of artificial neural networks in statistical climatology
- 1990 – 1996 **Diploma in Meteorology**
 Johann Wolfgang Goethe University Frankfurt, Institute for Atmospheric and Environmental Sciences, Altenhöferallee 1, 60438 Frankfurt/Main, Germany
 ▪ Thesis title: The use of self-organizing feature maps in climatology

PERSONAL SKILLS

Mother tongue(s) German

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
French	B1	B1	B1	B1	B1
Italian	A1	A1	A1	A1	A1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
 Common European Framework of Reference for Languages

ADDITIONAL INFORMATION

Selected Publications

- Dalelane, C., B. Früh, C. Steger, A. Walter, 2017: A pragmatic approach to build a reduced regional climate projection ensemble for Germany using the EURO-CORDEX 8.5 Ensemble. Journal of Applied Meteorology and Climatology, Early online release <http://journals.ametsoc.org/doi/abs/10.1175/JAMC-D-17-0141.1>.
- S. Krähenmann, A. Walter, F. Imbery, A. Matzarakis, 2018: High resolution grids of hourly meteorological variables for Germany. Theoretical and Applied Climatology, 131:899-926. DOI 10.1007/s00704-016-2003-7
- T. Junghänel, C. Brendel, T. Winterrath, A. Walter, 2016: Towards a radar- and observation-based hail climatology for Germany. Meteorologische Zeitschrift. DOI 10.1127/metz/2016/0734
- S. Brienens, B. Früh, A. Walter, K. Trusilova, P. Becker, 2016: The HYRAS precipitation climatology covering Germany and the neighbouring river basins, Part II: Evaluation of COSMO-CLM simulations using the HYRAS precipitation climatology. Meteorologische Zeitschrift, 2016. DOI 10.1127/metz/2016/0617
- C.-D. Schönwiese, A. Walter, S. Brinckmann, 2010: Statistical assessments of anthropogenic and natural global climate forcing. An update. Meteorologische Zeitschrift, Vol.19, Nr.1, pp. 3-10, 2010. doi:10.1127/0941-2948/2010/0421
- A. Walter, K. Keuler, D. Jacob, A. Block, S. Kotlarski, G. Müller-Westermeier R. Knoche, D. Rechid, W. Ahrens, 2006: A High Resolution Reference Data Set of German Wind Velocity 1951 – 2001 and Comparison with Regional Climate Model Results. Meteorologische Zeitschrift, Vol. 15, No. 6, pp. 585-596.
- S. Kotlarski, U. Böhm, D. Jacob, K. Keuler, R. Knoche, A. Walter, 2005: Regional Climate Model Simulations as Input for Hydrological Applications: Evaluations of Uncertainties. Advances in Geoscience, 5, pp. 119-125.

PERSONAL INFORMATION

Hilppa Henriika Gregow



 Erik Palmén place 1, 00101 Helsinki, Finland

 + 358505986881

 hilppa.gregow@fmi.fi



<http://en.ilmatiiteenlaitos.fi/weather-and-climate-change-impact-research>

Skype

Sex Female | Date of birth 02/08/1973 | Nationality Finnish

Children born on 2000, 2006, 2008.

WORK EXPERIENCE

2018 - present	Head of Unit, Weather and Climate Change Impact Research, FMI
2017 - present	Football assistant coach, PK35 T07/08
2014-2017	Head of Unit, Climate Service Centre, FMI
2011-2013	Group Leader, Climate Research and Applications, FMI
2008-2013	Doctoral researcher FMI/UEF
2001-2007	Climate service meteorologist participating in applied research projects, FMI
1999-2010	Freelancer, weather forecaster in television Channel 1, YLE
2002-2004	Researcher Manual Synoptic Satellite Meteorology Conceptual Models FMI/EUMETSAT
1998-2000	Meteorologist, sea weather forecasting, FMI
1997-1998	Researcher, high resolution numerical weather prediction modelling, FMI
1995-1996	Assistant meteorologist, FMI
1994	Observer of Helsinki-Kaisaniemi weather station, FMI
1992-1993	Teacher substitute, Herttoniemen yhteiskoulun lukio and Itä-Helsingin Musiikkiopisto.

EDUCATION AND TRAINING

2017	Adj.Prof., University of Eastern Finland
2015	Advanced Management Education Program (27 credits) Aalto University Executive Education (AEE) including a strategic analysis for company Otava "Strategic Alternatives for Adult and Vocational Education" and a study tour in Palo Alto, USA
2014	Media skills (Kalle Siira http://www.constra.fi/in-english/)
2008-2013	PhD (Forest sciences), University of Eastern Finland (UEF), Faculty of Science and Forestry
2012-2013	Special vocational degree (Product development and Innovative Leadership), RASTOR
2011	Singleimage Winning FP7 and CIP CIP BIDS by TEKEL
2011	Coaching techniques http://www.htmppartners.fi/e/home/
2010-2011	Singing classes – jazz and pop VUOMU, Helsinki
2010	Education for media (course by Leena Brandt, Press Officer at Finnish EU Representation)
2006	Empirical time-series analysis (Helsinki University 10 credits)
2003	Media skills (MTV3 television)
1999	Media skills (YLE television)
1992-1999	M.Sc. (Meteorology) University of Helsinki

PERSONAL SKILLS

Language(s) Finnish (mother tongue), English (fluent), Swedish (fluent), French (passive)

Communication skills Good communication skills in leadership and in the media. A former freelance TV-meteorologist with 11 years of experience in television work and communication.

Organisational / managerial skills A well experienced unit head with 7 years of managerial skills at FMI. Participation in > 15 projects with a PI or a manger/coordinator role. (10 recent projects mentioned below).

ADDITIONAL INFORMATION

Involvement in recent and on-going projects

EU-C3S 51 Lot4 (2016-2018) Data Evaluation for Climate Models. FMI, together with UH, GERICS, MetNo, DMI, OMSZ, ABHL and CSC Finland, will develop a framework for Quality Assurance for Multi-model climate projections (at global and regional level) for the Copernicus Climate Change Service (C3S) (**Project coordinator**)

SA CLIPS (2016-2018) CLimate services supporting Public activities and Safety (Key project funding from Academy of Finland) (**PI**)

Myrskyn merkit (Storm signs) – art project on storm experiences and impacts on individuals (**FMI PI in the start**, now the PI is Terhi Laurila) http://www.lusto.fi/lehdisto-tiedote/luston-johtamalle-myrskyn-merkit-hankkeelle-merkittaevae-rahoitus-suomen-kulttuurirahastolta/?doing_wp_cron=1474453876.0882279872894287109375.

EU-C3S CLIM4ENERGY (2016-2018) Energy mix transitioning for European systems, FMI focuses on e.g., freezing rain risks with *Fingrid* as a co-designer and soil frost and carrying capacity of soils on seasonal scale to advance timely harvesting and biomass production with *Metsäteho* as a co-designer (**PI for the soil part**)

Project ELASTINEN (2015-2016) Proactive management of short term risks related to weather, economy and climate (**Project coordinator**)

EU ERA4CS (2015-2020) (**Coordinator of FMI research involvement in the in-kind institutional integration of European Climate Services** – FMI works now for 5 in-kind projects: Windsurfer, Serv_forfire, INDICES, Dust_clim, Urclim).

EU FP7 project RAIN (2014-2016) (**Project partner, coordinator of FMI work**) (Risk Analysis of Infrastructure Networks in response to extreme weather) with focus on e.g., freezing rain, snow loads and forest fire and long range forecast possibilities.

EU FP7 project CORE-CLIMAX (2013-2015) (**PI**) (COordinating Earth observation data validation for RE-analysis for CLIMate ServiceS)

Project Extreme weather risks to nuclear power plant safety in Oulu (2013) (**Project manager**)

Project EXWE SAFIR2014 (2012-2013) (**Project manager**) focus on assessing the risks of the theoretically possible extreme weather events in Finland

RECENT PEER REVIEWED PUBLICATIONS

- Ervasti, T., **Gregow, H.**, Vajda, A., Laurila, T. and Mäkelä A. (submitted in January 2018) *Mapping users expectations regarding extended range forecasts*. ASR publications under review.
- Su, Z., Timmermans, W., Zeng, Y., Schulz, J., John, V.O., Roebeling, R.A., Poli, P., Tan, D., Kaspar, F., Kaiser-Weiss, A., Swinnen, E., Toté, C., **Gregow, H.**, Manninen, A., Riihelä, A., Calvet, J.-C., Ma, Y., Wen, J., An overview of European efforts in generating climate data records. 2017 (<https://doi.org/10.1175/BAMS-D-16-0074.1>)
- Gregow, H.**, Muzaffer, E. A. and Laaksonen, A. **2017** *Increasing large scale windstorm damage in Western, Central and Northern European forests, 1951-2010*. Scientific Reports. (<http://rdcu.be/q66j>)
- Harjanne, A., Haavisto, R., Tuomenvirta, H, and **Gregow, H.** *Risk management perspective for climate service development – Results from a study on Finnish organizations*. (Adv. Sci. Res in **2017**)
- Hyvärinen, O., Mäkelä, A., Kämäräinen, M., and **Gregow, H.** **2017**. *Long-range forecasts for the energy market – a case study*. Adv. Sci. Res., 14, 89-93, doi:10.5194/asr-14-89-2017.
- Gregow, H.**, K. Jylhä, H. Mäkelä, J. Aalto, T. Manninen, P. Karlsson, A. Kaiser-Weiss, F. Kaspar, P. Poli, D. Tan, A. Obregon, and Z. Su. **2016**, *Worldwide survey of awareness and needs concerning reanalyses, and respondents views on climate services*, Bull. Amer. Meteor. Soc., 10.1175/BAMS-D-14-00271.1
- Kämäräinen, M., Hyvärinen, O., Jylhä, K., Vajda, A., Neiglick, S., Nuottokari, J., and **Gregow, H.** 2016. *A Method to Estimate Freezing Rain Climatology from ERA-Interim Reanalysis over Europe*. Nat. Hazards Earth Syst. Sci. 17 (2), 243.

PERSONAL INFORMATION

Joni-Pekka Pietikäinen



 Erik Palménin aukio 1, P.O.Box 503, 00101 Helsinki

 +358 50 300 5152

 joni-pekka.pietikainen@fmi.fi

Sex Male | Date of birth 16/09/1981 | Nationality Finnish

POSITION

Head of the Seasonal and Climate applications group at the Finnish Meteorological Institute

WORK EXPERIENCE

JAN 2018 - PRESENT

Head of the Seasonal and Climate Applications group

Finnish Meteorological Institute

JAN 2015 – DEC 2017

Senior Research Scientist

Finnish Meteorological Institute

MAR 2011 – DEC 2014

Researcher / PhD student

Finnish Meteorological Institute and University of Eastern Finland

MAR 2008 – FEB 2011

Researcher / PhD student

Max Planck Institute for Meteorology (Hamburg, Germany) and University of Eastern Finland

JUN 2003 – FEB 2008

Researcher / Trainee

University of Kuopio (nowadays University of Eastern Finland)

EDUCATION AND TRAINING

MAR 2015

PhD in environmental physics

University of Eastern Finland, Kuopio

FEB 2006

MSc in environmental physics

University of Kuopio, Finland

PERSONAL SKILLS

Mother tongue(s)

Finnish

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
German	A2	A2	A1	A1	A1

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user
[Common European Framework of Reference for Languages](#)

Communication skills

Good communication skills gained through my several years of international working experience.

Organisational / managerial skills

- Leadership (currently responsible for a team of 9 people)
- Lead regional climate model development at FMI since 2011

Job-related skills

- regional and global climate models
- aerosol modelling
- cloud microphysics
- parallel computing
- supercomputing

Digital skills

- Operating systems: Linux, Windows
- Programming: Python, Fortran, Matlab, CDO, Shell, MPI
- Others: HTML, LaTeX, Office

Driving licence

BeC

ADDITIONAL INFORMATION

- Publications
- Presentations
- Projects
- Conferences
- Seminars
- Honours and awards
- Memberships
- References
- Citations
- Courses
- Certifications

- Candidate supervisions:
 - Risto Karinkanta (University of Helsinki, Physics), 2013.
 - Erika Toivonen (University of Helsinki, Meteorology), 2017-
- Finnish Association for Aerosol Research (FAAR) PhD award for excellent work in aerosol science (2017)
- The Finnish association for mathematicians, physicists, and computer scientist award for best master's thesis (2007)
- Climate modelling expert in international development project "CLimate Modelling and OBServations (in India) – CLIMOB", 2015-2017, Indian Meteorological Department, New Delhi, India. Funded by the Ministry of Foreign Affairs of Finland.
- In charge of the climate modelling in the project "Mitigation of Arctic warming by controlling European black carbon emissions (MACEB)", 2011-2013, www.maceb.fi

PERSONAL INFORMATION

Tiina Ervasti



 Erik Palménin aukio 1, P.O.Box 503, 00101 Helsinki,

 +358 50 3802758

 tiina.ervasti@fmi.fi

Sex Female | **Date of birth** 10/05/1989 | **Nationality** Finnish

POSITION

Science Editor, Seasonal and Climate Applications group at the Finnish Meteorological Institute

WORK EXPERIENCE

- JAN 2018 - PRESENT** Science Editor / Researcher, Seasonal and Climate Applications group
Finnish Meteorological Institute
- DEC 2014 – DEC 2017** Science Editor, Climate Service Centre
Finnish Meteorological Institute
- APR 2014 – JUN 2014** Communications Trainee, Climate Service Centre
Finnish Meteorological Institute
- OCT 2013 – DEC 2013** Communications Trainee
Finnish Ministry of Agriculture and Forestry

EDUCATION AND TRAINING

- MAR 2014** MA in Communication Studies
University of Vaasa, Finland
Minoring in International Marketing, Political Science (University of Vienna)
- MAR 2012** BA in Communication Studies
University of Vaasa, Finland
Minoring in Intercultural Communication, English Language

PERSONAL SKILLS

Mother tongue(s) Finnish

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
Minor subject studies (25 ects), University of Vaasa					
German	B1	B1	A2	A2	B1
B1, University of Vienna					
Spanish	B1	B1	B1	B1	B1
Finnish Matriculation Examination					
Swedish	A2	B1	A2	A2	B1
Finnish Matriculation Examination					

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
[Common European Framework of Reference for Languages](http://www.cedefop.europa.eu/en/files/quest_doc/2008/CERF/CERF_en.pdf)

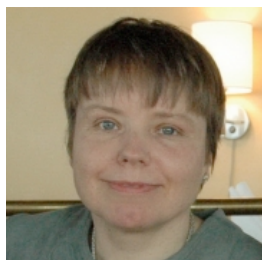
- Communication skills**
- Excellent communication skills gained through both University degree and work experience of several years in Communications
 - Fields of expertise mainly organizational communication (both internal and external) and science communications; topics related to e.g. climate change, climate applications, visualization of climate data
 - Good contact and communication skills in customer service
- Job-related skills**
- Mapping user needs of climate-related information
 - Collecting and applying user feedback to climate service development
 - User engagement and co-creation of new services
- Computer skills**
- Operating systems: Windows, Mac
 - Programming: Very basics of C#, HTML, PHP, JavaScript, CSS
 - Others: Office, LaTeX, video and photo editing softwares (Sony Vegas, Adobe Photoshop, Adobe Premiere Pro), desktop publishing software (Adobe InDesign), various CMS's (e.g. WordPress, Liferay), online survey tools
- Driving licence**
- B

ADDITIONAL INFORMATION

- Publications
 - Presentations
 - Projects
 - Conferences
 - Seminars
 - Honours and awards
 - Memberships
 - References
- Briefing of journalists in the climate change training organized annually by the FMI
 - Projects:
 - Signs of a storm, 2017–2019. Project where cultural history, art and science collide to provide representations of storms. Funded by the Finnish Literature Society (SKS).
 - CLIPS (CLimate services supporting Public activities and Safety), 2016–2018. Funded by the Academy of Finland.
 - ViVoTiVi (Climate change – visual power to the science communication), 2013–2016. Funded by the Association of Science Communication.
 - 5T-project (Science Education in Secondary Schools by Doing Research with Researchers), 2014–2015. Funded by the Finnish Ministry of Education and Culture.
 - Climateguide.fi portal, 2011–

PERSONAL INFORMATION

Kirsti Jylhä



- Erik Palménin aukio 1, P.O.Box 503, 00101 Helsinki
- +35850 433 6554
- Kirsti.jylha@fmi.fi
- [State personal website\(s\)](#)
- [Replace with type of IM service](#) [Replace with messaging account\(s\)](#)

Sex Female | Date of birth 31/12/1960 | Nationality Finnish

WORK EXPERIENCE

Replace with dates (from - to)

Senior Research Scientist (FMI)

- 1981 – 1985 (18 months) Weather Service Assistant (Finnish Meteorological Institute, FMI)
- 1984 – 1990 Research Assistant, Researcher (Univ. of Helsinki, Dep. of Meteorology)
- 1991 – 1997 Teaching lecturer (Univ. of Helsinki, Dep. of Meteorology)
- 1997 – 1998 Laboratory director (acting) (Univ. of Helsinki, Dep. of Meteorology)
- 1998 – 2000 Senior Research Scientist (FMI, Air Quality Research)
- 2000 – 2004 Senior Research Scientist (FMI)
- 2004 – 2007 Head of Group Climate Research (FMI)
- 2008 – 2010 Senior Research Scientist (FMI)
- 2010 Head of Group Climate Research and Applications (FMI)
- 2010 – Senior Research Scientist (FMI)

FMI, <http://ilmatieteenlaitos.fi/en>

- Climate research; media and stakeholder communications

Business or sector National research institute

EDUCATION AND TRAINING

Replace with dates (from - to)

[Add separate entries for each course. Start from the most recent.]

