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EUPORIAS

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EUPORIAS

EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale

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Contents

1. Project Objectives for the period

The EUPORIAS **vision** is that by developing end-to-end climate impact prediction services, operating on seasonal-to-decadal timescales, and clearly demonstrating their value in informing decision-making, we will stimulate a market for these new tools and thus improve the resilience of society to climate variability and change. EUPORIAS has **six top-level objectives**. During the first 18 months, the project has contributed to the achievement of these objectives as follows:

1. Develop and deliver reliable and trusted impact prediction systems for a number of carefully selected case studies. These will provide working examples of end-to-end climate-to-impacts-to-decision-making services operating on seasonal-to-decadal (S2D) timescales.

   The general assembly defined a set of criteria for the selection of the case studies (thereafter referred to as prototypes) that will be developed (Milestone 33). These criteria were then used within WP42 and WP3 to select the five prototypes that we are currently developing (Milestone 2 and Milestone 34).

2. Assess and document key knowledge gaps and vulnerabilities of important sectors (e.g. water, energy, health, transport, agriculture, tourism) along with the needs of specific users within these sectors, through close collaboration with project stakeholders.

   One fundamental requirement from EUPORIAS is to understand how seasonal and decadal information is currently used for decision making and what the main gaps are in the current capability that limits the usefulness of the climate information that is provided. To progress towards this understanding, a series of workshops have been conducted thus starting a dialogue with the project stakeholders in order to identify their key vulnerabilities and knowledge gaps. WP11 focussed on users' vulnerabilities whilst WP12 targeted more users' needs. The findings from these workshops have been summarised in reports available on the public web site (Milestone 4, Deliverable 11.1, Deliverable 12.1 and Deliverable 12.2). A series of in-depth interviews have been conducted and a report on the preliminary findings has been made available (Milestone 7). The analysis of an online user- survey and the results from a workshop with S2D prediction developers and purveyors is currently ongoing and the results will soon be made available (Deliverable 12.3 and Milestone 8).

3. Develop a set of standard tools tailored to the needs of stakeholders for calibrating, downscaling, and modelling sector-specific impacts on S2D timescales.

   Work has taken place within WP21 to identify the different bias-correction methodologies currently available for seasonal prediction. These are being implemented by UC within the MeteoLab toolbox. The bias-corrected data from ECMWF's seasonal forecast system (System 4) is now available through the ECOMS User Data Gateway (ECOMS-UDG), as is E-OBS. Data from the Met Office's seasonal prediction system (GloSea5) will become available soon. These activities have been conducted earlier than planned in order to ensure that the bias-corrected downscaled data required by WP23 is available (Milestone 12). The ECOMS-UDG is a shared data portal for hosting the data to be used in the FP7 EUPORIAS and SPECS projects.

4. Develop techniques to map the meteorological variables from the prediction systems provided by the WMO GPCs (two of which (Met Office and MeteoFrance) are partners in the project) into variables which are directly relevant to the needs of specific stakeholders.

   Two sets of work packages have been directly working towards this objective. On one hand WP22, WP23 and WP31 have been working on the development of impact models and

impact-related indices. These will provide a natural interface between meteorological parameters and user-identified ones. For example Deliverables 23.1 and 23.2 provided useful insights on how to best address the issues related to model initialisation. On the other hand WP41 and W42 will provide the stakeholders with inputs that can be directly fed into their decision support systems effectively translating meteo/climatic information into user-relevant data.

5. Develop a knowledge-sharing protocol necessary to promote the use of these technologies. This will include making uncertain information fit into the decision support systems used by stakeholders to take decisions on the S2D horizon. This objective will place Europe at the forefront of the implementation of the GFCS, through the GFCS's ambitions to develop climate services research, a climate services information system and a user interface platform.

   Within WP33 work has been conducted on the communication of levels of confidence to different audiences. A survey has been conducted to understand the preference of the users in terms of the graphical representation of the confidence in climate predictions. The results of this survey as well as results of a literature review have been summarised in Deliverables 33.1 and 33.2. We also expect significant progress towards this objective to emerge from Research Theme 4 (RT4) in the coming months.

6. Assess and document the current marketability of climate services in Europe and demonstrate how climate services on S2D time horizons can be made useful to end users.

   There has been no significant progress made in this period.

2. Work progress and achievements during the period

WP2 – Coordination across EUPORIAS, NACLIM and SPECS

Key Points/Significant Results:

- Undertaken the first steps to ensure the coordination between FP7 EUPORIAS, NACLIM and SPECS by establishing a project manager/coordinator's group;
- Produced a joint newsletter (October 2013) issued via ECOMS website;
- Created a "think tank" (ECOMS) to provide thought-leadership to the European Commission. This has strengthened links with other European projects and identified a common vision of the future research needs on Climate Modelling and Climate Services;
- White paper produced by ECOMS Board on the recommendations on the priorities for Horizon 2020 (with a focus on Challenge 5: Climate action, resource efficiency and raw materials) in the field of climate modelling and climate service development, underpinned by observations.

Executive summary

This work package is common to all three of the FP7 EUPORIAS, NACLIM and SPECS climate services projects, in order to ensure their close coordination.

During this period the following specific objectives have been achieved:

- Undertaken the first steps to ensure the coordination between the projects by establishing a project manager's and coordinator's group;
- Created a "Think tank" (ECOMS) to provide thought-leadership to the European Commission. This has strengthened links with other European projects already underway and identified a common vision of the future research needs on Climate Modelling and Climate Services.

Work package objectives

• Ensure close coordination between projects and activities in Europe in the area of seasonal to decadal climate predictions towards climate services;
• Provide thought leadership to the European Commission on future priorities in the area of seasonal to decadal climate predictions towards climate services.

Summary of progress towards objectives

Task 2.1: Coordination and cooperation of FP7 EUPORIAS, NACLIM and SPECS

EUPORIAS has undertaken a series of activities in order to strengthen the cooperation between the three projects; both on a scientific and a management level:

Between the Project Offices - The project managers have created a managers community; and are regularly in contact via e-mail and telephone to (i) discuss, and resolve, specific management/financial issues; (ii) share best FP7 management practices; and (iii) ensure information is exchanged regarding common science themes and project progress. The managers also communicate with other European FP7 projects such as EMBRACE and CLIM-RUN. Common templates and parallel instructions are often issued against shared timelines in order to make it as easy as possible (and to minimise the work required) for partners who are involved in more than one

project to provide the detail of information requested. For example, a single timeline was agreed for all three projects with common templates issued, for the partners to submit financial and technical information to feed into this periodic report.

Representation of project at each other's events – Representatives from SPECS and NACLIM have been invited to attend the EUPORIAS Management Board meetings (as observers); and vice versa. The projects are also invited to each other's General Assemblies. A joint kick-off meeting was held in November 2012. In October 2013, the EUPORIAS science coordinator and project manager attended the SPECS General Assembly, with the science coordinator presenting the highlights from EUPORIAS to date and the links between EUPORIAS and SPECS; and jointly facilitating, with the SPECS co-ordinator, a discussion around ways that the projects could practically benefit from each other.

Joint scientific activities – There is a continuous scientific interaction between the projects since several work packages in each project have common activities. EUPORIAS and SPECS have organised several workshops with cross-project representation. One example is a workshop held in June 2013 which focussed on agreeing a protocol for the initialisation of impacts models. Also, climate services sessions have been organised by project participants at the American Geophysical Union (AGU) Fall Meeting (December 2013 and 2013), the European Geosciences Union (EGU) general assembly (April 2013 and 2014), and the European Meteorological Society (EMS) annual meetings (September 2013). A shared data portal for hosting the data to be used in the EUPORIAS and SPECS projects has been designed and built (ECOMS-UDG).

Joint dissemination activities – The three projects strive to coordinate many of their dissemination and communication activities. Highlights include:

- Joint newsletter (input from EUPORIAS), October 2013;
- Umbrella website for the overarching coordination and dissemination activities; http://www.eu-ecoms.eu/;
- Relevant deliverable reports such as updated dissemination plans (Deliverable D4.1) have been shared in order ensure consistent communication activities.

Task 2.2: Creation of a "Think tank" (ECOMS) to provide thought leadership to the EC on future priorities, and close coordination with other European and global activities

The official launch of the European Climate Observations, Modelling and Services (ECOMS) think tank took place in November 2012 at the joint kick-off meeting of the EUPORIAS, NACLIM and SPECS projects. The main purpose of ECOMS is to act as an advisory group for the European Commission (EC) to identify priorities and research and investment needs in the field of climate observations, modelling and services.

ECOMS is comprised of the coordinators of EU FP7 climate modelling and climate service projects and representatives from European climate modelling and climate service centres as follows: Chris Hewitt (ECOMS Chair, Met Office, UK), Francisco Doblas-Reyes (SPECS Coordinator, IC3, Spain), Detlef Quadfasel (NACLIM Coordinator, Univ. Hamburg, Germany), Carlo Buontempo (EUPORIAS Science Coordinator, Met Office, UK), Pier Siebesma (EUCLIPSE Coordinator, KNMI, Netherlands), Colin Jones (EMBRACE Coordinator, previously SMHI, Sweden; now University of Leeds, UK), Paolo Ruti (CLIM-RUN Coordinator, ENEA, Italy), Roeland Van Oss and Wilco Hazeleger (ECLISE Coordinator and EC-Earth Chair, KNMI, Netherlands), Sylvie Joussaume (IS-ENES Coordinator, IPSL, France), Marco Giorgetta (COMBINE Coordinator, MPI, Germany), Guy Brasseur (representing IMPACT2C, CSC, Germany), Julia Slingo (Met Office, UK), Tim Palmer (University of Oxford, UK) and Claus Brüning (European Commission, Belgium).

This first ECOMS Board meeting took place in February 2013 (MS 1) and the conclusions of that meeting are summarised in a publically available white paper (Deliverable 2.1), which provides recommendations from ECOMS on the priorities for Horizon 2020 (specifically Challenge 5: Climate action, resource efficiency and raw materials) in the field of climate modelling and climate service development, underpinned by observations.

The EUPORIAS coordinator has been involved in his capacity as ECOMS chair, and through his role under the UN's Global Framework for Climate Services (GFCS), at the invitation of the EC's DG (Environment), to act as an expert in a series of climate service-related workshops. These include:

- Belmont Forum – international group of funding agencies, Goa India, November 2013
- Brussels April 2013 – H2020 Challenge 5 stakeholder meeting (rapporteur for sub-challenge 5.1)
- Brussels March 2014 – Towards a European market of climate services

Closely associated activities (not directly under ECOMS) that the ECOMS chair leads on include:

- The European Climate Service Partnership (ECSP) – an informal, open and inclusive European network available to climate service users, researchers, developers, providers and funders in the public and private sectors
- Ongoing development of the GFCS on part-time secondment to the GFCS Office in Geneva

Reasons for deviations from DoW and failing to achieve critical objectives

There are no deviations from the DoW.

Statement on the use of resources

The use of resources (Met Office only) is on track.

List of meetings (attendance funded through the project)

Brussels April 2013 and March 2014 – attendance by Chris Hewitt (EUPORIAS Coordinator), listed above

Key Points/Significant Results:

- Scientific coordination across the project has been maintained thanks to the use of routine teleconference and task-force teams, and one-to-one partner visits;
- The user-centrality of the project ensures that the optimal communication with stakeholders is reached. Such information gained through this two-way relationship has made its way into discussions on the COPERNICUS Climate Change Service, European Climate Service Partnership (ECSP), Climate Service Partnership (CSP) and JPI-Climate;
- The criteria for the selection of the prototypes were agreed by the general assembly of partners. The few prototypes that were chosen, through a rigorous selection process, have now been handed over to WP42 to develop.

Executive summary

The format for this project with its dynamic choice of prototypes during the course of the project means that a strong scientific coordination and leadership is needed to maintain the project cohesion and focus on its objectives. This is being achieved through a number of mechanisms such as face-to-face meetings with work package leaders and partners' representatives; frequent conference and Skype calls; and an active use of the project intranet as a platform for sharing documents, ideas and results.

Work package objectives

To establish and maintain a scientific coordination in order to meet the scientific objectives of the project

Summary of progress towards objectives

Task 3.1: Scientific coordination and monitoring of research themes, work packages and project progress

A clear procedure for the review and approval of the deliverables was put in place at the beginning of the project. This means that before its official submission to the EC, any deliverable needs to go through a series of review cycles before being approved by the Science Coordinator. Such a procedure, whilst time-consuming, guarantees the uniform quality of all deliverables and is a way of ensuring the consistency of the work within the project.

Individual; and clusters of; work packages conducted meetings during the two General Assemblies held so far, in order to ensure a shared understanding of the requirements, progress and plans within each work package. The Science Coordinator has a general oversight of the progress within each work package through regular e-mails and conference calls with the work package and task leaders. Each work package leader provides a short written progress update for all project members every three months.

Task 3.2: Co-ordinate the interdisciplinary and cross-cutting activities

An ambitious and challenging plan was put in place from the beginning of the project: visiting all partners in the project at least once during the first couple of years. During this first period, the Science Coordinator visited all but seven partners (namely MeteoSwiss, ENEA, WFP, AEMET, UC,

Predictia, UL-IDL, SMHI, UNIVLEEDS, FutureEverything, Meteo-France, KNMI, CETaqua, IC3 and Met Office). These visits enable the Science Coordinator to learn more about the scientific capacity and vision of the partner organisations and ensure that each partner understands their level of involvement and input into EUPORIAS.

Task 3.3: Management of scientific risk

All identified key scientific risks are listed in a risk register held by the Project Office.

The Project Office is available in order to advise on any scientific and technical issues, and rigorously challenges any requests to delay deliverables and tasks.

One example of where we have had to manage risk is around the selection of the prototypes. The project design, where the partner organisations submitted proposals for prototypes to be developed, meant that conflicts about the selection (and exclusion) of the prototypes were possible. An impartial selection process was put in place to minimise such a risk. For example, the criteria for the prototype selection and the names of the independent experts to sit on a review panel; were discussed and agreed in the plenary session during the October 2013 General Assembly. Once the panel of experts had made their recommendations and short list of prototypes in February 2014, these were accepted by the general assembly of partners.

Task 3.4: Co-ordination of case studies

The Science Coordinator led the discussions, processes and selection of the case studies and prototypes to be developed, ensuring that all partners were consulted and that the selections were impartial and rigorously challenged. Details of the selection process are given in WP42.

Now that the prototypes and case studies have been selected, one coordination activity is the holding of monthly conference calls with the prototype leads and, as required, the work package leaders from associated and impacted work packages (such as WP23 whose impact models' development will be used in the prototype development).

Task 3.5: Participation in scientific decision making bodies and panels. Provide specialist advice and promote the project

Linkages between EUPORIAS and other related activities and programmes include: the EUPORIAS Science Coordinator and coordinator are members (and chair) of the ECOMS Board and represent ECOMS at international meetings such as ECSP, EGU annual General Assemblies and AGU Fall Meetings. For example, the Science Coordinator and other partners facilitated sessions at AGU 2013 (GC044: Climate Services - translating climate science into societal benefit at seasonal to decadal time scales) and EGU 2014 (CL6.5: Climate services - underpinning science). Speeches about the project were given at the General Assemblies of FP7 SPECS and CLIPC and the science coordinator actively participated in the kick-off meetings of FP7 HELIX and UERRA.

The project has developed a web-based glossary of terms to ensure the use of a common language between providers and users of climate information. This glossary has attracted interest from other international initiatives such as FP7 IS-ENES2 and the EC-funded COST-action VALUE. Coordination was put in place between these initiatives to minimise the duplication of effort and promote a common language and understanding. In particular there is a joint plan with VALUE to embed the glossary terms in the metadata of the files used by the regional modelling community. For the time-being the attempt is limited to the downscaling community but the plan is to extend it to the S2D community.

(If applicable) Reasons for deviations from DoW and failing to achieve critical objectives

The work package is generally well aligned with what was described in the DoW. The only difference is on the definition of prototypes and case-studies. When writing the DoW two separate phases were planned; one focusing on developing the case-studies and subsequently choosing a few of these case studies to develop into climate service prototypes. It soon became evident that it was not realistic to develop the case-studies in the short time scheduled (first few months of the project). It was therefore decided that partners and associated stakeholders would submit proposals for possible prototypes. These proposals were informed by the collective experience and knowledge that the EUPORIAS partners have on the overall value of impact predictions and level of engagement from the associated stakeholders. It was this knowledge that was used for the prototype selection.

Statement on the use of resources

The resources used in this work package are broadly consistent with what we were expecting.

List of meetings (attendance funded through the project)

21-22 Mar 2013, FutureEverything Annual Festival, Bristol UK. Carlo Buontempo (Met Office) – Presentation of EUPORIAS

9–13 Sep 2013, 13th EMS Annual Meeting and 11th ECAM Meeting, Reading UK. Carlo Buontempo (Met Office) – Presentation of EUPORIAS results

18-20 Nov 2013, 6th ACRE Workshop, Lisbon Portugal. Carlo Buontempo (Met Office) – Presentation of EUPORIAS results

27 Apr - 2 May 2014, EGU General Assembly, Vienna Austria. Carlo Buontempo (Met Office) – Co-convener of session CL6.5 'Climate Services – Underpinning Science'

Lessons Learnt and Links Built

Probably one of the most important lessons we learnt from this work package is associated with the prototype selection process. Whilst there was a focus on identifying and agreeing a selection process that was both inclusive and fair, there are two aspects that we probably did not give enough consideration to. One is associated with the internal communication of the process itself, especially with regard to the importance of submitting comprehensive prototype proposals and the implication of the selection of prototypes (hence exclusion of others). The other aspect is associated with the way that the outcome of the prototype selection was presented to partners. We decided to distribute to all partners the final ranked list of prototypes with the average score obtained. Whilst this was in line with the procedure that was identified during the General Assembly, some partners felt such an exposure to be very direct and undiplomatic. In hindsight it may have been better to focus more attention than we did on the way in which the results of the selection were to be shared among the project partners.

Key Points/Significant Results:

- Updated the Dissemination Plan to provide more detail regarding target audiences, key messages and channels and tools for communicating these messages; plus the inclusion of some very specific outreach activities;
- Creation of a public project website, and the handover of responsibility of the website's brand, design, development and management to Predictia and FutureEverything;
- Formation of the EUPORIAS stakeholder group; plus a Stakeholder Task Team who will work with the Science Coordinator in ensuring the coordination of communication and project interactions with the stakeholder group;
- Establishment of a data management task force to ensure that data required for EUPORIAS is easily accessible and in the required formats, and that the appropriate data licensing terms are adhered to.

Executive summary

The focus of effort on this work package has been to confirm, through an updated dissemination plan, the mechanisms through which the project and its progress will be promoted. This includes developing the project brand and website. In parallel, the EUPORIAS stakeholder group has been formed, and the interactions of the project and the stakeholder group is managed by the Science Coordinator with assistance from a Stakeholder Task Team. A data management task force has been established to ensure that the data required for EUPORIAS is easily accessible, and the appropriate data licensing terms are adhered to.

Work package objectives

• Encourage and facilitate communication, promotion and dissemination of project progress, results and achievements;
• Oversight and management of the stakeholders within the project and ensure optimum exchange of information between stakeholders and project;
• Ensure that all the data used within the project are available in a predefined format and in a common location.

Summary of progress towards objectives

Task 4.1: Preparation of a project information-pack

An information pack (Deliverable 4.1) was circulated to all partners at the start of the project. The purpose of the pack was twofold. Firstly, it provided the partners and colleagues within their organisations with a common understanding of the project. This means that they can promote EUPORIAS using clear and consistent messages, and target the key audiences identified in the EUPORIAS Dissemination Plan. Secondly, it provides the partners with guidance regarding the use of the EU emblem and the mandatory EC acknowledgement on publications generated throughout the project.

The pack includes a leaflet and poster, plus an ECOMS press release that were produced for the project kick-off meeting. Two one-page documents detailing (a) project descriptions (short, medium and long) and (b) the project's key stages; were also included.

Task 4.2: Updated dissemination plan

An updated Dissemination Plan was written at the start of the project, and subsequent dissemination activities have been implemented, ensuring that the key audiences identified in the plan are being targeted. The plan was reviewed and updated in May 2013 to expand upon the original list of dissemination activities, and provide more detail regarding some of the target audiences, key messages, channels for communicating and some of the key people from the EUPORIAS partners who can support these communications and knowledge exchange.

Task 4.3: Public facing website

A basic public website (http://www.euporias.eu) was created by the Met Office as soon as the project started (Deliverable 4.3). This hosted information about the project and its structure, such as the factsheet and posters created for the kick-off meeting in November 2012. The responsibility for developing and maintaining the website was then handed over to Predictia and FutureEverything, as it was recognised that the website is a key tool in ensuring the optimal dissemination of the project and its results; therefore needs managing by appropriately skilled partners.

FutureEverything, in consultation with Nórr Design (http://norr.fi/), created a Brand for EUPORIAS and applied their design to the website, therefore contributing to an effective and consistent communication tool.

Task 4.4: Oversee the coordination of the stakeholder participation

The EUPORIAS stakeholders are the focal point of this project. There are over 70 stakeholders. These range from large multi-national companies (such as the EDF Group), to small private companies and national government agencies. They represent the sectors highlighted in the DoW. A list can be found on the stakeholder pages of the EUPORIAS website (http://www.euporias.eu/stakeholders). It is important that the multitude of complex interactions between the project and these stakeholders is well coordinated and documented, hence the need for this task, with the Science Coordinator ultimately responsible for it. Whilst fully integrating the stakeholders into the project is key - we need to ensure we are not over exposing them to the project as this may ultimately result in stakeholder fatigue.

A Stakeholder Task Team was formed at the kick-off meeting in Barcelona. This team comprises the Met Office, TEC, ENEA, IC3, UNIVLEEDS and FutureEverything. The purpose of the team is to work with the Science Coordinator in overseeing the stakeholder participation and interactions, and ensuring that all communications to stakeholders is consistent. Three main activities have been carried out:

- Create a database of the stakeholders and the existing relationships that each has with the project partners;
- Create a set of terms of engagement for talking to stakeholders. This set is aligned with the Dissemination Plan, and ensures that the project respects the existing relationships that exist between some of the stakeholders and the partners; and
- Define the stakeholder's journey or pathway through the project. This pathway is represented by Figure 1, which shows how each of the activities is related to the partners and the evolution of the project.

Figure 1: Stakeholder Pathway diagram

Task 4.5: Two summer schools for junior researchers in the area of climate science and stakeholder application

These two summer schools are planned to be held in the summers of 2015 and 2016, and will be coordinated by ENEA. ENEA has great experience in the running of similar schools; for example, in December 2013 they ran a school under the FP7 CLIM-RUN project about climate services. ENEA is already discussing the options for possible topics to include in these schools.

