



**European Research Area
for Climate Services**

Report on Final Meeting to present ERA4CS projects results

*Work Package 5.3, part 2
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Authors: *Maija Malnaca, Petra Manderscheid, BELSPO-CS*

Lead beneficiary: *BELSPO*

WWW.ERA4CS.EU

Project full title: *ERA-NET Cofund "European Research Area for Climate Services"*

Project acronym: *ERA4CS*

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Funding scheme: Horizon 2020 SC5-02-2015

Project start date: 1st January 2016
Duration: 60 months

Context

The ERA4CS Online presentation of the results of the ERA4CS projects took place on 23 September 2021 as an online meeting, co-organised by ANR with the contribution of BELSPO.

Announcement about the ERA4CS Online presentation event was sent to ERA4CS project LPs, funders and the cooperating organisations, JPI Climate community, advertised in the JPI Climate website and ERA4CS webpage.

Principle of the meeting: Each project is given 5 minutes for a 3-slide presentation. Q&A occurred at the end of each session.

Provisional agenda

10:00 – 10:05 Opening by Philippe Bougeault (ANR, coordinator of ERA4CS)

10:05 – 10:40 SESSION 1: MARINE AND COASTAL ISSUES (4 PROJECTS)

10:05 Coclime
10:10 Eclisea
10:15 Inseaption
10:20 Salienseas
10:25 **Q&A for Session 1**

10:40 - 11:00 Break

11:00 – 11:40 SESSION 2: POLICY, FINANCE, TOURISM (5 PROJECTS)

11:00 ClimInvest
11:05 Indecis
11:10 Senses
11:15 Windsurfer
11:20 Eupheme
11:25 **Q&A for Session 2**

11:40 – 12:00 Break

12:00 – 12:30 SESSION 3: SOCIAL-SCIENCE DRIVEN PROJECTS (4 PROJECTS)

12:00 Co-Cli-Serv
12:05 Evoked
12:10 Innova
12:15 Isipedia
12:15 **Q&A for Session 3**

12:30 – 13:30 Lunch Break

13:30 – 14:10 SESSION 4: CITIES, FIRES AND HEALTH (5 PROJECTS)

13:30 Citisense
 13:35 Climapp
 13:40 Dustclim
 13:45 Serv-for-fire
 13:50 Urclim
 13:55 **Q&A for Session 4**

14:10-14:30 Break

14:30 – 16:00 SESSION 5: WATER-AGRICULTURE-ENERGY (8 PROJECTS)

14:30 Aquaclew
 14:35 Cireg
 14:40 Clim2power
 14:45 Climalert
 14:50 Co-Micc
 14:55 Watexr
 15:00 Medscope
 15:05 Clisweln
 15:10 **Q&A for Session 5**

15:35 Report of the Working group on best practices for co-design with end-users

15:45 General discussion on pending issues and conclusions

16:00 END OF MEETING

Opening session

The Coordinator of the ERA4CS project Philippe Bougeault (ANR) opened the meeting with a reminder on the background of the ERA4CS project, a Flagship programme of JPI Climate - an ERA-NET for R&D in support of Climate Services (2016-2021) with 45 partners (15 RFO and 30 RPO). The objective was neither “research on the climate”, nor “development of operational climate services”, but to bridge these two activities. A call for research proposals was issued in Autumn 2016, with two topics:

- Topic A: Co-construction of climate services with the users (18 projects funded in cash by the RFOs and the EU)
- Topic B: Institutional integration (8 projects funded in-kind by the RPOs and in-cash by the EU)

Total funding granted to projects was about 63 M€. The projects have been active between September 2017 and June 2021. During the project's lifetime there were three inter-projects meetings: An inter-project working group on « Co-design of CS with users » to share experiences and propose best practices, and two assessment exercises (mid-term and final) by a team of independent reviewers. A summer school on Climate Services was organised in September 2018, in Pisa, Italy, several surveys on the status of Climate Services throughout the world were carried out, a pilot experiment for co-alignment of Climate Services: bilateral exchanges between climate service providers during the winter 2019-2020 and two Scoping Forums of the JPI Climate (2018 and 2020) were organised, regular exchanges and discussions of JPI Climate with other

communities to prepare joint actions as well as videos and other communication material, reports to promote ERA4CS and the Climate Services were developed.

Philippe gave the floor to the 26 projects to present their results, their future plans towards operational climate services, and the remaining barriers. He invited them to learn from each other and to share knowledge, ideas and experience.

Highlights of presentations and discussions

Presentations were grouped by 5 thematic sessions:

- Marine and coastal issues;
- Policy, finance and tourism
- Social-science driven projects
- Cities, fires and health
- Water, agriculture and energy

Cluster 1: Marine and coastal issues

CoCliME project



Co-develop climate services for ecosystems in Europe's Regional Seas with a focus on HABs (CoCliME) project

The Project Coordinator Caroline Cusack introduced the aim of the project to co-develop climate services for ecosystems in Europe's Regional Seas with a focus on HABs and produce bespoke, proof-of-concepts or prototype climate services to support informed decision making across European Regional Seas based on intensive user co-development, exploitation of existing data sets and new scientific knowledge. The objective was to use lessons learned and knowledge gained during the project and develop a CoCliME transferable framework for climate services development for application across different regions and impact areas.

Partners: climate and social scientists, marine ecosystem experts, economists and users from regional authorities / marine-related industry (tourism, seafood) impacted by Harmful Algal Blooms (HABs)

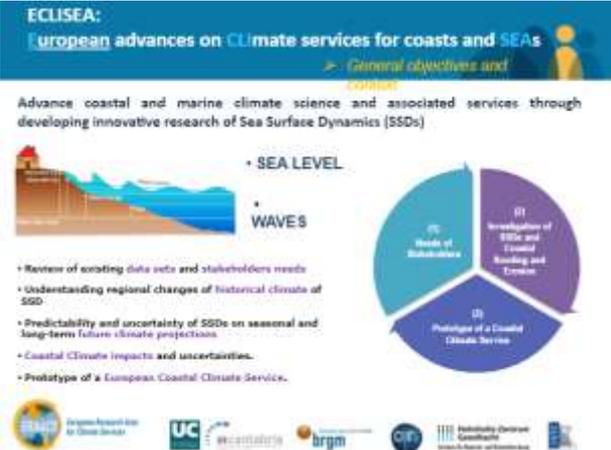
Around 60 case studies were carried out in 7 European regions: NE Atlantic, Baltic, Black Sea, Mediterranean, North Sea and Norwegian Sea.

Main accomplishments of CoCliME include the increase of awareness and exchange the knowledge transferred through dialogues with all co-developers (researchers, policy makers, industry), establishing and building trust with new people in research work, 32 Scientific publications have been produced including lessons learned, best practice on how to create a weekly HAB bulletin, numerous new scientific knowledge publications, 10 Service Specification Sheets with 53 products, e.g., new HAB monitoring programmes established, trade ban database for policy makers, different courses run by partners, partnerships, integration, capacity development, diversity, synergies across disciplines, co-design and co-production of HAB science, models and forecasting consulting with users throughout the process brings about a change in the approach to deliver better and timelier societal knowledge in this field, a transferable framework for use in other marine ecosystem disciplines.

Towards the future the questions have been asked: Can an “operational service” start immediately? No, because the targeted Technology Readiness Level (TRL) in this biologically focused project was low with many of the products/services a proof-of-concept (TRL 3). Some users have asked for further developments (e.g., continued monitoring and early warning system, national trade ban database, more graphics/illustrations to raise ocean and climate change awareness, higher resolution downscaled ocean climate models in several regions are needed). Future activities will require financial support and the partners are investigating what options are available to continue the work.

Additional steps are needed to reach an “operational” status would require follow-on projects to bring the TRL toward demonstration (TRL 7). The use of the project development by another community/organisation can be mentioned a Climate model in use by EuroSea, illustrations in-use by a community education course (Maharees Conservation Association) and the climate action regional office.

ECLISEA project



ECLISEA:
European advances on CLimate services for coasts and SEAs

► General objectives and context

Advance coastal and marine climate science and associated services through developing innovative research of Sea Surface Dynamics (SSDs)

• SEA LEVEL
• WAVES

• Review of existing data sets and stakeholders needs
• Understanding regional changes of historical climate of SSD
• Predictability and uncertainty of SSDs on seasonal and long-term future climate projections
• Coastal Climate impacts and uncertainties.
• Prototype of a European Coastal Climate Service.