- 2016, Docenture (meteorology, University of Helsinki)
- January 26, 2001 University of Helsinki, Ph.D meteorology
thesis subject: "The scavenging of air pollutants by precipitation, and its estimation with the aid of weather radar" (grade: Eximia Cum Laude Approbatur)
- October 10, 1991 University of Helsinki, Ph.Lic meteorology
- April 9, 1987 University of Helsinki, M.Sc. meteorology (major subject), physics and mathematics (secondary subjects)

Replace with EQF (or other) level if relevant

PERSONAL SKILLS

[Remove any headings left empty.]

Mother tongue(s) Finnish

Other language(s)

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	
Good	Good	Good	Good	Good
Replace with name of language certificate. Enter level if known.				
Enter level	Enter level	Enter level	Enter level	Enter level
Replace with name of language certificate. Enter level if known.				

Replace with language

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Communication skills ▪ Good communication skills gained through my several years of experience working with the media (interviews). Invited lectures on climate change.

Organisational / managerial skills ▪ 10-year experience as a project and group leadership

Job-related skills Replace with any job-related skills not listed elsewhere. Specify in what context they were acquired.
Example:
▪ Climate change: climate model projections, observations, impacts; climate change communication
▪ Wet deposition of aerosols and gaseous pollutants; weather radar

Computer skills ▪ Operating systems: Linux, Windows
 ▪ Programming: Fortran, Grads
 ▪ Others: LaTeX, Office

Other skills Replace with other relevant skills not already mentioned. Specify in what context they were acquired.
Example:
▪

Driving licence ▪ A/B

ADDITIONAL INFORMATION

Publications • See the annendix portfolio_Kirsti.Jylha.pdf
Presentations
Projects
Conferences
Seminars
Honours and awards
Memberships
References

ANNEXES

Replace with list of documents annexed to your CV. Examples:
▪ copies of degrees and qualifications;
▪ testimonial of employment or work placement;
▪ publications or research.

PERSONAL INFORMATION

Antti Mäkelä



[
Erik Palménin aukio 1, P.O.Box 503, 00101 Helsinki, Finland

☎ +358503011988

✉ antti.makela@fmi.fi

Sex Male | Date of birth 16/04/1978 | Nationality Finnish

JOB APPLIED FOR
POSITION
PREFERRED JOB
STUDIES APPLIED FOR
PERSONAL STATEMENT

Research Scientist (FMI), Head of Group (FMI)

WORK EXPERIENCE

1/2014 to present

Head of Group Weather and Climate Research

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

- Severe weather research and climatology, media and stakeholder communications

[Research](#)

1/2012-12/2013

Research Scientist/post-doctoral researcher

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

[Research](#)

4/2006-12/2011

Research Scientist/PhD researcher

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

[Research](#)

5/2005-3/2006

Research Assistant

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

[Research](#)

6/2004-8/2004

Research Assistant

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

[Research](#)

6/2003-8/2003

Trainee

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

[Research](#)

6/2002-8/2002

Trainee

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

[Research](#)

6/2001-8/2001

Trainee

Finnish Meteorological Institute (FMI), <http://ilmatieteenlaitos.fi/en>

[Research](#)

EDUCATION AND TRAINING

October 12, 2011

Ph.D Thesis subject: "Thunderstorm climatology and lightning location applications in northern Europe" (grade: Eximia Cum Laude Approbatur)

University of Helsinki (Finland)

- Meteorology (major subject) physics (secondary subject)

PERSONAL SKILLS

Mother tongue(s)	Finnish				
Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1

Communication skills

- Good communication skills gained through my several years of experience working with the media (interviews). Annual invited lectures on severe weather.

Organisational / managerial skills

- Leadership: (currently responsible for a team of 10 people)

Job-related skills

Replace with any job-related skills not listed elsewhere. Specify in what context they were acquired. Example:

- good command of quality control processes (currently responsible for quality audit)

- Operating systems: Linux, Windows, Mac

- Programming: PHP, Python, Perl, Java, Pascal,

- Others: HTML, LaTeX, Office, Oracle

Driving licence

B/C

ADDITIONAL INFORMATION

Publications

- Candidate supervisions:

- Petteri Karsisto (University of Helsinki, Meteorology), 2013.

- Ilkka Salminen (University of Turku), Geography), 2013.

- Elina Riskilä (University of Helsinki, Meteorology), 2014.

- Peter Ukkonen (University of Helsinki, Meteorology), 2014.

Honours and awards

- Lightning location expert in international development projects, training of forecasters and assisting in lightning location network establishment:

- Finnish Nepalese Project (FNEP I and II) in 2012, Kathmandu, Nepal. Funded by the Ministry of Foreign Affairs of Finland.

- PROMOSERV 2013-2014, Hanoi, Vietnam. Funded by the Ministry of Foreign Affairs of Finland.

- Finnish Pacific Project (FINPAC) 2013-2016, Pacific Independent Islands. Funded by the Ministry of Foreign Affairs of Finland.

- Nepal World Bank Project 2014-2016, Nepal. Funded by World Bank.

- Finnish Bhutanese Project, 2013-2015, Bhutan. Funded by the Ministry of Foreign Affairs of Finland.

- Finnish member on the ESF program "Thunderstorm Effects on Atmosphere-Ionosphere System" (2011-2015).

- Member of the Meteosat Third Generation (MTG) Lightning Imager Science Team (LIST) (assigned by EUMETSAT). 2009-2013.

- Member of the Meteosat Third Generation (MTG) Lightning Imager Advisory Group (assigned by EUMETSAT). Since 01/2014.

- "Study on the present status and future capabilities of ground-based lightning location networks" (EUM/CO/06/1584/KJG), EUMETSAT. Collaborative study between the Italian Air Force and FMI. Done in 2007.

- Participation to a Training School "Lightning Physics and Effects" in Kiten, Bulgaria, September 4-6, 2007 (organized by the European COST Action P18)

- Finnish member (since 2006) and Management Committee member (since Aug 2009) in the "European Cooperation in the Field of Scientific and Technical Research" (COST, action P18: The physics of lightning flash and its effects).

ANNEXES

- Annually, 1-5 invited lectures regarding thunderstorm and lightning protection issues.

- Participates on the lightning safety discussions with the authorized Finnish organisations.

- Is responsible at FMI for thunderstorm related question for open public and media. Annually, 20-50 interviews (newspapers, radio, TV, calls from citizens).






- Is responsible at FMI for the official statements on thunderstorm-caused accidents (e.g. for insurance companies and authorities).

- Co-author of a popular Finnish book "Ukkosta ilmassa" (Ursa, 2009) on thunders

PERSONAL INFORMATION

Taru Olsson (nee Balk)



-  Erik Palménin aukio 1, P.O.Box 503, 00101 Helsinki, Finland
-   +358503802517
-  taru.olsson@fmi.fi
-  <https://fi.linkedin.com/in/taruolsson>, orcid.org/0000-0001-9703-4896

Sex Female | Date of birth 14/12/1986 | Nationality Finnish

WORK EXPERIENCE

- 06/2011 – **Research Scientist**
Finnish Meteorological Institute (FMI), Climate Service Centre, Weather and Climate Research
<http://ilmatiiteenlaitos.fi/en>
 - Bias correction, regional climate models, precipitation, temperature
- 01/2010 –05/2011 **Research Assistant**
FMI, Climate Change, Climate Modelling
 - regional climate model REMO, precipitation, temperature
- 09/2008 –12/2009 **Trainee**
FMI, Air Quality
 - chemical weather portal

Business or sector National research institute

EDUCATION AND TRAINING

- 26/09/2009–27/05/2011 **Master of Science**
University of Helsinki, Helsinki, Finland
 - meteorology (major subject, 29 credits)
 - physics (secondary subject, 29 credits)
 - methodological sciences (secondary subject, 9 credits)
- 01/08/2005–25/09/2009 **Bachelor of Science**
University of Helsinki, Helsinki, Finland
 - meteorology (major subject, 98 credits)
 - physics (secondary subject, 25 credits)
 - methodological sciences (secondary subject, 26 credits)
- 08/2002–05/2005 **Secondary school graduate**
Kemin lyseon lukio, Kemi, Finland

PERSONAL SKILLS

Mother tongue(s) Finnish

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	Good	Good	Good	Good	Good
Swedish	Satisfactory	Good	Satisfactory	Satisfactory	Passable

- Communication skills
- Good communication skills.
- Computer skills
- Operating systems: Linux, Windows
 - Programming: R, GraDS, cdo, FORTRAN
 - Others: LaTeX, Office, Excel
- Driving licence
- B

ADDITIONAL INFORMATION




- Publications
- Olsson, T., Jakkila, J., Veijalainen, N., Backman, L., Kaurola, J., and Vehviläinen, B.: Impacts of climate change on temperature, precipitation and hydrology in Finland – studies using bias corrected Regional Climate Model data, *Hydrol. Earth Syst. Sci.*, 19, 3217-3238, doi:10.5194/hess-19-3217-2015, 2015.
 - Virkkula, A., Levula, J., Pohja, T., Aalto, P. P., Keronen, P., Schobesberger, S., Clements, C. B., Pirjola, L., Kieloaho, A.-J., Kulmala, L., Aaltonen, H., Patokoski, J., Pumpanen, J., Rinne, J., Ruuskanen, T., Pihlatie, M., Manninen, H. E., Aaltonen, V., Junninen, H., Petäjä, T., Backman, J., Dal Maso, M., Nieminen, T., Olsson, T., Grönholm, T., Aalto, J., Virtanen, T. H., Kajos, M., Kerminen, V.-M., Schultz, D. M., Kukkonen, J., Sofiev, M., De Leeuw, G., Bäck, J., Hari, P., and Kulmala, M.: Prescribed burning of logging slash in the boreal forest of Finland: emissions and effects on meteorological quantities and soil properties, *Atmos. Chem. Phys.*, 14, 4473-4502, doi:10.5194/acp-14-4473-2014, 2014.
 - Kukkonen, J., Olsson, T., Schultz, D. M., Baklanov, A., Klein, T., Miranda, A. I., Monteiro, A., Hirtl, M., Tarvainen, V., Boy, M., Peuch, V.-H., Poupkou, A., Kioutsioukis, I., Finardi, S., Sofiev, M., Sokhi, R., Lehtinen, K. E. J., Karatzas, K., San José, R., Astitha, M., Kallos, G., Schaap, M., Reimer, E., Jakobs, H., and Eben, K.: A review of operational, regional-scale, chemical weather forecasting models in Europe, *Atmos. Chem. Phys.*, 12, 1-87, doi:10.5194/acp-12-1-2012, 2012.
 - Balk, T., Kukkonen, J., Karatzas, K., Bassoukos, T., and Epitropou, V.: A European open access chemical weather forecasting portal, *Atmospheric Environment*, volume 45, issue 38, pages 6917–6922, 2011.
 - Kukkonen, J., Klein, T., Karatzas, K., Torseth, K., Fahre Vik, A., San José, R., Balk, T., and Sofiev, M.: COST ES0602: towards a European network on chemical weather forecasting and information systems, *Adv. Sci. Res.*, 3, 27-33, doi:10.5194/asr-3-27-2009, 2009.
- Projects
- Peru-AquaFutura – Development of an evaluation network for water resources management accounting for climate change and social-economic changes in Peru, 2012-2015. Funded by Academy of Finland.
 - ClimWater – Climate Change and Water Cycle: Effect to Water Resources and their Utilization in Finland, 2011-2014. Funded by Academy of Finland.
 - COST Action ES0602: Towards a European Network on Chemical Weather Forecasting and Information Systems, 2009-2011. Funded by EU Framework Programme Horizon 2020.
- Seminar posters
- Veijalainen, N., Jakkila, J., Olsson, T., Backman, L. and Vehviläinen, B.: Impacts of Climate Change on Hydrology and Floods using Bias Corrected RCM Temperature and Precipitation Data, Final Seminar of the Ficca Programme, 2014
 - Jakkila, J., Olsson, T., Kaurola, J. and Vehviläinen, B.: Bias Correction of RCM Temperature and Precipitation Data for Hydrological Modelling, Seminar of the Ficca Programme, 2013

ANNEXES

PERSONAL INFORMATION

Hadassa Hovestadt



 Erik Palménin aukio 1, P.O.Box 503, 00101 Helsinki
 +358503580859
 hadassa.hovestadt@fmi.fi
 Sex Female | Date of birth 16/04/1994 | Nationality Finnish

POSITION

Research Scientist, Finnish Meteorological Institute

WORK EXPERIENCE

MAY 2017 - PRESENT

Research Scientist, Climate Change and Extreme Weather

Finnish Meteorological Institute

SEP 2015 – MAY 2016

Research Assistant

University of Helsinki

EDUCATION AND TRAINING

MAR 2018

MSc in Meteorology

University of Helsinki, Finland

APR 2017

BSc in Meteorology

University of Helsinki, Finland

PERSONAL SKILLS

Mother tongue(s)

Finnish

Other language(s)

English

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	
C2	C2	C2	C2	C2

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user
[Common European Framework of Reference for Languages](#)

Communication skills

Good communication skills and pedagogical competence (substitute teacher at elementary school).

Job-related skills

Digital skills

- Operating systems: Linux, Windows
- Programming: Python, Shell
- Others: HTML, LaTeX, Office, mars, ECMWF data

Driving licence

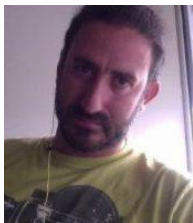
ADDITIONAL INFORMATION

Publications
Presentations
Projects
Conferences
Seminars
Honours and awards
Memberships
References
Citations
Courses
Certifications

- Communication, user engagement and feedback officer, and application developer at project CLIPS.fmi.fi (Climate services supporting public activities and safety).

PERSONAL INFORMATION

Alessandro Spinuso



📍 Utrechtseweg 297, 3731 GA De Bilt (Netherlands)

☎ +31644321941

✉ spinuso@knmi.nl

💬 Skype aspinuso

Sex Male | Date of birth 15/01/1979 | Nationality Italian

WORK EXPERIENCE

01/03/2011–Present

Researcher

KNMI - Koninklijk Nederlands Meteorologisch Instituut, De Bilt (Netherlands)

- Involved in international initiatives focusing on the realisation of eScience infrastructures and user-facing services for Climate and Solid Earth Science Research.
- Main R&D interest in data intensive applications adopted within collaborative eScience context. These involve scientific workflows, HPC, provenance management and Virtual Research Environments.

01/09/2010–03/03/2011

Research Assistant

University of Edinburgh, School of Informatics - Data Intensive Research Group, Edinburgh (United Kingdom)

- Working on to the ADMIRE project (<http://www.admire-project.eu>), researching on a distributed architecture for Data-mining.
- Research and development of a workflow application for Data Intensive Seismic Noise Cross-Correlation

01/07/2006–01/09/2010

Software Engineer

KNMI - Koninklijk Nederlands Meteorologisch Instituut, De Bilt (Netherlands)

Working on the NERIES EC project on the design and development of an e-infrastructure and a Web Portal for the dissemination of European seismological data.

01/07/2005–01/07/2006

J2EE Consultant

Reply spa, Rome (Italy)

Consultant in the following technologies: J2EE-Struts / COBOL / DB2.

EDUCATION AND TRAINING

01/09/1999–01/05/2005

Master in Computer Science

University of Rome "La Sapienza", Rome (Italy)

Thesis in the field of e-learning and Human Machine Interaction.

PERSONAL SKILLS

Mother tongue(s)

Italian

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
Common European Framework of Reference for Languages

Communication skills Good communicator. Analytical, conceptual. Experienced with working in geographically distributed teams.

Organisational / managerial skills Experience in chairing Project Executive Board with responsibilities on the technical progress. Work Package and task leader in EU projects. Experience in working in Agile teams and supervising students.

Job-related skills Skills in the following programming languages and technologies: Java/J2EE, JavaScript/ExtJS/d3js, Python, Nginx, SQL/No-SQL Docker.