Task 4.6: Data flow management

The access and use of climate prediction hindcast data is important for the success of the project so one of the first actions EUPORIAS took after the kick-off meeting was to establish a data flow management task force: UC, Met Office, IC3 and Meteo-France are members of this task force. Through a series of informal meetings and teleconferences it was agreed that datasets from ECMWF System 4, Met Office GloSea5 and Meteo-France System 4 will be made available to EUPORIAS partners for research purposes. The terms and conditions for the distribution of each dataset were discussed and agreed upon with each individual institution providing the model datasets. The data has been made available to project partners of EUPORIAS, SPECS and NACLIM through the ECOMS User Data Gateway (UDG), which is hosted by the IT infrastructure of UC. The UDG also provides a set of tools written in R to transform the data. In order to gain access to the service the user has to agree to all the terms and conditions required by each institution which provide the dataset. The user has to be authorised by a moderator designed for each dataset.

Later in the project EUPORIAS partners will need to gain access to real-time forecasts. It is not expected ECOMS-UDG will be used for such a delivery. This delivery will more than likely occur through other channels.

(If applicable) Reasons for deviations from DoW and failing to achieve critical objectives

There are no deviations from the DoW in this work package.

Statement on the use of resources

The overall use of resources is on track. It became evident that FutureEverything could provide technical, visualisation and communication expertise to EUPORIAS that had not been explored whilst defining the DoW. Subsequently, eight person months of funding have been re-allocated to FutureEverything for this work package.

List of meetings (attendance funded through the project)

None.

WP11 – Assess sector-specific vulnerability

Key Points/Significant Results:

- The first EUPORIAS Stakeholder Meeting was held in January 2013. It was the first step towards the establishment of a European community of users and providers of seasonal to decadal (S2D) climate information. This group is formally referred to as the EUPORIAS Stakeholder Group;
- The interaction and dialog with the stakeholders has made it possible to gain an understanding of sector-specific information regarding: (a) how stakeholders currently use S2D climate predictions; (b) critical/relevant choices in their business that could be affected by climate; (c) how climate influences their business choices; and (d) how climate information enters into the decision making procedures. This information was gathered through questionnaires, the Stakeholder Meeting, and subsequent discussions and workshops resulting through the growing relationships between stakeholders and partners;
- A protocol for stakeholder engagement and communication was designed, with a first step being the creation of a positive experience for the stakeholders at the first Stakeholder Meeting.

Executive summary

In its first 18 months the project started a dialogue with its stakeholders with the double intention of highlighting the potential that climate predictions have in informing sector-specific decisions and identifying the needs of these stakeholders in terms of climate information that they can make use of. Three main tasks contributed to this objective: an initial stakeholder meeting took place in Rome in January 2013. These stakeholders completed a short questionnaire during the workshop registration and an online survey that was circulated after the meeting. A summary of the findings from these has been written (Milestone 4 and Deliverable 11.1). The key sectors involved are energy, tourism, water, forestry, health, transport, agriculture and European support for developing countries.

Work package objectives

Main Objectives:

The work package focuses on the identification and analysis of sector-specific vulnerabilities based on an effective dialogue with stakeholders started early in the process and sustained throughout the project. It will contribute to (1) the identification of the relevant vulnerabilities (objective 2) for the case studies; and (2) support the advancement of the science underpinning the delivery of climate information for the most vulnerable economic sectors in Europe (objective 5).

Specific Objectives:

• To raise awareness of seasonal and decadal predictions and their limitations through a close interaction with a number or stakeholders (Task 11.1);
• To identify critical sector specific vulnerabilities operating on seasonal to decadal time scale (Task 11.1 and Task 11.2);
• To contribute to a prototype component of the CUIP (Climate User Interface Platform) within the GFCS (Global Framework for Climate Services) in terms of targeted vulnerability information and tailored data-flow in relevant European economic sectors for seasonal to decadal time scales (Task 11.3).

Summary of progress towards objectives

Task 11.1: In January 2013 the first EUPORIAS Stakeholder Meeting took place at ENEA Headquarters in Rome

The first phase of activity with the EUPORIAS stakeholders can be considered very satisfactory since all the associated objectives have been reached. Questionnaires were distributed to relevant stakeholders and a two day workshop was held during January 2013 in Rome. 43 people representing the water, health, energy, transport, food security, insurance, agriculture and forestry sectors from across Europe took part in the Stakeholder Meeting. Subsequently a community of users and providers of S2D climate information has been formed.

Stakeholders have been informed about the skills and limitations of S2D climate predictions. At the same time the interaction and dialogue with stakeholders about their knowledge, awareness and how they use S2D forecasts has provided relevant information on: i) the critical/relevant choices in their business that could be affected by climate; ii) how climate influences their business choices; iii) how climate information enters in decision making procedures. The first steps to reach the objective to create a community of users of climate information and develop climate user champions have been made. The workshop was an occasion for stakeholders and partners to learn from each other in a successful two-way stream of information, providing a fruitful experience for the difference communities of participants.

The findings from a *preliminary registration questionnaire* sent out prior to the Stakeholder Meeting shows that the majority of the identified stakeholders use seasonal or decadal climate predictions mainly for operations/planning and for research. A small group indicate that they use them to develop seasonal/decadal applications. Among the minority that do not use seasonal or decadal climate predications, most of them indicate that these predictions may be useful for their organisation. As a consequence, in future EUPORIAS stakeholders' activity, attention is to be devoted not only to refining tools for those stakeholders that already use them, but also identify "potential" future uses of these tools. In this questionnaire stakeholders express concern for technical barriers, data availability, difficulties in communicating uncertainties and costs.

The *first Stakeholder Meeting* in Rome enabled deepened understanding of the stakeholders' needs in the different sectors: water, energy, agriculture, transport, health, insurance. Some of the information gathered thanks to the *online questionnaires* further investigated the stakeholders' attitude towards S2D forecasts and the present and/or potential users' needs.

The results have been analysed and detailed in Deliverable 11.1: "Outlook of sector specific vulnerabilities for Europe S2D horizon".

Task 11.2: Assess sector-specific vulnerabilities

Sector-specific vulnerabilities will continue to be identified through a number of workshops (including sector-specific workshops) and ongoing discussions with the members of the stakeholder group. This activity is being coordinated with WP12 (which will focus on specific users' needs) and WP42 (through the development of the climate services prototypes). DWD is currently developing an appropriate framework to structurally evaluate the data gathered from all these stakeholder interactions plus existing literature. This framework will help to provide a holistic state-of-the-art assessment approach, in order to make the vulnerability information more comparable.

Task 11.3: Contribution to GFCS Climate User Interface Platform (CUIP)

WP11 will integrate the information gathered so far within this work package and that of WP12 and prepare targeted vulnerabilities information for different sectors and stakeholders across Europe to be inserted in a prototype component of the GFCS CUIP. One of the aims of the CUIP is to improve the risk management capacity of these users. This activity will be completed in the next 18 months.

Reasons for deviations from DoW and failing to achieve critical objectives

There are no deviations from the DoW in this work package.

Statement on the use of resources

Most of the activities have been devoted to the organisation of the first Stakeholder Meeting and to the analysis of the data gathered during the workshop. Most of the partners have contributed to the organisation of the workshop through tele-conferences and open discussions.

List of meetings (attendance funded through the project)

6-7 Feb 2013, STEPS (Social, Technological and Environmental Pathways to Sustainability) Centre Annual Symposium focussed on communicating complex scientific advice, Brighton UK. Felicity Liggins (Met Office) – Gather information and background around communicating uncertainty and framing scientific advice for decision making

13-14 Feb 2013, CINECA (Italian computing centre), Bologna Italy. Paolo Ruti, Gianmaria Sannino (ENEA) – Presentation of EUPORIAS and its results to CINECA

16-20 Mar 2013, Ecole Polytechnique, Brussels Belgium. Paolo Ruti (ENEA) – Presentation of the EUPORIAS results to Ecole Polytechnique who are acting as a training centre for the Climate-KIC; therefore discussed topics for proposed EUPORIAS summer schools

8 Apr 2013, EGU General Assembly, Vienna Austria. (DWD) – Poster presentation 'Linking teleconnection patterns to European temperature and precipitation – a systematic evaluation'; Vincenzo Artale, Paolo Ruti (ENEA) – Presentation on the application of climate information to marine energy exploitation

9-22 Jun 2013, CEA (Commissariat à l'énergie atomique et aux énergies alternatives) Workshop, Paris France. Paolo Ruti (ENEA) – Presentation of results from EUPORIAS Stakeholder Meeting

16-23 Aug 2013, IPSL (Institute Pierre Simon Laplace), Paris France. Paolo Ruti (ENEA) – Presentation of EUPORIAS and data gathered during EUPORIAS Stakeholder Meeting, and planning requirements for case studies/prototype selection

30 Sep – 8 Oct 2013, Paris France. Paolo Ruti (ENEA) – Presentation of EUPORIAS results to RTE (Réseau de Transport d'Ēlectricité) and CEA with aim of including them as project stakeholders

16-19 Feb 2014, ECMWF COPERNICUS Meeting, Reading UK. Vincenzo Artale (ENEA) – presentation 'Major outcomes of European Stakeholder Climate Services conference organised in the framework of EUPORIAS WP11'

Lessons Learnt and Links Built

Establishing a stakeholder board and convening it right at the beginning of the project has been a key characteristic of this project. Our intention was to ensure, as much a possible, that all stakeholders could feed into the project at a very early stage. Whilst we are still convinced this was a good idea we faced some practical challenges. It takes some time for all project partners to get together as a team and develop a coherent understanding on how the project is going to work in practice. Convening a stakeholder board and providing a clear and coherent summary of the project at such an early stage required more effort than we anticipated. The meeting was largely a success and it certainly helped to inform a number of other activities within the project but in hindsight it might have been better to have a larger number of more sector specific meetings. Subsequently, EUPORIAS tried to address this challenge by supporting, whenever possible and feasible, sector-specific workshops which could help the interaction between users and providers of climate information. Examples include the 2nd

International Conference for Energy & Meteorology (ICEM) conference in Toulouse in 2013 and the water-sector workshop organised by CETaqua and AEMET in Madrid in 2014.

It is important to notice that some *gaps* in climate information indicated by stakeholders are only *perceived gaps*, as the information is in fact already available, such as:

- Interpretation of confidence levels;
- Model outputs not bias-corrected compared to the observation data;
- Communication on uncertainty/skill/predictability/windows of predictability/future improvements to all.

A strong link has been developed with the FP7 CLIM-RUN project, and EUPORIAS is using the experience gathered in the Mediterranean region concerning the protocol to interact with stakeholders.

Key Points/Significant Results:

- Many of the tasks set out in WP12 have already been conducted including the systematic literature review (Task 12.1), the workshop with European climate service providers (Task 12.2) and the interviews with experts and other users (Task 12.3);
- The current use of seasonal forecasts in Europe to inform decision-making processes is limited to sectors such as energy, water, transport and insurance. Decadal predictions are still unchartered territory;
- Main barriers to the uptake of S2D climate predictions in Europe are largely related to the low reliability[1] of these types of predictions although other factors such as the usability of, and accessibility to, these predictions, have also been highlighted;
- In general, users' needs with regard to S2D climate predictions tend to differ substantially between and across sectors and organisations, and, in some cases, within the organisations themselves;
- The majority of stakeholders and users involved in EUPORIAS already use some form of weather and/or climate information to help them manage and plan their operations and activities. Many recognise the potential to consider S2D climate predictions in their organisations if these become more reliable in the future.

Executive summary

The aim of WP12 is to assess users' needs with regard to seasonal to decadal (S2D) climate predictions across European sectors. To achieve that, a range of tasks are being pursued including a systematic literature review, a workshop with national meteorological organisations, in-depth interviews with EUPORIAS stakeholders and other users. Based on the tasks performed to date the main findings have shown that:

- The use of seasonal forecasts across Europe to inform decision-making is still an emerging venture mainly due to the lack of skill and reliability over Europe. Decadal predictions are regarded as unchartered territory;
- Some sectors however were identified as using (to different extents) seasonal forecasts such as the energy, water, transport, and insurance sectors;
- ECMWF and national met services are regarded as the main providers of climate information in Europe including seasonal forecasts;
- The main perceived barriers to the uptake of these types of forecasts are mainly related to low reliability, but also related to other factors such as usability of the information provided and accessibility to such information by the end-users. Difficulties in integrating such information in existing operational models and structures, existing traditions of performing historical analyses, and not needing this type of information were also pointed out as reasons for not using S2D climate predictions;

[1] The term *Reliability* is used here as a synonym of trustworthiness and, as a result, it can be mapped onto a number of other technical concepts such as *skill*, *reliability*, and *sharpness*.

- Understanding decision-making processes within organisations can be difficult at times as responses provided by respondents are influenced not only by the size (i.e. multiplicity of activities) and nature (i.e. end-user *versus* intermediate organisations) of the organisation itself but also by the role of the interviewee in it (e.g. modeller, head of department);
- Timescales for decision-making tend to differ across and within sectors. In general terms, shorter timescales (up to one year) tend to be related to operational day-to-day activities within organisations/sectors whilst mid-term (one up to five years) and long-term timescales (five up to 30 years) tend to be associated with business plans/strategies and corporate/capital investment, respectively;
- Most organisations involved are sensitive to weather and climate conditions although some are more concerned with the impacts of extreme weather (e.g. drought, floods) whilst others are more interested in weather variables such as temperature and precipitation;
- Many organisations already use weather/climate information (mainly historical data/past observations and weather forecasts). Such information tends to be used to either develop/feed operational models, forecast seasonal variability based on past data, and/or understand future weather conditions all of which are used to inform decision-making processes within organisations. Many perform some kind of post-processing in-house;
- The majority of the organisations involved in this study are aware, to different degrees, of seasonal forecasts whilst decadal predictions are less known.
- There is a general understanding that information on the uncertainty of the information provided is a fundamental component of S2D climate predictions. Many organisations would prefer information on the uncertainty of forecasts to be provided using a deterministic approach and the preferred method for representing uncertainty is numerical (e.g. one figure, percentages) as it would facilitate the quantification and integration of uncertainty into models.

Work package objectives

Provide an assessment of S2D climate predictions user needs across European society.

Summary of progress towards objectives

Task 12.1: Systematic literature review of the use of S2D predictions across all sectors

The first step towards assessing the needs of the S2D climate prediction users was carried out through a systematic literature review. This review (of peer-reviewed publications and grey literature) provided an overall understanding of the current state of the use of S2D climate and climate impacts predictions across European sectors and summarised how seasonal forecasts are being used to inform decision making. The literature review also examined selected examples of the application of seasonal climate forecasts beyond Europe.

Deliverable 12.1: Literature review of the use of S2D predictions across all sectors (http://www.euporias.eu/sites/default/files/deliverables/D12.1_Final.pdf).

Task 12.2: Workshop with National Meteorological and Hydrological Services (NMHS) and other stakeholders

The workshop was held at the KNMI headquarters in De Bilt, The Netherlands on 14/15 March 2013. A total of 26 participants from a range of European NMHS and other climate service providers attended the workshop representing 11 countries, two European organisations and numerous sectors including water, energy, tourism, and health. The aim of the workshop was to gather an understanding of users' needs through the experiences and engagements of the S2D purveyors and providers with their stakeholders and users. The aim is to write a peer-reviewed paper on the findings from this workshop.

Deliverable 12.2: Report on findings on S2D users' needs from workshop with meteorological organisations (http://www.euporias.eu/sites/default/files/deliverables/D12.2_Final.pdf).

Task 12.3: Expert interviews with key stakeholders

The interviews being conducted with EUPORIAS stakeholders and other users are ongoing. Organisations interviewed to date span across various sectors and include public funded organisations, government agencies, and private companies. Many of these are large organisations operating at the international or European level.
To date 79 interviews have been conducted and another eight will be performed in the next few weeks.

An interview protocol was developed and all interviews were conducted under a consistent semi-structured format. This allowed (a) replication of the interview with others; (b) standardisation of questions and therefore data reliability; (c) ability to conduct the interviews in various modes (e.g. face-to-face, telephone etc); and (d) performing a qualitative analysis of the material collected during the interviews. The method to analyse the data collected was agreed by partners. All interviews were transcribed in full into English. All interviewees signed a consent form to declare their consent to participate in the study. In order to assure the stakeholders and partners that the EUPORIAS project respects the data protection rights of those who were interviewed (personal data and organisational data which may be 'commercial in confidence'), a set of confidentiality principles were written which all partners are to adhere to.

A preliminary report on the findings from the interviews (Milestone 7), along with the findings from the literature review and workshop, has been written and is hosted on the project website.

Task 12.4: Database of users and their needs

A database is being developed by UNIVLEEDS based on information collated through Tasks 12.1 and T12. The database includes information regarding the various stakeholders and other users (or potential users) of S2D climate predictions across European sectors and organisations. The aim of this database of users is to gather information collected during Tasks 12.1 and T12.2 in order to then target users for Tasks 12.3 (interviews) and T12.5 (surveys). It is an instrumental database for WP12 partners' use solely.

Task 12.5: Surveys of users' needs

The online and multi-lingual surveys have been launched and can be accessed via: http://survey.euporias.eu/.

The dissemination of the surveys is ongoing and has been pursued through contact with partners' internal and external contacts, official web pages, mailing lists, newsletters, Twitter, Facebook, and LinkedIn. To date there have been 200 responses across Europe, with a considerable increase in this sample expected during May and June 2014. The surveys are targeting users beyond those within the Stakeholder Group and those who were interviewed under Task 12.3.

Task 12.6: Workshop with S2D climate prediction developers

Arrangements for the workshop later in the year are already in motion. Minutes from this workshop are expected to be released in September 2014 (Milestone 9). A report on the findings from the workshop will be released in October 2014 (Deliverable 12.4).

(If applicable) Reasons for deviations from DoW and failing to achieve critical objectives

- Deliverable 12.1 (Systematic literature review) – One month extension was requested due to the late start of the research fellow and the paternity leave of the principal investigator during this period. The report was submitted on February 2013 with no impact in any of the other tasks and deliverables of this work package;
- Milestone 6 (Workshop minutes) was expected in month 3. However, to avoid an overlap with another workshop being organised by WP11, Task 12.2 was postponed and, as a result, an extension of a month was requested for this Milestone. This extension has not impacted any of the other tasks and deliverables in this work package;
- Milestone 7 (Preliminary report on user needs) was planned to be released in October 2013. However, in order to best inform the selection of the EUPORIAS prototypes an extension of two months was requested. The report was released in December 2013 with no impact in any of the other tasks and deliverables of this work package;
- Milestone 8 (preliminary report on the surveys of users' needs) was expected in April 2014. However, there were some delays due to difficulties with the translation of the surveys into different European languages which only allowed us to officially launch the surveys on 10 April. As a result, in order to analyse and include a more representative sample in the preliminary report an extension of one month was requested (report expected end of May 2014).

Statement on the use of resources

All partners have been involved, to different extents, in the various tasks and deliverables set out in WP12. All tasks are led by UNIVLEEDS. Therefore most of the time spent on this work package has been by UNIVLEEDS.

All partners were involved in the preparation of the interview protocol to be used in the interviews with key stakeholders. The interviews (Task 12.3) were conducted and transcribed by the majority of the partners:

Table 1: Number of interviews conducted by each partner (Task 12.3)

Partner	Interviews conducted
UNIVLEEDS	22
TEC	16
IC3*	4
ENEA	5
WHO*	5
UC	4
Predictia	4
UL-IDL	4
IPMA	0
CETaqua*	4
Met Office	2
MeteoSwiss	2
ULUND	0
AEMET*	2
Meteo-RO	0
EDF	2
SMHI**	5

* 2 interviews were conducted by more than 1 partner (AEMET+CETaqua and WHO+IC3) so these interviews are counted twice

** Non-WP12 partner

The surveys of users' needs (Task 12.5) were developed by the UNIVLEEDS but with input from all partners. In particular, Predictia helped to develop the online surveys; and UC, EDF, WHO and ENEA helped with the translation of the surveys in different European languages: Spanish French, German, and Italian. The majority of partners have been actively engaged in the dissemination of the surveys including other EUPORIAS partners outside WP12 such DWD and SMHI.

List of meetings (attendance funded through the project)

Jan 2013, Bordeaux France. Laurent Pouget (CETaqua) – meeting with EUPORIAS stakeholder Suez Environnement S.A.

11 Jan and 7 Oct 2013, Zaragoza Spain. Laurent Pouget, Àngels Cabello (CETaqua) - presentation of project and its advances, and carry out stakeholder interviews, Confederación Hidrográfica del Ebro (Ebro River Basin Agency)

19 Apr 2014; Horizon 2020 Challenge 5, Stakeholder Workshop, Brussels Belgium. James Creswick (WHO) – participation in working group

May 2013, Madrid Spain. Laurent Pouget (CETaqua) – to carry out stakeholder interviews with DGA

11-16 Jun 2013, Conference 'Weather risk and forecasting for the Energy Market', Berlin Germany. Melanie Davis (IC3) – presentation on EUPORIAS

18-19 Jun 2013, International Conference on Decision Supports System Planning and Management of Water Resources, Valencia Spain. Laurent Pouget (CETaqua) – Understand and discuss recent advances in impacts models for the water sector, and collaborate with EUPORIAS stakeholder MAGRAMA (Spanish Ministry of Agriculture, Food & Environment)

24-25 Jun 2013, 2nd International Conference for Energy & Meteorology (ICEM), Toulouse France. Melanie Davis (IC3) – to carry out stakeholder interviews

25 Jun – 5 Jul 2013, Toulouse France. Melanie Davis (IC3) – to carry out interviews with EUPORIAS energy stakeholders

17-25 Aug 2013, ICPAC 35th Greater Horn of Africa Climate Outlook Forum (GHACOF), Nairobi Kenya. Ronald Hutjes (WU) - presented and contributed 10 Sep 2013, Workshop 'European Energy Research Association', Pamplona Spain. Melanie Davis (IC3) – presentation on EUPORIAS and its relevance to the EERA Joint Programme for Wind

18 Oct 2013, Valladolid, Spain. Maria Dolores Frías Domínguez, Jesus Fernandez Fernandez (UC) – to carry out stakeholder interviews

17-18 Oct 2013, Workshop 'JPI-Climate', De Bilt The Netherlands. Marta Soares (UNIVLEEDS) – Shared findings from WP12

15 Nov 2013, Aviero Portugal. Rita Cardoso, Pedro Miranda, Cathy Besson (UL-IDL) – to carry out stakeholder interviews

7 Dec 2013, Summer School for FP7 CLIM-RUN, Trieste Italy. Melanie Davis, Verónica Torralba, Nube González (IC3) – Presentation and exchange of ideas as both EUPORIAS and CLIM-RUN are climate service projects

10-11 Feb 2014, Meeting of FP7 ECLISE project, Brussels Belgium. Melanie Davis (IC3) – presented EUPORIAS and created synergies between the two projects; Marta Soares (UNIVLEEDS) – shared findings from WP12 in discussion panel

13-15 Feb 2014, Madrid Spain. Maria Dolores Frías Domínguez, Jesus Fernandez Fernandez (UC) – to carry out stakeholder interviews

11-12 Mar 2014, EWEA Conference – Wind energy Workshop with VORTEX, Barcelona Spain. Melanie Davis (IC3) – Shared findings from WP12 and link with RESILIENCE (energy) prototype

17-18 Mar 2014, Workshop 'Towards a European market of climate services', Brussels Belgium. Melanie Davis (IC3) – At the invitation of the EC. Involvement in Group 2a 'Climate services for the business sector'; Bettina Menne (WHO) – panellist

10-12 Mar 2014, FP7 ERA-NET 'CIRCLE2' Conference 'European climate change adaptation and practice', Lisbon Portugal. Marta Soares (UNIVLEEDS) – presentation of WP12 results

Lessons Learnt and Links Built

Working with partners from very different organisations and backgrounds (e.g. met services, universities, private companies) meant that, at times, such differences had to be acknowledged, addressed, and reconciled in order to allow us to work as a group and deliver the tasks at hand.