01 Identification of State and Coastal Resilience and Trends
02 Needs of Stakeholders
03 Prototype of a Coastal Climate Service

ERA4CS European Research Area for Climate Services
UC University of Coimbra
IUGM Institut Français de Recherche pour l'Exploitation de la Mer
CIP Centre for Integrated Policy
European Centre for Medium-Range Weather Forecasts
IPCC Intergovernmental Panel on Climate Change

European advances on CLimate services for coasts and SEAs (ECLISEA) project was presented by its LPI Melisa Menendez. Melisa informed on general objectives and context of the project to advance coastal and marine climate science and associated services through developing innovative research of Sea Surface Dynamics (SSDs); review of existing data sets and define the needs of stakeholders; understanding regional changes of historical climate of SSD; predictability and uncertainty of SSDs on seasonal and long-term future climate projections;

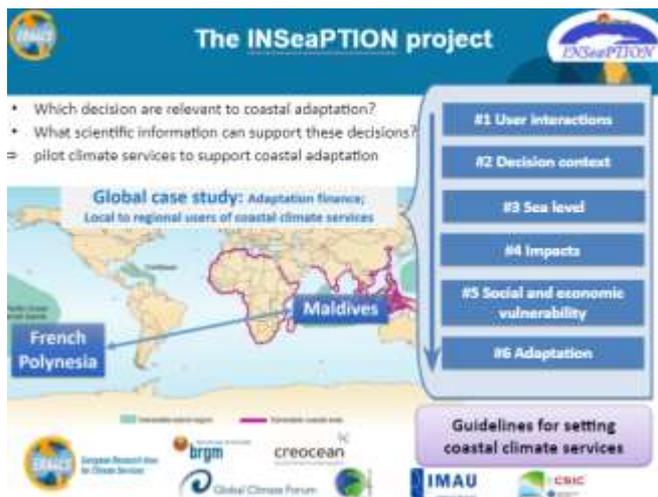
Coastal Climate impacts and uncertainties; produce prototype of a European Coastal Climate Service.

Project achievements: eleven documents including technical reports, recommendations, guidelines, scientific articles; developed six different methods and tools with open access possible to download from the website (downscaling methods, workshop/survey, data infrastructure, web atlas, coastal impact tool)

Four databases: The Coastal climate Change impact tool: <https://eclisea.brgm-rec.fr/appseclisea/>; ECLISEA GeoViewer - <https://eclisea.ihcantabria.com/>
Storm Surge Monitor and sea level monitor www.stormsurge-monitor.eu & www.sealevel-monitor.eu

Towards an operational climate service, the focus would be to expand the partnership and European collaboration to provide climate regional datasets of SSD in Europe (historical, extremes); to build an SSDs EURO-CORDEX (Coordinated Downscaling Experiment - European Domain. Regional Climate Change projections); to maintain, update and improve the developed coastal climate service prototypes across all relevant marine and coastal sectors and support the blue economy and transference of achievements to public operational services (at national level, Copernicus).

INSeaPTION project



INtegrating SEA-level Projections in climate services for coastal adaptaTION (INSeaPTION) project LPI Gonéri Le Cozannet presented the objective of the project to provide climate adaptation to the Sea level rise addressing these actions by co-designing and co-developing, together with users, coastal climate services based on state-of-the art sea-level rise, impact, adaptation and transdisciplinary science. The project delivered coastal climate services based on end-users' needs and their decision and governance context, covering the climate service development from global to regional mean and extreme sea-level projections with their impacts and uncertainties to local sea-level, coastal impacts and adaptation pathways.

Working together with the users the project team defined the key questions: Which decision are relevant to coastal adaptation? What scientific information can support these decisions?

There were two pilot climate services carried out in Maldives and French Polynesia to support coastal adaptation and global case study on adaptation finance: local to regional users of coastal climate services.

Gonéri emphasized several project achievements: guidelines for setting the coastal climate service; ~30 papers published, incl. Datasets, and contributions to IPCC SROCC; developed a replicable approach for End-Users interactions; created an interactive websites on sea-level rise and flooding (included in DRIAS the French climate service, with Météo France); produced Coastal flood modelling applications and carried out virtual training sessions to support Polynesia and Maldives stakeholders and provided two examples: swell and flood modelling Amores et al. (2021) and Integrated approach toward sea-level rise adaptation Hinkel et al. (2019); Stammer et al. (2019).

Towards the future the project pointed out a successful user engagement in the two case studies and in Europe (see inseaption.eu) and development of local and tailored climate services for adaptation to sea-level rise development of portals delivering sea-level scenarios (IPCC and user-defined). Current gaps: an authoritative climate service for coastal adaptation is still missing and there is an opportunistic/uncoordinated approach toward Copernicus. Gonéri also advised to fill these gaps by user training and support activities together with the developers of the next generation of coastal impact models.

Developing specific applications to connect existing and planned coastal impact tools with C3S (e.g., using its API). This includes provision of time series and data at the relevant resolution and location to best perform downscaling within coastal models used by coastal scientists and engineers. Develop a strategy for climate services for coastal adaptation to sea-level rise, linking the community of coastal scientists and engineers with the authoritative Copernicus services, the Copernicus roadmaps to better serve coastal users (see Marine Service) can be a starting point for this activity.

SALIENSEAS project



SALIENSEAS
SALIENT CLIMATE SERVICES

Partners	Funders	Role
Wageningen University & Research	NWO, NL	LPI, WP2 lead
Umeå University	FORMAS, SWE	WP1 lead
Tromsø University	NRC, NO	WP1
MET.no	NRC, NO	WP 3 lead
DMI	IFN, DK	WP3

Stakeholder Advisory Group + key informants

- Association of Arctic Expedition Cruise Operators (Norway)
- Hurtigruten (Norway)
- Oceanwide Expeditions (Netherlands)
- Maritimt Forum Nord SA (Norway)
- Royal Arctic Line (Greenland)
- Greenland Fishing and Hunting Association, KNAPK (Greenland)
- Greenland Pilot Service (Greenland)

Enhancing the Saliency of climate services for marine mobility Sectors in European Arctic Seas (SALIENSEAS) project presented the Project Coordinator Michael Lamoss by introducing the project consortium and mentioning that the project focus was on sea-ice and icebergs working together to co-produce a strengthened value-chain for sea-ice, weather and climate services in the European Arctic. Main accomplishments of SALIENSEAS are establishment of number of demonstration services: S2S Sea Ice Forecasts, Iceberg ATLAS,

Fast Ice Climatology; co-production methods; participatory GIS survey; serious gaming approach to understanding the potential of seasonal sea ice forecasts; created networking: multiple user engagement (online) meetings focused on new ice information and forecasting services; key publications on: Arctic mobility patterns, use of sea-ice services, future user needs, forecast skills.

Towards the future there is a flagship project of WMO-YOPP, as of legacy of the project can be mentioned three dedicated websites: Central project website: <https://salienseas.com/> Met.no demonstration site: <http://metno-salienseas.com>, DMI demonstration site: <http://ocean.dmi.dk/salienseas/> There are already two follow up projects SvalNav - Copernicus Marine Environment Monitoring Service (CMEMS) and FOCUS – Norwegian Research Council.

Highlights of discussion

During the Q&A session a term "fast ice" was explained - it is ice, which is connected to the land, and creates some problems during the wintertime for ships to enter the harbour but this ice is also important for the local communities as they can use it to transport themselves over certain places. Discussion on liability as services advised impact on life and goods, how to take service operational and protect the service provider. The operationalisation will not happen fast and if certain service is doubtful it will not be taken on board or other innovative approach suggested. Interactions with the Copernicus Marine Service (CMEMS), it was mentioned that Copernicus service were developed at the same time when ERA4CS projects started, due to this factor it was not easy to use their data from the beginning, but in the end, projects used a lot of data to prepare analyses. The main vision is to use data on coastal area and coastal risks to develop platform called Coclico and collaborate with the CMEMS. Also, for the SALIENSEAS project it was a good opportunity to use their services and collaborate with Met Services, also in the end of Co-CLiME project they could use more downscaling modules and high-resolution maps for regions requested from Copernicus data, but there are no clear pathways how to connect Copernicus with climate services, therefore it would be nice to bridge those services and transfer data from ERA4CS projects to Copernicus data base.