ADDITIONAL INFORMATION

Publications

- Proceedings: Atkinson, Malcolm, et al. "VERCE delivers a productive e-Science environment for seismology research." e-Science (e-Science), 2015 IEEE 11th International Conference on. IEEE, 2015.
- Proceedings: Filgueira, R., Krause, A., Atkinson, M., Klampanos, I., Spinuso, A., & Sanchez-Exposito, S. (2015, August). dispel4py: An agile framework for data-intensive escience. In e-Science (e-Science), 2015 IEEE 11th International Conference on (pp. 454-464). IEEE.
- Book chapter: Peter Kacsuk (Ed). *Science Gateways for Distributed Computing Infrastructures – Chapter Title: The VERCE Science Gateway: Enabling user-friendly, data-intensive and HPC applications across European e-Infrastructures*, Alessandro Spinuso and Malcolm Atkinson, Springer, 2014.
- Proceedings: Sandra Gesing, Malcolm Atkinson, Rosa Filgueira, Ian Taylor, Andrew Jones, Vlado Stankovski, Chee Sun Liew, Alessandro Spinuso, Gabor Terstyanszky, Peter Kacsuk. *Workflows in a Dashboard: A New Generation of Usability - 9th Workshop on Workflows in Support of Large-Scale Science*, New Orleans; 11/2014
- Proceedings: A. Spinuso, J. Cheney, and M. Atkinson. *Provenance for seismological processing pipelines in a distributed streaming workflow*. Proceedings of the Joint EDBT/ICDT 2013 Workshops, 2013.
- Book: M. Atkinson, R. Baxter, M. Galea, P. Brezany, M. Parsons, Ó. Corcho, J. van Hemert and D. Snelling. (Ed): *THE DATA BONANZA: Improving Knowledge Discovery for Science, Engineering and Business*. Chapter Title: *Data-Intensive Seismology: Research Horizons - Michelle Galea, Andreas Rietbrock, Alessandro Spinuso and Luca Trani*, John Wiley & Sons Ltd., 2013
- *Proceedings: Web Portal Developments for Interactive Access to Earthquake Data on a European Scale*. Published in: Brady, S.R., Sinha, A.K., and Gundersen, L.C., editors, 2008, Geoinformatics 2008—Data to Knowledge, Proceedings: U.S. Geological Survey Scientific Investigations Report 2008 -5172, 76 p.,

Projects

- EPOS: European Plate Observing System (<https://www.epos-ip.org>)
- VERCE: Virtual Earthquake and seismology Research Community e-science environment in Europe (<http://www.verce.eu/>)
- DARE: Delivering Agile Research Excellence on European e-Infrastructures (<http://project-dare.eu/>)
- CLIPC: Climate Information Portal (<http://www.clipc.eu>)

PERSONAL INFORMATION

Wim Som de Cerff



- Buitenzorglaan 7, 6712 GN, Ede, The Netherlands
- +31 30 2206871 +31 6 28723854
- sdecerff@gmail.com; sdecerff@knmi.nl
- www.linkedin.com/in/wjsomdecerff
- Skype: wjsdecerff

Sex Male | Date of birth 08/02/1971 | Nationality Nederlandse

WORK EXPERIENCE

2007 - Present (11 years)

Senior Researcher

Royal Netherlands Meteorological Institute (KNMI)

- Project leader C3S 34a (MAGIC)
- Product Owner for KNMI Data centre (data.knmi.nl)
- Scrum master for Operational Monitoring project (scrum team of 7)
- Involved as WP leader in EU H2020 projects (EUNADICS-AV,
- Team lead for KNMI effort in IS-ENES, CLIPC, EUPORIAS

Business or sector Government

September 2001 - 2007 (6 years)

Computer scientist at Royal Netherlands Meteorological Institute (KNMI)

September 1997 - September 2001 (4 years 1 month)

Software Engineer at Royal Netherlands Meteorological Institute (KNMI)

EDUCATION AND TRAINING

Replace with dates (from - to)

University of Twente

M.Sc., Software Engineering and Theoretical Informatics, 1994 - 1997

Replace with EQF (or other) level if relevant

Hogeschool Utrecht

B.Sc., Communication technology, 1989 - 1994

Relevant courses:

- UML
- Design Patterns
- Architecture Patterns
- Effective Communication (Schouten & Nelissen)

PERSONAL SKILLS

Mother tongue(s)

Dutch

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C
German	B	B	A	A	A

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Communication skills ▪ Good communication skills gained through participation in EU projects and training

Organisational / managerial skills ▪ WP lead in many EU projects
▪ Scrum master for 27 sprints (scrum team of 7 people)
▪ Product Owner for KNMI data centre (data.knmi.nl), team of 8 people

Job-related skills ▪ Excellent service architecture skills gained in many projects
▪ Excellent Agile Software Development skills gained in several Scrum projects
▪ Good SQL, Software Development, Software Architecture, Parallel and Distributed Computing, SOA

Computer skills ▪ Splunk experience gained in KNMI internal projects
▪ Java and Python programming skills
▪ Linux (RH, Fedora), Unix, OS X, Windows operating systems
▪ Good command of Microsoft Office™ tools

Other skills

Driving licence B

ADDITIONAL INFORMATION

Publications https://www.researchgate.net/profile/Wim_Jan_Som_De_Cerff
Presentations
Projects
Conferences
Seminars
Honours and awards
Memberships
References

ANNEXES

Book Chapters

Wim Jan Som de Cerff: *Data access for atmospheric research*. Dealing with the data flood, 01/2002: chapter Data access for atmospheric research: pages 85-93; STT study centre for technology trends., ISBN: ISBN-90-804496-6-0

Journal Publications

Wim Som de Cerff, Peter Thijsse, Maarten Plieger, Stephen Pascoe, Martin Juckes, Adam Leadbetter, Haase Goosen, Ernst Vreede: *Developing the architecture for the Climate Information Portal for Copernicus*.

Céline Déandreis, Christian Pagé, Pascale Braconnot, Lars Barring, Edoardo Bucchignani, Wim Som de Cerff, Ronald Hutjes, Sylvie Joussaume, Constantin Mares, Serge Planton, Maarten Plieger: *Towards a dedicated impact portal to bridge the gap between the impact and climate communities : Lessons from use cases*. Climatic Change 08/2014; 125(3-4):333-347. DOI:10.1007/s10584-014-1139-7

Wim Som de Cerff, Maarten Plieger, Christian Page, Ronald Hutjes, Fokke de Jong, Lars Barring, Elin Sjökvist: *The climate4impact portal: bridging CMIP5 data to impact users*.

PERSONAL INFORMATION

Maarten Plieger



📍 KNMI, Utrecht, De Bilt, The Netherlands

☎ +31 30 2206330

✉ Maarten.plieger@knmi.nl

Sex Male | Date of birth 17/03/1982 | Nationality Nederlandse

POSITION Developer Geo-ICT

WORK EXPERIENCE

2007- present

Developer Geo-ICT

Koninklijk Nederlands Meteorologisch Instituut (KNMI)

- Main developer of ADAGUC webgis <http://adaguc.knmi.nl/>
- Design and building of web portals <http://climate4impact.eu/>
- Implementation of OGC standards: WMS, WCS
- Implementation of the OpenDAP protocol
- Application of OGC standards, WMS, WMTS, WPS, WFS and WCS
- GIS Systems (ArcGIS, QGIS)
- Spatial analysis, spatial interpolation with R
- Remote sensing applications
- NetCDF data format
- Dissemination of work through presentations and posters at several conferences

Geographical Information Systems, Data Technology

EDUCATION AND TRAINING

2002 -2007

Master of Science (MSc), Earthsciences, Natural hazards and earth observation

University of Utrecht

PERSONAL SKILLS

Mother tongue(s) Dutch

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
French	B1	B2	A1	B1	A1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

- Communication skills**
- Good communication skills gained through my experience in several EU projects as developer and presenter.
 - Dissemination of work by presenting at conferences like EGU, EUMETSAT

- Organisational / managerial skills**
- Experienced organizer of workshops and trainings for the ADAGUC project

- Job-related skills**
- OMG-Certified UML Professional (2010)
 - Valori FAGAN inspectie certificate (2011)
 - ISTQB - ISEB Certified Tester Foundation Level (CTFL) (2012)
 - Interaction Design - LECTRIC Opleidingen (2013)
 - ENCS Cyber security cursus door ENCS 2014
 - Design Patterns / Realizing Software Architectures - Mithun (2014)

- Computer skills**
- Excellent command of C++: the ADAGUC server is written in this language.
 - Excellent command of JavaScript, experience gained during development of the ADAGUC viewer
 - Good command of Java, the climate4impact main framework is built in Java
 - Web development (CSS, JSP)
 - Python and R
 - ExtJS, JQuery

- Other skills**
- Data dissemination via OpenDAP and THREDDS dataserver
 - Climate and Forecast conventions

- Driving licence**
- B

ADDITIONAL INFORMATION

- Publications**
- A comparison between wcs and opendap for making model results and data products available through the internet, Transactions in GIS, April 2002, <http://dx.doi.org/10.1111/j.1467-9671.2012.01312.x>

- Projects**
- ADAGUC Web based GIS software using OGC standards. Main developer, organizer of workshops and trainings (2010-2015). <http://adaguc.knmi.nl/>
 - The climate4impact portal, Main developer, organizer of coding sprints: <https://climate4impact.eu/>

- Conferences**
- EGU, EUMETSAT

PERSONAL INFORMATION

Sven Kotlarski



📍 Federal Office of Meteorology and Climatology MeteoSwiss, Operation Center 1, 8058 Zurich-Airport (Switzerland)

☎ (+41) 79 718 85 45

✉ sven.kotlarski@meteoswiss.ch

Sex Male | Date of birth 08/04/1975 | Nationality German

WORK EXPERIENCE

01/09/2015–Present

Senior Scientist

Federal Office of Meteorology and Climatology MeteoSwiss, Zurich (Switzerland)

01/10/2013–31/08/2015

Senior Scientist

Institute for Atmospheric and Climate Science, ETH Zurich, Zurich (Switzerland)

01/08/2008–30/09/2013

Postdoctoral Research Scientist

Institute for Atmospheric and Climate Science, ETH Zurich, Zurich (Switzerland)

01/05/2007–31/07/2008

Postdoctoral Research Scientist

Max Planck Institute for Meteorology, Hamburg (Germany)

01/03/2002–30/04/2007

Doctoral Research Scientist

Max Planck Institute for Meteorology, Hamburg (Germany)

EDUCATION AND TRAINING

01/03/2002–31/07/2007

PhD in Meteorology

University of Hamburg, Hamburg (Germany)

01/08/1997–30/04/1998

ERASMUS Visiting Student

Université Louis Pasteur, Strasbourg (France)

01/03/1995–28/02/2002

Diploma in Hydrology

University of Freiburg, Freiburg i.Br. (Germany)

PERSONAL SKILLS

Job-related skills

- Broad interest in regional climate and climate change analysis with a focus on the European Alps
- Profound experience in dynamical and statistical climate downscaling
- Strong background in the representation of land-surface processes in climate models
- Contribution to climate impact assessments with a focus on Alpine hydrology and cryosphere
- Shaping of the interface between climate model output and impact models
- Active contribution to two generations of Swiss reference climate scenarios
- Training and support of climate scenario end users
- Main and co-supervision of master students, PhD students, PostDocs

Digital skills

- Operating systems: UNIX/Linux, MS Windows
- Operating systems: UNIX/Linux, MS Windows

- Programming languages: Fortran/Fortran 90, C/C++, Shell, (Java)
- Data processing, analysis and visualization tools: CDO, NCO, NetCDF, R, Matlab, GrADS, CorelDraw, (ArcGIS)
- Regional climate models: COSMO-CLM, REMO
- Standard office software: MS Office, OpenOffice
- Experience in developing and running regional climate model code on high-performance supercomputers (CSCS Lugano, DKRZ Hamburg)

ADDITIONAL INFORMATION




Publications (selected)

- Gutiérrez JM, Maraun D, Widmann M, Huth R, Hertig E, Benestad R, Roessler, O, Wibig, J, Wilcke, R, **Kotlarski S**, ... (2018) An intercomparison of a large ensemble of statistical downscaling methods over Europe: Results from the VALUE perfect predictor experiment. *International Journal of Climatology*, in press.
- Frei P, **Kotlarski S**, Liniger MA, Schär C (2018) Future snowfall in the Alps: Projections based on the EURO-CORDEX regional climate models. *The Cryosphere*, 12, 1-24. DOI: 10.5194/tc-12-1-2018.
- **Kotlarski S**, Szabó P, Herrera S, Rätty O, Keuler K, Soares PM, Cardoso RM, Bosshard T, Pagé C, Boberg F, Gutiérrez JM, Isotta FA, Jaczewski A, Kreienkamp F, Liniger MA, Lussana C, Pianko-Kluczynska K (2017) Observational uncertainty and regional climate model evaluation: A pan-European perspective. *International Journal of Climatology*, in press, DOI: 10.1002/joc.5249.
- Ivanov M, **Kotlarski S** (2017) Assessing distribution-based climate model bias-correction methods over an Alpine domain: Added value and limitations. *International Journal of Climatology*, 37, 2633-2653, DOI: 10.1002/joc.4870.
- Keuler K, Radtke K, **Kotlarski S**, Lüthi D (2016) Regional climate change over Europe in COSMO-CLM: Influence of emission scenario and driving global model. *Meteorologische Zeitschrift*, 25(2), 121-136.
- Rajczak J, **Kotlarski S**, Salzmann N, Schär C (2016) Robust climate scenarios for sites with sparse observations: A two-step bias correction approach. *International Journal of Climatology*, 36, 1226-1243.
- **Kotlarski S**, Lüthi D, Schär C (2015) The elevation dependency of 21st century European climate change: An RCM ensemble perspective. *International Journal of Climatology*, 35(13), 3902-3920.
- **Kotlarski S**, Keuler K, Christensen OB, Colette A, Déqué M, Gobiet A, Goergen K, Jacob D, Lüthi D, van Meijgaard E, Nikulin G, Schär C, Teichmann C, Vautard R, Warrach-Sagi K, Wulfmeyer V (2014) Regional climate modelling on European scales: A joint standard evaluation of the EURO-CORDEX RCM ensemble. *Geoscientific Model Development*, 7, 1297-1333.
- Jacob D, Petersen J, Eggert B, Alias A, Christensen OB, Bouwer LM, Braun A, Colette A, Déqué M, Georgievski G, Georgopoulou E, Gobiet A, Nikulin G, Haensler A, Hempelmann N, Jones C, Keuler K, Kovats S, Kröner N, **Kotlarski S**, Kriegsman A, Martin E, van Meijgaard E, Moseley C, Pfeifer S, Preuschmann S, Radtke K, Rechid D, Rounsevell M, Samuelsson P, Somot S, Soussana J-F, Teichmann C, Valentini R, Vautard R, Weber B (2014) EURO-CORDEX: New high-resolution climate change projections for European impact research. *Regional Environmental Change*, 14, 563-578.
- Bellprat O, **Kotlarski S**, Lüthi D, Schär C (2012) Objective calibration of regional climate models. *Journal of Geophysical Research*, 117, D23115.
- **Kotlarski S**, Bosshard T, Lüthi D, Pall P, Schär C (2012) Elevation Gradients of European Climate Change in the Regional Climate Model COSMO-CLM. *Climatic Change*, 112, 189-215.
- **Kotlarski S**, Jacob D, Podzun R, Paul F (2010) Representing Glaciers in a Regional Climate Model. *Climate Dynamics*, 34, 27-46.
- **Kotlarski S**, Block A, Böhm U, Jacob D, Keuler K, Knoche R, Rechid D, Walter A (2005) Regional Climate Model Simulations as Input for Hydrological Applications: Evaluation of Uncertainties. *Advances in Geosciences*, 5, 119-125.

PERSONAL INFORMATION



Dr Cornelia Schwierz

-  Federal Office of Meteorology and Climatology, MeteoSwiss, Operation Center 1, Post Box 257, 8058 Zurich-Airport, Switzerland
-  +41 58 460 92 75
-  cornelia.schwierz@meteoswiss.ch

Sex female | Date of birth 19/07/1970 | Nationality German, Swiss

WORK EXPERIENCE

-
- 10/2015 - present **Head of „Climate Monitoring and Scenarios“**
Federal Office of Meteorology and Climatology, MeteoSwiss www.meteoswiss.ch
- Responsible for MeteoSwiss activities in the fields of Climate Monitoring, Climate Scenarios and Climate Communication
 - Supervision of projects concerned with the evaluation of variability and trends of climate observations, and analysis of regional climate projections.
 - Supervision of user-specific analyses and communication of climate information for national adaptation and mitigation measures
- Business or sector** National Meteorological Service
- 12/2011 - 09/2015 **Senior Scientist and Project Manager**
Statistical Office of the City of Zurich, Statistik Stadt Zürich, Napfgasse 6, 8001 Zürich, Switzerland
www.stadt-zuerich.ch/statistik
- Business or sector** Administration, Statistical Office
- Senior Scientist, Statistical Consultant, Lecturer**
- 02/2009 - 12/2011 Seminar for Statistics and Institute for Terrestrial Ecosystems, ETH Zurich, Rämistr. 101, 8092 Zurich, Switzerland
www.ethz.ch
- Business or sector** Research Institution
- Lectureship**
- 02/2006 - 02/2009 Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, UK
www.see.leeds.ac.uk/research/icas/
- Research and Teaching in the field of Dynamical Meteorology
 - Predictability of extreme events and high-impact weather in current and future climate
 - NCAS Coordinator for the THORPEX-UK
- Business or sector** Research Institution
- Senior Scientist and Lecturer**
- 10/2001 - 02/2006 Institute for Atmospheric and Climate Sciences, ETH Zurich, Rämistr. 101, 8092 Zurich, Switzerland
www.iac.ethz.ch/
- Business or sector** Research Institution
- Doctoral Studies**
- 11/1997 - 09/2001 Institute for Atmospheric and Climate Sciences, ETH Zurich, Rämistr. 101, 8092 Zurich, Switzerland
www.iac.ethz.ch/
- Modelling of Northern hemisphere flow dynamics; Analyses of blocking; Synoptic climatologies
- Business or sector** Research Institution

EDUCATION AND TRAINING

- 11/1997 - 09/2001 **Dr. sc. nat. (PhD)**

Institute for Atmospheric and Climate Sciences, ETH Zurich, Sästr. 101, 8092 Zurich, Switzerland
www.iac.ethz.ch/; Prof. Huw. C. Davies

Thesis title: "Interactions of Greenland-scale orography with synoptic-scale flow", PhD thesis, No. 14356, Swiss Federal Institute of Technology (ETH).

02/1999 - 07/2001

Advanced Studies in Applied Statistics

Seminar for Statistics, ETH Zurich, Sästr. 101, 8092 Zurich, Switzerland www.ethz.ch

09/1989 - 08/1997

"Nachdiplomkurs in Angewandter Statistik" (DAS)

Diploma in Physics (Dipl.-Phys.), with honors

Technical University of Munich, Arcisstraße 21, 80333 München, Germany

Major: Biophysics; Statistical Physics, Medical Physics

09/1992-07/1993: Exchange Year at Heriot-Watt University, Edinburgh, Scotland

PERSONAL SKILLS

Mother tongue(s)

German

Other language(s)

UNDERSTANDING

SPEAKING

WRITING

Listening

Reading

Spoken interaction

Spoken production

English

C2

C2

C2

C1

C1

ADDITIONAL INFORMATION

Publications (selection out of ~50 publications)

Pfahl, S., Schwierz, C., Croci-Maspoli, M., Grams, C. M. and H. Wernli, 2015: The importance of diabatic heating for atmospheric blocking, *Nature Geoscience* 8(8):610-614; DOI 10.1038/ngeo2487.