Some difficulties were also felt in terms of reaching enough interviewees (in Task 12.3) in order to allow us to perform the 100 interviews expected in the DoW. This was due to a number of reasons including the fact that the 'snowball effect' (whereby interviewees provide us with further contacts) did not occur as expected. As a result, we had to find alternative ways of contacting other organisations of interest across Europe (e.g. by contacting organisations working in the sectors of interest and involved in other European projects).

Some technical difficulties also occurred when developing the survey of users' needs (Task 12.5) mainly in terms of the translation of the survey into five different European languages and the careful co-ordination that that entailed.

The information collated during WP12 has been used to inform other WPs, including:

- Information on sector's vulnerabilities (WP11);
- Information on the use of climate information indices (WP22);
- Dealing with uncertainty (WP33);
- Understanding decision-making processes in organisations (WP41); and
- Information for prototype selection (WP42).

WP21 – Calibration and downscaling

Key Points/Significant Results:

- A number of different bias correction techniques have been tested for use with seasonal forecasts and a few of them selected for implementation in a software package;
- Different statistical downscaling approaches have been adapted and applied for the downscaling of seasonal forecasts in Europe with focus on the hydropower sector;
- An ensemble of five-month (May to September) global seasonal hindcasts (15 members, 1991 – 2012) for downscaling in eastern Africa has been produced;
- The first downscaled hindcast over eastern Africa at about 25km resolution is already available for evaluation.

Executive summary

WP21 mainly aims to provide bias-corrected or dynamically- and statistically-downscaled seasonal forecasts over Europe and eastern Africa for impact modelling studies. A number of different bias correction techniques have been tested for use with seasonal forecasts and implementation of a few of them in a software package is ongoing. Application of more than one bias-correction method allows assessing uncertainties related to bias-correction of seasonal forecasts. In addition to the bias-correction activities, a statistical assessment of the drift in seasonal forecasts (bias dependence on the forecast time) has been undertaken. Several advances have been obtained regarding the adaptation and application of statistical downscaling methods to seasonal forecasts for the hydropower sector in Europe. In eastern Africa the main focus is on dynamical and statistical downscaling of the May-September seasonal forecast in Ethiopia which could be used as input to the Livelihoods, Early Assessment and Protection (LEAP) system for the World Food Programme (WFP). An ensemble of global seasonal hindcast (15 members, 1991-2010) has been produced and the first downscaled results (2009) are already available for evaluation. In addition to the dynamical downscaling the performance of different standard statistical downscaling approaches for eastern Africa has been assessing.

Work package objectives

• To develop and apply a set of bias-correction and downscaling methods for use with seasonal to decadal forecasts;
• To downscale standard climate variables and advanced climate indices for use in the EUPORIAS case studies;
• To assess the uncertainty associated with the downscaling methods in collaboration with WP 33;
• To make available, through the EUPORIAS web portal, downscaled data, along with a number of calibrated methodologies.

Summary of progress

Task 21.1: Statistical Downscaling and Bias correction of GCM forecasts over Europe

Task leader UC

Task 21.1 Highlights:

- More bias-correction techniques than planned have been used

- The first bias-corrected results will be available sooner than expected
- The first downscaled results are already available

One of the two main activities in the Task 21.1 is bias correction and three partners (UC, MeteoSwiss and SMHI) have been working on the adaptation of different bias-correction techniques for use with seasonal forecasts. MeteoSwiss is focusing on appropriate methods to correct Climate Impact Indicators (CII) while SMHI is adapting the in-house Distribution Based Scaling (DBS) method (Yang et al. 2010) for hydrological applications. UC is working on implementation of a few standard bias-correction techniques in a software package - the MeteoLab toolbox. The toolbox will be used for bias correction of variables needed in other EUPORIAS activities and for intercomparison of different bias correction methods. Application of more than one bias-correction method will allow assessing uncertainties related to bias-correction of seasonal forecasts.

Moreover, since WP23 does already need bias-corrected data before WP21 begins delivering results (Milestone 12, month 24), extra effort has been provided in order to speed-up the process of implementing a general purpose (to cover as many variables as possible) bias-correction method to serve as a starting point for impact models. A survey of the methods proposed in the literature has been conducted by UC and a bias-correction candidate, developed in the framework of the Inter-Sectoral Impact Model Intercomparison Project - ISI-MIP (Hempel et al., 2013) has been selected. This method has been already implemented and tested in the MeteoLab toolbox and discussions with the WP23 partners are ongoing in order to start bias correction of the ECMWF System 4 seasonal forecasts. The bias-corrected seasonal forecast will be distributed via the ECOMS-UDG (https://meteo.unican.es/trac/wiki/EcomsUdg) and the first results will be used as a test case for a few impact applications in WP23.

Several advances have been made regarding the adaptation and application of statistical downscaling methods to seasonal forecasts. SMHI started working on a statistical downscaling method based on a singular value decomposition (SVD) approach to provide downscaled seasonal forecasts to hydropower companies in Sweden. EDF, with a focus on the hydropower sector in France, set up an analog method to get temperature and rainfall for 35 watersheds from the ECMWF System 4 forecasts which will be used as input to a hydrological model - MORDOR. Two different methods are used by Meteo-France for downscaling temperature and rainfall from the Meteo-France's operational seasonal forecast from about 250km resolution to 8km. The spring and summer seasons, crucial in terms of water resources management, have been investigated first and the downscaled results are already available. UC started assessing the performance of different standard statistical downscaling approaches (analogs and generalised linear models) for different climate zones (the tropics and extra tropics).

Finally, since both bias-correction and downscaling techniques have to deal with the bias of the models, a statistical assessment of the drift (bias dependence on the forecast time) has been undertaken by UC, considering precipitation and temperature from the System 4 at different forecast times (0 to six months). Significant varying biases (drifts) are found worldwide (Figure 2 shows an example for Europe) and several issues relevant for bias correction have been raised. The results are being documented in a paper which will be submitted for publication soon and further research will be conducted in order to analyse the implications of these results for correcting the model bias/drift. In addition, SMHI has made a preliminary analysis of the biases in the System 4 over Sweden (Figure 3) and the same type of analysis is ongoing on the pan- European scale.

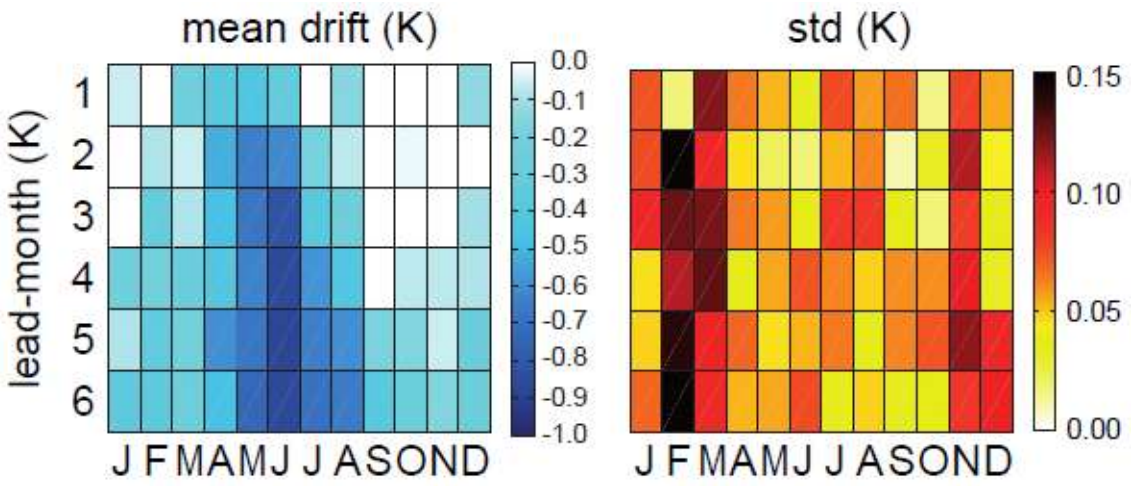


Figure 2: **Mean drift in surface temperature forecasted by System 4 averaged over Europe (left). Standard deviation of the drift of each of the 15 System 4 members (right)**

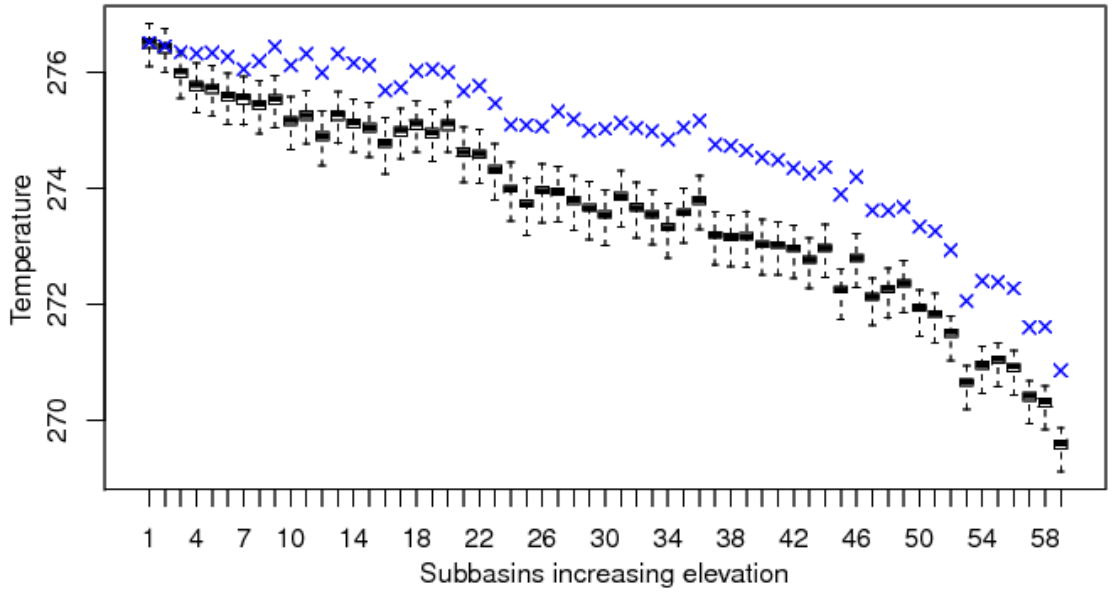


Figure 3: Comparison of observed mean April temperature in 60 Swedish sub-catchments (blue) to the forecasted mean April temperature of ECMWF System 4 (black whiskers boxes). The range of the whiskers boxes represents the range of the 15 members of the System 4

Task 21.2: Combined Statistical and Dynamical Downscaling over East Africa

Task leader SMHI

Task 21.2 Highlights:

- 20 years of the EC-EARTH global hindcast instead of the proposed six years
- One year 2009 has already been distributed to all partners involved
- The first downscaling of the EC-EARTH global hindcast has been done

The main activity in the Task 21.2 is to assess utility of both statistical and dynamical downscaling of global seasonal forecasts over eastern Africa to provide the downscaled information to impact models over the region. After consultations with the WFP it has been decided that the main focus in the task is the May-September seasonal forecast in Ethiopia which will be used as input to the LEAP system

developed at WFP. In addition, a few partners from WP23 will also test the downscaled forecast in their impact models.

The first step of Task 21.2 is to provide boundary conditions from a global seasonal forecast to regional climate modelling groups for subsequent downscaling. A straightforward approach is to downscale the ECMWF System 4 seasonal hindcast which is available for the 1981-2013 period. However, in the System 4 the model levels necessary for downscaling are not saved for all members of the seasonal hindcast ensemble and only every second model level is saved. To provide consistent boundary conditions for downscaling it has been decided to rerun the System 4 hindcast by a global climate model EC-EARTH which is based on the ECMWF Integrated Forecast System using the same resolution (T255) and the same number of the vertical levels (91) as in the System 4. In addition, since the drift in seasonal forecasts in the tropics is mainly related to sea surface temperature (SST) a bias correction replacing the System 4 monthly mean SST climatology with the ERA-Interim mean SST climatology (but preserving anomalies) has been applied. Following this approach an ensemble of 5-month (May-September) global seasonal hindcasts has been produced at SMHI by EC-EARTH taking the initial conditions and the bias-corrected SST from the System 4 hindcast. The ensemble includes 15 members, initialised on May 1st and covers the period 1991-2010. This is a substantial increase compared to the proposed six years (two dry, two wet and two about average). The first analysis of the EC-EARTH hindcast and comparison with the ECMWF System 4 (assessment of the drift) are ongoing. In addition to the EC-EARTH seasonal hindcast, the high-resolution GloSea5 is being used by the Met Office.

The EC-EARTH model levels have been saved for subsequent downscaling over eastern Africa and will be made available via an iRODS server installed at SMHI (Milestone 11). One year (2009) for downscaling has been already provided to all RCM groups involved as a test. A number of domain configurations for eastern Africa, different in size and resolution, were tested and a common recommended domain for downscaling has been set up (Figure 4). After consultations with all WP21 partners and additionally with the WP23 partners a list of variables needed for impact models and for evaluation of the downscaled seasonal hindcast has been created. Five regional climate models are involved in the downscaling activities over eastern Africa, namely: CCLM (DWD), RegCM4 (ENEA), RCA4 (SMHI), WRF (UC and UL-IDL) and HadGEM3-RA (Met Office). All RCM groups are configuring and setting up their RCMs for downscaling one of the two global hindcasts (EC-EARTH or GloSea5) in eastern Africa. That activity includes transformation of boundary conditions from the global models to an input specific for each RCM and a number of test simulations with different combinations of RCM parameters in order to select a combination giving the best performance in eastern Africa. The EC-EARTH hindcast for 2009 have been already downscaled by a few RCMs and the first analysis of the downscaled seasonal hindcast is ongoing (Figures 5 and 6). Discussions about how many RCM groups can downscale the full 1991-2010 hindcast period, instead of the proposed six years are also ongoing.

In addition to the dynamical downscaling UC is assessing the performance of different standard statistical downscaling approaches for eastern Africa. Availability of high-resolution observational data sets is a common problem in Africa and it is proposed that the WATCH-Forcing-Data-ERA-Interim (WFDEI) daily gridded products (bias-corrected ERA-Interim reanalysis) will be used as a reference data set for statistical downscaling.

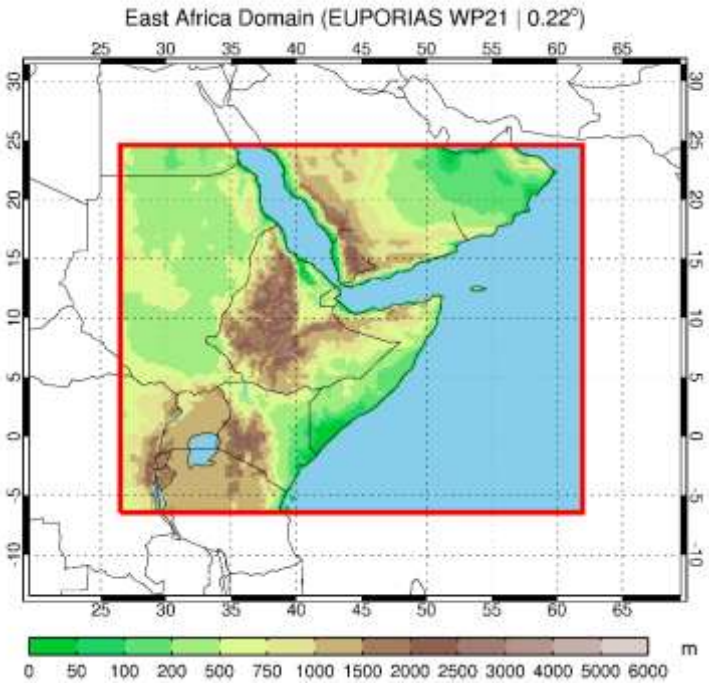


Figure 4: East African domain proposed for downscaling in EUPORIAS Task 21.2

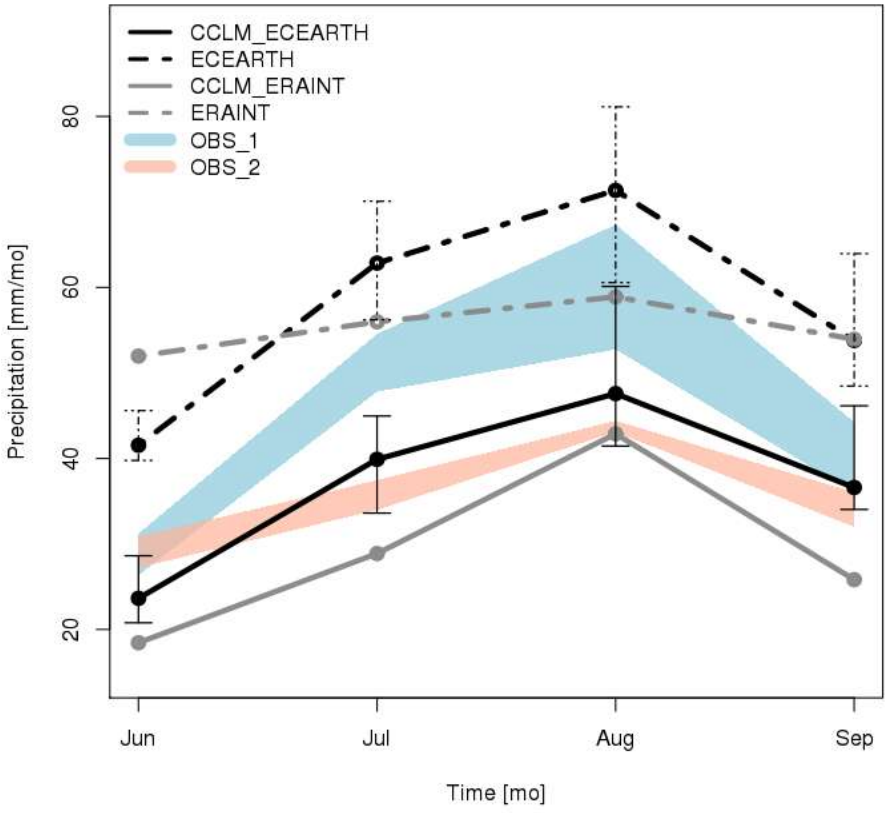


Figure 5: Rainfall time series as simulated by CCLM and the driving GCMs (error bars are the inter-quantile ranges as computed from all 15 ensemble members) . The observationally based datasets are indicated with the shaded light blue (OBS_1: CRU+GPCP+GPCC+WIL_MAT) and light pink (OBS_2: ARC+CMAP) colors. Rainfall is averaged over the eastern Africa domain (land only) for 2009

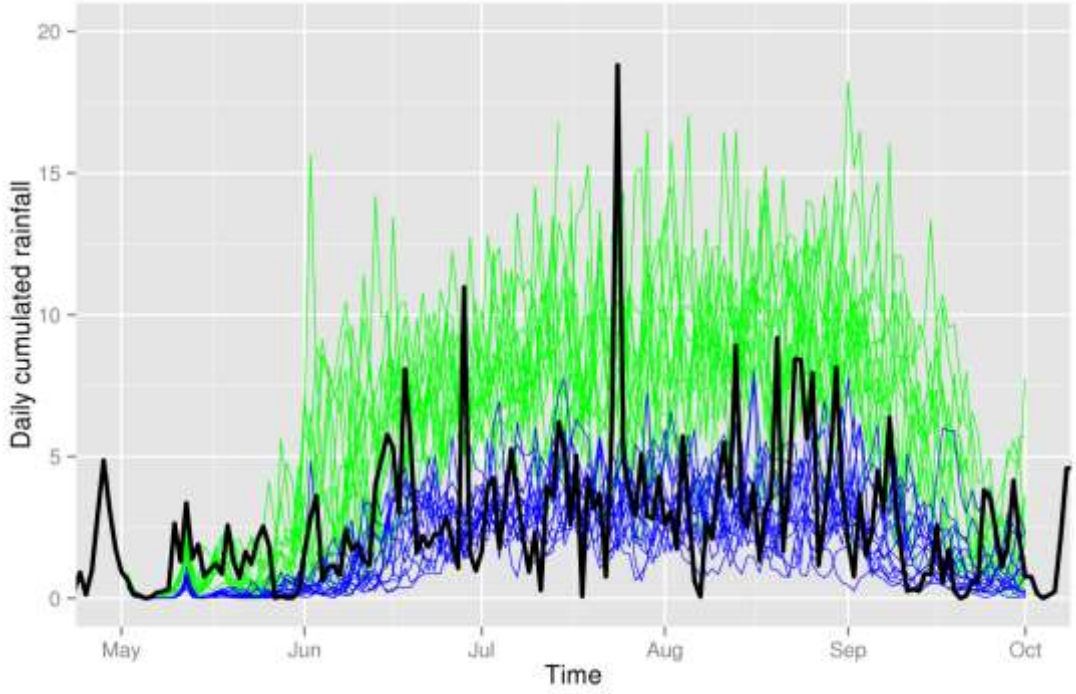


Figure 6: Daily rainfall downscaled by RegCM4 at ENEA and averaged over a box covering approximately the Ethiopian highlands. The regional ensemble is driven by the EC-EARTH hindcast for 2009 and consists of 15 members: total rainfall (green) and convective rainfall (blue). Observational estimates from satellite (CPC-NOAA) are in black

References

Hempel, S., Frieler, K., Warszawski, L., Schewe, J., and Piontek, F. 2013. A trend-preserving bias correction – the ISI-MIP approach, Earth Syst. Dynam., 4, 219-236, doi:10.5194/esd-4-219-2013

Yang, W., Andréasson, J., Graham, L.P., Olsson, J., Rosberg, J., and Wetterhall, F. 2010. Distribution-based scaling to improve usability of regional climate model projections for hydrological climate change impacts studies, Hydrol. Res., 41, 211-229, doi:10.2166/nh.2010.004

(If applicable) Reasons for deviations from DoW and failing to achieve critical objectives

DWD is responsible for Deliverable 21.1 (month 42) and Milestone 12 (month 24) in the DoW. Both Deliverable 21.1 and Milestone12 are related to Task 21.1 (Europe) while DWD is only involved in Task 21.2 (Africa). So it has been agreed that UC should take over the lead in both Deliverable 21.1 and Milestone 12 from DWD.

Cancelation of Milestone 10 (month 15, January 2014), ”RCM historical climate simulations driven by EC-EARTH completed”:

The LEAP system requires regional forecast anomalies over Ethiopia as input. Calculation of such anomalies in turn requires a climatology based on a long enough period of forecast (about 20 years least). A limited number of years (six) have been proposed for downscaling because of high computational demands and climatology cannot be directly established using only these six years. The main aim of the MS10 was to provide such climatology taking RCM simulations driven by the historical EC-EARTH simulation which is long enough.