The engagement of private sector in coastal municipalities work was discussed, they use private coastal consultants as there is a mandatory regulation to produce coastal risk maps which initiates the involvement of the private sector in climate services and cooperation with researchers and end users.

JPI Climate works on establishment of the Sea Level Rise Knowledge HUB and the outputs of the ERA4CS marine projects and future ideas can be linked to this HUB as it is very relevant and provides an opportunity for future connections.

Cluster 2: Policy, finance, tourism

ClimINVEST project



Key resources

- Interactive climate indicators platform
- Set of scientific factsheets
- Webinar series
- Final Capstone Report

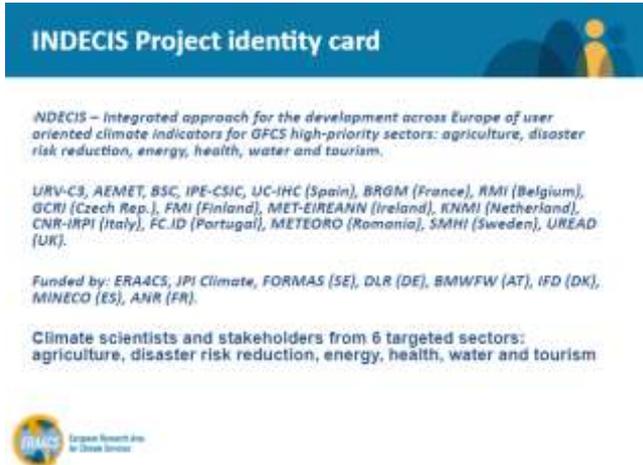
ClimINVEST resources:
<https://www.cicm.no/en/climinvest>

ERA4CS
Copernicus
Clim INVEST

Tailored physical climate risk information for investors (ClimINVEST) presented Iulia Marginean by emphasising the project objectives: to help investors respond to TCFD – physical risk; to produce Climate, physical and financial indicators; to define impact chains linking climate with finance, to provide climate risk assessment services, to create transparent methodology and publicly available data and disclosure of uncertainties and constraints. The project approach - climate proved investment decisions, monitoring and evaluation (user group: institutional, investors, pension funds, asset managers, banks and insurance companies), communication among scientists (social scientists, economists, natural scientists) and tailored information on physical climate risks.

Key resources: Interactive climate indicators platform, Set of scientific factsheets, webinar series, Final Capstone Report. ClimINVEST progressed on managing physical climate risk in finance by clarifying short-term effects of climate change and strategic importance of the long-term, the project increased transparency of available information and revealed already large expertise on the subject, they experienced data challenge and lack of financial impact estimates.

INDECIS project



INDECIS Project identity card

INDECIS – integrated approach for the development across Europe of user oriented climate indicators for GFCs high-priority sectors: agriculture, disaster risk reduction, energy, health, water and tourism.

URV-CS, AEMET, BSC, IPE-CSIC, UC-IHC (Spain), BRGM (France), RMI (Belgium), GCRI (Czech Rep.), FMI (Finland), MET-EIREANN (Ireland), KNMI (Netherlands), CNR-IRPI (Italy), FCJD (Portugal), METEORO (Romania), SMHI (Sweden), UREAD (UK).

Funded by: ERA4CS, JPI Climate, FORMAS (SE), DLR (DE), BMWFV (AT), IFD (DK), MINECO (ES), ANR (FR).

Climate scientists and stakeholders from 6 targeted sectors: agriculture, disaster risk reduction, energy, health, water and tourism



Sectoral Climate services INDECIS – Integrated approach for the development across Europe of user oriented climate indicators for GFCs high-priority sectors: agriculture, disaster risk reduction, energy, health, water and tourism project collaborated with climate scientists and stakeholders from 6 targeted sectors: agriculture, disaster risk reduction, energy, health, water and tourism.

Accomplishments of the project and examples of key results and findings of the project and how they will be used to develop climate services were presented by Jon Xavier Olano. Datasets not only for the Balkans and Central Europe (including pre 1920 Poland data) but also daily data for Italy (1901-1947) and Ireland (1856-1959) were recovered. Data is available (when license allows) via INDECIS and ECA&D. INDECIS Project has developed software suites for quality control and homogenization of datasets (such as INQC, MetQC, QC suite for tall towers wind data, and special version of Climatol for the Homogenization for ECA&D Daily Series). Other suites have been developed: ClimIND (to calculate Indices); Suite of Atmospheric Circulation Indices Calculation; INTERDECIS suite for intercomparison of reanalysis datasets; and fireDanger for the calculation of fire danger indices. ClimInd suite software and ECTACI derived Atlas of Indicators allow to compare the INDECIS Indicators with sectorial data such as mortality, vegetation

greening or forest growth, applications based on INDECIS indices for near real-time simulation of groundwater, farming or snow tourism resorts were also developed.

Recovered data, public data and software suites allow developing studies in the activity sectors to quantify correlations with climate indices and reconstruct historical and non-historical atmospheric patterns. Some examples are the reconstruction of the drought of 1921, regional correlation analysis for Calabria (1951-2010), Indices relationships with Euro-Atlantic circulation patterns, the recent record-breaking temperature in Europe (2018-201). Sectorial indices for seasonal predictions of wind-power; seasonal forecast for the wine sector and seasonal forecasting for agriculture, winter tourism and hydropower.

INDECIS project has developed a new methodology for co-creation climate services with local agents from user and stakeholder engagement. Co-creation methodology led tourism researchers to define two tourism co-created daily indices for snow tourism and beach tourism and are expected indices for other tourism types (as outdoor [e.g., climbing or cycling]; cultural or MICE).

INDECIS legacy is composed by INDECIS data portal (with recovered station data, and homogenized and quality-controlled data); almost 100 papers produced, INDECIS software (for quality control and homogenization of daily data, to calculate INDECIS Indices and other applications (comparison of reanalysis datasets, fire danger or beach tourism index (beta). New methodology developed for user engagement and co-creation of CS with local agents used to define tourism destination needs has been tested and published and will be applied in a local project not only for tourism (e.g., energy). INDECIS partner (URV-C3) is leading a WP in Erasmus ++ Project “ClimEd” whose main objective is to develop CS in Ukraine. More information on legacy can be found in INDECIS Portal: <http://www.indecis.eu>

An operational service could be initiated relatively quickly for specific locations where beach tourism plays an important role in the economy. In 2-3 years' time range could be possible to develop a co-created CS for Beach Tourism (medium) and other types of tourism (long) in an interactive platform for Europe. Time and budget for developing this interactive platform would be as additional steps needed to reach an “operational” status.

SENSES project



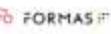
Climate Change ScENario ServiceS: Mapping the future (SENSES)
<http://senses-project.org/>

Objective
Make climate change scenarios more accessible and usable by effective communication and empowering users to explore scenario information.

Consortium SENSES

<ul style="list-style-type: none"> Climate impact projections Scenario development Scenario analysis 	<ul style="list-style-type: none"> Accessibility Communicability Clarity building Flexibility Interactivity Integration 	<ul style="list-style-type: none"> Policy makers Business sector Education sector Research sector
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Global climate change scenarios
Integrated Assessment
Scenario co-production
Regional Scenarios
Data visualization
Toolkit design

Funded by:     

Climate Change ScENario ServiceS: Mapping the future (SENSES) project coordinator Elmar Kriegler introduced with the project consortium and focus on climate change scenarios to make more accessible for strategical planning and usable by effective communication and empowering users to explore scenario information. There are various Climate change scenarios Climate impact projections, Socioeconomic and mitigation, and adaptation scenarios creating climate change scenario service highly demanded by target users from policy makers, finance

sector, business sector and regional sectors. The SENSES Scenario Toolkit is available <https://climatescenarios.org/toolkit/>

A particular interest in the toolkit was expressed from finance sector. The scenario service approach developed by SENSES is published. The global scenario users and stakeholders were from Climate change impacts (Plan Adapt, GIZ) Businesses (World Energy Council, Toyota), Finances (BaFin, Deutsche Bundesbank, Bank of England, UNEP Finance Initiative, International Finance Cooperation, EU Commission FISMA, Oliver Wyman, 2° Investing Initiative, Carbon Disclosure Project)

Stakeholder workshop and case study reports plus co-production and scenario visualisation tools: <http://senses-project.org/results/> have been produced. Regional case studies were organised in the Netherlands led by Wageningen University on Local adaptation & mitigation trade-offs and in Kenya led by SEI on Transnational climate impacts.