Wiegand, L., Twitchett, A., Schwierz, C. and P. Knippertz, 2011: Heavy precipitation at the Alpine south side and Saharan dust over central Europe: A predictability study using TIGGE., *Weather and Forecasting.*, 26(6), 957-974. doi: 10. 1 175/WAF-D- 10-05060. 1.

Schwierz, C., Kollner-Heck, P., Zenklusen Mutter, E., Bresch, D.N., Vidale, P.-L., Wild, M. and C. Schar, 2010: Modelling European winter wind storm losses in current and future climate., *Climatic Change*, 101 (3-4), pp. 485-514, doi: 10.1007/s10584-009-9712-1

Martius, O., Schwierz, C. and Davies, H. C., 2008b: Far-upstream Precursors of Heavy Precipitation Events on the Alpine South-side, *QJRMS*, 134(631), pp. 417-428.

Raible, C. C., Della-Marta, P. M., Schwierz, C., Wernli, H. and Blender, R., 2008. Northern Hemisphere Midlatitude Cyclones: A Comparison of Detection, and Tracking Methods and Different Reanalyses, *Monthly Weather Review*, 136, pp. 880-897.

Croci-Maspoli, M.; Schwierz, C. and Davies, H. C., 2007a: A multi-faceted climatology of atmospheric blocking and its recent linear trend, *J. Clim.*, 20, pp.633-649.

Schwierz, C., Appenzeller, C., Davies, H.C., Liniger, M., Muller, W., Stocker T. and M. Yoshimori, 2006: "Challenges posed by and Approaches to the study of Seasonal-to-Decadal Climate Variability", *Climatic Change*, 79 (1-2), pp.31-63.

Scherrer, S.C.; Croci-Maspoli, M.; Schwierz, C.; Appenzeller, C., 2006: Two-dimensional indices of atmospheric blocking and their statistical relationship with winter climate patterns in the Euro-Atlantic region, *Int. J. Clim*, 26, pp.233 - 249.

Wernli, H. and Schwierz, C., 2006: Surface cyclones in the ERA40 data set (1958-2001). Part I: novel identification method and global climatology, *J. Atmos. Sci.*, 63 (10), pp.2486-2507.

Schwierz, C., Croci-Maspoli, M. and Davies, H. C., 2004b: A perspicacious indicator of atmospheric blocking. *Geophys. Res. Letters*, 31 (6), L06125, doi:10.1029/2003GL019341.

Schwierz, C., Dirren S. and Davies, H. C., 2004a: Forced Waves on a Zonally-Aligned Jet Stream. *J. Atmos. Sci.*, 61 (1), 73-87.

PERSONAL INFORMATION



Gutiérrez Llorente, José Manuel

Avda. Cardenal Herrera Oria 14, 3A. Santander (39011) Spain

+34 942 200893 +34 608 481623

gutierjm@unican.es

http://www.meteo.unican.es/people/gutierrez_jm

Skype egutierjm

Sex Male | Date of birth 13/01/1969 | Nationality Spanish

CURRENT POSITION

Full research professor of the Spanish National Research Council (CSIC) at the Instituto de Física de Cantabria (IFCA). IFCA is a mixed research institute of Universidad de Cantabria and CSIC, based at Santander, Spain.

WORK EXPERIENCE

2012 - 2014

Consultant for downscaling of climate predictions

Food and Agriculture Organization (FAO)

- Consultant for climate change adaptation programs in Philippines, Morocco and Peru in the framework of the MOSAICC and AMICAF projects.

Consulting

2009 - present

Full research professor

Spanish National Research Council (CSIC).

- Head of the group on meteorology and climate change

Academia

1996 - 2008

Associate professor

Dept. of Applied Mathematics and Computer Science. University of Cantabria (UC)

- Researcher and lecturer. Head of the Department from 2000 to 2008. Head of the official Master studies on Mathematics and Computation from 2000 to 2004.

Academia

EDUCATION AND TRAINING

1992 – 1995

PhD in Mathematics and Computer Science

University of Cantabria (Spain)

1987 – 1991

BSc and MSc in Mathematics

University of Cantabria (Spain)

PERSONAL SKILLS

Mother tongue(s)

Spanish

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C1	C2	C2

Communication skills

- Good communication skills gained through my experience as lecturer, and participation in conferences and research seminars.

Organisational / managerial skills

- Leadership (currently responsible for a research team of 15 people, <http://www.meteo.unican.es>, and formerly head of a Department of 80 people).

ADDITIONAL INFORMATION

Selected recent publications

- Gutiérrez, J. M. and the VALUE collaboration (2018) An intercomparison of a large ensemble of statistical downscaling methods over Europe: Results from the VALUE perfect predictor cross-validation experiment. **International Journal of Climatology**. DOI: 10.1002/joc.5462
- Maraun, D., Shepherd, T.G., Widmann, M., Zappa, G., Walton, D., Gutiérrez, J.M., Hagemann, S., Richter, I., Soares, P.M.M., Hall, A., Mearns, L.O. (2017) Towards process-informed bias correction of climate change simulations. **Nature Climate Change**. DOI: 10.1038/NCLIMATE3418
- A Casanueva, A. Gutiérrez, J.M. et al. (2016) Daily precipitation statistics in a EURO-CORDEX RCM ensemble: added value of raw and bias-corrected high-resolution simulations. **Climatic Change**, 47, 719-737.
- Manzanas, R., S. Brands, D. San-Martín, A. Lucero, C. Limbo, and J. M. Gutiérrez (2015) "Statistical Downscaling in the Tropics Can Be Sensitive to Reanalysis Choice: A Case Study for Precipitation in the Philippines." **Journal of Climate** 28: 4171–84. doi:10.1175/JCLI-D-14-00331.1.
- Brands, S., S. Herrera, J. Fernández, and J. M. Gutiérrez (2013) How Well Do CMIP5 Earth System Models Simulate Present Climate Conditions in Europe and Africa?. **Climate Dynamics**, 41: 803–17. doi:10.1007/s00382-013-1742-8.
- Gutiérrez, J. M., D. San-Martín, S. Brands, R. Manzanas, and S. Herrera (2013) "Reassessing Statistical Downscaling Techniques for Their Robust Application under Climate Change Conditions." **Journal of Climate** 26: 171–88.

A complete list available in google scholar:

<https://scholar.google.com/citations?user=gFex3BcAAAAJ&sortBy=pubdate>

Projects and international initiatives

Participation in several international research projects, including **ENSEMBLES** (dealing with regional climate change scenarios), **EELA** (GRID infrastructure shared between Europe and Latin America for climate simulation), **QWeCI** (impacts of climate in vector borne diseases), **FUME** (impacts of climate change in forest fires), **INTACT** (resilience of critical infrastructures to climate change), **SPECS** (new generation of seasonal-to-decadal climate prediction models) and **Africultures** (enhancing food security in african agricultural systems with the support of remote sensing). Prof. Gutiérrez is also involved in the **QA4Seas COPERNICUS** C3S tender (quality assurance for multi-model seasonal forecast products).

Coordination of several national projects and the strategic action **ESTCENA** for the production of regional climate change scenarios in Spain, supported by the Spanish Ministry of Environment and Agriculture.

Currently involved in different international initiatives in the framework of regional climate change projection including **VALUE** (member of the steering committee and responsible of the development of the VALUE validation portal; <http://www.value-cost.eu>), and **CORDEX** (local contact point of statistical downscaling in **EURO-CORDEX**; <http://www.cordex.org/index.php/community/domain-euro-cordex>).

Visitor

Academic visitor at the Department of Physics (Atmospheric, Oceanic and Planetary Physics) at Oxford University, UK, 2014-2015 (7 months).
Postdoctoral visiting fellow at Cornell University. USA, 1996 (12 months).

ANNEXES

None. Details of the above projects and activities are given in <http://www.meteo.unican.es>

PERSONAL INFORMATION

Daniel San Martín Segura



 28 5ºB, General Dávila, Santander, 39005, Spain

 +34 942764410  +34 667075952

 daniel@predictia.es

Sex Male | Date of birth 31/01/1982 | Nationality Spanish

WORK EXPERIENCE

2008 - present

General Manager

Predictia Intelligent Data Solutions SL
Santander, Spain
<http://www.predictia.es>

- Project management
- Software development
- Research

2006 - 2008

Researcher

Universidad de Cantabria
Santander, Spain
<http://www.unican.es>

- Software development
- Research
- Teaching

EDUCATION AND TRAINING

2006 - 2009

Master's degree in Applied mathematics and Computer Science

Universidad de Cantabria, Spain

- Machine learning
- Advanced statistics
- High performance computing

2006 - 2009

Telecommunications engineering

Universidad de Cantabria, Spain

- Software
- Electronics
- Mathematics
- Signal processing

PERSONAL SKILLS

Mother tongue(s)

Spanish

Other language(s)

English

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	
B2	B2	B2	B2	B2

Organisational / managerial skills

- Leadership (currently responsible for a team of 5 people)
- Project management

- Computer skills**
- Programming languages:
 - Java (advanced)
 - JavaScript (advanced)
 - Matlab (advanced)
 - R (advanced)
 - Python (advanced)
 - C (middle)
 - Database skills:
 - SQL, Cypher, Database management (MySQL, MariaDB, PostgreSQL, Informix, Oracle and Neo4j), ORMs (Hibernate, MyBatis, Jooq, Spring Data, JPA)
 - Web development:
 - Backend: Vaadin, Spring Framework, Struts, Web services
 - Frontend: CSS, jQuery, D3js, Thymeleaf, Freemarker, Bootstrap, AngularJS, ExtJS
 - GIS:
 - PostGIS, Leaflet, Openlayers, Mapnik, GDAL, SAGA, QGIS, Python (matplotlib)
 - Development Tools:
 - Maven, Git, SVN, Jenkins

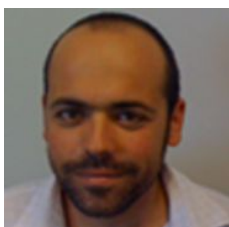
Driving licence B

ADDITIONAL INFORMATION

- Publications**
- Reassessing Model Uncertainty for Regional Projections of Precipitation with an Ensemble of Statistical Downscaling Methods, *Journal of Climate*, 2017.
- Statistical Downscaling in the Tropics can be Sensitive to Reanalysis Choice: A Case Study for Precipitation in the Philippines, *Journal of Climate*, 2015.
- Assessing and Improving the Local Added Value of WRF for Wind Downscaling, *Journal of Applied Meteorology and Climatology*, 2015.
- Statistical downscaling of climate impact indices: Testing the direct approach, *Climatic Change*, 2014.
- Reassessing statistical downscaling techniques for their robust application under climate change conditions, *Journal of Climate*, 2013.
- Robust projections of Fire Weather Index in the Mediterranean using Statistical Downscaling, *Climatic Change*, 2013.
- Validation of the ENSEMBLES global climate models over southwestern Europe using probability density functions, from a downscaling perspective, *Climate Research*, 2011.
- Snow trends in northern Spain. Analysis and simulation with statistical downscaling methods, *International Journal of Climatology*, 2010.
- A web portal for regional projection of weather forecast using GRID middleware, *Lecture Notes in Computer Science*, 2007.
- Projects**
- QA4Seas (Copernicus Climate Change Service, 2016-2018)
- Primavera (Horizon 2020, 2016-2020)
- EUPORIAS (European Commission's 7th Framework Programme 2010-2016)
- ICMBD (supported by the Spanish Ministry of Health)
- ENSEMBLES (European Commission's 6th Framework Programme 2004-2009)

PERSONAL INFORMATION

Joaquín Bedia Jiménez



Location: C/ Gerardo Diego 1, 8B, 39011, Santander, Spain

Phone: +34 942 20 20 64 **Mobile:** +34 699 475 201

Email: bediai@predictia.es

Website: <http://www.meteo.unican.es/en/node/72789> | <http://orcid.org/0000-0001-6219-4312>

Sex: Male | **Date of birth:** 20/04/1978 | **Nationality:** Spain

POSITIONS

- Since Dec 2016: R&D Manager Predictia Intelligent Data Solutions Inc.
- Since Sept 2014: Associate Professor at the Department of Applied Mathematics and Computer Science (University of Cantabria).

WORK EXPERIENCE

2014- 2016

Hired Researcher

Institute of Physics of Cantabria (IFCA-CSIC) Meteorology Group
 ▪ Researcher

2010-2014

Research Fellow

Department of Applied Mathematics and Computer Science (University of Cantabria)
 ▪ Researcher
 ▪ Teaching assistance

EDUCATION AND TRAINING

2012-2015

PhD Programme in Science, Computing and Technology

PhD

University of Cantabria (Santander, Spain)

- PhD Thesis: Downscaling of Climate Scenarios for wildfire Danger Assessment: Development and applications <https://repositorio.unican.es/xmlui/handle/10902/8363>

2010-2011

MSc Programme Applied Mathematics and Computer Science

MSc

University of Cantabria (Santander, Spain)

- MSc Thesis: Predicting Plant Species Distributions across an Alpine Rangeland in Northern Spain: A comparison of probabilistic Methods. <http://onlinelibrary.wiley.com/doi/10.1111/j.1654-109X.2011.01128.x/abstract>

1999-2003

BSc (Hons.) Environmental Science

BSc

Wolverhampton University (Wolverhampton, UK)

PERSONAL SKILLS

Mother tongue(s)

Spanish

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
Cambridge ESOL Level 2 Certificate in Advanced English					

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user
[Common European Framework of Reference for Languages](#)

Communication skills

Good communication skills, both oral and written, gained through my experience as lecturer, and participation in conferences and research seminars, and production of scientific reports

and journal articles.

Digital skills

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Proficient User	Proficient User	Independent User	Independent User	Proficient User

Levels: Basic user - Independent user - Proficient user

[Digital competences - Self-assessment grid](#)

Good programming skills, particularly using the R environment for statistical computing and similar scripting scientific languages (MatLab™, Python), acquired during the development of different software packages. Selected examples:

- *climate4R*: a bundle of R packages for transparent climate data access, post processing (including bias correction and downscaling) and visualization. <http://www.meteo.unican.es/climate4R>

ADDITIONAL INFORMATION

Selected publications (climate service development, climate-oriented toolboxes, climate change impact applications)

Bedia, J., Golding, N., Casanueva, A., Iturbide, M., Buontempo, C., Gutiérrez, J.M., 2018. Seasonal predictions of Fire Weather Index: Paving the way for their operational applicability in Mediterranean Europe. *Climate Services*. <https://doi.org/10.1016/j.cliser.2017.04.001>

Bedia, J., Herrera, S., Camia, A., Moreno, J.M., Gutierrez, J.M., 2014. Forest Fire Danger Projections in the Mediterranean using ENSEMBLES Regional Climate Change Scenarios. *Climatic Change* 122, 185--199. <https://doi.org/10.1007/s10584-013-1005-z>

Bedia, J., Herrera, S., Gutiérrez, J.M., 2013. Dangers of using global bioclimatic datasets for ecological niche modeling. Limitations for future climate projections. *Global and Planetary Change* 107, 1–12. <https://doi.org/10.1016/j.gloplacha.2013.04.005>

Bedia, J., Herrera, S., Gutierrez, J.M., Benali, A., Brands, S., Mota, B., Moreno, J.M., 2015. Global patterns in the sensitivity of burned area to fire-weather: implications for climate change. *Agr. Forest Meteorol.* 214--215, 369--379. <https://doi.org/10.1016/j.agrformet.2015.09.002>

Cofiño, A.S., Bedia, J., Iturbide, M., Vega, M., Herrera, S., Fernández, J., Frías, M.D., Manzanas, R., Gutiérrez, J.M., 2017. The ECOMS User Data Gateway: Towards seasonal forecast data provision and research reproducibility in the era of Climate Services. *Climate Services*. <https://doi.org/10.1016/j.cliser.2017.07.001>

Frías, M.D., Iturbide, M., Manzanas, R., Bedia, J., Fernández, J., Herrera, S., Cofiño, A.S., Gutiérrez, J.M., 2018. An R package to visualize and communicate uncertainty in seasonal climate prediction. *Environmental Modelling & Software* 99, 101–110. <https://doi.org/10.1016/j.envsoft.2017.09.008>

A complete list of journal articles is available at: <https://orcid.org/0000-0001-6219-4312>

Participation in Projects and international initiatives

European FP7 Projects

- FUME (impacts of climate change in forest fires)
- INTACT (resilience of critical infrastructures to climate change)
- CLIMRUN (Climate Local Information in the Mediterranean region Responding to User Needs)
- EUPORIAS (development of prototypes of climate services addressing the need of specific users)
- SPECS (new generation of seasonal-to-decadal climate prediction models).

Action COST VALUE (2012-2015) aiming to provide a European network to validate and develop downscaling methods and improve the collaboration between the dispersed research communities and with stakeholders.