However, it was found later that such an approach is not the best solution as it does not take into account the drift which is virtually an integral part of any forecast system but is absent in the non-

initialised historical simulation. In addition, 20 years of the global EC-EARTH hindcast has been produced instead of the proposed six years (see Milestone 11). Based on availability of the 20-year global hindcast it was decided that all groups which plan (have resources) to downscale all 20 years will use the full period and all 15 members for the climatology. All other groups downscaling only six years (15 members) will additionally downscale the first three members of the EC-EARTH hindcast for the full 1991-2010 period and will use these three members for establishing the hindcast climatology.

Therefore Milestone 10 is no longer necessary and is going to be cancelled. The cancelation of the milestone does not impact other milestones and deliverables in the project.

Statement on the use of resources

The use of resources is on track.

List of meetings (attendance funded through the project)

27 Aug – 1 Sep 2013, CLM Community Assembly, Zurich Switzerland. (DWD) – Presentation 'Evaluation of regional climate model simulations over Central Europe using the new high-resolution HYRAS precipitation climatology'

4 – 7 Nov 2013, CORDEX Conference, Brussels Belgium. Suzanne Brienen, Barbara Früh (DWD) – Poster presentation of basic work on evaluation of regional climate model simulations over central Europe and associated analysis tools of use to EUPORIAS

Lessons Learnt and Links Built

A strong regional climate modelling team with focus on eastern Africa was build during the first 18 months of the EUPORIAS project.

A good connection was established with WP23 with many consultations regarding which variables from seasonal forecasts are needed for the WP23 impact studies.

Statistical downscaling studies focus on different sectors and countries applying different methodologies and therefore, these are very diverse. It is difficult to find a common framework for all groups, although there has been remarkable progress since UC agreed to coordinate Task 21.1.

WP22 – Impact relevant climate information indices (CII)

Key Points/Significant Results:

- Defined a preliminary set of Climate Information Indices (CIIs) based on the expertise of the partners, Milestone 19;
- Specialised set of CIIs agreed – based on WP12 user requirements, Milestone 20;
- Starting to implement methods to calculate the CIIs using index-specific approaches. As each CII has its own requirements, there is no overall method that will yield the indices. A major issue is the bias correction for the daily data. In this work package bias correction approaches have been evaluated;
- Benchmark datasets and skill scores as validation measures were chosen in order to validate seasonal forecasts of the CIIs. Furthermore, observed climatologies of the CIIs will be calculated for Deliverable 22.1 based on the same benchmark datasets as used for the validation (Task T22.2, Milestone 20).

Executive summary

The aim of this work package is to identify a set of CIIs that are of interest to the users and validate the skill in long-range forecasts. Seasonal forecasts of CIIs serve directly the decision making process of users as CIIs can be calculated quickly – once the method is established – and are application related. For example, heating degree days (HDDs) are strongly correlated to the energy demand of heating and show consequently a high correlation to energy prices. As such, CIIs act as a first guidance for users. CIIs have a lower complexity than application models (coupled to seasonal forecasts) and the sources of uncertainty stem from the atmospheric variables only. From this perspective, WP22 complements the work undertaken in WP23 and will contribute to the understanding of the uncertainty cascade in the model chain (WP31).

As a first step (Milestone 19), a preliminary set of CIIs was defined in order to start a first analysis. This first analysis provided a helpful insight into the subject and what difficulties might arise and have to be treated carefully. To name some issues: It is a matter of ongoing work which verification measures are useful for which type of CIIs (indices based on rare events will need a different verification approach than an index which cumulates more frequent events (e.g. HDD)). Another issue is the availability of data for index calculations.

In a second step (Milestone 20) the set of CIIs was expanded to the specialised set of indices. This was mainly done based on results provided by WP12. The interviews conducted in WP12 provided a list of CIIs that are of interest to the various stakeholders. These are the indices that will be used for the performance studies in the following WP22 tasks. The CIIs were chosen such that they cover all economic sectors and provide a large variety of inputs to the stakeholders. Most partners have already implemented methods to calculate the indices with observations and are working on applying these techniques to seasonal forecast data (mainly ECMWF System 4). An example of a skill assessment of an index, in this case Frost Days, is given in Figure 7.

The knowledge gained from this work will contribute to the prototypes. A direct contribution is planned for the LEAP prototype. The results of WP22 will help the prototypes to select user oriented and skilful quantities. Eventually, the CIIs of WP22 can directly be used in the prototypes (e.g. seasonal forecasts of frost days for the prototype in the agricultural sector).

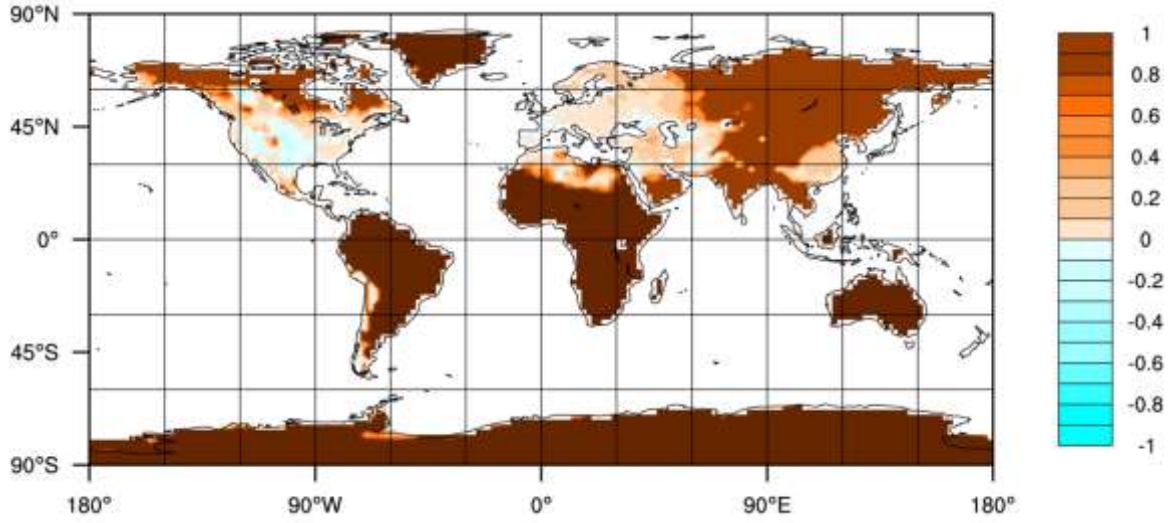


Figure 7: RPSS of de-biased frost days in December-January-February of System4 model output

Work package objectives

• To generate a user-targeted collection of climate information indices (CII) to provide the best and most reliable estimate of the current and upcoming climate. As such, they provide an easy to use alternative to sophisticated, application-specific impact models. The CIIs are selected in order to target applications defined by the prototypes and the user needs identified in WP12;
• To evaluate, implement and assess methods to calculate the CII. The methods will be based on CII specific, computationally efficient algorithms combining the S2D data with specific climatological observational data sets available to the users. The quality and value of the CII will be assessed from an end-user perspective;
• To provide CII hindcasts and validation results to the case studies;
• To make available to partners the methods and evaluation results so that they can be integrated in the prototype climate services;
• To contribute to the optimal design and form of climate information for users and building the climate services envisaged in WP42.

Summary of progress

Task 22.1: Set of preliminary CIIs

For Milestone 19 we agreed on the CIIs summarised in Table 2. Based on these, the first analysis was performed (such as what spatial and temporal resolution is needed to compute CIIs or assessments of how skill analysis can be performed for the various CIIs). This analysis has already lead to a number of important conclusions and revealed some difficulties when working with indices. One issue is that some indices are defined such that the model data does not provide the temporal resolution to compute the CII. Or that more insight needs to be gained into which skill scores are useful for which specific CII.

Table 2: Set of preliminary CIIs

	CCI

IC3	Upper wind speed threshold
IC3	Temperature related mortality index
UC	Canadian Forest Fire Weather Index System (CFFWIS)
UC	Physiological Equivalent Temperature (PET)
MeteoSwiss	Heating Degree Days (HDD)
UL-IDL	Occurrence of temperatures below −17°C
UL-IDL	Growing season suitability (GSS)
UL-IDL	Growing season precipitation (GSP)
UL-IDL	Cool night index (CI)
UL-IDL	Huglin Heliothermal Index (HI)
UL-IDL	Hydrothermic Index (HyI)

Task 22.2: Decision on a set of specialised CIIs

Based on the information obtained from WP12 (primarily through the user interviews) the following set of CIIs was put together and distributed among the project partners (Table 3). Furthermore, two sets of benchmark data sets (European and global) and a basic set of skill scores were chosen for the work that will be performed in the upcoming Deliverable 22.1 (to be delivered in October 2014).

Table 3: Summary of specialised set of CII's and responsibility (shown in red)

Sector/Index						
Energy	Solar	Wind	HDD	CDD		
	IC3	IC3	MCH	UKMO/ENEA		
Agri/Food	GDD	FD	Panom	WB	D	Tropical D
	UL-IDL	UL-IDL/MCH	MF/KNMI	MF	MF	ENEA
Forest	GDD*	FD*	Fire			
			UC			
Infrastructure	FD*					
Insurance	HDD*					
Health	Heat-Mortality					
	IC3/WHO					
Water	Heavy Precip					
	UKMO					
Tourisme	Snowfall					
	(MCH)					

**This CII is already assigned to an institution

Task 22.3: Implementation and calibration of CIIs

In Task 22.2 a basic set of validation measures as well as two benchmark data sets were chosen (one data set for European and one for global analysis). Based on these and the specialised CIIs, the model data (ECMWF System 4) will be validated. An important issue will be how to correct the bias, as many CIIs are based on thresholds. Hence, the model output needs to be calibrated in order to improve the forecast quality.

Task 22.4: Validation of CIIs:

Which skill scores are best to determine quality of a forecast of a CII is an open research question given that for CIIs, the sample size can often be an issue. Also, the base rate of the CII varies strongly with space and season. For example, in the southern part of Europe frost days are a very rare event. Hence, one must carefully evaluate how to determine the skill when working with data that is spatially and seasonally very variable.

Reasons for deviations from DoW and failing to achieve critical objectives

Milestone 20 was postponed for six months to month 18. This made it possible to take the results from WP12 interviews into account. It was very important that the information gained in WP12 could be used to inform some of the work carried out in this work package in order to define the specialised set of CIIs. There is no impact on other tasks within the project.

Statement on the use of resources

There are no known deviations from the planned resource use.

List of meetings (attendance funded through the project)

5-7 Jun 2013, ECMWF User Meeting, Reading UK. Irina Mahlstein (MeteoSwiss) – gave a presentation on EUPORIAS

27 Jun 2013, Stakeholder meeting, Toulouse France, Jean-Pierre Ceron (Meteo-France) – met with stakeholders from Adour-Garonne river basin agency and DREAL Midi-Pyrenees to discuss plans and objectives of the project and possible prototype ideas [no costs to project]

11 Jul 2013, Stakeholder meeting, Paris France. Jean-Pierre Ceron (Meteo-France) – met with EDF, ETB Seine Grands Lacs, DGLAN (French Drought National Committee) and ASEN (river catchment agency) similar meeting to stakeholder meeting above

20-26 Aug 2013, GEOVET 2013 conference, East London UK. Rachel Lowe (IC3) – international forum with researchers, policy-makers and agencies that use spatial epidemiological methods to present, review and discussion methods and applications – direct relevance to developing climate-driven mortality predictions for Europe

9-13 Sep 2013, European Meteorological Society (EMS), Reading UK. Irina Mahlstein (MeteoSwiss) – presented first results from WP22 to scientific audience

9-12 Dec 2013, AGU Fall meeting, San Francisco USA. Rachel Lowe (IC3) – convened session GC12C 'Translating Science into Action: Innovative Services for the Geo- and Environmental-Sciences in the era of bid data'; and presented a series of posters

28-29 Oct 2013, Statistical modelling meeting, Bergamo Italy. Rachel Lowe (IC3) – Exchange of results and experiences with StEPhl project (http://stephiproject.it/). INLA-SPDE approach benefited EUPORIAS by improving operational climate services due to fast computing time

4-6 Dec 2013, International Conference on Climate Services – 3, Montego Bay Jamaica. Rachel Lowe (IC3) – IC3 and NCAR led a session 'The role of climate in disease decision support systems'

3-14 Feb 2014, Workshop, Rio de Janeiro Brazil. Rachel Lowe (IC3) – Integration of environmental remote sensing products to inform health early warning systems

27 Apr - 2 May 2014, EGU General Assembly, Vienna Austria. Rachel Lowe (IC3) – Poster presentation 'A decision support system for temperature related mortality in Europe'; Mark Liniger (Meteo-Swiss) – Co-convener of session CL4.4/NH1.3/NP3.11 'Decadal, seasonal and monthly climate predictions'

Lessons Learnt and Links Built

Model data is usually not available at temporal resolutions higher than 6-hourly. Higher resolution data may be required for the calculation of some CIIs in order to bridge the gap between the end-users' needs and the climate modellers' community. So it is necessary to achieve a consensus on model output to ensure that the requirements for CII computation are met by the climate model outputs.

Some of the CIIs analysed within this work package appear to be region-specific and are therefore not easy to be exported to other regions. However, this is exactly what the prototypes will be designed for and therefore these products have the potential of an added value to the user, as the index is specifically defined for the user.

Overall it seems that the most value can be gained by defining specific CIIs including specific thresholds for a specific user need. However, starting with a basic (unspecific) set of CIIs was a good first approach. It offered the possibility to explore the field of bias correction and skill analysis as little is known to date about these relationships.

For the reporting period, the most obvious link for the whole work package is to WP12. The work done in WP12 helped to identify the set of specialised CIIs. In the upcoming phase of the project, the link to WP42 will gain of further importance, as the CIIs are planned to serve the prototypes with the findings and results (e.g. maps of CIIs) of this WP22.

WP23 – Impact models for impact predictions

Key Points/Significant Results:

- WP23 has further developed the complex impact models available to the consortium. These will be used to address the users' needs and inform the case studies being investigated in WP23, and the prototypes being developed under WP42. For instance, alternative and additional processes have been added to water models by SMHI; the Met Office has further developed crop types in their generic crop model; and ULUND has developed their forestry/ecosystem models;

- The work package has developed a prototype operational workflow to use the impact models in S2D forecast mode; both through defining ways to initialise the models via a workshop and series of reports, and through agreeing a modelling protocol for using seasonal hindcasts with the models. Most partners have set up their models with observed forcing datasets as a baseline, and have began to download the currently available seasonal hindcasts from the ECOMS-UDG;

- WP23 has begun to assess and improve the predictive skill of impact models by analysing simulations driven by seasonal hindcasts. For example, CETaqua has analysed sensitivity of water impacts to seasonal climate conditions and the Met Office has run crop simulations using GloSea5 seasonal hindcasts. The work package has produced milestone reports on low- and high-end impact events/case studies to focus on (e.g. discharge, crop yields etc);

- WP23 has started to assess how optimal geographical forecasting units can be developed, as a function of model physics and stakeholders' needs. For instance, CETaqua's usual modelling approach is applied at small basin scale, which is most relevant to their key stakeholders, but following discussions on seasonal forecast skill, the work package is considering how larger-scale simulations could be used to support the needs of water sector stakeholders in southern Europe.

Executive summary

In addition to sessions at the General Assemblies, WP23 held a workshop on model initialisation at the Met Office in Exeter in June 2013. WP23 partners have been working with UC and SMHI to ensure the seasonal forecast data (and downscaled data) provided meets the needs of the WP23 impact models. The WP23 partners have been developing a modelling protocol, which will define and coordinate the impact modelling simulations to be run across the work package. A number of WP23 partners have begun to set up their impact models for use with seasonal hindcast data, and to improve their performance and develop the models in general. The three activities mentioned above are all contributions towards Milestone 23 (Initial simulations for common cases ready). WP23 have also been involved in two successful prototype proposals, the LEAP proposal for food security in East Africa, and the Land Management Tool for the UK.

Work package objectives

To further develop the complex impact models able to address the users' needs and inform the case studies and the prototypes:
• To develop a prototype operational workflow to use these models in S2D forecast mode;
• To assess and improve their predictive skill by analysing hind casts of low- and high-end impact events (hi/lo discharge, crop yields, etc);
• To develop optimal geographical forecasting units, as a function of model physics and stakeholder needs.

Summary of progress towards objectives

Task 23.1: Data flow

WP23 partners provided UC with a coordinated list of their data requirements for running impact models, ensuring the right data could be provided through the ECOMS-UDG.

Predictia has focused its activity collecting users' data needs in order to define the variables available. Predictia has also been involved in the user support for using the R Package for data access at ECOMS-UDG.

CETaqua identified the data flow related to the water management tool AQUATOOL, the hydrological models commonly used by river basin agency in Spain, and seasonal water forecast model.

Task 23.2: Model initialisation

Two deliverable reports (Deliverable 23.1 and Deliverable 23.2) have been prepared on model initialisation following the Exeter workshop held jointly between WP23 and WP31 in June 2013:

Originally, is was hypothesised that impact models targeting systems that exhibit distinct memory effects (known or presumed) may need proper initialisation of their state variables at the start of a forecast/hindcast simulation. This may be expected to apply especially to models of hydrological systems where significant stores of soil moisture, snow and surface water in lakes/reservoirs/wetlands may reflect accumulated effects of past fluxes. Similarly this would apply to models of vegetation dynamics though probably more so for perennial vegetation than for annual vegetation and crops. As a result impact models for sectors that build on these, e.g. hydropower or forestry, likewise may be sensitive to initial states. Initialisation of impact models for systems that are sensitive to instantaneous weather impacts only (e.g. solar and wind power or tourism), on the contrary is likely to be relatively unimportant.

This hypothesis was, by and large, confirmed by the workshop participants representing the various impact modelling groups, based on their expert judgement and existing literature. For the particular models used in the consortium the effect of various possible approaches towards initialising relevant state variables based on model spin-up, on climatology or on observations (e.g. remote sensing) needs to be assessed. Sensitivity experiments will be done for those models where initialisation is considered critical.

The EUPORIAS WP23/31 partners agreed that:

- The overall aim was to provide the best model performance possible to meet stakeholder needs, rather than to perform a strict model inter-comparison experiment;
- They need to perform various sensitivity experiments to assess the effects of different climate model forcing data (with/without bias-correction), the effect of impact model initialisation uncertainties (using various sources, or arbitrary changes e.g. +/- 20% soil moisture/snow values), and compare against our “best” forcing and initialisation estimates;
- A common climatology would be used for reference forcing, general initialisation either observed EObs, analysed (ERA-I) or merged (WFDEI), and whether bias-correction would be used or not. As far as resources for each of the partners allow, we would favour:
- Spin-up using WFDEI, the period depending on the model being used; and
- Run using both raw and bias corrected seasonal forecast/hindcast model data;
- The sensitivity experiments can be done on full climatological skill statistics, but also on (common) studies of particular events (exhibiting both weather and impact anomalies, and the latter caused by the former, not e.g. socioeconomic conditions). The latter may provide more insights as to why our impact models do or do not show skill through detailed analysis of propagation of errors in initial conditions, forcing data or parameters; and

- Stakeholder engagement is vital to the case study selection process, but may also influence the selection of appropriate skill metrics or their visualisation.

The deliverable report (Deliverable 23.2) focus on initialisation aspects of impact models only. Other operational issues for WP23 discussed during the workshop can be found in Deliverable 23.1.

CETaqua has carried out some experiments to check the sensitivity of different type of impacts (reservoir filling, urban water demand) to seasonal climate conditions. The response to the climate drivers was analysed at (i) different time scales for a small river basin in Spain (part of the Ebro river basin, Najerilla sub-basin with the Mansilla dam); and (ii) regarding water demand, for an urban area close to Barcelona. For example, Figure 8 shows the relationship between temperature anomalies and water consumption anomalies for an urban area close to Barcelona for the period 2004 to 2012.

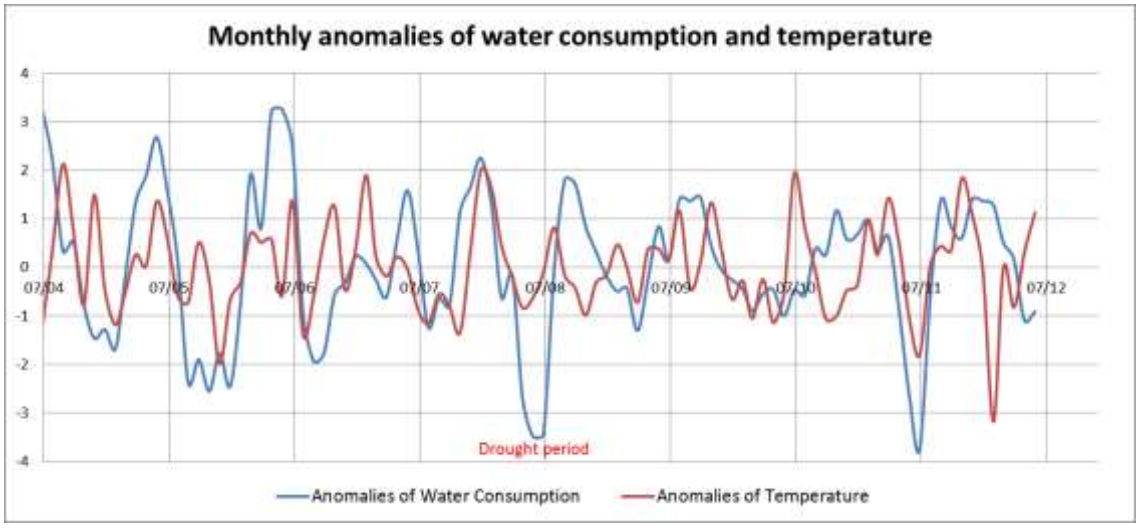


Figure 8: Monthly comparison between anomaly in temperature (red) and water demand (blue) for the period 2004-2012

IC3 took part in the WP23 workshop on model initialisation via teleconference, and are applying their health-related modelling approach in WP23. In their approach, temperature and humidity are related to human mortality via location-specific transfer functions (e.g. countries, regions), calculated using historical data (Ballester et al., 2011). Using predefined categories of temperature-related mortality risk, probabilistic projections for human mortality are developed at monthly/seasonal time scales. The probabilistic approach allows public health decision-makers to identify areas where models predicts with certainty area-specific heat-waves or cold snaps, in order to effectively target resources to those areas most at risk, and plan for a given season or year.