Future needs to operationalise the service: SENSES toolkit provides a prototypical example of scenario services and generated large interest in academic (provider) and user communities. However, the prominence is starting to fade as toolkit was completed in February 2021 and project ended half a year ago, there is a need to make it a widely used and “living” resource, to continue maintenance of web presence and curation of (new) content. The guided explore modules and co-production formats using the toolkit should be further developed and to continue promotion of the toolkit and active facilitation of capacity building activities using the toolkit. These functions need to be institutionalised for transferring them to a permanent institution(s) such as, for example, the Integrated Assessment Modelling Consortium (IAMC).

WINDSURFER project



WIND and wave Scenarios, Uncertainty and climate Risk assessments for Forestry, Energy and Reinsurance (WINDSURFER) project was presented by the project coordinator Len Schaffrey. The project co-developed new methods, tools and assessments of extreme wind and wave risk with the particular focus on forestry, offshore energy and insurance. Len presented how windstorms effects the Europe: Windstorm Kyrill - €6Bn losses and 53 fatalities and Windstorm Gudrun - felled annual Swedish forestry output. The extreme waves can reach 20 meters and it puts on risk offshore infrastructure and sometimes people have to work in extreme conditions to fix the damages.

WINDSURFER results are 18 journal publications, UK Royal Met Society COP26 briefing paper on storms and climate change Data: 1900-1940 Historical storms (Met Éireann)

NORA3 and NORA10EI extreme wave datasets (Haakenstad et al., 2021, 2022, Met Norway); N. Atlantic Wave Datasets (UC-IHC); Eastern Mediterranean Wave datasets (Emmanouil et al., NCSR); Synthetic Storm Surge dataset (Van den Brink, 2021, KNMI) MED-CORDEX 0.11o Simulations (Conte et al., 2020, CMCC), to mention also interactions with stakeholders and end users, on insurance side the project co-developed simple insurance loss model for European windstorm and presented results at Industry conferences in 2018, 2019; Cat Risk London 200. Results taken forward in UK Centre for Greening Finance and Investment www.ukcgfi.org

On the forestry side the project was very active in developing Finnish forestry wind damage model (FMI), Role of windstorms and frozen soil (FMI) Valta et al. (2019) Scatterplot of wind gust versus Finnish forestry damage.

In terms of offshore energy, the project was presented at International Oil and Gas Producer Events on climate change; wave datasets used in risk assessment for offshore energy platform design and operation.

EUPHEME project



European Prototype demonstrator for the Harmonisation and Evaluation of Methodologies for attribution of extreme weather Events (EUPHEME) project objectives were presented by the science coordinator Nikos Christidis: to develop state of the art methods for the attribution of extreme weather and climate events; to develop a platform that provides a collaboration space for scientists from partner institutions and provide a user-oriented synthesis of attribution assessments through a prototype attribution service website and demonstrate the potential of attribution products to stakeholders.

Throughout the project close engagement with stakeholder groups were organised via workshops: Dublin, Ireland, in May 2019; Brno, Czech Republic, Nov 2019. Representatives from environment, infrastructure, agriculture, transport, energy, scientific research sectors, national authorities & agencies, NGOs, private enterprises were in the list of attendees. Stakeholder feedback helped to develop useful attribution products like information factsheets on prominent extreme events to be bases for the effective decision making.

Nikos highlighted just some of the accomplishments: organised several high-impact extreme events and generated timely assessments, also summarised in subsequent peer-reviewed publications; wide press coverage by almost all national newspapers. The Guardian online article was the most read article on its website. Interviews with the BBC, Guardian, Telegraph, Channel 5 News, Daily Mail, The i, Carbon Brief and ZME Science

Main accomplishments are series of paper (16) and book chapters (8) exploring avenues for CS coproduction, field-tested hands-on conceptualization of co-production and co-production challenges allowed for many explorations on the nature of climate information for action. Functional relationships for future projects with Cities of Dordrecht and Bergen Theatre du Grain and Le Maquis. Within the consortium they have submitted several new projects (SeMPER, KQA SMD, IA) some directly linked to CS and some border on climate issues. One of project's juniors got an ERC Junior grant on seasonality and with a CS component and much cross-fertilisation already concretised.

Towards the future: Operational versions of practical tools for CS co-production in the form of process and/or user manual and/or reports; KQA procedure adopted in other projects (e.g., LoVeSe on SDG) and from the scenario results spin off in the form of "A toolbox with participatory foresight methods." The Curriculum and online training suite for CS co-production about to be implemented, and already officially approved as part of a master's degree in adaptation to climate change.

EVOKED project



EVOKED - Enhancing the value of climate data project's overarching objective is to re-frame the risk and uncertainty associated with climate data into knowledge products more understandable and useful for end-users concerned with risk mitigation and adaptation. The Coordinator of the project Amy Oen presented the end-user partners who initiated and facilitated co-production of climate services with local stakeholders: Larvik Municipality, Norway, Värmland County Admin. Board, Sweden, Province of North Brabant, NL, Waterboard Drents Overijsselse Delta, NL and City of Flensburg, Germany

Amy emphasised three main accomplishments: evaluation of the climate services and the co-design and co-production process using questionnaires during the Living Labs and the satisfaction of the developed climate services; developing and implementing the Living Labs methodology at the case study sites provided a framework for the co-design co-production process for climate services; application of the 'climate information design' template to frame the process of creating climate services for each of the case study sites in the Living Labs.

Towards the future Operational climate services: Värmland County in Sweden launched a story map to create awareness among officials and politicians. The story map illustrates what municipalities can do, not what they must do. The City of Flensburg in Germany also created a story map in an iterative process with citizens. Their story map focuses on illustrating flood impacts in the city. The Waterboard Drents Overijsselse Delta in the Netherlands concentrated efforts on updating their existing climate service referred to as the 'climate atlas'. North Brabant

in the Netherlands, together with the municipalities and waterboards, updated their Regional Adaptation Strategy report based on the Dutch National Adaptation Strategy (NAS) infographic.

Additional steps for some climate services: Larvik Municipality in Norway has together with planners in the municipality and local contractors developed a 'Climate menu' checklist to facilitate dialogue on climate adaptation measures. Steps towards operationalisation includes

testing the 'Climate menu' at a location currently at this stage in the zoning permitting process and developing the checklist into a digital format using additional funds received from the Norwegian Environment Agency's climate fund for local initiatives.

INNOVA project

www.innovaclimate.org



INNOVA Climate Service Provision project general objectives were presented by María Máñez Costa. The INNOVA project considers climate services innovations for transformational adaptation in addition to incremental adaptation. Transdisciplinary knowledge collected from different sources representing the information feed-forward and feed-back processes across individuals that are necessary for transformations in societal processes.

Some challenges of the project were user's diversity, not proper access to information to find good data on islands situation, different languages and how to deal with this. INNOVA developed diagnostic tools and business models in five HUBs Guadeloupe, Kiel Bay, Valencia, Nijmegen.

The project analysed complexity of users and evaluated compatibility of users with climate services the project was going to co-produce together.

Some INNOVA products are Ezines <https://www.innovaclimate.org/ezines/> narratives, videos <http://innova.univ-antilles.fr/innova/>, DKP <http://innova.univ-antilles.fr/innova/>, Data knowledge platform. Several regional workshops were organised to transfer INNOVA results in other areas with similar conditions.

ISIpedia project



ISIpedia: the open climate-impacts encyclopaedia project was presented by the Project Manager Martin Park who informed that the project overall objectives were to provide public access to climate impact science to generate a better understanding of climate related risks.

The ISIpedia project features peer review studies on data base for intersectoral modules led by ISIMIP Team (PIK) responsible for the cross-sectoral and sector-specific coordination of the ISIMIP climate-impacts simulations, as well as the overall ISIpedia project coordination.

Stakeholder perspective was address by the Stakeholder Engagement Team (SET, led by Climate Analytics) they were responsible for ensuring that the needs and interest of end users are represented in every aspect of ISIpedia: design of the simulations, content of the impact assessments, and design of the online portal. The team involved about 25 actively engaged key stakeholders. Scientists actively used ISIpedia platform to present their results, explained methods and backgrounds of the studies and informed about the mitigation f.eg. It was supported by Assessment & Editorial Team led by IASA, responsible for curating the content of the ISIpedia impact assessments, and for the online portal as a whole.