Copernicus Climate Change Service: QA4Seas (Quality assessment for seasonal products)

Details of the above projects and activities are given in <http://www.meteo.unican.es>

Curriculum Vitae

PERSONAL INFORMATION



Fernando Martín Marlasca

Ruiz Zorrilla, Santander, 39009, Spain

+34 699518577 +34 699518577

fmartin@predictia.es

Sex Male | Date of birth 30/05/1988 | Nationality Spanish

JOB APPLIED FOR
POSITION
PREFERRED JOB
STUDIES APPLIED FOR
PERSONAL STATEMENT

WORK EXPERIENCE

January 2018 - Today

Senior Programmer

Predictia Data Solutions, Santander, Spain - <http://predictia.es>

- Front-end programming tasks

Business or sector Weather forecast, data mining, big data

November 2012 – January 2018

Senior Programmer

ISBAN, Santander, Spain - <http://www.isban.com>

- Front-end and back-end programming tasks
- Projects management
- Trainer

Business or sector Banking

March 2012 – November 2012

Programmer

Accenture, Bilbao, Spain - <https://www.accenture.com>

- SAP solutions programming

Business or sector Consulting

August 2011 – September 2011

Developer

EPAM Systems, Minsk, Belarus - <https://www.epam.com/>

- Back-end programming

Business or sector Consulting

EDUCATION AND TRAINING

2006 - 2011

Computer Engineering

University of Cantabria, Santander, Spain

- Replace with a list of principal subjects covered or skills acquired

EQF 7

PERSONAL SKILLS

Mother tongue(s) Spanish

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	B2	B2	B2	B2	B2
First Certificate in English –FCE					

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user
[Common European Framework of Reference for Languages](#)

Communication skills ■ Good communication skills gained through my experience as trainer of new employees

Organisational / managerial skills ■ Leadership (in the past responsible for a team of 4 people)
 ■ Agile methodology (I did an Agile Scrum training and I have worked with this methodology)

Job-related skills ■ Good command of quality deliverables (project responsible)

Digital skills	SELF-ASSESSMENT				
	Information processing	Communication	Content creation	Safety	Problem solving
	Proficient user	Proficient user	Proficient user	Independent user	Proficient user

Levels: Basic user - Independent user - Proficient user
[Digital competences - Self-assessment grid](#)

■ good programming skills, I work as a programmer

Other skills ■ Team work, gained as monitor of youth groups

Driving licence B

ADDITIONAL INFORMATION





Publications
 Presentations ■ Course: Programming ABAP IV (Accenture) – Madrid, 2012
 Projects ■ Course: Human-Computer Interaction (Stanford University) – online, 2012
 Conferences ■ Certification: CMMI2 (Sopra-Steria) – Santander, 2016
 Seminars ■ Course: Framework Agile (Opinno) – Santander, 2017
 Honours and awards
 Memberships
 References
 Citations
 Courses
 Certifications

ANNEXES

PERSONAL INFORMATION

Antonio S. Cofiño González



 ETSI Caminos, Canales y Puertos, Universidad de Cantabria, Avenida de los Castros sn, 39005, Santander, Spain
 [+34 942 20 17 31](tel:+34942201731)
 antonio.cofino@unican.es
 <http://meteo.unican.es/people/cofinoa>

Sex Male | Date of birth 25/07/1975 | Nationality Spanish

WORK EXPERIENCE

2009 - current

Associate Professor

Head of the Meteorology and Computing Group from the Universidad de Cantabria and responsible of the e-Science in Earth Sciences research line of the Santander Met. Group. (<http://meteo.unican.es>)
 Director of the Climate Data Service (Sci&Tech Infrastructure of the Universidad de Cantabria)

2006 - 2009

Assistant Professor

Department of Applied Mathematics and Computing Science of the University of Cantabria

2005 - 2006

Project Assistant Researcher

Spanish National Meteorology Institute (currently AEMet), Madrid, Spain

2005 - 2005

Research Contractor

Orla Cronin Research Ltd, Wirral, UK

Research on Application and Development of Probabilistic Graphical Models

2004 - 2005

Research Assistant

Computing and Mathematical Sciences, Liverpool John Moores University, Liverpool, UK

Research Contract by Unilever's Personal Care R&D, Port Sunlight, UK

1998 - 2004

Research Fellow

Research group of Artificial Intelligence and Meteorology, University of Cantabria, Spain

EDUCATION AND TRAINING

2004

PhD in Mathematics and Computing

EQF-level 8

Universidad de Cantabria

1998

Graduate in Physics Sciences

EQF-level 6

Universidad de Cantabria

PERSONAL SKILLS

Mother tongue(s)

Other language(s)

Spanish

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	
C1	C1	C1	C1	C1

English

Communication skills

Good communications skills gained through my experience as lecturer, and participation in conferences and research seminars.

Organisational / managerial skills

- Deputy Head of Dep. of Applied Mathematics and Computational Sciences at Uni. of Cantabria.
- Head of Research Group on Meteorology and Computer Sciences at University of Cantabria.
- Director of the Climate Data Service Sci&Tech Infrastructure of the Universidad de Cantabria .
<http://meteo.unican.es/dataservices>
- PhD Theses: 3 directed and 1 on-going

Other skills

Applications' reviewer of the Spanish e-Science Network and researcher of the MM5 Iberian Network and the I-Math Network. Former technical editor for the TEST Journal

ADDITIONAL INFORMATION

Selected recent publications

- 36 papers in peer-reviewed journals, with 410 citations in Scopus leading to an h-index of 10. A complete list available in Research ID: <http://www.researcherid.com/rid/G-6247-2010>, and Scopus: <https://www.scopus.com/authid/detail.uri?authorid=6505838419>
- Frías, M.D., Iturbide, M., Manzanas, R., Bedia, J., Fernández, J., Herrera, S., **Cofiño, A.S.**, Gutiérrez, J.M. (2018). An R Package to Visualize and Communicate Uncertainty in Seasonal Climate Prediction. *Environmental Modelling & Software*. 99, pp.101–110.
 - **Cofiño, A.S.**, Bedia, J., Iturbide, M., Vega, M., Herrera, S., Fernández, J., Frías, M.D., Manzanas, R., Gutiérrez, J.M. (2017). The ECOMS User Data Gateway: Towards seasonal forecast data provision and research reproducibility in the era of Climate Services. *Climate Services*. <https://doi.org/10.1016/j.ciser.2017.07.001>
 - Manzanas, R., Gutiérrez, J.M., Fernández, J., van Meijgaard, E., Calmanti, S., Magariño, M.E., **Cofiño, A.S.**, Herrera, S. (2017). Dynamical and statistical downscaling of seasonal temperature forecasts in Europe: Added value for user applications. *Climate Services*. <https://doi.org/10.1016%2Fj.ciser.2017.06.004>
 - Fernández-Quiruelas V, Blanco C, **Cofiño A.S.** and Fernández J. (2015). Large-scale climate simulations harnessing Clusters, Grid and Cloud infrastructures. *Future Generation Computer Systems*. 15, pp.36-44.
 - Manzanas, R. Frías, M.D. **Cofiño, A.S.** Gutiérrez, J.M. (2014). Validation of 40 year multimodel seasonal precipitation forecasts: The role of ENSO on the global skill. *Journal of Geophysical Research Atmospheres*. 119 – 4, pp.1708-1719.
 - Brands, S. Gutiérrez, J.M. Herrera, S. **Cofiño, A.S.** (2012). On the Use of Reanalysis Data for Downscaling. *Journal of Climate*. 25, pp.2517-2526.
 - Fernández-Quiruelas, V. Fernández, J. **Cofiño, A.S.** Fita, L. Gutiérrez, J.M. (2011). Benefits and requirements of grid computing for climate applications. An example with the community atmospheric model. *Environmental Modelling & Software*. 26 – 9, pp.1057-1069.
 - Brands, S. Taboada, J.J. **Cofiño, A.S.** Sauter, T. Schneider, C. (2011). Statistical downscaling of daily temperatures in the NW Iberian Peninsula from global climate models: validation and future scenarios. *Climate Research*. 48 – 2, pp.163-176.
 - Díez, E. Orfila, B. Frías, M.D. Fernández, J. **Cofiño, A.S.** Gutiérrez, J.M. (2011). Downscaling ECMWF seasonal precipitation forecasts in Europe using the RCA model. *Tellus Series A-Dynamic Meteorology and Oceanography*. 63 – 4, pp.757-762.
 - Frías, M.D. Herrera, S. **Cofiño, A.S.** Gutiérrez, J.M. (2010). Assessing the Skill of Precipitation and Temperature Seasonal Forecasts in Spain. *Windows of Opportunity Related to ENSO Events*. *Journal of Climate*. 23, pp.209-220.
 - Fernández-Quiruelas, V. Fernández, J. Baeza, C. **Cofiño, A.S.** Gutiérrez, J.M. (2009). Execution management in the GRID for sensitivity studies of global climate simulations. *Earth Science Informatics*. 2, pp.75-82.

Projects and international initiatives

Principal Investigator for Universidad de Cantabria in EU FP projects, **EELA-2** (building GRID infrastructure and capacities shared between Europe and Latin America), **METAFOR** (common metadata for climate modeling digital repositories), **SCI-BUS** (scientific gateway based user support) and **IS-ENES2** (infrastructure for the european network for earth system modelling) and participation in several international projects: **DEMETER** (development of a european multimodel ensemble system for seasonal to interannual prediction), **CrossGRID** (developing, implementing and exploiting new grid components for interactive compute and data intensive applications), **ENSEMBLES** (dealing with regional climate change scenarios), **EELA** (e-infrastructure shared between Europe and Latin America), **CLIM-RUN** (dealing with the impact of climate change in several sectors), **QweCI** (Quantifying Weather and Climate Impacts on Health in Developing Countries), **FUME** (impacts of climate change in forest fires), **EUPORIAS** (european provision of regional impact assessment on a seasonal-to-decadal timescale), **SPECS** (new generation of seasonal-to-decadal climate prediction models). Principal investigator on Spanish National R&D program projects **WRF4G** (Adaptation of WRF Model to GRID Infrastructures and user-case for wind hindcast over Europe) and **INSIGNIA** (contribution to CORDEX Flagship Pilot Studies: regional climate downscaling and data publishing). Subcontractor of the ECMWF's **C3S 34a Lot 1 (CORDEX4CDS)**. Subcontractor of the **ECMWF's Product Section** for recommendations to **encode netCDF datasets**.

Software development

- **MeteoLab**, Development of programming and web tools for climate data access, analysis, manipulation and statistical downscaling: <http://meteo.unican.es/software/meteolab>
- **ENSEMBLES Downscaling Portal**: <https://meteo.unican.es/downscaling/ensembles>
- **DP2C4I**: integration of ENSEMBLES Downscaling Portal into the Climate4Impact portal: <https://climate4impact.eu/impactportal/downscaling/downscalingdocs.jsp>
- **WRF4G**, workflow management of WRF experiments on distributed computer resource: <https://meteo.unican.es/trac/wiki/WRF4G2.0>
- **DRM4G**, open platform for geographically distributed computational jobs: <https://meteo.unican.es/trac/wiki/DRM4G>
- **UDG**, the user data gateway for climate data access: <https://meteo.unican.es/trac/wiki/udg>
- **ESGFToolsUI**, integration on the netcd-java ToolsUI the ESGF infrastructure services: <https://meteo.unican.es/trac/wiki/ESGFToolsUI>
- **ESGFGetCredentials**, a GUI and CLI for ESGF user credentials: <https://meteo.unican.es/trac/wiki/ESGFGetCredentials>
- GitHub's profile <https://github.com/cofinoa>





ANNEXES

Details of the above projects and activities are given in <http://meteo.unican.es>

PERSONAL INFORMATION

Christopher Kadow



-  Poschingerstr. 22, 12157 Berlin (Germany)
-  (+49)1785058611
-  christopher.kadow@met.fu-berlin.de
-  https://www.researchgate.net/profile/Christopher_Kadow

WORK EXPERIENCE

15/12/2011–Present

Project Coordinator in Research Project

Freie Universität Berlin, Berlin (Germany)

- project coordination in a climate science project "INTEGRATED data and evaluation system for decadal scale predicTION"
- development and advancement of a software framework for scientific research
- data and software management on HPCs in shell and web
- MiKlip project on decadal climate prediction - www-miklip.dkrz.de
- Education and Teaching at the University - freva.met.fu-berlin.de
- German contribution to CMIP6 - cmip-eval.dkrz.de

EDUCATION AND TRAINING

01/04/2005–14/12/2011

Studies of Meteorology - German Diploma

Freie Universität Berlin, Berlin (Germany)

- Meteorology, Climate Science

PERSONAL SKILLS

Mother tongue(s) German

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C1

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
 Common European Framework of Reference for Languages

Organisational / managerial skills

- project management
- data and software management

Job-related skills

- Decadal climate predictions improved by ocean ensemble dispersion filtering
 C Kadow, S Illing, I Kröner, U Ulbrich, U Cubasch Journal of Advances in Modeling Earth Systems 9 (2), 1138-1149
 DOI: 10.1002/2016MS000787
- Evaluation of forecasts by accuracy and spread in the MiKlip decadal climate prediction system
 C Kadow, S Illing, O Kunst, HW Rust, H Pohlmann, WA Müller, U Cubasch Meteorologische Zeitschrift 25 (6), 13 2016
 DOI: 10.1127/metz/2015/0639

MiKlip: A National Research Project on Decadal Climate Prediction

J Marotzke, WA Müller, FSE Vamborg, P Becker, U Cubasch, H Feldmann, ... C Kadow, ...

Bulletin of the American Meteorological Society 97 (12), 2379-2394 9 2016

DOI: 10.1175/BAMS-D-15-00184.1

MurCSS: A tool for standardized evaluation of decadal hindcast systems

S Illing, C Kadow, K Oliver, U Cubasch Journal of Open Research Software 2 (1) 9 2014

DOI: 10.5334/jors.136

Improved forecast skill in the tropics in the new MiKlip decadal climate predictions

H Pohlmann, WA Mueller, K Kulkarni, M Kameswarrao, D Matei, ..., C Kadow, ..., J Marotzke

Geophysical Research Letters 40 (21), 5798-5802 44 2013

DOI: 10.3402/tellusa.v66.22830

Probabilistic evaluation of decadal prediction skill regarding Northern Hemisphere winter storms

T Kruschke, HW Rust, C Kadow, WA Müller, H Pohlmann, GC Leckebusch

Meteorologische Zeitschrift 25 (6), 721-738 17 2016

DOI: 10.1127/metz/2015/0641

Decadal hindcasts initialized using observed surface wind stress: evaluation and prediction out to

2024 M Thoma, RJ Greatbatch, C Kadow, R Gerdes Geophysical Research Letters 42 (15), 6454-

6461 15 2015

DOI: 10.1002/2015GL064833

Global climate change and aspects of regional climate change in the Berlin-Brandenburg region

U Cubasch and C Kadow Erde 142 (1-2), 3-20 13 2011

The impact of stratospheric volcanic aerosol on decadal-scale climate predictions

C Timmreck, H Pohlmann, S Illing, C Kadow Geophysical Research Letters 43 (2), 834-842 10 2016

DOI: 10.1002/2015GL067431

Evaluating decadal predictions of northern hemispheric cyclone frequencies

T Kruschke, HW Rust, C Kadow, GC Leckebusch, U Ulbrich Tellus A: Dynamic Meteorology and Oceanography 66 (1), 22830 10 2014

DOI: 10.3402/tellusa.v66.22830

Bias and Drift of the Medium-Range Decadal Climate Prediction System (MiKlip) validated by

European Radiosonde Data M Pattantyús-Ábrahám, C Kadow, S Illing, WA Müller, H Pohlmann, ...

2 2016

DOI: 10.1127/metz/2016/0803

Seasonal prediction skill of East Asian summer monsoon in CMIP5-Models

B Huang, U Cubasch, C Kadow Earth System Dynamics Discussions

DOI: 10.5194/esd-2017-51

PERSONAL INFORMATION

Uwe Ulbrich

 Märkische Heide 8, 14532 Kleinmachnow (Germany)

 +49 30 838 71186

 ulbrich@met.fu-berlin.de

WORK EXPERIENCE

01/05/1985–31/05/1990

Doctoral Research assistant

Universität zu Köln, Köln (Germany)

Project work on the Atmospheric Energy Cycle

01/06/1990–31/08/2004

Post-Doctoral Researcher

Universität zu Köln, Köln (Germany)

Work on different meteorological projects, then university position with both administrative, teaching and project work. Supervision of PhD students, several project proposals on model evaluation, atmospheric variability and impacts.

01/09/2004–Present

Full Professor

Freie Universität Berlin, Berlin (Germany)

6 years vice dean of the faculty for Geosciences.

Current position: Acting head of department.

2012–Present

Executive Editor of the Journal "Natural Hazards and Earth System Sciences"

2004–Present

Advisory Board member

Advisor to institutions like Helmholtz-Zentrum Geesthacht, European Severe Storms Laboratory, member of Belmont Forum e-infrastructures and data management knowledge hub, steering committee member of MedCLIVAR initiative and others

EDUCATION AND TRAINING

1978–1985

Student of Geophysics

Diploma in Geophysics

Universität zu Köln, Köln (Germany)

Geophysics, Thesis on Seismology

1985–1990

PhD in Natural Sciences (Meteorology)

Dr. rer. nat.

Universität zu Köln, Köln (Germany)

Dissertation on the Atmospheric Energy Cycle in GCMs and Analysis data

1996–2000

Habilitation

Universität zu Köln, Köln (Germany)

Habilitation thesis on Baroclinic Wave Activity in the Northern Hemisphere

PERSONAL SKILLS

Mother tongue(s) German

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
Spanish	B1	B1	B1	B1	A2

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
Common European Framework of Reference for Languages

Communication skills Very good communication skills, gained through different positions, including international committees.

Organisational / managerial skills Former Vice dean of research, current acting director. Project leader and work package leader in National and European projects.