Task 23.3: Impact models for the water sector

SMHI has been working on refinements of the E-HYPE hydrological model which can have an impact on the model's initialisation and performance. The current operational E-HYPE is based on the HYPE model v4.3.1 (move from previous version 4.1.0), which overcomes some technical problems and allows a better initialisation of state model variables. In particular:

- Spin up can be used to estimate the initial water level in the dams;
- Alternative/additional processes are now present allowing a better representation of the hydro-climatic processes; hence extraction of additional variables;
- Introduction of new performance criteria which are useful in the evaluation of hydrological forecasts;

- In parallel to model developments, we have been working on the coupling of forcing data (mainly precipitation) and the hydrological model;
- We aim to improve the representation of WFDEI precipitation data in the model in order to adequately estimate the sub-basin mean precipitation. The difference between WFDEI and E-HYPE spatial resolution could result into under- / over-estimation of extremes; hence different spatial interpolation methods are investigated and their corresponding runoff is assessed.

Finally, substantial effort is currently being given on improving the parameterisation of the model and improving further the models performance in the hindcast period. The new improved E-HYPE version will become operational (hence replace the current existing) and will be tested within EUPORIAS.

EDF's goal is to run their hydrological model (MORDOR) with seasonal forecasts. The model will be run on a large set of 35 watersheds in France (Figure 9 and Table 4). EDF is currently determining the list of watersheds, depending on the availability of the hydrological model on each of them, and the availability of temperature, precipitation and river flow data. They have started downloading ECMWF System 4 seasonal hindcasts (1981-2010) over the North Atlantic / Europe sector. Direct temperature and precipitation forecasts at the local scale are not skilful enough, and so they are using an analog method to get temperature and precipitation (T/P) forecasts. The method is that briefly described in the proceedings of the ECMWF 2012 seminar: http://www.ecmwf.int/publications/library/ecpublications/_pdf/seminar/2012/Dubus.pdf. These variables will be used in an analog method (WP21) to obtain precipitation and temperature forecasts on the watersheds. This stage includes an evaluation of the forecasts with respect to reanalysis (ERAinterim and/or NCEP), and an evaluation of the T/P forecasts on the watersheds.

The impact (hydrological) model will be run by the EDF operational Hydro-meteorological Forecasting Division once they are provided with the analog dates and temperature/precipitation forecasts. The joint analysis of results will include comparison with Meteo-France's hydrological forecasting chain.

Figure 9: Map showing the set of 35 watersheds to be simulated using MORDOR

FRHI	Rhin	Rhin@Kembs
FALN	Alpes Nord	Q1 : Q0001 : Fond de France Q2 : Q3660 : Doubs aux Brenets Q3 : W1410010 : Isère à Grenoble Q4 : Arve@Arthaz
FRHOI	Rhône-Isère	Q1 : BviRhone@Bugey Q2 : Ain@Vouglans Q3 : Q0024 (IsereàPizancon) Q4 : Q0037 (BourneàPontManne) Q5 : Rhone@Scex
FDT	Durance-Tinée	Q1:Q0314 (TinéePontLune) Q2:BviDurance@Cadarache Q3:BviDurance@Escale Q4:BviVerdon@SteCroix
LDD	Drac-Durance	Q1 : Drac@Sautet Q2 : Durance@SerrePoncon Q3 : Verdon@Castillon
LALP	Alpes	Q1 : Isère ValdIsère (Q3302) Q2 : Romanche@Chambon Q3 : Cenise@MontCenis Q4 : Doron@Roselend Q5 : Ain@Vouglans
MASSIF-CENTRAL		
DOR	Dordogne	Q1 : Dordogne@Bort Q2 : Q2454 : Cere à Cantales Q3 : Q2154 : Vezere à Montceaux
TRU	Truyère	Q1 : Truyere@Grandval Q2 : Q2704 : Lot à Castelnau
LOI	Loire	Q1 : Allier@StYorre Q2 : ChassezacPiedBorne (Q0384) Q3 : Arn à StPeyre (Q1643)
PYRENEES		
FPYR	Pyrénées	Q1 : Q1043 (Aspe à Pont d'Escot) Q2 : Arriougrand@Migouelou Q3 : Aston@Laparan Q4 : Aude@Puyvalador Q5 : Brousset@Pontdecamps Q6 : Gave@LaRaillere
LPYR	Pyrénées	Q1 : Q1043 (Aspe à Pont d'Escot) Q2 : Arriougrand@Migouelou Q3 : Aston@Laparan Q4 : Aude@Puyvalador Q5 : Gave@LaRaillere

Table 4: Set of watersheds to be simulated using MORDOR

Meteo-France started the production of the impact variables hindcast using the downscaled data provided in WP21. Two seasons were investigated first; the Spring and Summer seasons as they are crucial in term of water resource management. These results will be extended for other periods of interest. A hindcast of 30 years was issued for both the Soil Wetness Index (on an 8 km grid over France) and the River Flow (for more than 900 stations along the rivers). These hindcasts were evaluated against a relevant hydrological reanalysis (so call SIM reanalysis) which was validated against observation (contribution to Deliverable 23.4). Probabilistic scores and deterministic scores were computed. In addition, to demonstrate the added value brought by such a forecasting suite, a specific experiment using random atmospheric forcing (and so call RAF experiment) was prepared. The same scores for these experiments were also performed.

The SWI and River Flow hindcasts for MAM and JJA are available to project partners for case studies.

CETaqua started to test the use of seasonal predictions as input into the AQUATOOL impacts model to predict the potential impacts. The first results have been presented to the project stakeholders.

WU has worked on setting up the VIC and LPJml models for hydrological forecasts in Europe (initially; later perhaps also for East Africa). Both have been run with WFD-EI to provide a base run for initialisation of the hindcasts and as reference. The base run has been validated against an observed discharge dataset based on GRDC augmented for some basins. Presently, we are developing scripts to perform the hindcast runs starting with System 4 data.

The System 4 hindcast has been downloaded from the ECOMS-UDG, re-gridded to 0.5^{o}, reformatted to NETCDF conform protocol, a land mask applied and re-organised to one annotated file (with all variables) for each forecast (i.e. a total of 5400 files = 360 7-month forecasts x 15members). These can be made available to other partners upon request. A bias and skill assessment has been performed for selected grid boxes across Europe (see WP31/32 reports).

Figure 10 shows examples of the performance/validation of both VIC and LPJml models for a selected basin. A challenge to be addressed in validating the hydrological models, will be matching the temporal coverage of the observational data in GRDC with the model outputs.

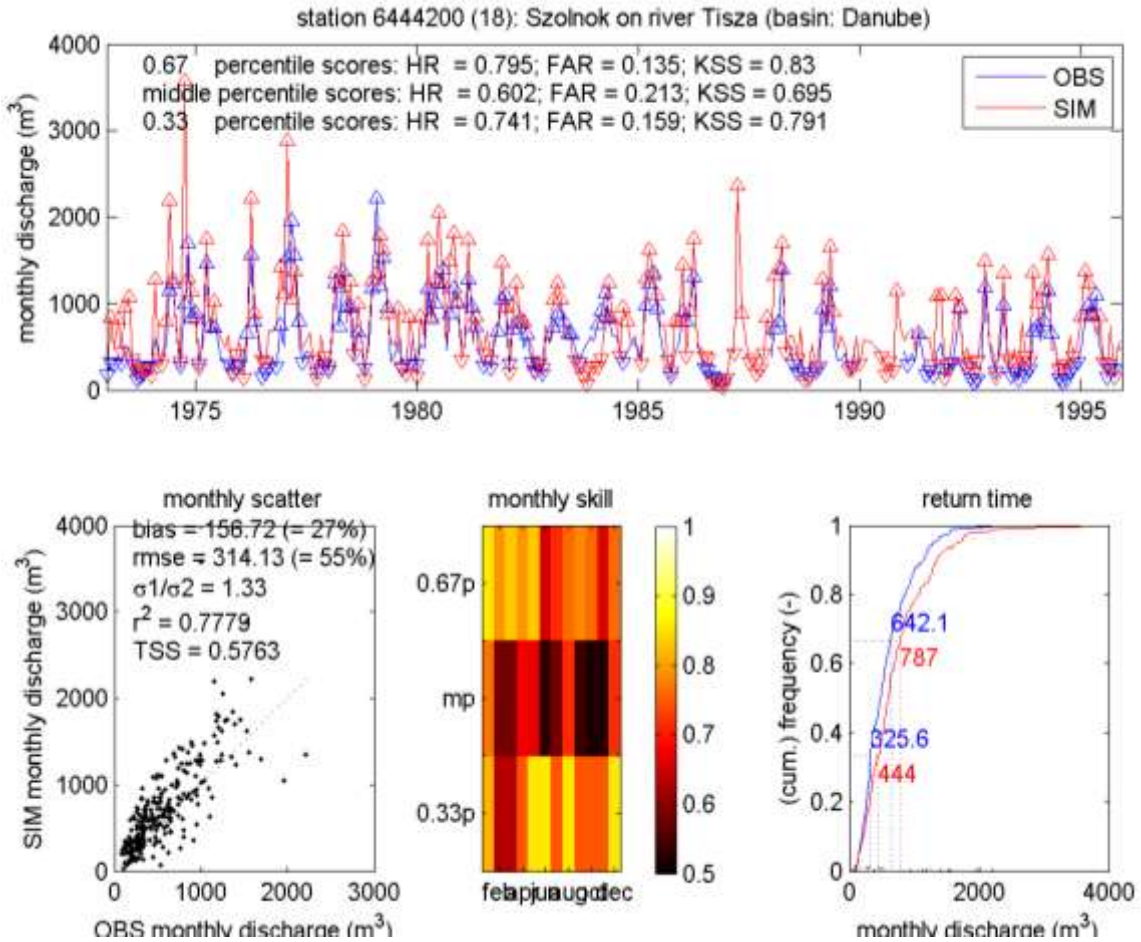


Figure 10: Example discharge validation LPJml forced by WFD for the Tisza. The bottom-centre figure presents the skill (HansenKuiper score) for above/below normal discharges using the reference forcing, setting the target for the hindcast ensemble

Task 23.4: Impact models for the agriculture sector

The Met Office has begun to use Glosea5 seasonal hindcast data with the JULES impact model, and to assess the impact of data disaggregation on model results. The latter work is particularly important since sub-daily driving data, needed for running the JULES model, may only be available from a more limited set of seasonal hindcasts. The Met Office has also been working on developments to the JULES model, including on the JULES_crop crop model, on including an inline forcing data disaggregator, on adding a crop product pool, and enabling spatially varying heights of forcing data in the model. Further work is also ongoing to include an irrigation scheme which will eventually include both demand (crop requirement) and supply (removal of water from rivers and groundwater).

UNIVLEEDS has been getting GLAM-maize ready to simulate yields in East Africa. This has involved checking through the code and contacting the different people working on GLAM-maize and making sure that the model version has all the relevant updates and recent bug fixes. Appropriate parameter values for maize in East Africa are also being assessed, and a strategy for dealing with the many different maize varieties grown across the region is being developed. In collaboration with WU, a likely approach will be to categorise the huge number of maize varieties into a few distinct groups and then find suitable parameter values for each group of maize varieties.

WU has worked on setting up the CGMS/WOFOST and LPJml models for agricultural forecasts in East Africa (initially; later perhaps also for Europe). Both have been run with WFD-EI to provide a base run for initialisation the hindcasts and as reference. The base run is presently being validated against an observed crop production dataset based on FAOSTAT, augmented with sub-national statistics for Kenya and Tanzania. Initially we will focus on Maize production, later other crops may be added (e.g. wheat, millet). Presently, we are developing scripts to perform the hindcast runs starting with System 4 data.

WU has downloaded and processed System 4 hindcast data as described under Task 23.3.

Figures 11 and 12 show examples of the performance/validation of both WOFOST and LPJml models for the whole of the Greater Horn of Africa (GHA) using national statistics from the FAO only. Several problems arise with the observed statistics that are currently being worked on: calendar issues (different databases use different calendars, causing shifts in the series), aggregation issues (reported production at different administrative levels do not always add up to total of next higher level; administrative reorganizations), only part of interannual variability is climate related (check for major alternative causes, e.g. political upheaval), records at all levels exhibit considerable gaps. Work is underway to consolidate this as well as possible. We may also have to consider assessing the skill of hindcasts not only with respect to observed crop yields, but also with respect to those simulated in the reference run forced with WFD-EI.

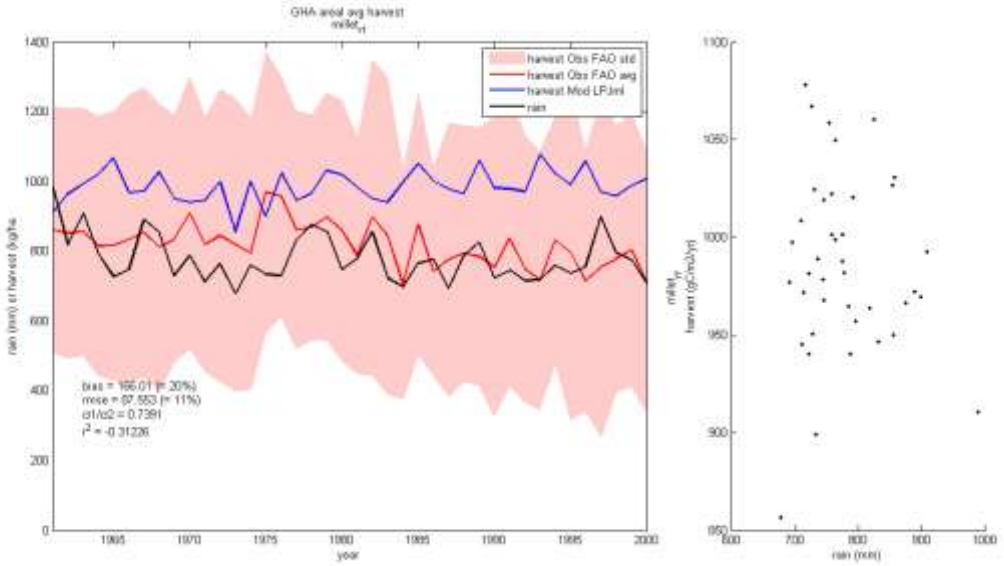


Figure 11: Observed (FAOSTAT) Millet production for GHA compared to model by LPJml (forced by WFD). Major driver rain is also plotted

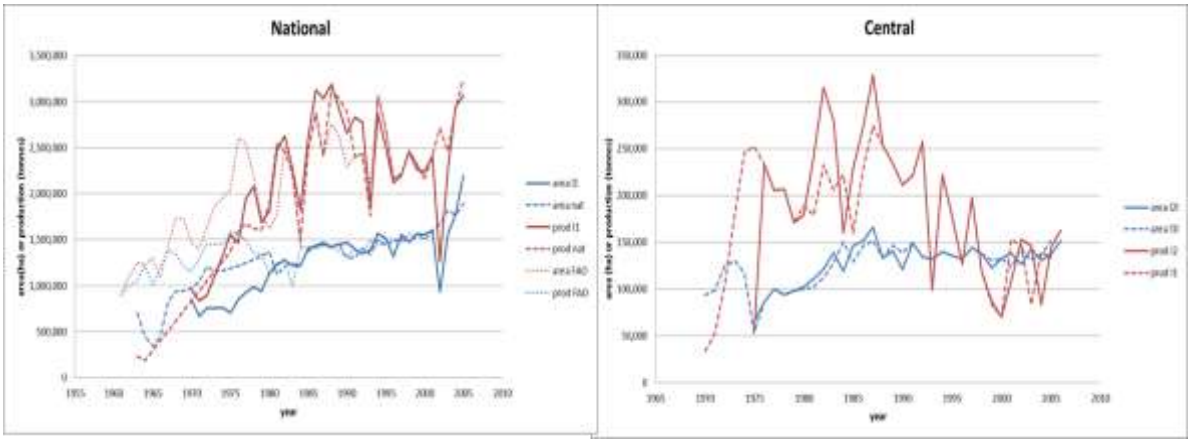


Figure 12: Inconsistencies between Maize production in Kenya as reported at four different levels of spatial aggregation; by FAO, national total, sum of l1 (8 provinces) and sum of l2 (46 districts) subdivision

Task 23.5: Impact models for the forestry sector

ULUND has started to test the impact models (forestry sector) and SMHI is to provide relevant S2D model data. They are proposing, and working on, a forestry case study focused on planning of harvesting activities in the winter season. The reason for this is twofold. Firstly, the best prospects for achieving some skill at the seasonal time-scale are likely to be in predicting winter NAO conditions, which in turn have a high correlation to Scandinavian winter temperature (and precipitation). Secondly, winter-time harvesting poses major logistic and environmental challenges in which climate and weather are major components. Thinning and clear cutting are commonly practiced in winter when the soil is frozen. However, rainy autumns and mild winters make it difficult to harvest forest standing on wet soils, as the heavy machines cause driving damage (soil compaction, deep wheel tracks that permanently changes water flow). Seasonal forecasts of enough skill will provide a tool to substantially improve the planning of harvesting and associated logistics of forest companies.

ULUND and SMHI have been collaborating in developing the local surface climate downscaling tool/model LDCLIM, which integrates existing modelling components into a tool for describing local

climate conditions and ecological impacts as the combined effect of regional atmospheric forcing and local physiographical and biological conditions. For the WP23 case study, the following variables are required as input:

- daily 2-metre temperature and precipitation (after bias correction);
- 3-hourly temperature, specific humidity, wind speed (u and v) at the lowest (preferably) model level of the seasonal forecasting system, and additionally downward radiation shortwave (preferable divided into direct and diffuse component) and longwave, as well as rain and snow intensity and surface pressure.

ULUND's approach has been to work on and apply different model components in parallel, both the fully integrated LDCLIM model and the model component (LPJ-Guess) for forestry and ecological impacts.

References

Ballester, J., Robine, J. M., Herrmann, F. R., Rodo, X. (2011). Long-term projections and acclimatization scenarios of temperature-related mortality in Europe. Nature communications, 2, 358.

Reasons for deviations from DoW and failing to achieve critical objectives

Deliverable 23.3 and the related Milestone 23 were delayed for six months from month 15 (January 2014) to July 2014. During the related initial workshop in June 2013, which included representation from the FP7 SPECS project, the work package partners made plans on how to approach the issues involved in initialisation of impact models for seasonal to decadal predictions (Task 23.2). This is reflected in the two finished deliverables. These approaches are now being used, and most groups have begun implementing the workflow for running hindcasts through our impacts models. We then have to set up the analysis workflow for the skill assessments of our impacts models. Only then can we start analysing the various contributions to the overall skill, of which initialisation is just one. The postponement of six months ensures the presentation of results significantly beyond those in Deliverable 23.2, and the plan is to write an associated peer reviewed paper. This will provide a more complete analysis of initialisation effects on skill which will inform further deliverables (24.4, 24.5 and 24.6).

No negative impact on other work packages within EUPORIAS is anticipated. In fact, the delay to this deliverable will improve the quality and value of the output from WP23 and in no way adversely affect the general delivery of the project.

Statement on the use of resources

The resource usage of all partners in this work package is on schedule. No time has formally been declared by ULUND, however Task 23.5 has benefited from the model development work that is being carried out by another project which ULUND is involved in.

MS21 and MS22: Define common flow conditions for hydrological/agricultural/forestry skill analysis: Month 3 (January 2013), comprising the following:

- Draft WP23 impacts model data requirements document
- Draft WP23 case study discussion document
- Draft WP23 case study document: anomalous years

More specifically, MS21 and MS22 were important contributions to specifying data requirements for the ECOMS portal, and in helping to define the modelling approach to be taken in Tasks 23.3-23.5.

List of meetings (attendance funded through the project)

None.

Lessons Learnt and Links Built

We explored the possibility of linking seasonal prediction directly to impact-relevant parameters. The preliminary tests performed by CETaqua do not show a very clear relationship between regional and local precipitation (at one weather station in the basin) and the Mansilla dam filling (estimated from a downstream gauging station and the water level in the dam). Finding such a direct relationship would have helped in linking seasonal prediction output to users' needs without the use of a hydrological model. A possible reason for this missing link could be associated with the local nature of intense precipitations, prevalent in this catchment in some period of the year which may be misrepresented, displaced spatially or missed altogether by the dynamical models (Figure 13).

The usefulness of getting such inflow prediction for the Mansilla dam has also been assessed. It would be limited to some optimisation of the energy production during the dam filling period. Indeed, the current management rules do not allow much flexibility since the main purpose of the dam is for irrigation (the dam should be filled before the irrigation period, which has been the case in the last 10 years) and since the size of dam do not allow pluriannual management (the dam fill and empty every year). In conjunction with AEMET and CETaqua it was decided to extend the geographical scope of the case study to cover a larger basin with pluriannual dam(s) and more data available.

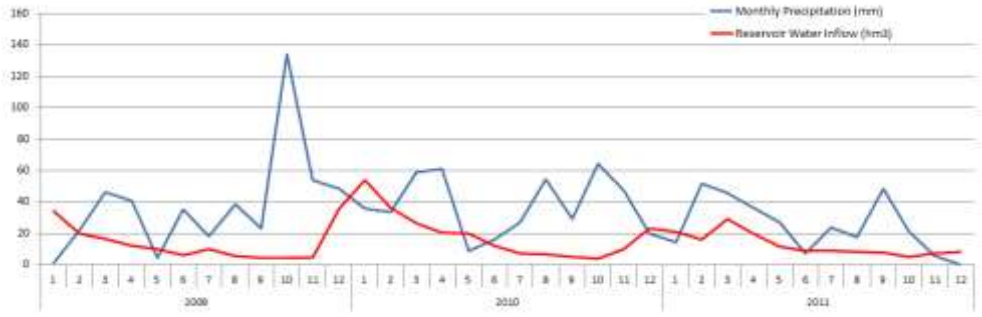


Figure 13: Monthly comparison between simulated inflow (input of the SIMGES model) to the dam and local rainfall data

WP31 – Quantifying uncertainty in impact models

Key Points/Significant Results:

- WP31 (with WP23) has started to develop a common protocol for performing hindcast experiments and for storing and exchanging results as a prerequisite for impact model intercomparison and multi-model ensemble predictive skills analysis;
- WP31 has started to assess the level of confidence of the forecast products that are needed to drive the various impacts models. On a global level, UC has assessed the biases and skills of ECMWF's System 4 hindcasts of temperature and humidity, where WU zoomed in on Europe and Eastern Africa. IC3 did the same for wind speed forecast skills. With this information, the most suitable regions for hydrology, crop and wind power forecasting impact applications on seasonal time-scales can be identified;
- WP31 has started to develop skill indices for their impacts models similar to those used in the meteorological forecasts. Skill indices for river discharge have been adapted and tested on baseline runs by WU and SMHI. Similarly, skill indices for crop yields are in development by WU. In this case, complications have arisen in discriminating climate driven anomalies from non-climate driven anomalies.

Executive summary

Most partners are still very much at the stage of setting up their impact models for the various target areas. The forcing data (at the moment, hindcasts of mostly System 4 and one partner Glosea5) are being downloaded and analysed. Performance statistics developed for meteorological forecasts are being adapted to use for impact forecasts. Common protocols for runs and analyses are in development. Service prototypes have been defined and development of these just started.

Work package objectives

To fully characterise the level of confidence we can associate to specific impact models. Multi model, multi driver and perturbed physics parameters ensembles will be used for this purpose.