Main accomplishment is the ISIpedia portal, you can filter content for the different topics. There are three type of studies: observed impacts; model evaluation and future projections. It can be broken down from the global to the national level assessments. ISIpedia is the outreach channel of ISIMIP presenting latest climate impact science in lay-man's terms. It is an online portal featuring national-level, cross-sectoral climate-impact assessments, based on state-of-the-art climate-impacts simulations from ISIMIP.

Coordination of the ISIMIP network and launch of three simulations rounds and all scientific output which was generated in this content can be considered as the achievements of the project.

Full potential of ISIpedia will be exploited by scaling up content and reach, to feed the platform with new content and scientific papers and continue to develop the communication strategy involving 25 key stakeholders and enlarge this network. For this a dedicated Editorial Team should be established which curates the content and scales up the outreach. Team would consist of Creative Director, Graphic Designer, Text Editor, Web Administrator. This would create a strong knowledge base for expert use.

Highlights of the discussions

Issue on quality assessment and co-evaluation of the services provided was discussed. As there was not involved any external facilitator and evaluator in this process and the end users could be

the drivers and researchers followed the request, but other projects indicated that external expertise procedure neutral is needed.

Cluster 4: Cities, fires and health

CitizenSensing project



CitizenSensing Urban climate resilience through participatory risk management project was presented by the Project Coordinator Tina Neset. Tina began her presentation with the objectives of the project to co-develop a Participatory Risk Management System to increase urban climate resilience and analyse potential of the Participatory Risk Management System to increase preparedness and appropriate responses by citizens and authorities to increase urban climate resilience in different European and climate contexts. The project involved climate adaptation researchers and experts, local authorities, citizen groups and carried out four pilots in Rotterdam, Trondheim, Norrköping & Porto.

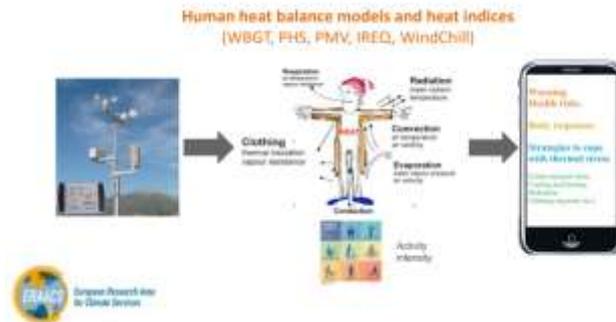
Accomplishments of the project are Scientific publications and resources for educational activities; CitizenSensing Web App for portable devices; CitizenSensing Web Portal allowing citizens and decision makers to share and explore reports on climate-related risks; CitizenSensing Visual Analysis Interface (CS-VAI) designed to enable more flexible and detailed visual exploration of the data; WayFinder routing tool supporting pedestrian navigation in hazard-exposed urban areas.

Legacy/Operationalisation is the CitizenSensing Web Application as part of new projects & collaborations. There is an interest from the municipalities on tailored versions of the Citizen Sensing software and steps towards operational product required, e.g. compatibility, interaction stability, database, integrity, capacity.

ClimApp project

ClimApp objectives

- 1) To develop a mobile App that integrates weather forecast into heat balance models,
- 2) To improve personalized adaptation strategies when facing climate challenges.



Translating climate service into personalized adaptation strategies to cope with thermal stress (ClimApp) project main result was introduced by the Project Coordinator Chuansi Gao. The project developed a smartphone app that integrates climate service data into human heat balance models and provide a personalized tool for heat/cold stress warnings and advice to increase thermal resilience.

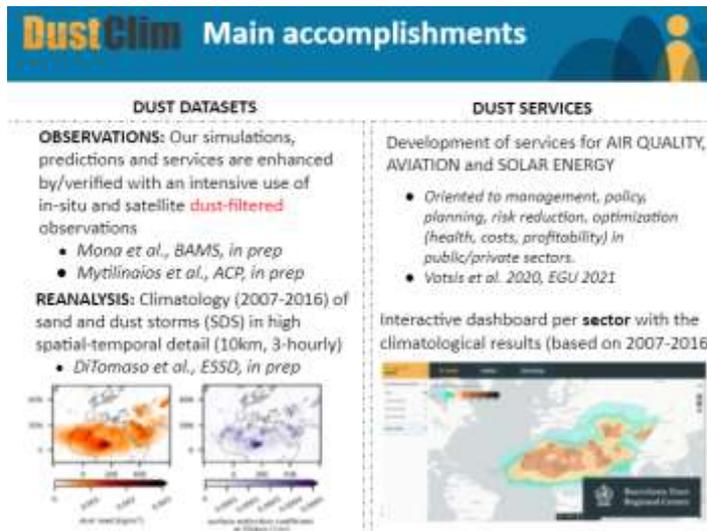
Users involved: 1) Regional Public Health Services VGGM, The Netherlands, 2) Taiga AB, 3) AA-Miljö, 4) Outdoor tourism, Sweden, 5) MeteoSwiss, Switzerland, 6) RedCross, The Netherlands, etc

Main accomplishments: A personalized tool for health risk warnings and advice to cope with heat/cold stress. ClimApp is publicly available for Android and iPhone. It works globally in 10 languages. As of 30 June, there are more than 1 200 users, about 30 new users/month. There are 839 users from 45 countries interacting with the project (<https://www.lth.se/climapp/>). Eight papers published in journals, 12 presented at conferences and three under review. Data input into human thermal models: weather data from OpenWeatherMap with free API, and user's personal data.

ClimApp was awarded by WMO in 2020 for Originality and Innovation.

The ClimApp is developed, tested and it is functioning. For an operational service, the following steps are needed: to access to weather forecast data with free API (application programming interface) and collaborate with Met Services, public health or occupational health agencies to officially promote use of App to a wider audience and test effectiveness and health benefit among larger user groups. Further improvement of usability/user interface design and functionality, long term maintenance and update would be required and to adjust the heat stress warning thresholds for vulnerable groups. ClimApp can be used by public and private sectors, and by all mobile phone users, and organisations who take care of vulnerable groups when facing extreme weather events such as heat waves.

DustClim project



Dust Storms Assessment for the development of user-oriented Climate Services in Northern Africa, the Middle East and Europe (DustClim) project was presented by the Project Coordinator Sara Basart. She highlighted that Sand and Dust Storms (SDS) are a serious hazard for life, health, environment, and economy; scarcity of dust observations (past trends and current conditions) but the information is missing in the regions where it is most affected. The goal was to develop dust-related services for specific socio-economic sectors based on an advanced dust reanalysis for the NAMEE region. The project worked on Data Assimilation Model Evaluation, stakeholder and user engagement, user-oriented products - air quality, aviation and solar energy, dust climatology, data assimilation model evaluation.

Main accomplishments are DUST datasets obtained through observations coming from satellites and institutes networks. The simulations, predictions and services are enhanced and verified with an intensive use of in-situ and satellite dust-filtered observations. Dust services are oriented to the management and planning, it will be displayed, and access given to the potential users. BSC in the frame of the project developed services for air quality, aviation and solar energy oriented to management, policy, planning, risk reduction, optimisation (health, costs, profitability) in public/private sectors. The WMO Barcelona Dust Regional Center coordinates the activities of the NAMEE node and aims to enhance capacity building within the region by promoting collaborations and by producing dust services. These dust products will be accessible through the WMO Regional Center. New products should be investigated in partnership with public/private sector. UN agencies are interested to include more sectors and regions. The Center is supported by BSC and AEMET but the project team also looks for additional funding to continue started activities.

Further efforts are needed, and funding were applied to improve the forecast quality and maintaining the service.

Next steps would be to reach a full operational status, additional funding is needed, to promote the SERV_FOR FIRE holistic approach and products, spread the SERV_FOR FIRE results and promote the SERV_FORFIRE case studies and show the demonstrators' tools in action, as in the Copernicus Climate Change Service.