PERSONAL INFORMATION

Ingo Kirchner

 Carl-Heinrich-Becker-Weg 6-10, 12165 Berlin (Germany)

 (+49) 30 838 71151

 ingo.kirchner@met.fu-berlin.de

WORK EXPERIENCE

Scientist

Freie Universität, Berlin (Germany)

- weather forecast 5 years practice
- climate reseach and climate modelling since 1991
- graduate teaching (statistics, modelling, programming) since 2003

EDUCATION AND TRAINING

1 Aug 1981–31 Jul 1986

Diploma in Meteorology

Humboldt University, Berlin (Germany)

1 Jan 1991–28 Feb 1994

doctoral candidate

EQF level 4

Max-Planck-Institute of Meteorology, Hamburg (Germany)

PERSONAL SKILLS

Mother tongue(s) German

Other language(s)

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	

English

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
Common European Framework of Reference for Languages

Digital skills

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Proficient user	Proficient user	Proficient user	Proficient user	Proficient user

Digital skills - Self-assessment grid

- UNIX, Python, FORTRAN, PERL, SQL, PHP, HTML and other relevant computer languages
- advanced knowledge in diagnostics e.g. R, matlab
- advanced knowledge in visualization e.g. paraview, OpenGL, WebGL
- special Earth system software e.g. CDO

PERSONAL INFORMATION

Sebastian Illing



📍 Carl-Heinrich-Becker-Weg 6-10, 12165 Berlin (Germany)

✉ sebastian.illing@met.fu-berlin.de

🗣 Sebastian Illing

WORK EXPERIENCE

Nov 2012–Present

Scientific Programmer

Freie Universität Berlin, Berlin (Germany)

- Development for INTEGRATION (subproject of the nationwide, government funded research initiative MiKlip - Decadal climate prediction)
- Conception and technical realization of a central evaluation system for decadal climate predictions ("FREVA"), that meanwhile has been implemented internationally at various research institutes
- Programming of the django based website to access the evaluation system running on a high performance computer through the web (<https://www-miklip.dkrz.de>)

EDUCATION AND TRAINING

Nov 2012–Present

Phd student

Freie Universität Berlin - Institute of Meteorology, Berlin (Germany)

Oct 2005–Dec 2011

Diploma in Physics

University Heidelberg, Heidelberg (Germany)

Graduation: Diploma in Physics

Title (supervised by Prof. Dr. Ulrich Platt): "Entwicklung und Erprobung eines kostengünstigen SO₂-Kamera Prototyps zur Messung von vulkanischen Gasemissionen"

Aug 2008–Mar 2009

ERASMUS

Universita degli Studi di Torino, Torino (Italy)

ERASMUS Scholarship for foreign studies at the faculty of physics

PERSONAL SKILLS

Mother tongue(s)

German

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C1	C1	C1

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
Common European Framework of Reference for Languages

Job-related skills

Assessing the Impact of a Future Volcanic Eruption on Decadal Predictions

S Illing, C Kadow, H Pohlmann, and C Timmreck Earth System Dynamics Discussions 2018

DOI: 10.5194/esd-2018-5

MurCSS: A tool for standardized evaluation of decadal hindcast systems
 S Illing, C Kadow, K Oliver, U Cubasch Journal of Open Research Software 2 (1) 9 2014
 DOI: 10.5334/jors.136

The impact of stratospheric volcanic aerosol on decadal-scale climate predictions
 C Timmreck, H Pohlmann, S Illing, C Kadow Geophysical Research Letters 43 (2), 834-842 10 2016
 DOI: 10.1002/2015GL067431

Decadal climate predictions improved by ocean ensemble dispersion filtering
 C Kadow, S Illing, I Kröner, U Ulbrich, U Cubasch Journal of Advances in Modeling Earth Systems 9 (2), 1138-1149
 DOI: 10.1002/2016MS000787

Evaluation of forecasts by accuracy and spread in the MiKlip decadal climate prediction system
 C Kadow, S Illing, O Kunst, HW Rust, H Pohlmann, WA Müller, U Cubasch Meteorologische Zeitschrift 25 (6), 13 2016
 DOI: 10.1127/metz/2015/0639

Improved forecast skill in the tropics in the new MiKlip decadal climate predictions
 H Pohlmann, WA Mueller, K Kulkarni, M Kameswarrao, D Matei, ..., C Kadow ,..., J Marotzke
 Geophysical Research Letters 40 (21), 5798-5802 44 2013
 DOI: 10.3402/tellusa.v66.22830

Bias and Drift of the Medium-Range Decadal Climate Prediction System (MiKlip) validated by
 European Radiosonde Data M Pattantyús-Ábrahám, C Kadow, S Illing, WA Müller, H Pohlmann, ...
 2 2016
 DOI: 10.1127/metz/2016/0803

Digital skills

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Proficient user	Proficient user	Proficient user	Proficient user	Proficient user


Digital skills - Self-assessment grid

PERSONAL INFORMATION

Federico Fierli



 Institute of Atmospheric Sciences and Climate, National Research Council

 +39 0649934313  3668010874

 f.fierli@isac.cnr.it



Current position: Senior Researcher, Head of the CNR C3S_511 technical team

WORK EXPERIENCE

2002-now Researcher, Consiglio Nazionale delle Ricerche, Roma & Bologna, Italy

2004-now Associate Professor of Climate Physics, University of Rome, Tor Vergata

2000-2002 European Space Agency Post-doc research fellowship, Paris & Sophia Antipolis, France

Visiting at:

NCAR, Atmospheric Chemistry Division, Boulder, US (August 2010, August-December 2012, August 2014)

LATMOS-CNRS, Paris (on average 2 weeks per year)

NILU, Norway, October 2014

KIT/FZJ, Karlsruhe, Germany, August 2015

2005-Now Professor of Climate Physics (60 hours) University Rome Tor Vergata, Faculty of Physics (syllabus in <http://www.isac.cnr.it/~utls/?q=node/243>)

EDUCATION

1996-1999 PhD in Meteorology and Oceanography, University Pierre et Marie Curie, Paris VI

1995 Degree in Physics, Università di Roma "La Sapienza", Final note 110/110 cum laude

Relevant projects

Service manager of C3S_511 ECMWF-Copernicus, Evaluation of ECVs, 2018-2021 (4.8 MEuro)

C3S_25 ECMWF-Copernicus, Climate toolbox, 2016-2019 (120 kE)

Diplomazia2, Grant system on climate change and impacts, Foreign Affairs Dept., 2017 (90 kE)

PI of ISAC unit, STRATOCLIM-EU, FP7, 2014-2020 (140 kE)

Nextdata, Climate database national research programme, 2014-2015 (30 kE)

Chairman, COST-Action "Water Vapour in the climate system" WAVACS 2007-2011 (320 kE)

PI of ISAC unit ASI QUILTSAT assimilation in AQ models 2006-2009 (130 kE)

PI of Programma Nazionale Ricerche Antartiche project CLIVA 2006-2009 (90 kE)

PI of CNR, VIFP UE project Multidisciplinary Analysis of African Monsoon (AMMA) 2005-2010 (610 kE)

I-AMICA, Progetto Operativo Nazionale, "Transport of pollutants in the mediterranean basin", 2012-2014 - Regional Environmental Agency, "Pollution in the Po-Valley region", 2011-2015 (40 kE, shared with F. Cairo)

Participation to 8 EU projects and 5 national projects as CO-I and to 5 International measurement campaigns

Science and Technical Skills relevant for this tender

The common line of my research since the end of 90's is the interaction between atmospheric circulation and composition, focusing on key processes for climate. In general, I have chosen an approach based on the use of best available in-situ and remote sensing observations and different level of complexity models. I hence developed marked skills in advanced data analysis, in writing specific components in atmospheric models and evaluating a large range of simulations. Specifically to this call, I am largely involved in the build-up of the Climate Data Store through the management of the C3S_511 EQC service, the Toolbox C3S_25 tender and definition of the CDS content and Common Data Model

Communication and training on Climate

2016: Writing and conduction of 1h documentary on Climate on the Italian National Broadcasting Channel

Frequent (10 in 2016) contributions in radio / national TV – as example recent on National news:

<http://www.cnrweb.tv/atmosfera-lanidride-carbonica-e-in-aumento/>

Invited talk to > 20 public conferences (General Public / Secondary schools)

2015: support for aerosol observation Citizen Science "ISPEX" in Rome area

2010-now Member of the science committee of "START laboratorio di culture creative", partnership between Fondazione Marino Golinelli and Comune di Bologna

2010-2011 ISAC coordination for "150 anni di scienza", to the Genova science Festival

2010-2011 ISAC coordination for "Researchers Night" projects in Bologna

2006-2010 Coordination and animation of science labs on climate in 4 editions of "La Scienza in Piazza™"

2010-2011 Participation to the NCAR-NSF & COST-ESF science communication training workshop, NCAR, Boulder, CO, USA & Città della Scienza, Napoli, Italy

Additional information:

- Associate Editor for Atmospheric Chemistry and Physics - Referee for Climate Dynamics, Annales Geophysicae, Journal Geophysical Research, Geophysical Research Letter, Atmospheric Chemistry and Physics

- Evaluator for National Science Foundation (US), Agence Nationale Recherche (France), MIUR (Italy) research proposals

Main (or equivalent to main in terms of writing / analysis) author of 16 (out of 48 total) papers indexed in ISI

H-index (googlescholar) = 15

Author of 1 position paper on national climate, 2 science popularization papers, 6 press releases

Author / co-author of a large number of conference proceedings

Author / co-author of > 80 conference workshop contribution

Author / co-author of 12 invited talks and seminars

Mother tongue(s) Italian

Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
French	C2	C2	C2	C2	C2

PERSONAL INFORMATION



Chiara Cagnazzo

📍 Via del Fosso del Cavaliere 100, 00133, Rome - Italy

☎ +390649934278 📠 +393477380235

✉ c.cagnazzo@isac.cnr.it

Sex F || Nationality Italian

POSITION

Researcher

PERSONAL STATEMENT

Climate variability and global changes, Earth and atmospheric numerical modeling, Radiation and climate, Climate predictability, Stratospheric composition and dynamics, Evaluation of chemistry climate models, troposphere-stratosphere coupling, Temperature satellite observations, Aerosols in situ observations.

WORK EXPERIENCE

20 Dec 2011– present

Feb 2007 – Dec 2011

Feb 2005 – Jan 2007

Sep 2003 – Mar 2004

Mar 2000 – Aug 2003

Permanent Researcher at Istituto di Scienze dell’Atmosfera e del Clima, ISAC-CNR
Scientist and Junior Scientist at Centro Euro-Mediterraneo per I Cambiamenti Climatici (CMCC), Bologna.

PostDoc at Istituto Nazionale di Geofisica e Vulcanologia (INGV), Bologna.

Research Fellow at Ente per le Nuove tecnologie, l’Energia e l’Ambiente (ENEA), Rome

Ingenieur de Recherche and PhD Student at LMD-CNRS and Ecole Polytechnique, France

EDUCATION AND TRAINING

Jun 2004

Oct 1999

PhD Ecole Polytechnique, France. “Variabilité de la température dans la stratosphère”. Très honorable avec félicitations

MSc and BS in Physics. Dep. of Physics, University of Rome “La Sapienza” (Italy)

PERSONAL SKILLS

Mother tongue(s)

Other language(s)

Italian

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1/C2	C1/C2	C1/C2	C1/C2	C1/C2
French	C1/C2	C1/C2	C1/C2	C1/C2	C1/C2

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user

[Common European Framework of Reference for Languages](#)

Teaching

Course “Numerical Modeling” (FIS01), University of Rome Tor Vergata, 8 CFU (60 hours), years: 2012- to present

Course on “Geophysical Fluid Dynamics” University of Rome Tor Vergata, 9 CFU, 2016-to present.

PhD course “Radiation and Climate” (30 hours), PhD in Science and Management of Climate Change, University of Venice Ca’ Foscari, years: 2007-2012

2011-2012: Member of the Faculty Board of the Ph.D. Programme on Science and Management of Climate Change, Ca’ Foscari University.

Job-related skills

ECV data evaluation, Earth System Modeling development and evaluation, participation in CMIP5 and CCM/CCMVAL SPARC WCRP

Review Editor on Chapter 5: Stratospheric ozone changes and climate 2018 UNEP/WMO Scientific Assessment of Ozone Depletion

Expert Reviewer of the IPCC WGI Fifth Assessment Report;

Digital competence

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Proficient user	Proficient user	Proficient user	Proficient user	Proficient user

Experience with a wide range of computer platforms, including leading edge HPC platforms (NEC SX vector multiprocessor, IBM Power, CRAY X, IBM iDataPlex). Experience with the most common operating systems (Windows, Mac OS, UNIX/Linux), with excellent knowledge of UNIX/Linux systems. Programming languages: excellent knowledge of FORTRAN (77/90/95/2003) and UNIX shell; good knowledge of C; basics of Perl, awk, Intel x86 assembler. Development tools: UNIX make, GNU autoconf, CVS, subversion, Git; benchmarking and debugging. Parallel programming: MPI, OpenMP. Scientific analysis and visualization software: MATLAB, IDL, Grid Analysis and Display System (GrADS), NCAR Command Language (NCL), netCDF Operator (NCO), Climate Data Operators (CDO), Python. Other: LaTeX, HTML/CSS, office suites

ADDITIONAL INFORMATION

Selected Publications (of 34)

Rea, G., Riccio, A., Fierli, F., F. Cairo and **C. Cagnazzo**(*), Stratosphere-resolving CMIP5 models simulate different changes in the Southern Hemisphere, *Clim Dyn* (2017). <https://doi.org/10.1007/s00382-017-3746-2> (*)corresponding

D'Errico, M., **C. Cagnazzo**, P. G. Fogli, W. K. M. Lau, et al. (2015), Indian monsoon and the elevated-heat-pump mechanism in a coupled aerosol-climate model, *J. Geophys. Res. Atmos.*, 120, 8712–8723, doi:10.1002/2015JD023346.

Davini, P. & **Cagnazzo, C.**(2014), On the misinterpretation of the North Atlantic Oscillation in CMIP5 models, *Climate Dynamics*, 43: 1497. doi:10.1007/s00382-013-1970-y

Cagnazzo, C., E. Manzini, P.G. Fogli, M. Vichi, P. Davini (2013), Role of stratospheric dynamics in the ozone–carbon connection in the Southern Hemisphere. *Clim Dyn.* doi:10.1007/s00382-013-1745-5

Davini P., **C. Cagnazzo**, P. G. Fogli, E. Manzini, S. Gualdi, A. Navarra (2013), European blocking and Atlantic jet stream variability in the NCEP/NCAR reanalysis and the CMCC-CMS climate model, *Clim Dyn.*, 10.1007/s00382-013-1873-y

Manzini, E., **C. Cagnazzo**, P. G. Fogli, A. Bellucci, and W. A. Müller (2012), Stratosphere-troposphere coupling at inter-decadal time scales: Implications for the North Atlantic Ocean, *Geophys. Res. Lett.*, 39, L05801, doi:10.1029/2011GL050771

Cagnazzo C., Manzini, E., Giorgetta, M. A., Forster, P. M. De F., and Morcrette, J. J. (2007), Impact of an improved shortwave radiation scheme in the MAECHAM5 General Circulation Model, *Atmos. Chem. Phys.*, 7, 2503-2515.

Projects

Since 2017, Collaborator in Tender C3S_422 (PI for CNR) and C3S_511 (WP leader)

Since 2016, Collaborator in the Tender for Copernicus Climate Change Service Toolbox C3S_25 (PI for CNR) and Global Climate Projections C3S_34a

Since 2016, Collaborator of the PRIMAVERA H2020

Nov 2015-Oct 2017. Tutor of the AXA Junior Research (Post-Doctoral) Fellowships : ENHANCED MONSOON PREDICTABILITY: ROLE OF AEROSOLS IN THE TROPOSPHERE (EMPATHIA), Dr Riccardo Biondi

2013-2018 EU Project StratoClim “Stratospheric and upper tropospheric processes for better climate predictions”, co-leader of WP5

2009-2013 EU Project COMBINE: “New components in Earth System modelling for better climate projections”. PI for CMCC and co-leader of WP3

2009-2010: Chemistry-Climate Model Validation Activity for SPARC (CCMVal)

2010-2013 PAPRIKA-Italia Ev-K2-CNR SHARE project, PI for CMCC

2008: Italy-France cooperation GALILEO (Italian Foreign Minister, Ministère de l'Education Nationale), “Variabilité Solaire et Climat”, in collaboration with LMD-CNRS. PI for INGV

2007-2009: EU Project CIRCE, “Climate Change and Impact Research: the Mediterranean Environment”

2006-2009: PNRA Project, “CLimate Variability in the Antarctic Stratosphere”.

2005-2006: EU Project SCOUT-O3: “Stratospheric ozone-climate interactions”.

2000-2003: EU Projects EuroSPICE “Stratospheric processes and their impact on climate and the environment”, and SOLICE “SOLar Impacts on Climate and the Environment”

2002: Projet National de Chimie Atmosphérique: “Climate change and dynamical barriers in the atmosphere”

1998-1999: APE-THESEO EU Project in the Tropics

PERSONAL INFORMATION

Rosalia Santoleri
 CNR-ISAC, Via del Fosso del Cavaliere, 100 – 00133 Roma

 +39-0649934346  +39-3357270363

 r.santoleri@isac.cnr.it
 [State personal website\(s\)](#)

Sex Female | Date of birth 27/08/ 1957 | Nationality Italy

ACTUAL POSITION

Research Director working at CNR Institute of Atmosphere and Climate (ISAC). Head of the Ocean Satellite monitoring and marine ecosystem studies group (GOS) of the CNR-ISAC a group comprising 25 researchers with additional visitors and students.