Summary of progress towards objectives

Task 31.1: Development of common uncertainty assessment protocol for impact models

The Met Office has been leading development of the WP23/31 modelling protocol, which in its definition of common domains, common forcing data and common NetCDF output formats will facilitate multi model analyses once the simulations become available. Partners WU and others contributed.

WU has downloaded System 4 hindcasts (vars available to date) and bias and skill assessments have been performed, using WFD-EI as reference, for the European and Eastern African domains. Similarly we started developing probabilistic validation/skill assessment scripts for impact parameters from our hydrology and crop models (Figure 14). Issues with skill assessments against observed impact parameters may be hindered, especially for the East Africa region, by lack of sufficiently long observational records (e.g. discharge crop yield) within the hindcast period (1980-2000) or other factors affecting anomalies besides climate. Alternatively skill may have to be assessed not against observed impacts but against impact dynamics from a reference run.

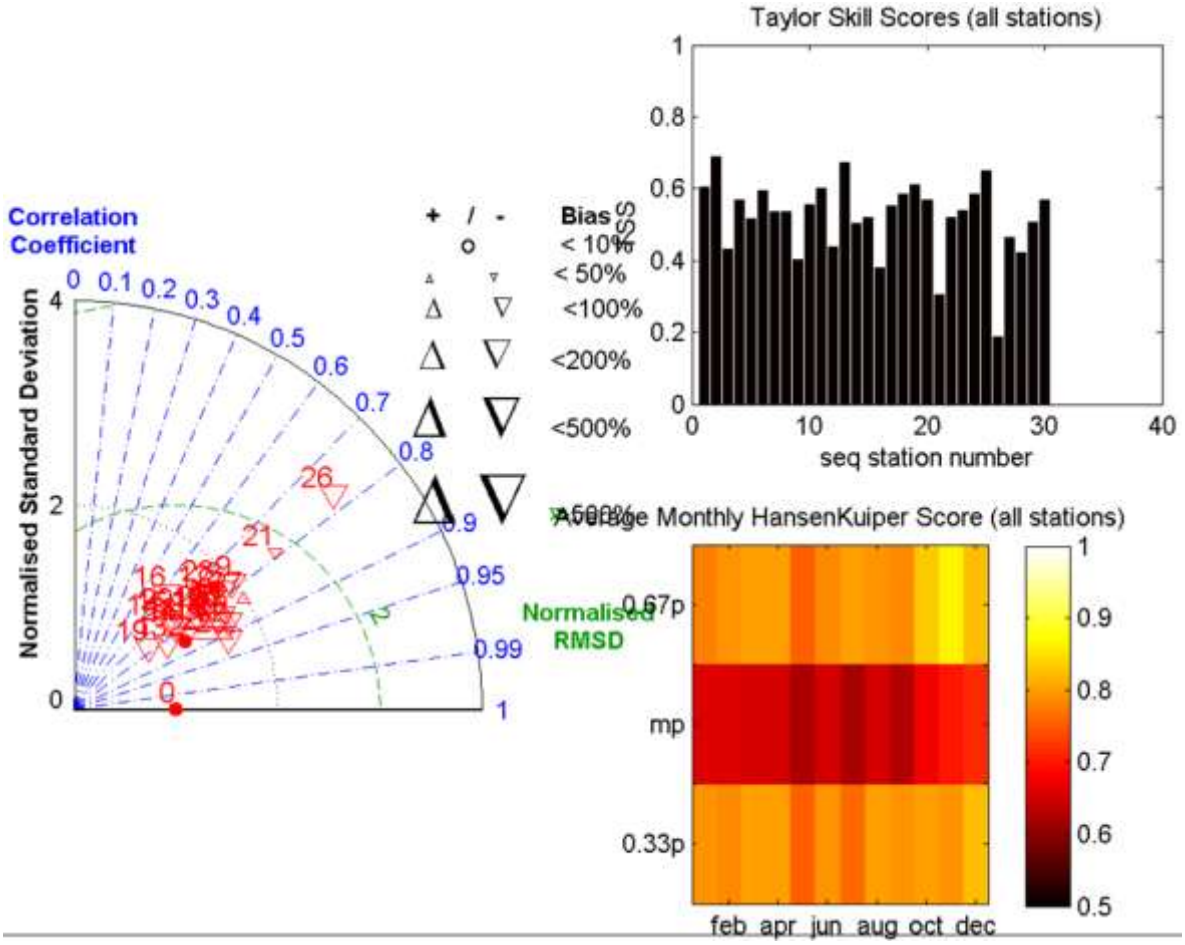


Figure 14: Validation of LPJml discharge simulations for 30 stations in Europe using both conventional statistics (left and top diagram displaying bias, correlation RMSE and standard deviation in Taylor plots, and focussing on monthly anomalies in a probabilistic score (bottom right)

UC has been working to provide early bias corrected data and make available all S2D forecast variables required by the impacts groups through the ECOMS-UDG. Most required variables are available and the access tool in R (developed in collaboration with SPECS) is ready. The tool to retrieve bias corrected data from the ECOMS-UDG is work in progress and will be available in the beginning of the next reporting period. More information on these activities can be found in WP32.

SMHI has been working on providing a new pan European version of the HYPE hydrological model. This involved both a new setup of the model and technical refinements of the HYPE code; the latter can have an impact on the model's initialisation and performance. For instance, new performance criteria, useful in the evaluation of hydrological forecasts, are included. SMHI has also been working on linking model results to a visualisation tool to allow a quick and flexible presentation of model performances.

Task 31.2: Producing S2D impact scenarios

Work at the Met Office has begun to use Glosea5 seasonal hindcast data with the JULES impact model, and to assess the impact of data disaggregation on model results. The latter work is particularly important since sub-daily driving data, needed for running the JULES model, may only be available from a more limited set of seasonal hindcasts.

WU has been setting up its three impact models (CGMS/WOFOST, LPJml and VIC) and reference runs using WFDEI have been performed and (cross) validation, focussing on interannual variability /

anomalous impacts (see WP23 report also). System 4 hindcast data have been downloaded and scripts are in development to force our impact models with these.

UNIVLEEDS has been developing the GLAM-maize crop model for use in East Africa (one of the common crop modelling regions). Processes that may be particularly important in the region (such as the impact of water stress around flowering) have been added to the model and suitable parameter values for maize in East Africa are being collected.

Task 31.3: Analyse respective contribution of forcing, initial conditions and parameter uncertainties on various impact indices

The task has not started yet, since impact ensemble data sets are still to be produced within the project.

Task 31.4: Evaluate the evolution of forecast uncertainty through the forecast period

Analysing the evolution of forecast uncertainty through the forecast period has been done for the forcing data, but not yet for the impact forecasts.

UC has assessed the forecast skill of System 4 globally in relation also with Task 32.1. This allows identifying the most suitable regions for impact applications on seasonal time-scales. The main results are available in a public report[1]. An example is given in WP32.

WU has explored how to assess impact model forecast skills using similar statistics as in meteorological S2D forecasts (see also Task 31.1) and started to make an inventory of possible anomalous events for E-African crop anomalies. System 4 has been downloaded (vars available to date) and bias and skill assessments have been performed, using WFD-EI as reference (see Figure 15).

[1] https://meteo.unican.es/trac/attachment/wiki/EcomsUdg/System4Validation_v1.pdf

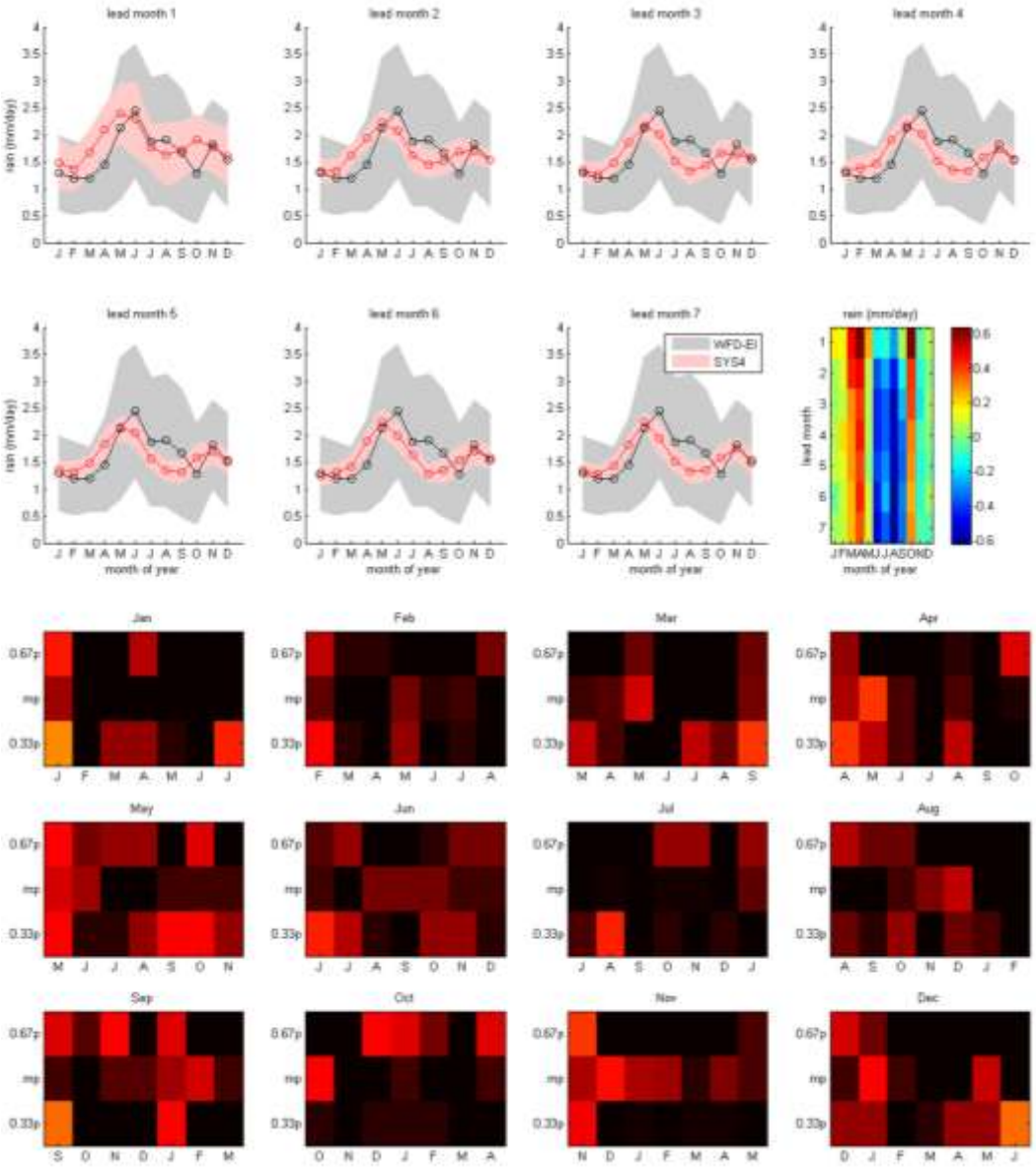
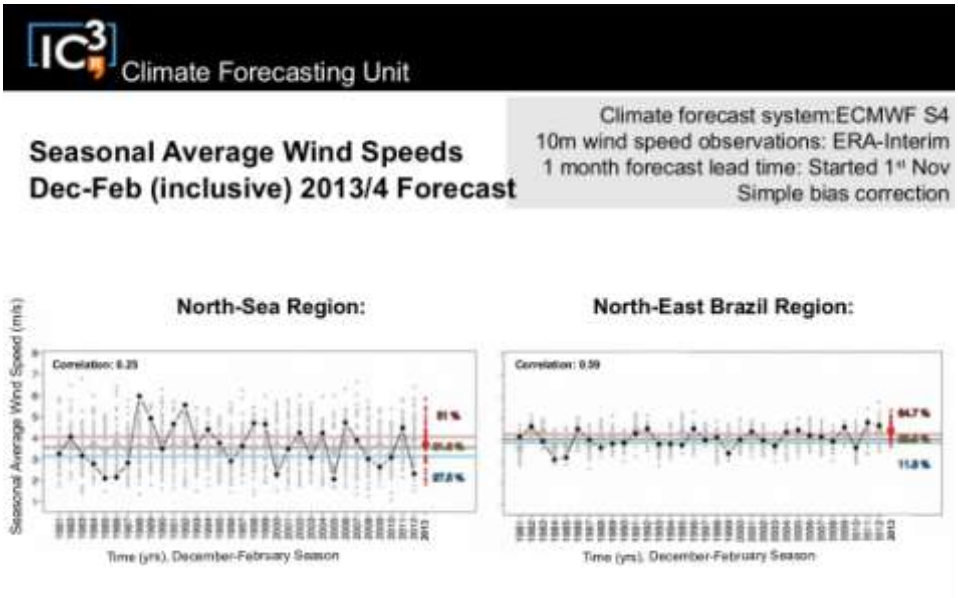
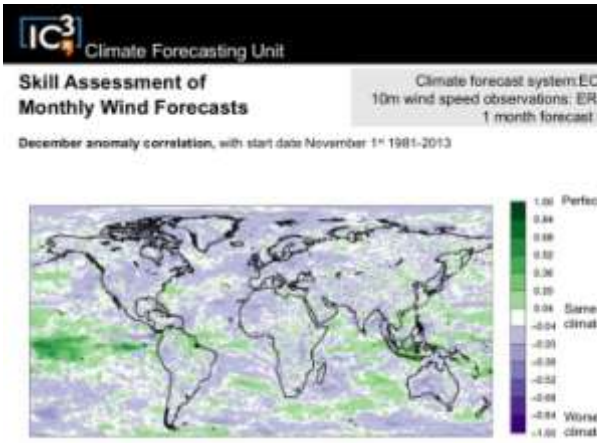


Figure 15: Assessment of System 4 precipitation bias (top) and skill (bottom) for grid box centered on Budapest, as function of lead month and time of year (in bottom figure black is no skill, increasing through red, orange, yellow to white-perfect skill) (source: WU)

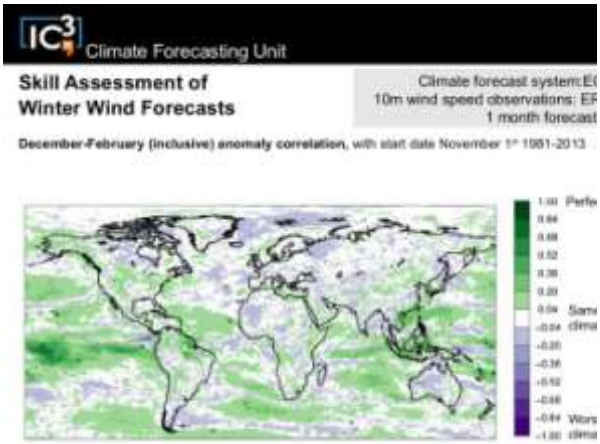
IC3 has looked at seasonal, bias corrected wind speed forecast skill assessment in term of anomaly correlation and ranked probability skill scores at global and site specific scales using the System 4 forecast system. With this information, the most suitable regions for wind power forecasting impact applications on seasonal time-scales can be identified. The main results are presented in Figure 16.



Example of a winter, seasonal forecast for wind speed in the North Sea and North-East Brazil regions



Example of forecast skill assessment for winter month wind speed forecasts



Example of forecast skill assessment for winter season wind speed forecasts

Figure 16: Examples of forecast skill assessment

Task 31.5: Develop impact S2D service prototype

Most teams contributed to the formulation of S2D service prototypes:

- to the LEAP prototype (crop forecasts in Ethiopia) WU, UNIVLEEDS and Met Office contributed (coordinated by WFP/ENEA);

- to the Land Management Tool prototype proposals the Met Office contributed (and is coordinated by the Met Office);

- to the Hydrologic multi-model seasonal forecast system prototype (coordinated by SMHI).

(If applicable) Reasons for deviations from DoW and failing to achieve critical objectives

The DoW mistakenly assigned UC to lead the agriculture impact scenario production in Task 31.2, when in fact this institution has no role in crop modelling. The lead for crop modelling in Task 31.2 is now WU.

Milestone 26 (internal report on S2D uncertainty assessment protocol for impact models) was due in month 10, right at the start of WP31 activities. It has been delayed for six months, in order to allow for the involvement of all groups in the definition of the basic aspects of the uncertainty chain, which will be covered by the uncertainty assessment protocol developed within Task 31.1. The report has now been made available to partners through the project's intranet. The delay had a minimal impact on this or any other work package activity and contributed to active discussions of the key aspects of the seasonal impact forecasting chain, which are included in the report.

Milestone 27 (Deliver impact model S2D scenarios to central database/ftp server; due month 18; Task 31.2) needs postponing since most impact model groups are still developing, setting up and validating their models. Moreover, not all variables needed for these models are available yet from the hindcast datasets on the ECOM-UDG, nor are bias corrected versions of these data. It is expected that this milestone will be met by October 2014.

Statement on the use of resources

The resource usage for this work package is on schedule.

List of meetings (attendance funded through the project)

8-10 Apr 2013, EGU General Assembly, Vienna Austria. Ronald Hutjes (WU)

Lessons Learnt and Links Built

The discussion of the key aspects of the seasonal forecast chain (Milestone 26) contributed to establishing cross-work package links with WP21, WP23, WP31 and WP32. So all work package-specific meetings have been, and will probably continue to be, organised together with WP23.

In the common service prototype development (see Task 31.5 above), collaboration across partners and work packages will intensify.

Key Points/Significant Results:

- WP32 has evaluated the System 4 seasonal forecasting system in order to identify the most suitable regions for impact applications on seasonal time-scales using different observational datasets as reference. Biases and skill on prototypes regions (East African regarding crop models and Europe for hydrological purposes) have been explored;
- Regarding S2D forecast combination, WP32 applied Bayesian calibration and combination methods over Europe with difference settings, slightly improving upon the skill of the individual models;
- WP32 has started the assessment of the contribution of difference sources of the uncertainty chain. In that sense, the skill of downscaled data (rainfall and temperature) has been compared to the skill of the large scale signal.

Executive summary

The initial stage of this work package (nine months so far) has focussed on the assessment and combination of seasonal climate forecasts. The skill of the ECMWF's System 4 seasonal forecasts has been evaluated globally and forecast assimilation calibration and combination techniques have been applied over Europe to operational products from ECMWF, Met Office, Meteo-France and NCEP (National Centers for Environmental Prediction, NOAA). The preservation of the seasonal forecast skill through the downscaling process has also been evaluated.

Work package objectives

This work package will look at the best way of combining the main sources of uncertainty in seasonal impact predictions (i.e. uncertainty from the climate predictions and uncertainty in the impact model formulation) in a single coherent assessment.

Summary of progress

Task 32.1: Assessment and combination of climate predictions

Different activities in EUPORIAS require seasonal predictions to feed different impact models, to serve as input to different downscaling techniques, or to test different validation methodologies. Typically, precipitation and surface temperatures are used for this purpose. The ECMWF System 4 seasonal forecasting system has been selected as the initial model to undertake these activities. The available System 4 hindcast covers the period 1981-2010, and several variables have already been included in the ECOMS-UDG[2]. This information is available for downloading through a THREDDS server for the ECOMS community, both directly and through an R-package for homogenous data access.

A key task in the uncertainty framework is the worldwide assessment of the forecast skill of the S2D forecasts to be used, so appropriate decisions can be made based on the model skill. UC conducted a preliminary validation of the "System 4 seasonal range (15 members)" data set. This allows identifying the most suitable regions for impact applications on seasonal time-scales. This task will be updated in the coming months to include the validation results for further seasonal forecasting systems to be included in the ECOMS-UDG. The analysis was performed considering the four

[2] http://meteo.unican.es/ecoms-udg

seasons DJF, MAM, JJA, and SON, and with one month forecast time for the whole 15-member ensemble hindcast period (1981-2010). As an example, Figure 17 shows the ROC Skill Score (ROCSS) for precipitation terciles. Details can be found in the validation report available at the UDG wiki[3].

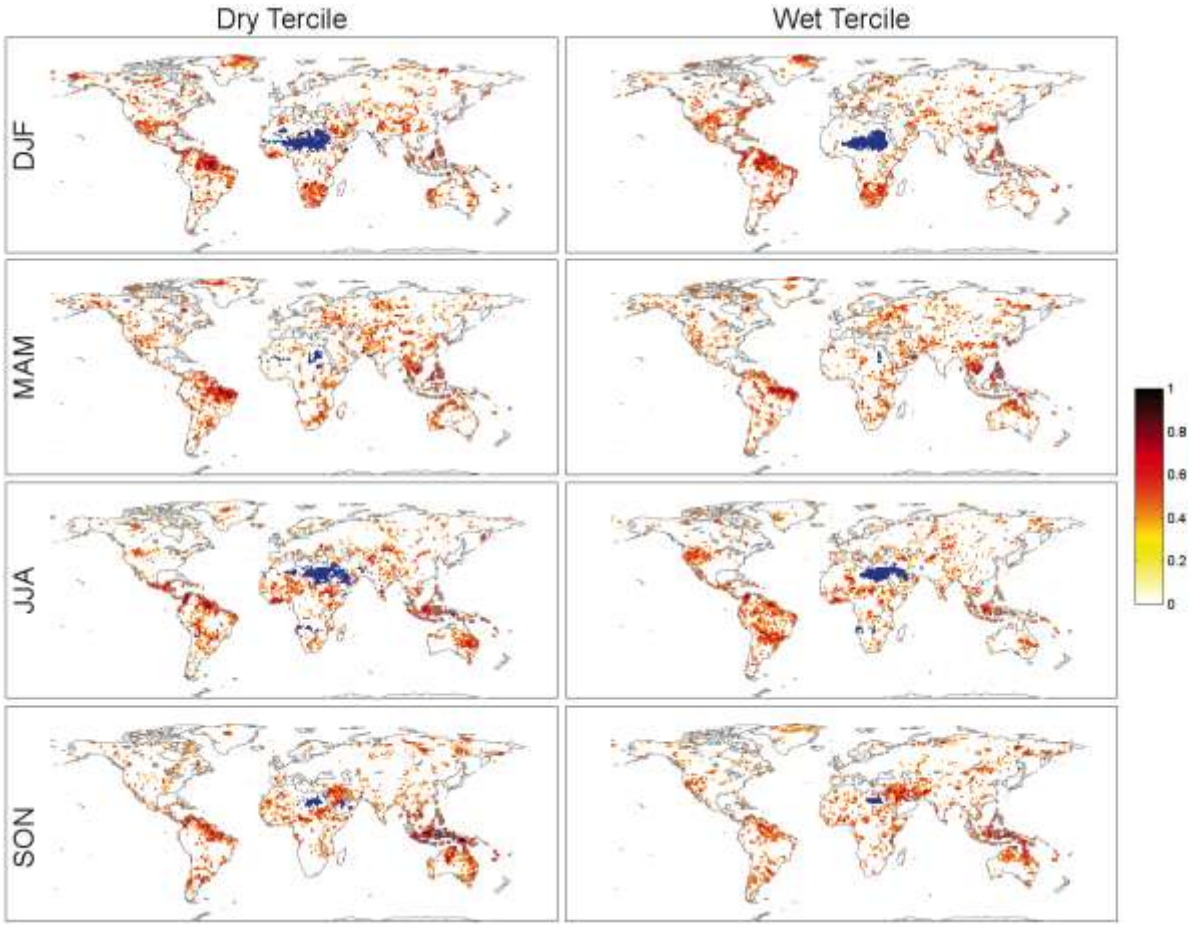


Figure 17: Seasonal ROCSS for the dry and wet terciles for the whole hindcast period 1981-2000. Precipitation from System 4 has been validated against GPCC v5. Only statistically significant (at a 5% level) ROCSS are shown. Blue points indicate grid boxes where the corresponding tercile category has never been observed during the hindcast period

Regarding S2D forecast combination, AEMET has focused on state-of-the-art operational seasonal forecast models. Direct outputs from four models (ECMWF System 4, Meteo-France System3 (MF3), Met Office GloSea3 and National Center for Environmental Prediction (CFSv2)) have been initially considered. Then, the Bayesian calibration and combination method described by Stephenson et al. (2005), also named forecast assimilation (FA), with different settings has been applied in an attempt to improve the skill scores of individual seasonal forecasting systems.