URCLIM project



URCLIM : Urban CLIMate services

- Climate Services for *Urban Planners*
 - High-resolution urban maps anywhere
 - Down-scaling uncertainties
 - multi-criteria impacts
 - Urban Climate Services developed in collaboration with users
- 5 Meteorological Institutes, 1 mapping agency, 1 laboratory in geomatics




- 5 cases studies in 5 European countries



URCLIM : Urban CLIMate services project presented the Project Coordinator Valéry Masson introducing the project focus on cities and what climate services can offer to cities especially for Urban Planners. The project provided high-resolution urban maps and worked on down-scaling uncertainties to go from regional modules to the cities and cities suburbs with multi-criteria impacts. Urban Climate Services were developed in collaboration with users. The project was implemented by five Meteorological Institutes, one mapping agency, one laboratory in geomatics and carried out five case studies in 5 European countries.

Main accomplishments of the project are a development of software to use Open Street Map data to map parameters for urban climate; multi-criteria impact (e.g. health) on cities; UCS prototypes & Urban climate 3D Visualisation tools; urbanised Downscaling methods from Regional Climate Models; ability to distinguish climate change & urban change drivers for impacts; message to stakeholders about adaptation strategies: “what is done today will still be effective in future climate.”

Towards the future C3S service on Surface Land Information Mapping incorporated maps of urban parameters on whole Europe. A potential interest for Destination Earth on Urban Areas. Downscaling methods are a potential tool for the analysis and exploitation of the WCRP CORDEX Flagship Pilot Study “Europe: URBan environments and Regional Climate Change (URB-RCC)” The future of climate services is the use of produced products by urban stakeholders.

Highlights of discussion

Question on maintaining and updating the ClimApp application was raised, partners of the ClimApp project maintain and update the app, but they are looking for Met Services, public health or occupational health agencies to officially promote the use of this app to a wider audience. A link with EFFIS were commented by Serv_FORFIRE project team having JRC as an associate partner and cooperating in other EU project and together involved in joint assessment of Sentinel

1 and sentinel 2 fire severity estimation. TCDF is preparing climate projections of FWI (Canadian Model) at 10km with CMIP6 and transpose this to sub-seasonal/seasonal forecast of FWI, if any of the projects are interested in high-res CMIP6 projections (<https://doi.org/10.31223/X5S610>) an interaction was offered. Another discussion point touched the value of seasonal forecast if it helps to extinguish the fire, yes, but the seasonal estimation must be improved. It was announced to reach out JPI Climate Central Secretariat if projects want to promote their results via Twitter and use #era4cs.

Cluster 5: Water, agriculture, energy

AquaClew project



Advancing the Quality of Climate Services for European Water

AIMS:

- Improve co-development to better incorporate multiple user feedbacks along the entire climate service production chain
- Taylor data, quality-assurance metrics to closer meet user requirements, including resolution and precision

CONSORTIUM:
8 partners & 7 case studies:

USERS:
User community, Focus group, Students

Project AQUACLEW is part of ERA4CS, an ERA-NET initiated by JPI Climate, and funded by FORNAS (SE), DLR (DE), BMBWF (AT), WD (DK), MINECO (ES), ANR (FR) with co-funding by the European Union (Grant 696462).

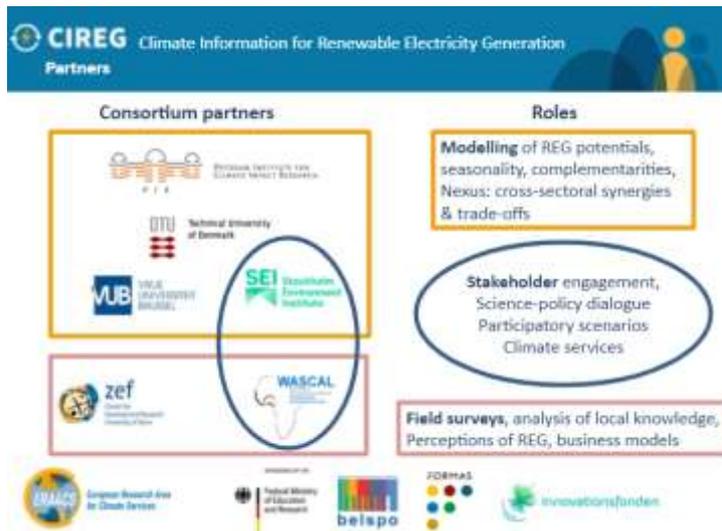
Advancing the Quality of Climate Services for European Water (AquaClew) project

aims were explained by the Project Coordinator Christiana Photiadou. The project improved co-development by incorporating multiple user feedbacks along the entire climate service production chain and focused on advancing the data methods and tools already used in climate services. Each of eight partners had its own case study (agriculture production, urban flash floods, fluvial flash floods, hydropower production, water recourse allocation service) and in each service they had to handle the water issue. Taylor data, quality-assurance metrics to closer meet user requirements, including resolution and precision were produced.

Main accomplishments are seven case studies and the project worked with increase of data quality and methods used by improving user's operational services, worked with climate models and high-resolution data. examining different bias correction methods, focusing on calibration, validation of 9 hydrological models, used Operational water service input, how can a pan European service complement a national/regional service and how to provide more confidence in modelling. The team created focus groups dedicated to each region involving policy makers, water managers and researchers and developed feedback loops. New tools to assess quality: DSST BIAS, HYDRO, Expert elicitation, RAT.

Towards the future is to continue to improve robustness, the methods used in climate services to better understand uncertainty, to improve resolution, quality of data and methods, recruitments in CS with the user community, focus groups on user's knowledge and uptake students experiments to increase knowledge. Reform is very important in assessing the impact of new data and methods in the decision-making process and reflection from both sides the service developers & the users. Some of the case studies are already at the operational level – this status needs to be maintained and to continue this development for the other case studies.

CIREG project



Climate Information for Renewable Electricity Generation (CIREG) objectives were introduced by the Project Coordinator Stefan Liersch to support sustainable decision making in West Africa's electricity sector by advertising the leap frogging on renewable technologies and having positive impacts on electricity and water security, GHG emissions. The project explored the seasonality and complementarity of solar, wind, and hydropower and co-developed climate-resilient and water-smart RE scenarios (WEF-Nexus approach), business models for decentralized electrification systems (local demonstrators). Roles of Modelling of REG potentials, seasonality, complementarities, Nexus: cross-sectoral synergies & trade-offs were shared with the project partners. Another important task was a stakeholder engagement, to organise Science-policy dialogue, participatory scenarios of Climate services, field surveys, analysis of local knowledge, perceptions of REG, business models. Among the users/stakeholders were National and regional water and energy sectors, short-listed national users, National electricity company (SONABEL), Agency for renewable energy (ANEERE), Directorate for Water Resources (DGRE), Togo - National Civil Protection Agency; Renewable Electrification Agency (AT2ER), Ghana - Energy Commission; Water Resources Commission, Niger - Electricity Commission (NIGELEC); Energy Ministry (ANPER); Water Resources Ministry.

Main accomplishment is a co-development of RE scenarios for renewable electricity generation especially in West Africa (Volta basin). The project developed REVUB Model which can be used to optimise renewable sources into the stable power mix based on the renewables. they performed many model trainings asked by the stakeholders, there was an experience exchange also with local technicians. During three local demonstrators (Solar PV & small hydro) business models were developed and contributed to electrification of small villages in West Africa. The project team produced ten publications (especially proud of two in nature family).

Legacy of the project are databases: West African Renewable Power Database, Hydropower Atlas, Hydroclimatic and hydropower projections. The project provided three communities provided with renewable electricity. In terms of operationalisation the project wants to bring climate services produced into the cloud and go forward with selected stakeholders, tackling unsolved issues.

Clim2power project



Clim2power: Translating Climate Data into Power Plant Operational Guidance project presented the Project Coordinator Sofia Simões. Climate service covers whole interconnected European electric system & tested/validated over 4 regional case-studies: Focus on taking climate data and translated into the power plant operational guidance information. The project had EU Users Board and four National Boards in Austria, France, Portugal, and Sweden. Project assessed how the climate data can be the best used for energy system models, not only solar, wind or hydro models, but putting together in an energy system and electricity model to see how different variations will affect the climate. It was done in two different time scales for the next season and for the long-term models for 2050. Three power companies were included in the consortium to test all the results and information coming from the climate services.