WORK EXPERIENCE

- 2012-2015 Head of the Global Ocean Satellite monitoring and marine ecosystem studies group of the Institute of Atmosphere and Climate (ISAC) of the National Research Council (CNR): physical oceanography, satellite oceanography, operational oceanography, physical-biological interaction, air-sea interaction, numerical modelling, lagrangian modelling.
- 2015-now Coordinator of the Ocean Colour Thematic Assembling Center service of the Copernicus Marine Environmental Service (CMEMS). Budget: €2.500.000
- 2017-now Manager of the C3S_511 service on assessment of scientific quality of CDS ECVs Budget: €4.800.000
- 2015-now Coordinator of the CNR-Ministry of Environment inter-governmental agreement for national implementation of European Marine Strategy Framework of Directive. Budget: €7.600.000
- 2002-now Responsible of the near real time SST and ocean color Mediterranean satellite observing system in the framework of the Mediterranean Forecasting System and of the Mediterranean Operational Oceanography Network (MONGOOS).
- 1997-2006 Responsible, for the Italian Space Agency, of the Italian ocean colour validation and calibration activity for SeaWiFS, MODIS and MERIS.
- 1995-2012 Senior Researcher at CNR-ISAC. Head of the Satellite Oceanography Group (GOS) of the Institute of Atmosphere and Climate (ISAC) of the National Research Council (CNR) . Coordination of GOS, research in: satellite oceanography, physical oceanography, air-sea interaction, satellite calibration/validation activities, and climate study.
- 1984-1995 Research at CNR-IFA (Institute of Atmospheric Physics). In charge of air-sea interaction and climate studies. In charge in the satellite data acquisition- processing - analysis, in situ data analysis, algorithm development. Responsible of several oceanographic cruises in the Mediterranean Sea for satellite data calibration and validation. Coordination of Italian Space Agency Projects.
- 1981-1984 Research Assistant at University of Rome La Sapienza. In charge on acquisition processing and analysis of analysis of hydrological data and baroclinic instabilities studies.

Visiting scientist at: l'University of Washigton, AT&T Bell Laboratories, North Caroline State University, Massachusetts Institute of Technology, Rosenstiel School of Marine and Atmospheric Sciences-University of Miami.

EDUCATION AND TRAINING

1981 Degree in Doctor in Physics, Università di Roma “La Sapienza”, Final note 110/110 cum laude

HONOR AWARDS MEMBERSHIP

- 2017- now Member of the GEO Board
- 2016-now Member of the GHRST Science Team providing the intellectual guidance to the entire GHRST
- 2015-now Member of the IOCCG Executive Committee. The board has mandate to steering and coordinate the activities of the IOCCG
- 2015-now Member of the EuroGOOS Executive Directors Board. The Board is composed of a Chair and 7 members, has the mandate to manage the organization.
- 2014-now President of the Italian Oceanographic Commission, National body of the Intergovernmental Oceanographic Commission (IOC) of UNESCO
- 2013-now Member of Sentinel-3 Working Group on Quality Indicator established by ESA and EUMETSAT
- 2012- now Expert Member of the Global Ocean Observing System (GOOS) Steering Committee, established by UNESCO/IOC to define Ocean Essential Variable a design the future Ocean Observing system
- 2011-now Member of the EO Science team of the ESA Ocean Colour Climatic Initiative Project
- 2009-2015 Member of the MyOcean- MyOcean2-MyOcean FO Executive Committee

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	Enter level





Organisational / managerial skills

- 2005-now Responsible of 42 national and international scientific projects.
- 1999-now Scientific coordinator of 21 national and international (EU, ESA) scientific projects.
- Scientific skill climate variability marine circulation, physical-biological interaction, remote sensing, satellite oceanography, air-sea interaction, satellite and model data qualification and validation.
- Publications She is author or co-author of more than 140 publications in the internationally referred literature, reference books. Career citations of 2410, h-index 28, 139 citations for most cited paper (Google Scholar).

PERSONAL INFORMATION

Paolo Cristofanelli



-  20, Via Archimede, Reggio nell'Emilia, 41122, Italy
-  +39 051 6399597
-  p.cristofanelli@isac.cnr.it
-  <http://www.isac.cnr.it/en/users/paolo-cristofanelli>
-  Skype p.cristofanelli

Sex M | Date of birth 27/12/1974 | Nationality Italian

POSITION

Permanent Scientist, National Research Council of Italy, Institute of Atmospheric Science and Climate

WORK EXPERIENCE

- From 2009 Permanent Scientist, Institute of Atmospheric Science and Climate (ISAC), National Research Council of Italy (CNR-ISAC), Bologna, Italy
- From 2008 to 2009 Contract Scientist, CNR-ISAC, Bologna, Italy
- From 2003 to 2008 Post-doc position, CNR-ISAC, Bologna, Italy
- From 2000 to 2003 PhD student (research fellowship), Urbino University, Urbino and CNR-ISAC, Bologna, Italy

EDUCATION AND TRAINING

- From 2000 to 2003 PhD in Environmental Sciences, Urbino University, Italy
- From 1993 to 1999 Master degree in Physics, Bologna University, Italy

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	B2	B2	B2	B2	B2
French	A2	A2	A2	A2	A2

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user
[Common European Framework of Reference for Languages](#)

Review/Evaluation skills

Reviewer for ACP, AMT, Atmospheric Environment, Atmospheric Researches, Atmospheric Pollution Research, Journal Geophysical Research – Atmosphere

Organisational / managerial skills

Ability in working as a function of objectives within integrated projects, ability in mitigating risks and coping against failures, experience in working groups / Experience with project management and project WP coordination. Management of a WMO/GAW Global Station.

Scientific skills Data analysis and interpretation of ECVs (meteorological parameters and atmospheric composition data), knowledge of ground-based atmospheric measurement techniques, experience in the development and application of QA/QC methodologies for atmospheric observation and data exploitation, outreach and educational

Computing skills R, FORTRAN, MATLAB, Microsoft Office, Sigmaplot,

ADDITIONAL INFORMATION

Publications F. Graziosi, J. Arduini, F. Furlani, U. Giostra, P. Cristofanelli, X. Fang, O. Hermanssen, C. Lunder, G. Maenhout, S. O'Doherty, S. Reimann, N. Schmidbauer, M.K. Vollmer, D. Young, M. Maione, European emissions of the powerful greenhouse gases hydrofluorocarbons inferred from atmospheric measurements and their comparison with annual national reports to UNFCCC. Atmospheric Environment, 158, 2017.

Wagner, A., Blechschmidt, A.-M., Bouarar, I., et al. , Evaluation of the MACC operational forecast system – potential and challenges of global near-real-time modelling with respect to reactive gases in the troposphere, Atmos. Chem. Phys., 15, 14005-14030, doi:10.5194/acp-15-14005-2015, 2015.

Cristofanelli, P., Bonasoni, P., Collins, W., et al., Stratosphere-to-troposphere transport: A model and method evaluation, Journal of Geophysical Research Atmospheres, 108 (12), 2003.

Projects

Scopus ID: 55663790800

ORCID: orcid.org/0000-0001-5666-9131

2017-current ICOS-Italy JRU. **Role:** PI **Objective:** to implement ICOS activities among Italian atmospheric stations.

2016 - current ICOS-RI (Integrated Carbon Observation System – European Research Infrastructure). **Role:** Station PI **Objective:** to implement ICOS QA/QC protocols and methodologies to CO₂, CH₄ and CO in-situ observations at the Mt. Cimone global GAW/WMO station.

2014 – current ACTRIS 2- Aerosols, Clouds, and Trace gases Research Infrastructure Network (EU Project). **Role:** scientist. **Objective:** Implementation of quality-assessed ECVs (reactive gases) at the Mt. Cimone global GAW/WMO station, data QA/QC and process analysis.

2012 – 2015 I - AMICA (PONa3_00363/ERDF) Infrastructure of High Technology for Integrated Climate and Environmental Monitoring. **Role:** WP leader **Objective:** Implementation of a regional network of 4 supersites for observations of ECVs (trace gases, aerosol, radiation fluxes, meteorological parameters). This activities included the integration of standardized procedures for measurement execution and QA/QC processes following WMO/GAW guidelines.

2012 – 2015 Project of National Interest NEXTDATA. **Role:** Leader Sub-Project 1 “Integrated observation system for environmental and climate monitoring”; Leader WP1.1 “High-altitude climate observation system”. **Objectives:** To create an integrated observation for ECVs in remote (mountain) regions. Special emphasis to QA/QC activities and data integration.

2011 – 2013 ACTRIS - Aerosols, Clouds, and Trace gases Research Infrastructure Network (EU Project). **Role:** scientist. **Objectives:** QA/QC and data analysis, processes interpretation and investigation for near-surface ECVs (reactive gases and aerosol properties).

2008 – 2013 SHARE (Station at High Altitude for Research on the Environment). **Role:** scientist. **Objectives:** Responsible for ozone and meteorological parameter observations at two GAW-WMO Global Stations. QA/QC and data analysis, interpretation and investigation of variability.

2006 – 2011: EUSAAR - European Supersites for Atmospheric Aerosol Research (EU Project). **Role:** scientist. **Objectives:** QA/QC and data analysis, processes interpretation and investigation for near-surface ECVs (reactive gases and aerosol properties).. Atmospheric processes investigation.

Honours Awards Memberships

Best communication awards (Session 4a, SIF National Congress, Parma, October 2003)
 Young Scientist Best Poster Awards (ACCENT Symposium, Urbino, September 2005)
 Tropospheric Ozone Assessment Report (Reviewer)

PERSONAL INFORMATION

Fabio Madonna



Consiglio Nazionale delle Ricerche. Istituto di Metodologie per l'Analisi Ambientale

✉ fabio.madonna@imaa.cnr.it

🌐 www.ciao.imaa.cnr.it

Sex Male | Nationality Italy

POSITION Research Scientist

WORK EXPERIENCE

2011- Research Scientist

Consiglio Nazionale delle Ricerche (CNR)

- Research scientist on Atmospheric Sciences and ground-based remote sensing at the CNR-IMAA Atmospheric Observatory (CIAO) at CNR.

Business or sector Government / Research

EDUCATION AND TRAINING

2003-2007 PhD in physics

University of Basilicata, Potenza, Italy

- Methods and Technologies for the environmental monitoring

PERSONAL SKILLS

Mother tongue(s) Italian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
French	A1	A1	A1	A1	A1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Communication skills

- Tutor of undergraduate, PhD and post-doc students
- Invited speaker at conferences
- Media appearances (print, TV, online)
- Project scientific reporting and reporting to general public

Organisational / managerial skills

- Technical and Service Manager of the C3S 311a Lot3 service (Access to Reference and Baseline Observations)
- Member of the WG-GRUAN (2011-present)
- Chair of GATNDOR (GRUAN Analysis Team for Network Design and Operations Research), (2010-2014)
- Supervised PhD student to completion
- PI of the TransNational Access Activities) for the CIAO station for EU FP7 ACTRIS (Aerosols, Clouds, and Trace gases Research InfraStructure Network)
- WP and task leader of EU FP7 and H2020 projects
- Responsible of the TNA activities for the CIAO ACTRIS station

- Job-related skills
 - Observational data analysis
 - Database construction
 - Dataset creation
 - Advanced statistical analysis
 - Expert of in-situ remote sensing technologies
 - Atmospheric measurement uncertainty analysis
 - Validation of field measurement techniques

- Computer skills
 - IDL, Fortran, Visual basic, Matlab, JAVA, Windows, OS, Linux
 - MS Office
 - ZEMAX
 - Website design

- Other skills
 - Scientific assessments

ADDITIONAL INFORMATION

- Publications
 - 35 peer-reviewed papers


Most relevant publications


- Lolli, S., Madonna, F., Rosoldi, M., Campbell, J. R., Welton, E. J., Lewis, J. R., Gu, Y., and Pappalardo, G.: Fu-Liou Gu radiative transfer model used as proxy to evaluate the impact of data processing and different lidar measurement techniques in view of next and current lidar space missions, *Atmos. Meas. Tech.*, <https://doi.org/10.5194/amt-2017-182>, accepted, 2018.
- Thorne, P. W., Madonna, F., Schulz, J., Oakley, T., Ingleby, B., Rosoldi, M., Tramutola, E., Arola, A., Buschmann, M., Mikalsen, A. C., Davy, R., Voces, C., Kreher, K., De Maziere, M., and Pappalardo, G.: Making better sense of the mosaic of environmental measurement networks: a system-of-systems approach and quantitative assessment, *Geosci. Instrum. Method. Data Syst.*, 6, 453-472, <https://doi.org/10.5194/gi-6-453-2017>, 2017.
- O. Caumont, Domenico Cimini, U. Lonhert, L. Alados-Arboledas, R. Bleisch, F. Buffa, M. Enrico Ferrario, A. Haefele, T. Huet, F. Madonna and G. Pace, "Assimilation of humidity and temperature observations retrieved from ground-based microwave radiometers into a convective-scale NWP model", *Quarterly Journal of the Royal Meteorological Society*, in press, doi: 10.1002/qj.2860
- I. Mattis, G. D'Amico, H. Baars, A. Amodeo, F. Madonna, and M. Iarlori, EARLINET Single Calculus Chain – technical Part 2: Calculation of optical products, *Atmos. Meas. Tech.*, 9, 3009-3029, doi:10.5194/amt.
- Nickovic, S., Cvetkovic, B., Madonna, F., Rosoldi, M., Pejanovic, G., Petkovic, S., and Nikolic, J.: Cloud ice caused by atmospheric mineral dust – Part 1: Parameterization of ice nuclei concentration in the NMME-DREAM model, *Atmos. Chem. Phys.*, 16, 11367-11378, <https://doi.org/10.5194/acp-16-11367-2016>, 2016.
- M. Haefelin, S. Crewell, A. J. Illingworth, G. Pappalardo, H. Russchenberg, M. Chiriaco, K. Ebell, R. J. Hogan, F. Madonna: Parallel developments and formal collaborations between European atmospheric profiling observatories and US ARM research programs. Accepted in *American Meteorological Society Monograph series*. 10.1175/AMSMONOGRAPHS-D-15-0045.1, 2016.
- G. E. Bodeker et al. (2016): Reference Upper-Air Observations for Climate: From Concept to Reality. *Bull. Amer. Meteor. Soc.*, 97, 123–135. doi: <http://dx.doi.org/10.1175/BAMS-D-14-00072.1>
- F. Madonna, Rosoldi, M., Guldner, J., Haefele, A., Kivi, R., Cadeddu, M. P., Sisterson, D., and Pappalardo, G.: Quantifying the value of redundant measurements at GRUAN sites, *Atmos. Meas. Tech.*, 7, 3813–3823, www.atmos-meas-tech.net/7/3813/2014/, doi:10.5194/amt-7-3813-2014, (2014).

PERSONAL INFORMATION



Annemarie Groot

 Hullenbergweg 12, 6721AN Bennekom (Netherlands)

 0031317483935

 annemarie.groot@wur.nl

Sex Female | Date of birth 29/04/1961 | Nationality Dutch

WORK EXPERIENCE

- 2009-present **Senior researcher international climate change adaptation research - climate smart agriculture / climate services**
 Climate Change and Land and Water Management, Alterra, Wageningen University and Research Centre, Netherlands
- Leading work packages and tasks on user engagement and evaluation in climate service projects including:
- Copernicus Climate Change Service projects (GLORIOUS, SWICCA)
 - Horizon 2020 CLIPC (Climate Information Platform for Copernicus) project, URBANFLUXES project, BRIDGE project
 - Leading CGIAR/ CCAFS 'cluster of activities' on finance, business and capacity building in Latin America, West Africa, East Africa, South Asia and Southeast Asia
 - Advisor governance and capacity building in climate change adaptation in the Himalayan Adaptation, Water and Resilience (HI-AWARE) initiative
 - Methodology development, capacity building and advisor stakeholder engagement in the Highnoon Project, India
 - Research on science –policy interactions in the Climate Impact Research & Response Coordination for a Larger Europe (CIRCLE II) project
 - Project leader 'climate smart agriculture: Identifying and assessing triple wins for food security, adaptation and mitigation', Ethiopia
 - Process manager 'Communities of Practice' in the 'sustainaBle uRban planning Decision support accountinG for urban mEtabolism (BRIDGE) project
 - Coordinator Strategic Programme Green Climate Solutions at Alterra, Wageningen UR
- 2002-2009 **Senior researcher stakeholder participation in natural resources management and innovation management**
 Centrum for Landscape, Alterra, Wageningen University and Research Centre, Netherlands
- Organisation and facilitation of diverse international conferences, workshops and other processes in the domain of sustainable development, regional innovation, sustainable agriculture, soil and water management, change management)
- 2003-2014 **Trainer in multi-stakeholder processes and concepts**
 The International Centre for Development Oriented Research (ICRA), The Netherlands and France
- Stakeholder analysis
 - Systems thinking
 - Scenario thinking
- 1992 – 2003 **Teacher /researcher facilitation of multi stakeholder processes**
 Communication and Innovation Department, Wageningen University, The Netherlands
- Teaching courses 'Participatory methodologies' and 'Design, implementation and evaluation of extension programmes'
 - World Bank (pre-) appraisal missions Privatisation of Extension in Uganda
 - Process manager Privatisation of the Ile à Morphil irrigation project, Cas-cas, Senegal
- 1988-1992 **Agricultural Extensionist in the Programme d'Exécution d'un Développement Intégré', Burkina Faso**
 SNV Dutch International Development Organisation
- Capacity building of local extension workers

EDUCATION AND TRAINING

- 1997-2002 **PhD**
Department of Communication and Innovation Studies, Wageningen University, Wageningen (Netherlands). Facilitation of Multi- Actor Learning Processes in natural resources management

- 1980-1987 **MSc**
Department of Tropical Agriculture, Wageningen University, Wageningen (Netherlands); Tropical Agriculture (major); Irrigation, Agricultural extension and Agrarian law (minors)

PERSONAL SKILLS

Mother tongue(s)	Dutch				
Other language(s)	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2	C2	C2	C2	C2
French	A2	A2	A2	A2	A2

Communication skills Good process and project management skills developed in numerous participatory (research) projects

PERSONAL INFORMATION

Judith E.M. Klostermann



 PO Box 47, 6700 AA Wageningen, the Netherlands
 +31 317 486427  +31 6 13513846
 Judith.Klostermann@wur.nl

Sex Female | Date of birth 15/06/1963 | Nationality Dutch

JOB APPLIED FOR
POSITION
PREFERRED JOB
STUDIES APPLIED FOR
PERSONAL STATEMENT

Researcher climate adaptation and water policy

Judith Klostermann leads research projects on adaptation to climate change, water and coastal management, environment and sustainability. She works on the interface of climate and water science and practitioners, for example, by organizing Communities of Practice to bridge the gap between stakeholders and natural scientists. She involves local stakeholders in the planning phase of infrastructural projects, such as the Dutch Delta Program for adaptation of flood prevention structures, including a communication plan. She has assessed the legal barriers for innovation of coastal protection systems. She developed a monitoring system for local and national adaptation to climate change and she designed new indicators for socio-economic assessments in the High North, taking into account local economies and cultural traditions. Furthermore she assessed the governance structures for urban drainage in Georgetown, Guyana and she contributed to a course on water management in Chittagong, Bangladesh.