The focus was on the Mediterranean region, and the analysis was conducted on four regions (Iberia, France, Italy and the Balkans). For each region, the operational seasonal forecast skill was evaluated. The FA method has proved to be competitive against the Simple Multi-Model (SMM) method - where all single models are equally weighted - and other combination methods (Lage et al. 2014). The FA method calibrates and combines predictions from several sources with prior (historical) empirical information (Stephenson et al. 2005). The work conducted so far has allowed the comparison of the performance of the four models and their skill depending on the month, forecast time, variable and particular score. Also an optimum setting for the calibration and combination algorithm permitting some moderate improvements for the calibrated and combined forecasts with respect to the skill of

[3] https://meteo.unican.es/trac/attachment/wiki/EcomsUdg/System4Validation_v1.pdf

the individual models has been proposed. Figure shows an example of the results found for the Iberian Peninsula, using individual model direct output, and also after the application of the FA calibration and combination method both to individual models and to the combination of the four models. Extended information of this work is available in the EUPORIAS wiki: https://euporias.wikidot.com/local--files/wp32-meeting20140401/WP32_Progress_report_AEMET_Apr2014.pdf

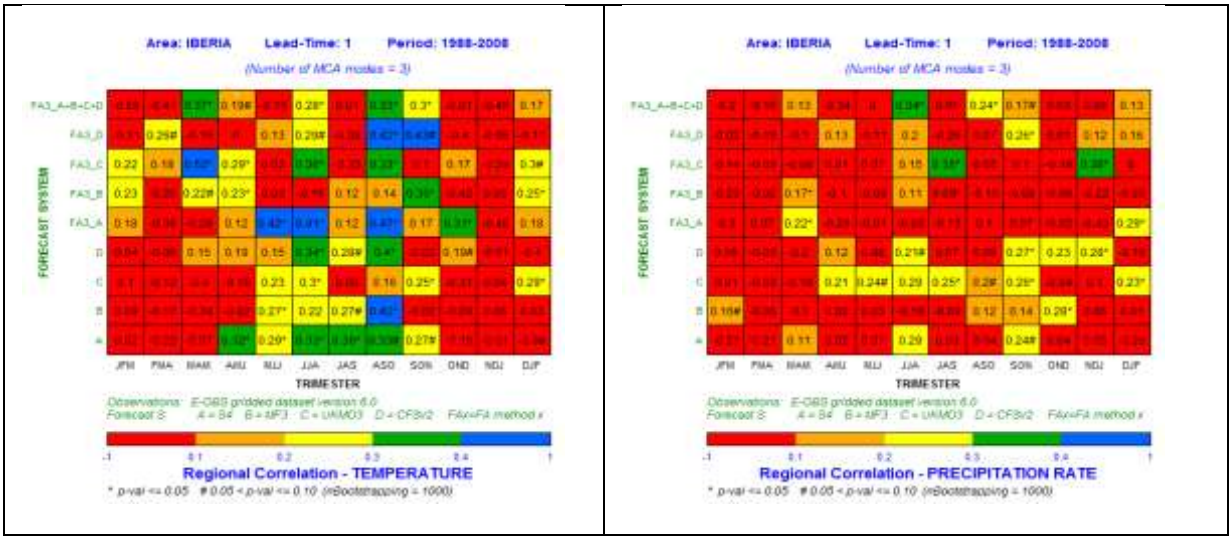


Figure 18: Pearson correlation coefficient of seasonal forecast temperature (left) and precipitation (right) computed for the Iberian Peninsula domain using: direct output seasonal forecasts from four models (ECMWF S4, MF3, UKMO3, CFSv2); seasonal forecasts obtained after the application of the forecast assimilation algorithm individually to each model; and seasonal forecast obtained after the application of the forecast assimilation combining the four models. Significant values are also estimated (* p-value 0.05, # p-value 0.10)

Meteo-France has been mostly dedicated to the assessment of seasonal predictions. The targeted seasons at this stage are the Spring and Summer seasons which are of major interest for water resource management. The skill of downscaled data (rainfall and temperature) has been compared to the skill of the large scale signal in order to assess the influence of the downscaling process on the final result. The main result is that there is no degradation in the skill of the atmospheric seasonal forecast when introducing the downscaling process in spite of the relative fine resolution used (8km grid). In addition, two different downscaling methods have been compared, one already used for the river flow medium-range forecast and one using a weather-type-like approach (so call DSClim). The main result is that the two methods lead, in the end, to very similar results in terms of impact variable (SWI and River Flow) so that the simplest method is better to use especially with respect of operational purposes.

Task 32.2: Uncertainty framework for seasonal impact predictions

For the focus areas of the WU impact models, Europe and East Africa, the bias and skill of System 4 has been explored, using WFD-EI as the reference climate. Thus far, this has been done for a number of locations across Europe (n=8) and East Africa (n=5) but the analysis will be extended to the full grid of each domain. As an example we describe the bias and skill for Nairobi.

System 4 precipitation (Figure 19) biases are reasonable for this area. Except for lead month 1, System 4 is up to 2.5mm/day too dry in the long rains season, especially during April and May. During the short rains season (OND) System 4 on the contrary is too wet, especially for longer lead times up to 1.5mm/day. For the rest of the year precipitation (P) -biases are negligible. Skills to predict above/below normal rains (p66 / p33, respectively) are a bit disappointing (see Figure 20). There is

some skill for below normal MAM rains with lead time <3 months, and slightly more skill for both above and below normal P in the OND season, but again with short lead times (<3 month).

For temperature (T) (not shown[4]), System 4 predicts too small a seasonal range for Nairobi, although biases stay within +/- 2K. The wet seasons are too cold the dry season too warm. Moreover the T-bias is a stronger function of lead time. Skills to predict above/below normal temperatures are fairly high, almost throughout the year.

These finding are fairly representative for the East African locations analysed so far (Addis Ababa, Kigali), though for Dodoma and Kampala T biases are more constant and larger suggesting an altitude difference between model grids and reference stations.

For Europe (not shown[4]) the results are more varied. Biases in both P and T are generally reasonable; skills for P anomaly forecasts are low; skills for T anomalies may be useful for winter/spring.

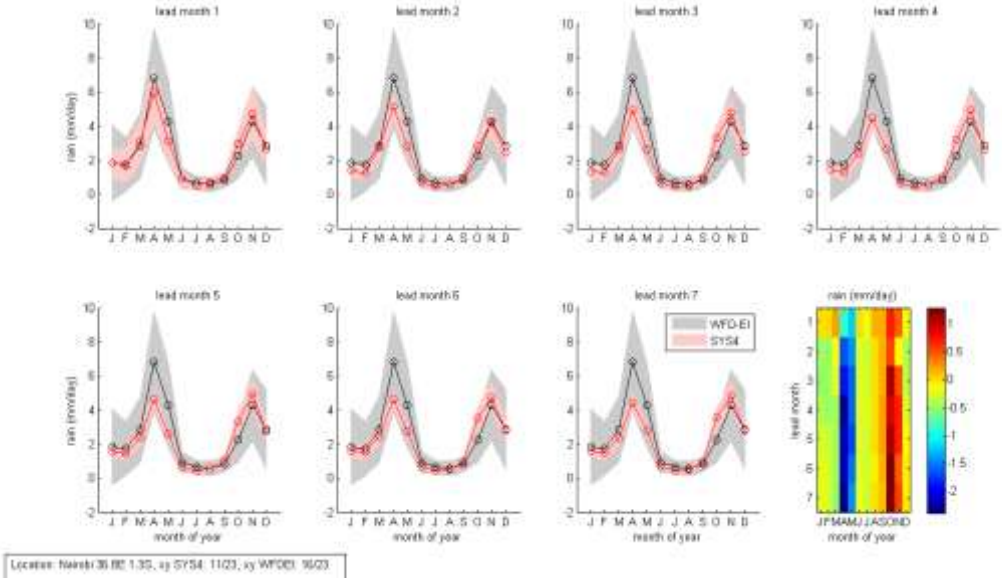


Figure 19: Precipitation biases as a function of lead time, averaged over 15 ensemble members. The seven line graphs are for increasing lead times (maximum seven months)

[4] available upon request

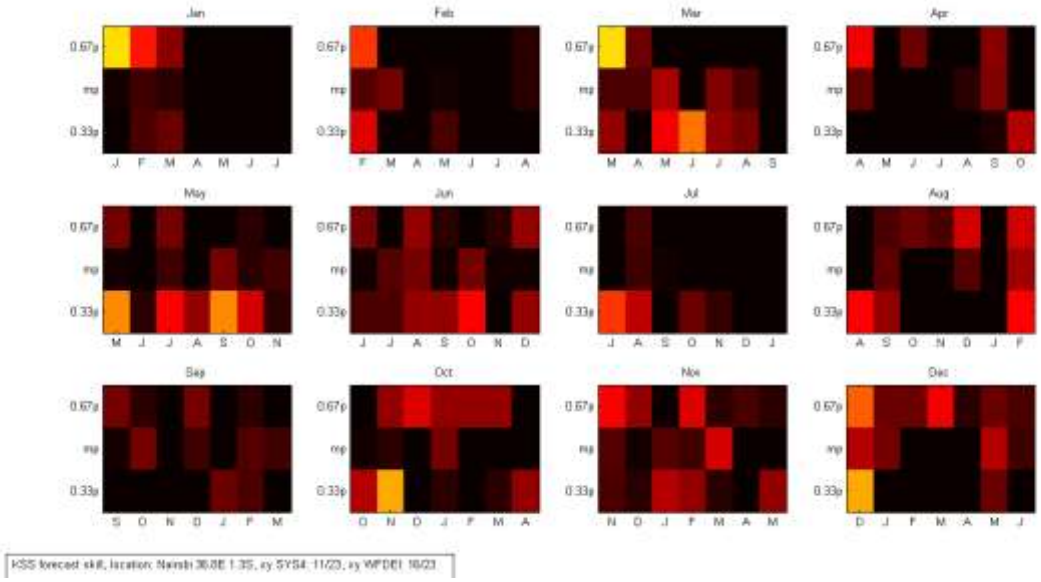


Figure 20: Precipitation skill (scaled Hansen-Kuiper score, black no skill, through red, orange, yellow to white perfect skill) as a function of lead time, averaged over 15 ensemble members. The 12 panels are for each month a forecast is issued

Several impact modelling groups (UNIVLEEDS, Met Office, WU) are ready to feed back with this task.

UC is collaborating with WU (WP23, WP31) to set up an initial test of the whole uncertainty chain, including bias correction through ECOMS-UDG access tools and crop (East Africa) and hydrology (Europe) impact modelling.

The scores of the seasonal forecasts of the impact variables considered by Meteo-France have been compared with the ones issued from the RAF experiments. Skill scores have been computed and thanks to a bootstrap procedure, a statistical test has been performed to highlight the zones where the seasonal forecast outperforms significantly the climatology-like impact forecasts.

References

DB Stephenson, CAS Coelho, FJ Doblas-Reyes (2005) “Forecast assimilation: a unified framework for the combination of multi-model weather and climate predictions” Tellus A57:253-264. DOI: 10.1111/j.1600-0870.2005.00110.x

LR Lage, FJ Doblas-Reyes, CAS Coelho (2014) “Multi-model calibration and combination of tropical SST forecasts” Climate Dynamics 42:597-616. DOI: 10.1007/s00382-013-1779-8

Reasons for deviations from DoW and failing to achieve critical objectives

The analyses of model combination undertaken by AEMET (using Bayesian Model Averaging, BMA) have focused on European regions, which are the most relevant for other EUPORIAS work packages. However, these regions show very low seasonal prediction skill and, therefore, BMA does not show an optimal performance. UC has been preparing statistical downscaling methodologies (bias correction and perfect prog), prioritising bias correction to early meet other EUPORIAS users' needs. Some downscaling experiments (considering the FP6 ENSEMBLES multi-model hindcast) have been applied to tropical regions, where the skill is much higher than over Europe. In order to provide a complete report on the assessment and combination of S2D predictions, BMA would be applied, building on AEMET's work, to cover raw, calibrated and downscaled model output in the Philippines region, exhibiting a variety of performances (skill for some seasons in some regions, no skill in other regions).

For this purpose, a three-month extension period for Deliverable 32.1 is required (now to be delivered in July 2014). This extension will not significantly affect other activities within WP32). The activities of other work packages shouldn't be affected by the extension since the most related work package (WP31) is at an early phase. UC (through WP21) is working with WP31 to provide early bias corrected data (scheduled for month 24, but that will be available in a couple of months). This effort for early delivery of bias-corrected data is also a reason to extend the deadline for Deliverable 32.1.

Statement on the use of resources

There are no known deviations from the planned resource use.

List of meetings (attendance funded through the project)

7-12 Apr 2013, EGU General Assembly, Vienna Austria. Ernesto Rodríguez (AEMET) – Presentation on EUPORIAS project

Lessons Learnt and Links Built

WP32's work is crucial for the preparation of the prototypes (verifying that the seasonal forecasts can bring added value in the targeted zones) and the corresponding evaluation of the impact of the information onto the Decision Making Processes (DMPs) (demonstration of the value of the provided Climate Service).

As expected, the WP32 has links with WP21 (namely, with Task 21.1, in charge of providing bias corrected and downscaled S2D forecasts) and WP31 (exploring the uncertainty in impact models). Preliminary work will test in the coming months the pipeline W21-WP31, which will explore the complete impact forecast chain. For this purpose, tools developed in collaboration with FP7 project SPECS were used.

WP33 – Communicating levels of confidence

Key Points/Significant Results:

- The findings of the survey of users' needs (Task 33.1) indicated that, for current users of S2D, seasonal and inter-annual predictions were perceived to be more useful than they were accessible or understandable. Perceived accessibility and understandability were found to be strongly associated with one another; but not associated with perceived usefulness. This highlights a clear need for 'user friendliness' in the presentation of predictions. Likewise, a large minority of current S2D users indicated that they did not receive information about how well predictions performed relative to observation but would like to do so; thus indicating that reliability information is often not presented in a manner that is clearly recognisable and interpretable;
- Of the subset of visualisation types presented in the users' needs survey, maps and measures of spread were overall the most highly favoured forms of representation. However, while maps were consistently popular across respondent groups, those who indicated that they were less comfortable with statistics measures of dispersion favoured the measures of spread less. Differences in statistical expertise amongst end-users should thus be considered;
- The WP33 review of existing methods of communicating (Task 33.2) highlights the potential for factors such as ambiguity aversion, prior knowledge, tolerance for false alarms, and cognitive biases to impact on the interpretation of information about confidence and uncertainty.

Executive summary

To date the focus of work within WP33 has predominantly been on Task 33.1 (Survey of end-user requirements) and Task 33.2 (Review of existing approaches of communicating confidence levels). Deliverable 33.1 (Report on survey of end-user requirements) was completed in January 2014. Deliverable 33.2 (Report on existing approaches to communicating confidence levels and uncertainty) was submitted in April 2014. Looking forward, a teleconference was held on 31st March 2014 to discuss Task 33.3.

Work package objectives

Test the effectiveness of different approaches of communicating the confidence and uncertainty associated with S2D predictions and its impacts.

Summary of progress

Task 33.1: Survey of end-user requirements

Deliverable 33.1: Report on survey of end-user requirements has been completed.

Task 33.2: Review of existing approaches of communicating confidence levels

A draft of Deliverable 33.2: Report on existing approaches to communicating confidence levels and uncertainty was submitted to the coordinators on 2nd April 2014. The final version of this Deliverable will be submitted on 30th April 2014.

Task 33.3: Formulation of strategies for communicating confidence levels for S2D forecasts

Work Package 33 teleconference to discuss Task 33.3 was held on 31st March 2014.

Task 33.4: Decision Lab with relevant stakeholders

To be commenced.

Task 33.5: Dissemination and publication of the strategies developed

To be commenced.

Reasons for deviations from DoW and failing to achieve critical objectives

An extension of three months to Deliverable 33.1 was requested and granted. The extension was requested for two reasons: (i) to draw upon themes emerging from the WP12 interviews in survey development; and (ii) to enable a greater number of survey responses to be collected (thus ensuring greater robustness of findings). This delay did not adversely impact on other WP33 deliverables or EUPORIAS work packages.

Statement on the use of resources

It should be noted that work on WP33 during the first 12 months of the project has been more heavily concentrated at UNIVLEEDS than the DoW would seem to suggest. This is due to UNIVLEEDS being best placed to take the lead in Tasks 33.1 and 33.2. Hence the person months of other work package partners will be more heavily concentrated in the upcoming tasks: T33.3, T33.4 and T33.5.

List of meetings (attendance funded through the project)

None.

Lessons Learnt and Links Built

The delay in the delivery of Deliverable 33.1 has highlighted the need to budget more time in future for revisions, alterations and unforeseen delays in acquiring and disseminating materials.

Owing to a shared focus on user needs WP33 has built links with WP12. In the next 12 months we intend to forge links with WP31, WP32 and WP42.

WP41 – Climate information and decision making processes

Key Points/Significant Results:

- WP41 does not formally start until November 2014 (month 25);
- Dedicated meetings with stakeholders have started;
- An internal document 'The Placebo Concept: Evaluation of the impact of climate information on Decision Making Processes (DMPs)' was written;
- General barriers to the use of seasonal forecasts in DMPs have been discussed amongst the partners.

Executive Summary

Several preparatory activities have started. At the General Assembly in October 2013, an outline of the work package was presented and concepts discussed. Since this event, discussions have taken place, taking advantage of other work package events (i.e. WP41 meeting held at the end of the WP42/43 kick-off meeting). Some useful documents for the initiation of the work have also been created and circulated amongst key partners. The kick-off meeting for this work package will be at the October 2014 General Assembly.

Work package objectives

To assess the climate and non-climate related options available to decision makers; To assess the value of Climate Information within the Decision Making Processes (DMP); To assess the impact of S2D forecasts developed in Research Theme 2 onto DMPs.

Summary of progress towards objectives

Task 41.1: Choose the decision making chains to be evaluated and the corresponding reference strategies. Choose the economic model(s) and knowledge systems relevant to the selected decision making chain(s). Understand the inherent risks (climate and non-climate) of the decision processes identified.

Meteo-France held a dedicated meeting with its stakeholders (Adour-Garonne river basin agency, DREAL Midi-Pyrenees, EDF, ETB Seine Grands Lac, DGLAN and ASEN) in order to clarify and understand their decision making chain and the different options available for making decisions. An internal report will be made available to the partners.

The WP41 partners have been evaluating the needs of their stakeholders and the associated decision making processes through their interactions under WP12. This knowledge will form the basis for further analysis, within this work package, of the decision processes in the context of a chain of actions that lead to a final outcome.

Task 41.2: Assess the different impacts and risk management strategies throughout the DMPs over S2D timescales, especially (but not exclusively) their possible use as an adaptive strategy, and with respect to the updates of information over time.

The foundation for risk management strategy information will again come from WP12. Examples of where past climatological information is used to project future climate for decision making will be explored further, to demonstrate where S2D forecasts could improve on existing climate-input methodologies for decision making. In addition, new applications of S2D forecast information will be explored.

Task 41.3: Define a methodology to evaluate the DMPs that are affected by climate for key stakeholders in specific sectors

Meteo-France prepared an internal document on a possible method (called the Placebo protocol) to be used in this work package for the evaluation of the impact of the use of the provided climate information onto the DMPs.

Task 41.4: Evaluate the relative weight of climate information on the relevant DMP

Some general barriers to the use of seasonal forecasts in DMPs have been discussed with project partners. These include the user's ability to interpret and make a decision based on (a) probabilistic information, as opposed to deterministic information; and (b) forecast skill scores (especially low ones). It is proposed that these points are investigated in this work package.

Task 41.5: Define standardised protocol(s) for evaluating DMPs and prepare a (preliminary) guidance document

This task will build upon the knowledge gained from the previous tasks described above.

Task 41.6: Review the WMO RA VI RCC (Regional Climate Centre) network information and its relevance to the DMP of various stakeholders. Especially, the climate knowledge data base of hazards (already built up with the RA VI RCC) will be used and the Climate Watch system (early warning of upcoming climate events – in development with the RA VI RCC network) as well. The information input will be taken from WP11, Task 11.3

This task will build upon knowledge gained from Deliverable 11.3, which is due in month 36.

Reasons for deviations from DoW and failing to achieve critical objectives

No major deviations are envisaged at this stage.

Statement on the use of resources

No changes to the planned use of resources is known.

List of meetings (attendance funded through the project)

Jun and Jul 2013, Stakeholder meetings held by Meteo-France, listed in WP22, were of benefit to this work package

List of publications, including peer-reviewed articles

Internal document to the project: 'The Placebo Concept: Evaluation of the impact of climate information on DMPs'.

Lessons Learnt and Links Built

Links are already starting to be built with WP12 and WP42 to ensure that WP41 builds upon, and addresses, their identified research areas.

Links with FP7 SPECS are also being made, especially in relation to SPECS WP61 'Pilot applications', which includes a wind energy end-user. Information about their, and their client's, use of climate data for the decision making process is being explored in SPECS, and will be further assessed in this WP41.

Key Points/Significant Results:

- Through an open consultation amongst all of the partners, a set of criteria for the selection of the prototypes was agreed;
- An external set of independent experts helped the project select the most 'promising' prototypes;
- Five (plus one) prototypes were selected from the 12 applications;
- Work is currently underway to develop these prototypes, in close interaction with the end users.

Executive summary

Although WP42 only formally started in January 2014, some important activities have already taken place. One of the main tasks has been in defining the criteria for the selection of the prototypes (joint milestone with WP3). This important step was followed by the selection of the 5+1[1] prototypes that will be developed by the project and by a meeting which kicked-off the prototype development. The work package is now well underway: weekly interactions occur within each prototype while monthly meetings ensure that there is good coordination across prototypes and the associated work packages.

Work package objectives

To develop a set of experimental semi-operational prototypes of climate impact predictions operating on a seasonal or decadal time scale.