Main accomplishments of the C2P project are web service <http://viewer.webservice-energy.org/clim2power>, data collected for time scale of 2030 and 2050; produced six climate model applications; created ten indicators for the power sector; C2P data & model pipeline can be plugged in into the Copernicus Climate Change Service...but this is not easy! Two EU User Boards and 5+ national user board meetings; 5 international collaborations with projects & initiatives; 1 MSc & 1 PhD students; 6/17 papers / presentations in scientific events.

Towards the future the project cannot start immediately an operational CS although the C2P web service maintained till end 2022. There is a question if the maintenance of this web service is still research or not. These type of climate services for the power sector are not yet accurate enough to be commercially exploited and end users are not feeling to be funders at this stage. Next Generation Challenges in Energy-Climate Modelling <https://doi.org/10.1175/BAMS-D-20-0256.1> Climate scientists and energy modellers speak different languages and it is a challenge to take climate data and put in a small model.

CLIMALERT project



CLIMALERT: Climate Alert Smart System for Sustainable Water and Agriculture project general objective presented Giorgio Pace. The project co-developed new tools to incorporate climate information into the decision-making and promoted an adaptive management for water and agriculture. The project involved multidisciplinary team to cover different areas from climatology to ecology, water research and social science. During the co-development process the project had three case studies in Portugal, Spain and Germany focusing on water management and agriculture.

Key project results are CLIMALERT Mobile App codeveloped with the stakeholders and oriented to farmers - full service ready to operate. Tutorials <https://www.youtube.com/channel/UCMtwU-9vkujjCBqMCsLx99g>

Another service produced is Web application oriented to water managers in long term scenarios for selected ecosystem services taking into account future concentration of GHG emissions. Current situation versus short- and long-term predictions for water provision, water purification, sedimentation, precipitation <http://193.136.12.30:8000>

Towards the future the project considers that both tools are ready to operate but limited to the case study areas. Funding is needed to maintain the services operational (e.g. data flow, server) and extend the cover area (Europe, Global), upgrade the list of indicators (C3S). Opportunities found during the workshops with stakeholders to extend the scope to Forestry management, Municipalities and Civil Protection. Major constrain is that Portuguese RFO (FCT) will not Co-Fund next ERA4CS call.

CO-MICC project



CO-MICC – Supporting risk assessment and adaptation at multiple spatial scales: CO-development of Methods to utilize uncertain multi-model-based Information on freshwater-related hazards of Climate Change project presented the Project Coordinator Petra Döll. The project aimed to co-develop the exploitation of multi-model ensembles for global-scale water-related hazards of climate change & risk assessments www.co-micc.eu

The project groups consisted of global-scale hydrologists, social scientists & IT specialists from Germany, France, Austria, Intl. Centre for Water Resources and Global Change (ICWRGC) who is the host of CO-MICC web portal. The end users were involved in the project such as River basin scale water management experts (Spain and Northern Africa) and globally acting companies.

Main accomplishments are improved global hydrological modelling of CC impacts and extended MME by mimicking the dynamic vegetation response to CO₂ and changing climate in two global hydrological models, two evapotranspiration schemes (PT, PM)

MME: 6 GHM variants x 4 GCMs x 4 RCPs. The project co-designed hydrological hazard indicators and how to represent uncertainty in 15 variables, associated specific indicators at the three times scales (annual, seasonal, monthly). Stakeholders evaluated this as “not lost in sheer numbers, well rounded, relevant”. CO-MICC climate service has been embedded in the map-based data and knowledge portal.

As a third accomplishment can be mentioned a new method for utilising global-scale MME data for basin-scale CC risk assessments using Bayesian Networks. Take-home message from co-design was that it works well but experts/users desire more training in methods.

Towards the future the project will have pre-launch and launch events in October & December 2021 of Technology demonstration with functional portal. The project can continue with the Prototype demonstration in operational environment for the next years, based on financial bridge via in-kind resources by ICWRGC and the German National Hydrological Service. However, to get really operationalised service, the additional funded is needed to complete operational system that data would be checked and included in WMO Climate Data Catalogue (climatedata-catalogue.wmo.int).

WARExR project



WARExR Integration of climate seasonal prediction and ecosystem impact modelling for an efficient adaptation of water resources management to increasing climate extreme events project <https://watexr.eu/> aims to integrate state-of-the-art climate seasonal prediction and water quality simulation in a QGIS-based advanced solution to ensure efficient decision making and adaptation of water resources management to an increased frequency of climate extreme events. The project coordinator Rafael Marcé highlighted that the project spotted a gap in seasonal climate prediction for water quality modelling. Additional project objectives were to integrate seasonal prediction in tools tailored to different needs of end-users in the water quality sector, co-develop the tools as QGIS plug-ins to facilitate the adaptation of climate services by the water quality sector, show how seasonal prediction helps tackling impacts on water quality, thereby improving decision making and adaptation strategies and link to the Inter-Sectoral Impact Model Intercomparison project (ISI-MIP) by contributing a new Lake Impact Sector.

In co-development with the water sector seven case-studies have been performed. The first applications of seasonal climate prediction for water quality variables were co-developed by producing open-source workflows. WARExR decisively contributed to establish the new Lake Sector in ISI-MIP and produced influential publications. Co-development and industry trust building, workflows and apps -QGIS plug-in for salmon migration forecasts were carried out in Ireland, Voila app for WFD Ecological Status forecast in Lake Vansjo, Norway.

The project reached out the Water quality research community and water sector primed with the idea that using seasonal prediction for water management is now possible, creating the opportunity to develop operational climate services for water quality based on seasonal prediction - Services developed at varying maturity, several applications (Ireland, Norway, Germany) still to be fully validated in relevant environment, but very promising results, temperature and water level seasonal forecasting at Sau Reservoir (Spain) being demonstrated with ATL Water Supply Co. Spin-off by one of the partners inspired by PROGNOSE and WARExR projects. Fully operational but seasonal prediction missing. Application will break into TRL 8-9 with a follow up project, and a unique opportunity to make a global scale seasonal climate service focused on water quality (potential partnership with WaterWebTools). New MSCA ITN steaming from WARExR <https://inventwater.eu/>

MEDSCOPE project



MEDSCOPE project identity card

MEDiterranean Services Chain based On climate PrEdictions

Partners: AEMET (Spain), BSC (Spain), CMCC (Italy), CNR (Italy), INRA (France), MétéoFrance (France), RMI (Belgium)

www.medscope-project.eu

Scope: enhance the exploitation of climate predictions (seasonal forecast), maximising the potential of their **application in different economic sectors** of relevance for the **Mediterranean region**.

Specific Objectives:

- improve **understanding** of the climate predictability on seasonal (to multiannual) timescales in the Mediterranean. (WP2) CNR, AEMET, BSC, CMCC
- develop **advanced tools** to improve the extraction of information from climate prediction systems and assess their robustness and uncertainty. (WP3) BSC, INRA, CMCC, CNR, MF
- serve as a **community builder** for **climate service** activities in the **Mediterranean**, based on a common and shared knowledge. (WP4) AEMET, INRA, BSC, CMCC, CNR, MF

User Community: MedCOF = operators Renewable Energy, Water Management, Agri-Forestry sectors

MEDiterranean Services Chain based On climate PrEdictions (MEDSCOPE) project presented the Project Coordinator Silvio Gualdi. The scope of the project was to enhance the exploitation of climate predictions (seasonal forecast), maximising the potential of their application in different economic sectors of relevance for the Mediterranean region. A specific focus was on improving understanding of the climate predictability on seasonal (to multiannual) timescales in the Mediterranean area and develop advanced tools to improve the extraction of information from climate prediction systems and assess their robustness and uncertainty, the third specific objective was to serve as a community builder for climate service activities in the Mediterranean, based on a common and shared knowledge.

Main accomplishment of the project in terms of advancement in scientific understanding are more than 30 papers published in peer review journals on climate variability and predictability in the Med region, skill evaluation seasonal forecasting systems (C3S), and climate service prototypes and published a Special Issue on Mediterranean variability and predictability in Climate Dynamics.

Development of ClimateServiceTool: a set of software tools to manipulate climate predictions (download from the C3S CDS, downscaling, bias-correction, visualization, sectorial indicators): there are 48 functions (as of version 4.0.0). All functions have gone through a testing process. This package is free and available online in CRAN depository. 10 vignettes and video tutorials are also available.