WORK EXPERIENCE

2003 to present

Researcher climate adaptation and water policy

Wageningen Environmental Research (WENR) – Stichting Wageningen Research, the Netherlands
[Knowledge Institute](#)

1990-1998

TNO Environmental consultancy, Delft and Apeldoorn

TNO Location Delft, Stieltjesweg 1, NL-2628 CK Delft, Postal address: P.O. Box 155, NL-2600 AD Delft, +31 88 866 20 00, <https://www.tno.nl/en/>

- Applied research into waste re-use and waste prevention
- Research into sustainable product design.

Research

1990-1998

Science shop Biology

Utrecht University

- Managing applied research projects; involving chair groups and students to answer the research questions for stakeholders from society.
- Writing internal newsletter

Research

EDUCATION AND TRAINING

1998 – 2003

PhD Social Science

Erasmus University Rotterdam

- Literature research on sustainability, corporate strategy and social construction. Development of a qualitative research method aided by Atlas-ti software. Case studies in Dutch drinking water companies and the network of organizations around them. Writing a dissertation 'Social construction of sustainability in Dutch drinking water companies'.

1982-1989

MSc Biology

Utrecht University

- Bachelor in chemical biology. MSc specialization in plant sciences and MSc thesis on immunotoxicology. Minors in communication of science and didactics of biology.

PERSONAL SKILLS

Mother tongue(s)
Other language(s)

	Dutch				
	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C2 Mastery or proficiency	C2 Mastery or proficiency	C2 Mastery or proficiency	C2 Mastery or proficiency	C1 Effective Operational Proficiency or advanced
German	C1 Effective Operational Proficiency or advanced	C1 Effective Operational Proficiency or advanced	B1 Threshold or intermediate	B1 Threshold or intermediate	B1 Threshold or intermediate
French	A2 Waystage or elementary	A2 Waystage or elementary	A2 Waystage or elementary		A2 Waystage or elementary
Spanish	A1 Breakthrough or beginner		A1 Breakthrough or beginner		

Communication skills
Organisational / managerial skills
Job-related skills

- Chairing meetings, interviewing
- Project leadership
- Social scientific research: human perceptions, institutions, networks, communities
- Regular MS Office programs, Atlas-ti analysis software
- Creativity in language and ideas

Digital skills

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Independent user	Independent user	Independent user	Independent user	Basic user

ADDITIONAL INFORMATION

Publications



- Klostermann, J.E.M. ; Sandt, K. van de; Harley, M. ; Hilden, M. ; Leiter, T. ; Minnen, J. van; Pieterse, N. ; Bree, L. van (2018). Towards a framework to access, compare and develop monitoring and evaluation of climate change adaptation in Europe. *Mitigation and Adaptation Strategies for Global Change* 23 (2). - p. 187 - 209.
- Steijn, R.C., F. Westebring, J.E.M. Klostermann (2016) DRR-Team Mission Report Guyana. (in prep) <http://www.dutchwatersector.com/news-events/news/16766-dutch-risk-reduction-team-advice-on-upgrade-drainage-system-in-georgetown-guyana.html>
- Gupta, J. ; Bergsma, E. ; Termeer, C.J.A.M. ; Biesbroek, G.R. ; Brink, M.H. van den; Jong, P. ; Klostermann, J.E.M. ; Meijerink, S.M. ; Nooteboom, S.G. (2015). The adaptive capacity of institutions in the spatial planning, water, agriculture and nature sectors in the Netherlands (online first). *Mitigation and Adaptation Strategies for Global Change*.
- Biesbroek, G.R. ; Termeer, C.J.A.M. ; Klostermann, J.E.M. ; Kabat, P. (2014) Rethinking barriers to adaptation: mechanism-based explanation of impasses in the governance of an innovative adaptation measure. *Global environmental change : human and policy dimensions* 26 . - p. 108 - 118.
- Chrysoulakis, N. ; Lopes, M. ; San José, R. ; Grimmond, C.S.B. ; Jones, M.B. ; Magliulo, V. ; Klostermann, J.E.M. ; Synnefa, A. ; Mitraka, Z. ; Castro, E. ; González, A. ; Vogt, R. ; Vesala, T. ; Spano, D. ; Pigeon, G. ; Freer-Smith, P. ; Staszewski, T. ; Hodges, N. ; Mills, G. ; Cartalis, C. (2013) Sustainable urban metabolism as a link between bio-physical sciences and urban planning: The BRIDGE project. *Landscape and Urban Planning* 112 . - p. 100 - 117.
- Turnhout, E. ; Stuiver, M. ; Klostermann, J.E.M. ; Harms, B. ; Leeuwis, C. (2013). New roles of science in society: Different repertoires of knowledge brokering. *Science and Public Policy* 40 (3). - p. 354 - 365.

PERSONAL INFORMATION

Wilma Jans



 De Pas 8, 6681 KC Bommel. The Netherlands

 +32 317487896  +31 0644250299

 Wilma.jans@wur.nl

Sex Female | Date of birth 06/08/1960 | Nationality Dutch

WORK EXPERIENCE

- 1985-present **Senior Research Assistant**
Wageningen Research, Wageningen Environmental Research (WEnR), Wageningen (the Netherlands).
Research on carbon sequestration in forests and agricultural croplands in the context of climate change and greenhouse gas exchanges. Experienced in preparation and execution of fieldwork (national and international), data management and analysis.
- 2015-2017 **Project manager CLIPC project. Climate Information Platform for Copernicus. EU Seventh framework programme.**
- 2013-2014 **Project manager AMAZALERT. Impacts of Climate and Land use changes in the Amazon environment.**
- 2012-2015 **Researcher in the AMAZALERT project.** Temperature response of leaf photosynthesis of Amazon forest trees and its acclimation to mean temperature change.
- 2006-2012 **Researcher in BSIK ME1 project.** Water and carbon fluxes in forests and agricultural croplands.

EDUCATION AND TRAINING

Replace with dates (from - to)

Bachelor

Larenstein, International Agricultural College (Botanical Analyst)

PERSONAL SKILLS

Mother tongue(s) Dutch

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1
German	C2	C2	B1	B1	B1

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

Organisational skills

Project management skills. Experience in organising workshops and summer schools. Scientific, instrumental and logistic preparation and execution of climate research field campaign's. Training of counterparts in managing field installations

Computer skills ▪ good command of Microsoft Office™ tools

Driving licence ▪ BE

ADDITIONAL INFORMATION

- Publications
- Verina Ingram, Wilma Jans, Jaclyn Rooker, 2017. Agroforestry systems in the Upper Mara Basin. A practical guide for farmers. Wageningen University & Research and SNV. Wageningen, The Netherlands and Nairobi, Kenya. ISBN: 978-94-6343-224-5. DOI: <https://doi.org/10.18174/428431>.
- Verina Ingram, Wilma Jans, Geoffrey Kiganiri, 2017. Trees and plants for bees and beekeepers in the Upper Mara Basin. Guide to useful melliferous trees and crops for beekeepers. Wageningen University & Research and SNV. Wageningen, The Netherlands and Nairobi, Kenya. ISBN: 978-94-6343-225-2. DOI: <https://doi.org/10.18174/428433>.
- Vuichard, N., Jans, W., Wu, X., 2016. Simulating the net ecosystem CO₂ exchange and its components over winter wheat cultivation sites across a large climate gradient in Europe using the ORCHIDEE-STICS generic model. *Agriculture, Ecosystems and Environment*, 226, 1–17. DOI:10.1016/j.agee.2016.04.017.
- Wu, X., Vuichard, Jans, W., Ripoche, D., 2015. ORCHIDEE-CROP (v0), a new process based Agro-Land Surface Model: model description and evaluation over Europe. *Geosci. Model Dev. Discuss.*, 8, 4653-4696. Doi:10.5194/gmdd-8-4653-2015.
- Otto, J., Jans, W., Luyssaert, S., 2014. Forest summer albedo is sensitive to species and thinning: how should we account for this in Earth system models? *Biogeosciences*, 11, 2411–2427; doi:10.5194/bg-11-2411-2014.
- Otto Juliane, Wilma Jans, Sebastiaan Luyssaert, 2013. Effects of species selection and management on forest canopy albedo. *Geophysical Research Abstracts*, Vol. 15, EGU2013-10100.
- Otto, J., W. Jans, S. Luyssaert, 2013. Summertime canopy albedo is sensitive to forest thinning. *Biogeosciences Discussions* 09/2013; 10(9):15373-15414.
- Jans, W.W.P., P.J. van der Meer, 2012. Effects of light and soil flooding on the growth and photosynthesis of ramin (*Gonystylus bancanus*) seedlings in Malaysia. *Journal of Tropical Forest Science* 24(1): 54–63.
- Elbers Jan A., Wilma W.P. Jans, Eddy J. Moors, 2011. Assessing the uncertainty of estimated annual totals of net ecosystem productivity: A practical approach applied to a mid-latitude temperate pine forest. *Agricultural and Forest Meteorology*, doi:10.1016/j.agrformet.2011.07.020.
- Li, L., Jans, W., Bernhofer, C., 2011. Importance of crop varieties and management practices: evaluation of a process-based model for simulating CO₂ and H₂O fluxes at five European maize (*Zea mays* L.) sites. *Biogeosciences*, 8, 1721–1736; doi:10.5194/bg-8-1721-2011.
- Jans, W.W.P., Moors, E.J.. Carbon exchange of a maize (*Zea mays* L.) crop: influence of phenology, 2010. *Agriculture, Ecosystems & Environment*, 139, 316-324.
- Moors Eddy.J., Wilma Jans, Hendrik Soegaard, 2010. Variability in carbon exchange of European croplands. *Agriculture, Ecosystem & Environment*, 139(3): 325-335.
- Ceschia, Jans, W.W.P., Wattenbach, M., 2009. Management effects on net ecosystem carbon and GHG budgets at European crop sites. *Agriculture, Ecosystems & Environment*, 139, 363-383.
- Eugster Werner, Wilma Jans, Nina Buchmann. Management Effects on European Cropland Respiration. *Agriculture, Ecosystems & Environment*, 139, 346-362.

PERSONAL INFORMATION



Karianne de Bruin

📍 Wageningen Environmental Research (Alterra), P.O. Box 47, 6700 AA, Wageningen, the Netherlands

☎ +31 317 481744 / + 31 6 30902415

✉ karianne.debruin@wur.nl

🌐 <http://www.wur.nl/en/Expertise-Services/Research-Institutes/Environmental-Research.htm>

Sex Female | Date of birth 09/08/1978 | Nationality Dutch

WORK EXPERIENCE

Sept. 2015 - Present

Researcher (80%) – Water, Climate and Adaptation Economics

Climate Change team, Wageningen Environmental Research (Alterra), Wageningen UR, P.O. Box 47, 6700 AA, Wageningen, the Netherlands

- Leading, planning, managing and conducting interdisciplinary projects focused on climate services, user engagement, climate adaptation decision-making and economic modeling of the linkage between climate, water and agriculture. Leading sub-team of strategic programme Climate Adaptive Society on climate services for business.

Business or sector Research

Sept. 2015 - Present

Researcher (20%) – Environmental and Adaptation Economics,

Center for International Climate and Environmental Research – Oslo (CICERO), Gaustadalléen 21, 0349 Oslo, Norway, www.cicero.oslo.no

- Leading and conducting project work on economic modelling related to adaptation decision-making under uncertainty to extreme events, specifically related to floods and heatwaves.

Business or sector Research

2011 - 2015

Researcher (100%) – Environmental and Adaptation Economics,

Center for International Climate and Environmental Research – Oslo (CICERO), Gaustadalléen 21, 0349 Oslo, Norway, www.cicero.oslo.no

- Conducting and leading research projects, including economic modelling for further development and application of economic based appraisal techniques in the context of adapting to climate change and extremes, in both developed and developing countries.

Business or sector Research

EDUCATION AND TRAINING

2006-2011

PhD in Environmental Economics – Thesis title ‘An economic analysis of adaptation to climate change under uncertainty’

Environmental Economics and Natural Resources Group, Wageningen University, the Netherlands

- Environmental Economics

2005

Advanced Master in International Development

Radboud University Nijmegen, the Netherlands

- Policy and practice in international development

1998-2004

MSc

Environmental Economics and Natural Resources Group, Wageningen University, the Netherlands

- Environmental Economics

PERSONAL SKILLS

Mother tongue(s)

Dutch

Other language(s)

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	

English	C2	C1	C1	C1	C1
German	B1	B1	B1	B1	A2
Norwegian	B1	B1	A2	A2	A2

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user
Common European Framework of Reference for Languages

ADDITIONAL INFORMATION

Publications

Thorarinsdottir, T.L., P. Guttorp, M. Drews, P. Skougaard Kaspersen, and K. de Bruin (2017). Sea level adaptation decisions under uncertainty. *Water Resources Research* 53(10), 8147-8163

Swart, R., K. de Bruin, S. Dhenain, G. Dubois, A. Groot, E. von der Forst (2017). Developing climate information portals with users: promises and pitfalls. *Journal Climate Services* 6, 12-22

Wei, T., T. Zhang, K. de Bruin, S. Glomsrød, and S. Shi (2017). Extreme weather impacts on maize yield: the case of Shanxi Province in China. *Sustainability* 9(1), 41

Thorarinsdottir, T.L. and K. de Bruin (2016). Challenges of Climate Change Adaptation. *EOS* 97

WSS Fellows on RIA* (2014). Reporting on the Seminar - Risk Interpretation and Action (RIA): Decision Making Under Conditions of Uncertainty. *Australasian Journal of Disaster and Trauma Studies* 18(1) 27-37.

De Bruin, K., H. Goosen, R. Groeneveld and E.C. van Ierland (2014). Costs and benefits of adapting spatial planning to climate change: lessons learned from a large-scale urban development project in the Netherlands. *Regional Environmental Change* 14(3), 1009-1020

Mustelin, J., N. Kuruppu, A. Matus Kramer, A. Guerra-Noriega, K. de Bruin and J. Daron (2013). Climate adaptation research for the next generation. *Climate and Development* 5(3), 189-193

De Bruin, K. and E. Ansink (2011). Investment in flood protection measures under climate change uncertainty. *Climate Change Economics* 2(4): 321-339

De Bruin, K. (2011). An economic analysis of adaptation to climate change under uncertainty. PhD thesis Wageningen University (<http://edepot.wur.nl/182256>)

De Bruin, K., et al. (2009). Adapting to climate change in The Netherlands: an inventory of climate adaptation options and ranking of alternatives. *Climatic Change* 95(1-2): 23-45

Projects

2017-2018, Copernicus C3S Global Agriculture-C3S422Lot1WEnR (ECMWF C3S) – Contribution to user engagement on developed of a set of operational services

2017-2021, NewWaterWays-Towards water-sensitive and climate-adapted Nordic cities (Norwegian Research Council) – WP lead valuation and evaluation of solutions

2017-2020, ClimINVEST-Tools for climate-resilient investment (ERA4CS/JPI Climate) – WP lead mapping and visualization of climate indicators for institutional investors

2016 – Towards Water Smart Cities (Climate-KIC) - Researcher contributing to barriers of and business case for investments in water smart city solutions

2016-2017, SECTEUR – Sector Engagement for C3S, Translating European User Requirements (ECMWF C3S) - Researcher contributing to the WEnR’s work on the sector Agriculture and Forestry.

2015 – ongoing, Physical and statistical analysis of climate extremes in large datasets (Norwegian Research Council) - Work package leader on economic modelling in the context of adaptation decision-making under uncertainty

2014 – 2015, Multi-scale policy implementation for natural hazard risk reduction (International START Secretariat) - Project leader of a comparative analysis of natural hazard plans of between different cities in New Zealand, Mexico, Norway and Taiwan.

2012-2015, Climate change and Chinese agriculture: effects on food production and options for adaptation (Norwegian Research Council) - Researcher responsible for economic investment modeling, linking economic, agricultural and water issues

2012-2014, Extreme risks, vulnerability and community-based adaptation in India (Royal Norwegian Embassy New Delhi, India) - Participatory multi-criteria analysis assessment