Climate service prototypes in relevant socio-economic sectors for the Med region developed in three sectors:

- Renewable energy: - Wind capacity (BSC)
- hydropower (AEMET, MF)
- Hydrology: - winter inflow for Belesar Water Reservoir (AEMET)
- rivers discharge for Durance (France), Ebro (Spain) and Po (Italy)
- snowpack and glacier in North-Western Italy (CNR)
- Agriculture and Forestry: - cereal crop yield in Castilla y León (AEMET)
- agriculture and forest management in Southern France (INRA)
- agriculture and forest management in Central Italy (CMCC)

Legacy and future outlook: knowledge and developments transferred to other users and communities are well represented. Many users from all over the world have downloaded the functions of the CSTool. MEDSCOPE organised training sessions at the MedCOF on climate

variability and sources of predictability in the Mediterranean region, CSTool functions tutorials, examples of climate service prototypes.

Mediterranean Seasonal Climate Update monthly update the seasonal forecasts for the Med based on the C3S multi-system. Two service of prototypes S-ClimWaRe and Winter cereal crops harvest yield predictions for Castilla y León region are operational and the operations will be continued by AEMET. Services that could be “operationalised”: Wind Energy Sector (BSC) and Seasonal forecasts of mountain snow depth for water management (CNR). Follow up plan is to sustain the MEDSCOPE scientific community and enlarge it in support to the MedCOF and to the climate service activities in the Med region.

CLISWELN project



Climate Services for the Water-Energy-Land Nexus (CLISWELN) project <http://clisweln.info> team was not present during the meeting but sent their summary of activities performed. The project aimed to enhance the existing portfolio of climate services with a conceptually and methodologically meaningful approach to the water-energy-land-food nexus, from which coherent policies could be derived.

Accomplished cross-sectoral and -scale integration in climate services 3 case studies with co-production processes for tailored information and tools:

- Forestry and water infrastructure (Romania)
- Agriculture and biodiversity (Austria)
- Cities, tourism and river basins (Spain)

Tailored information across case studies, including factsheets and policy briefs.

Policy impacts across the multiple scales involved contribution to workshops and talks at policy events and processes in each case study and at each national level; Contribution with talks at workshops co-organised by the European Commission “Methods, tools and data for policy support on the Nexus”, “Climate services for a climate-resilient Europe”.

Main productions include: one brand new model for cities and droughts: The Urban Drought Nexus Tool. Open source at <http://doi.org/10.5281/zenodo.4587632> ; twelve publications in indexed journals; Multiple sessions organised in top conferences (Adaptation Futures 2018, ECCA 2019, SRI 2021) with 25 conference presentation and 5 thematic workshops.

Legacy activities, leadership on guidance, and continued implementation of policy recommendations: Information currently used as tailored by stakeholders in cities (Braşov, Romania) and agricultural areas (Seewinkel Austria), further developments applying the new “Urban Drought Nexus Tool” in Germany. Highly cited guidelines: “Ten principles to integrate the water-energy-land nexus with climate services for co-producing local and regional integrated assessments” top 80th centile of cited papers (Scopus).

Highlights of discussions

The maintenance of data is very important point when the projects end. C2P project emphasised that they developed new methods, scientific knowledge and translation of data to useful information for power companies required a lot and unfortunately the market end users already announced that they will not be willing to invest in such commercial service as uncertainties are too high but considering this as a research activity a follow-up could be to find funding from the research organisations. Some other projects had support from the stakeholders who want to investigate cooperation possibilities and ready to invest for example in seasonal prediction data.

The difficulties of engaging the stakeholders were raised and how familiar they are with the processes in climate change. The organisations involved in the projects had good knowledge on climate change, but raising the awareness among local communities, municipalities the projects elaborated a special approach involving also social scientists and clearly demonstrating the methods used and final results, but other sector representatives as farmers are well aware on climate change and even request more precise data, there is also a difference between users from public and private sectors, the users from public sector are interested in the services provided, but users from private sector request clear economical value, how this information can be translated to the improvement for their decision making process and there is an opportunity for future collaboration. Questions to think about; For which climate variables and/or sectoral applications do you see the most potential in Europe for seasonal predictions? To what extent do the projects begin by exploring the value of climate services within the decision-making processes being used by the targeted clients/users? This includes understanding the sensitivity within those decision-making processes to identify where and what climate information, including the associated uncertainties, can be introduced to enhance the robustness of the process and decisions being taken.

Report of the Working group on best practices for co-design with end-users



**A diversity of approaches and good practice
from the ERA4CS projects (2018-2021)**



Amy Oen (CICERO) presented the work done by the dedicated Work Group on Co-production of Climate Services and prepared report "A diversity of approaches and good practice from the ERA4CS projects (2018-2021)". Scope of this report and the overall aim of this guide is to define and recommend good practices relating to transdisciplinary co-production of climate services to funding agencies, researchers, and businesses.

The group based their findings on recent literature comprising all elements of the process including co-designing the research process or the service itself, the co-development and co-production process and principles, as well as the more comprehensive scope of co-creation research processes and the focus was on end-users as the stakeholders and owners of the climate services and mapping the diversity of co-production of climate services.

Survey developed by the Working Group was disseminated to all 26 ERA4CS funded projects in Spring 2020 and they received responses from 15 projects. Limitations were that the survey was completed by self-selected respondents representing the research partners in the respective projects and a variation in how projects responded to questions that addressed multiple case study sites or multiple climate services within the different projects. But in general, the group got rich data and additionally conducted interviews with 12 projects.

Spatial scale distribution of ERA4CS funded projects that have completed the good-practice examples of climate services template was showcased with colour coding indicated number of project partners per country and number of users per country and temporal scale distribution of ERA4CS funded project that have completed the template.

Modes and methods of stakeholder involvement and engagement were illustrated in the graphic when and what type of methods were used. As very positive point in coproduction was that a half of the projects involved end users in the problem definition and all projects are engaged with the stakeholders.

Evaluation of co-production methods documented are adapted in the report. Tina Neset (NGI) presented the typology of key aspects for CS co-production to guide good practices and forms of engagement, entry points of engagement, intensity of engagement. Forms of engagement can be informing people (public talks, training courses, seminars), learning from people (questionnaires, needs of stakeholders, end-users and evaluations of services, interviews), learning with people (collaborative process, meet the science events).

Entry points of engagement, when to start involved stakeholders/end users in the proposal phase as partners, the beginning of the project or the 'middle' phase when the entry of stakeholders is more structured to present the first prototype. The evaluation and implementation phase are to receive the feedback from stakeholders.

Maria Manez Costa (GERICS) highlighted the recommendations on disentangling co-production for four groups: for researchers, users, funders and private sector which will be available in the report. There are many definitions of co-productions in the literature found but from the lessons learnt it could be integrative process with a T shape including in status quo of problem definition with different disciplines, social perspectives, epistemologies and scientists, practitioners and in-depth problem solving as a second part providing climate services as innovative solutions.

The unification of knowledge and the importance of the non-denial of non-formal knowledge builds the basis for the transdisciplinary approach we are implementing within the development of climate services. The connection between the ontological dimension, i.e., a solid science

knowledge, and the epistemological dimension, i.e. the connection between users and services. We should see science-based services as drivers for social innovation. Social Innovation should be understood as "any project, product, process, program that challenges and, over time, changes, the defining routines, resource and authority flows or beliefs of the broader social system which created the problem in the first place" (Griggs et al. 2021).

A special issue "Co-designing climate services: The diversity of concepts and practices" will be published in the journal *Climate Services* and video was produced for ECCA2021.

The work group was invited to present this report at the next JPI Climate Transdisciplinary Advisory Board meeting and discussions touched upon the cooperation with the private sector and engineering consultancies, from the survey answers it was not captured, but the price for climate services was considered as one option.

The Project Coordinator of ERA4CS project Philippe Bougeault updated on funding opportunities for operationalisation of the climate services to submit a proposal to the upcoming call in Spring 2022 and some additional support is expected from several funding agencies.

The project results are available in the document [Tables of productions of the projects](#) coproduced with the ERA4CS projects. All presentations are available [here](#).

ERA4CS project team thanked the presenters for their great contribution to the Final Meeting on Climate Services, to the project teams and partners for implementing the ERA4CS projects, to the European Commission, funding agencies and Patrick Monfray from the Ministry of Higher Education, Research and Innovation of France for initiating the ERA4CS programme and being the first coordinator of the ERA4CS project.