Summary of progress towards objectives

The principles for prototype selection identified during the 2013 General Assembly were then documented and circulated amongst the EUPORIAS partners. Once the document was finalised it was passed to an external panel of experts. The experts scored each of the 12 proposals that had been submitted by partners based on the selection criteria, and recommended the five prototypes to subsequently develop. These recommendations were scrutinised by the general assembly who were then asked to decide whether to accept the recommendations or not. The unanimous vote in favour of the suggested selection indicates that no major concerns were identified by the partners.

Task 42.1: Identify and agree a clear set of criteria for case study selection

Whist the work package activities formally started in January 2014, we used the October 2013 General Assembly to start the discussion on the selection criteria. Most partners took part to the lively debate that we had. This helped us in identifying the guiding principles for the selection. Whilst a number of aspects have been included (the full document is available on the wiki) two principles were considered of a particular importance:

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[1] The sixth prototype (lead SMHI) will be funded externally to EUPORIAS, but be developed alongside the five EUPORIAS-funded prototypes.

1) The identification of at least one decision of one specific stakeholder that the prototype aims to address; and

2) An assessment of the overall expected value of the prototype to the stakeholder (a combination of skill and exposure).

Task 42.2: Design a prototype for climate watch

No concrete progress has been made. However, there have been some preliminary discussions between, and within, the Met Office and DWD on how to best setup a prototype for a climate watch (an early warning system).

Task 42.3: Investigate the feasibility of implementing a new operational Hydropower Climate Service prototype

SMHI has worked very closely with one of the project's stakeholders ELFORSK AB (Swedish Energy R&D Organisation) and decided to pursue the development of a prototype for the water/energy sector. Whist such a prototype was one of those selected by the project the level of commitment from the stakeholder was so strong that they decided to fund the prototype independently from EUPORIAS

Task 42.4: Selection of prototypes

Having decided on the selection criteria the work package identified a panel of independent experts who could help the project select the most promising prototypes. The experts selected were: Dr Steve Zebiak (IRI, Columbia University, USA), Dr Roger Street (UKCIP, UK) and Prof Roger Stone (University of Southern Queensland, Australia). Each of them was given a scoring matrix and set of rules on how to score the prototypes. EUPORIAS picked the highest scoring prototypes in the ranked list. The ranking was a result of taking the averaging of the inputs from the three experts. Whist there were significant differences among the experts in the exact score of each prototype, the overall ranking was very similar among the three.

The prototypes that have been selected through this procedure are:

Winter conditions for UK Transport (Prototype lead, Met Office; Contributors, UC, Predictia, KNMI)

Objective: To assess the potential skill for transport impacts forecasts using GloSea5 and UK transport data

Stakeholder: UK Dept for Transport (https://www.gov.uk/government/organisations/department-for-transport)

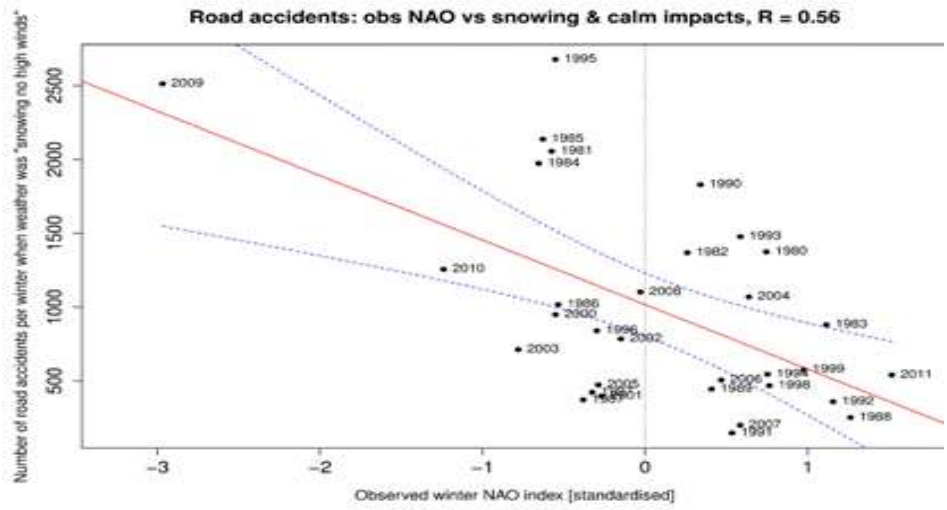

Figure 21: Road accidents (not related to wind) as a function of observed NAO index for different years

As recent years have demonstrated, wintry conditions have a significant impact on most forms of transport in the UK and Northern Europe. Airport closures, road accidents and delays/cancellations of train services are just some examples of the possible consequences of widespread snowfall over the British Isles. Recently it has been discovered that skilful predictions can be made of the likelihood of occurrence of cold air outbreaks in winter, at lead times of weeks to months. The Met Office engaged with a transport stakeholder group coordinated by the UK Government's Department for Transport (DfT) about the predictability of winter conditions at seasonal timescales, and hence the possibility of providing risk-based forecasts to transport stakeholders to enhance their winter preparedness and resilience. Stakeholder decisions which could be supported by these forecasts include those related to winter resilience and planning. This prototype will interact with UK transport stakeholders, to develop a method for optimal communication of risk-based forecasts to the UK's main transport stakeholder group (as coordinated by DfT), and subsequent provision and evaluation of these forecasts.

Resilience (Prototype lead, IC3; Contributors, EDF)

Objective: To provide monthly to seasonal probabilistic climate forecasts for safe and efficient energy management

Stakeholders: Energy producers (e.g. EDF, www.edf.com), grid operators (e.g. REE, www.ree.es), renewable energy operators (e.g. EDP,www.edp.com), energy investors (e.g. Iberdrola, www.iberdrola.com), energy insurers (e.g. Munich RE, www.munichre.com)

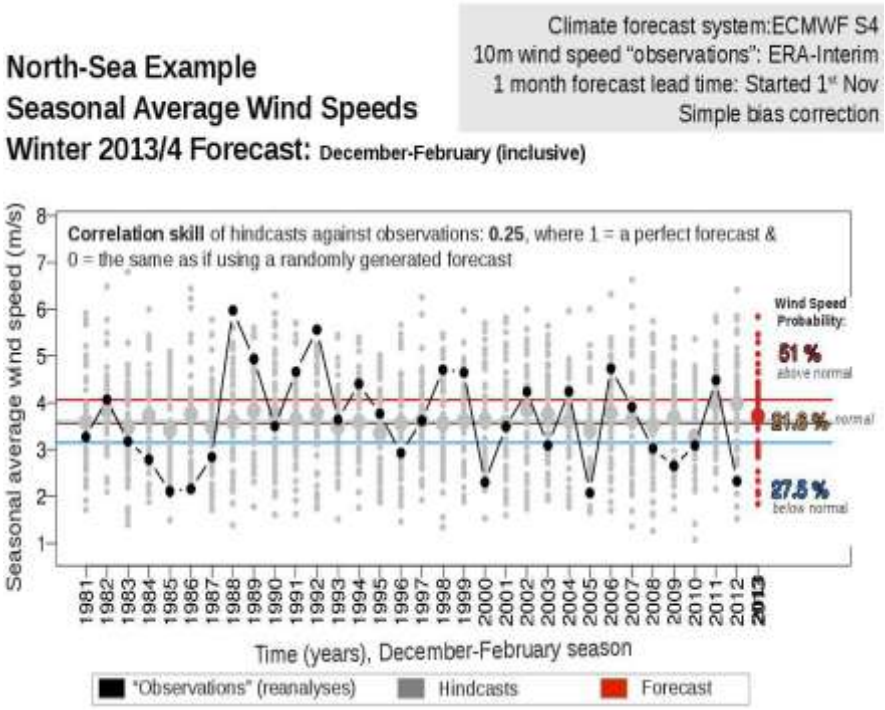

Figure 22: Seasonal prediction hindcast ensemble (grey) compared to observation of seasonal mean wind speed for the North Sea in winter, plus forecast (red)

The primary aim of the RESILIENCE prototype is to secure the provision of energy to society. It will facilitate important decisions related to the operations, planning and adaptation of energy systems, by providing robust knowledge of the future variability in energy supply and demand. Probabilistic forecasting of climate components that have a large affect on the energy system will be the focus. For example, energy demand linked to temperature and energy supply to wind, hydro and solar power generation will be explored. Geographical regions where the monthly to seasonal variability of such meteorological variables can be skilfully forecast will be evaluated, and quasi-operational forecasts will be effectively communicated to end users. The outcome will lead to a safer, more efficient and therefore cost-effective operation of the energy system, from the EU power network scale to individual renewable energy power plants.

Land management tool (prototype lead: Met Office; Contributors, UC, KNMI, UL-IDL)

Objective: Enable land managers to make more weather-resilient decisions.

Stakeholder: Clinton Devon Estates *www.**clintondevon**.com*

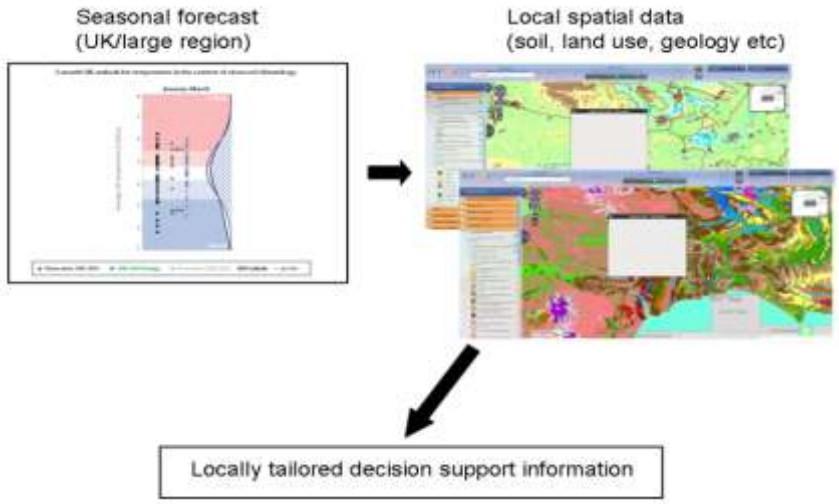

Figure 23: Draft schematic of components of the land management tool

Clinton Devon Estates (CDE) is a major regional land owner in the South-West UK, with responsibility for 25,000 acres of land. Its areas of business cover farming, sustainable forestry, conservation management, deer management, commercial and residential property and businesses (including the region's premier equestrian venue). CDE's decision making depends critically on-land and weather conditions, covering timescales from hours to decades. The aim is to develop a specific working tool for one application which can later be extended to other uses, while also serving as a blueprint for a weather-decision making tool for land managers and farmers in general. The specific decision is cover crop planting. A cover crop is a crop planted primarily to manage soil fertility, carbon storage, soil quality, water, weeds, pests, diseases, biodiversity and wildlife. Advance knowledge of a very wet winter would enable the farm manager to choose an appropriate summer/autumn sown cover crop which will protect soils that would otherwise be left bare and susceptible to run-off and erosion. The farm is in a Water Framework Directive (WFD) valley catchment. This will also strongly relate to Nitrate Vulnerable Zone (NVZ) regulations, cross compliance for Single Farm Payment (SFP) in terms of Soil Protection Review, both of which look at runoff appropriate cultivations and timings of such as well as the application of fertilisers.

LEAP- Ethiopia's National Food Security Early Warning System (Prototype lead, ENEA and WFP; Contributors Met Office, Meteo-Swiss, UC, KNMI, SMHI)

Objectives: The prototype will enable the integration of seasonal weather forecasts into Ethiopia's existing national food security early warning system, known as LEAP (Livelihoods, Early Assessment and Protection), to enable earlier and more accurate estimates of the people in need of food assistance in the coming months.

Stakeholders: World Food Programme (WFP) http://www.wfp.org/disaster-risk-reduction/leap

Disaster Risk Management and Food Security Sector (DRMFSS) of the Ethiopian Ministry of Agriculture http://www.dppc.gov.et/

LEAP is the Government of Ethiopia's national food security early warning system, established with the support of WFP in 2008. LEAP uses rainfall monitoring data to estimate the number of people who will be in need of food assistance after harvest time, due to drought. By providing early and objective estimates of the expected magnitude of humanitarian needs, LEAP helps increase both the speed and transparency with which food assistance can be provided.

Currently, LEAP uses monitoring rainfall data to calculate future needs. The aim of the LEAP EUPORIAS prototype is to integrate seasonal rainfall forecasts into the calculations, which will enable the model to provide earlier and more accurate projections of beneficiary numbers. At the same time, the prototype will also allow LEAP users to view seasonal forecast as "standalone" products (i.e. not integrated in the beneficiary calculations), alongside the other agro-climatic information already provided by the LEAP tool.

River Flow Forecasts for Water Resource Management in France (Prototype lead, Meteo-France; Contributors, TEC, AEMET, DHI, DWD, CETaqua, EDF)

Objective: to provide relevant and tailored information leading to an effective decision for the water-stock management for both the refilling and low-flow periods.

Stakeholder: EPTB Seine Grands Lacs: www.**seinegrandslacs**.fr

DREAl Midi-Pyrénnées: www.**midi-pyrenees**.developpement-durable.gouv.fr

Figure 24: Example of impact of drought and flood in France

The main stakes to be managed in this prototype are related to fresh water supply, power station cooling, summer irrigation and reservoir refilling in France. The crucial decisional periods are typically May/June for the low flow period and the end of winter/beginning of spring for the reservoir refilling. These same periods are also relevant to the energy suppliers. Downscaled near surface temperature and precipitation, coming from the Meteo-France operational seasonal forecasting system will feed into the SIM suit (SVAT model at an 8-km resolution coupled with a river routing module) to produce a probabilistic forecast of river flows for specific stations along the rivers, at different lead-times. River flow forecasts will be tailored to fir specific decision making processes (e.g. critical thresholds and seasons) Through dedicated meetings, the stations and critical thresholds will be defined in liaison with stakeholders so that the forecasts could feed directly into warning system and stakeholder-specific decision-making processes (i.e. warning or crisis thresholds or near wet or dry quintile or decile).

Meteo-France has conducted a specific meeting with its own stakeholders in order to prepare the prototype development and to fully understand the nature and impact of the corresponding Decision Making Processes (DMPs). A learning phase is anticipated for this prototype which will involve both Meteo-France and its stakeholders running the DMPs with all potential available information over a limited and selected set of years proposed by the stakeholders.

Seasonal discharge multi-model forecast system (Prototype lead, SMHI)

*Objective***:** The objective of this prototype is to provide the hydropower industry with high quality discharge forecasts at the seasonal scale of to assist them in decision making and planning of operations.

*Stakeholder***:** ELFORSK (www.elforsk.se)

Figure 25: Hydropower station on the Ångerman River in northern Sweden

This prototype is a multi-model seasonal forecast system for making ensemble stream flow predictions. The system will be implemented for the Ångerman River in northern Sweden. The basin is Sweden's third largest by area, 31864 km², and the second largest by hydropower production with an average annual production of 6900 GWh. The multi-model is a system of models and data selection methods developed to make seasonal forecasts. The models are the HBV rainfall runoff model (Lindström et al 1997) and a linear regression model that uses the SVD approach (singular variable decomposition) with the aim of downscaling atmospheric variables to accumulated seasonal discharge (Bertacchi et al., 2001). The data streams are a mixture of historical observations, meteorological seasonal forecasts and satellite snow products. The multi-model system will be evaluated using cross-validated hindcasts for a 30 year period, 1982-2011, and will be tested under both simulated and operational conditions for the period 2012-2015. Lastly, the hindcasted forecast skills and associated climate data will be used to develop an index that estimates the skill of the system's forecast at forecast date, such an index is of great interest to the stakeholder.

Task 42.5: Development of a stakeholder-specific communication strategy including a way of assessing the quality of real-time forecasts

This task is designed to ensure that a suitable interface between each prototype team and its stakeholders/end users is maintained throughout the development of the prototype. The dialogue with the users must also cover the way in which the forecasts quality will be assessed, A meeting with all the partners involved in the development of the prototypes was organised in Manchester, UK on March 26/27 2014. Such a meeting was an occasion to discuss how to best develop the prototypes to ensure a close coordination (Figure 26). Initial discussions on how to communicate and visualise the findings to the end-users also took place in this event, this kicking off the activities within this task.

In order to maximise the prototype uptake by the users the way in which the information is presented and displayed in the prototype is of critical importance. EUPORIAS will embed an expert in data-visualisation in the development team of one of the prototype. Through an internal competed process the visualisation expert was assigned to the RESILIENCE prototype.

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Figure 26: One of the discussions on prototypes during the meeting in Manchester 2014

It is important that links are developed and maintained between W42 and the other work packages, especially those in RT2. The participants to the workshop discussed how to best ensure a dialogue is maintained with RT2. Some prototypes, as for example LEAP, will link directly with some of the activities with WP21. Others, such as the Land-Management tool, will link more directly to the tasks with WP23.

Tasks 42.6, 42.7 and 42.8: Run the prototypes in hindcast mode and forecast mode, and assess the usefulness and limitations of the prototypes

These tasks have not started yet.

References

Lindström, G., Johansson, B., Persson, M., Gardelin, M. & Bergström, S. (1997): Development and test of the distributed HBV-96 model. J.Hydrol. 201, 272-288.

Bertacchi Uvo, C., Olsson, J., Morita, O., Jinno, K., Kawamura, A., Nishiyama, K., Koreeda, N. & Nakashima, T. (2001): Statistical atmospheric downscaling for rainfall estimation in Kyushu Island, Japan, Hydrol. Earth. System Sci., 5,259–271.

(If applicable) Reasons for deviations from DoW and failing to achieve critical objectives

The only difference between the current status of the work package and what was agreed in the DoW is in the number of prototypes. The idea was to significantly limit the overall number of prototypes to avoid developing ill-designed generic solutions for too many recipients. Instead, the plan is to focus on very specific user-focused prototypes. In the DoW such a limit was fixed at two or three. This number has been increased to five to cover most of the key sectors EUPORIAS wants to work on. It is anticipated that there is enough resource within the project budget to allow for the development of this revised number.

Statement on the use of resources

The use of resources is on schedule.

Many partners working in this work package will contribute and lead on the development of specific prototypes. However, some partners, such as MeteoSwiss, UC and DWD will provide overarching support to all the prototypes. For example, UC will provide data access and downscaling support.

List of meetings (attendance funded through the project)

23-29 Jun 2013, 2nd International Conference for Energy & Meteorology (ICEM), Toulouse France. Kean Foster (SMHI) – presentation 'Climate and hydrology – understanding the engine that powers our rivers to improve seasonal forecasts', related to seasonal hydrological forecasting for hydropower industry

11-12 Mar 2014, EWEA Conference – Wind energy Workshop with VORTEX, Barcelona Spain. Carlo Buontempo (Met Office) – Shared findings from WP12 and link with RESILIENCE (energy) prototype

Lessons Learnt and Links Built

Please refer to WP3.

WP43 – Stakeholder engagement

Key Points/Significant Results:

- The EUPORIAS public website has been developed and is actively managed and maintained as a key communication channel;
- The kick-off meeting for WP43 was held jointly with WP42. It was run as a workshop aimed at arming the partners with a series of tools to help them with the development of the prototypes.

Executive summary

Most of the tasks in this work package are scheduled for the last two years of the project. In these first 18 months, the work has been focussed on:

- The design and development of the project's public website; and
- The organisation of the joint kick-off meeting for WP42 and WP43.

Work package objectives

• To engage with EU citizens about the use of S2D data in everyday decisions;
• To demonstrate ways in which a climate service can be developed to address specific users' needs;
• To facilitate clear communication and exchange of information with stakeholder groups;
• To empowering SMEs, and allow them to develop their own climate services.

Summary of progress towards objectives

Task 43.1: Run workshops and meetings with key sector stakeholder to present the service prototypes developed in WP42

This task is scheduled for the last year of the project.

Task 43.2: Run a high visibility general workshop at the end of the project to disseminate the relevant results to stakeholders

This task is scheduled for the last year of the project,

Task 43.3: Establish an active communication channel with stakeholder groups to inform them of the project news and achievements:

In order to engage with stakeholders and EU citizens, a public website (http://www.euporias.eu) has been developed. This website (Figure 27) has been designed following the best practice guidelines for EU project websites.

The website contains information about the project structure (work packages, partners, stakeholders, deliverables...), publications, news, integration with social networks and a glossary of terms to facilitate the comprehension of S2D data. This glossary has been developed in collaboration with other projects including FP7 SPECS and IS-ENES, and COST-action VALUE.

Figure 27: Home page of the EUPORIAS public website

Task 43.4: Draw upon methods from art and design to ensure uncertainty and confidence is communicated in an imaginative and tangible way

A kick-off meeting for WP42 and WP43 was organised in Manchester, UK in March 2014. This workshop focussed on the prototype development strategy and included a series of presentations and activities around innovative ways of communicating and visualising information and uncertainty. The Agile methodology was introduced with encouragement to adopt this methodology when progressing some of the development activites. Agile development is a method based on iterative and incremental development in which requirements and solutions evolve through collaboration between cross-functional teams.

Task 43.5: Develop feedback mechanisms from stakeholder to forecast producers

This task is scheduled for the last two years of the project.

Task 43.6: Develop a mobile phone application associated to one of the prototypes developed in WP42

This task is scheduled for the last year of the project.

Reasons for deviations from DoW and failing to achieve critical objectives

There have been no deviations from the DoW.

Statement on the use of resources

The Met Office, Predictia and FutureEverything have contributed to WP43.

List of meetings (attendance funded through the project)

None.

Lessons learnt and links built

There has been collaboration with WP42 for the organisation of the joint kick-off meeting in Manchester.

Key Points/Significant Results:

- WP44 does not formally start until August 2014 (month 21);
- WP44 work package leader (KNMI) attended the WP42/WP43 kick-off meeting as a step towards ensuring that the activities within this work package are aligned with, and directly benefit, the development of the climate service prototypes.

Executive summary

The work package leader (KNMI) attended the WP42 kick-off meeting in order to ensure that WP44 contributes to the development of the prototypes and designs appropriate tools to deliver the associated climate services.

Work package objectives

To identify, develop and maintain an interface which will allow an effective delivery of the climate services developed in WP42 to both the general public and the relevant decision-makers. In this manner, EUPORIAS goes beyond merely improving the reliability of the underlying prediction systems to enhancing the usability of these forecasts in practical applications.

Summary of progress towards objectives

This work package does not formally start until August 2014. However, in order to ensure that WP44 activities and plans are aligned with the development of the prototypes, and where possible contribute to their development and dissemination, the work package leader (KNMI) has joined all work package leader teleconferences and attended the WP42/WP43 kick-off meeting.

Task 44.1: Inventory of existing climate data portals and tools

This task has not yet started.

Task 44.2: Climate Service Architecture development and improvements

The work package leader (KNMI) joined the WP42/WP43 kick-off workshop to understand how WP44 will contribute and work with the prototype development activities.

Task 44.3: Service delivery and operation

This task has not yet started.

Task 44.4: Web interface for end users of the EUPORIAS service prototypes

This task has not yet started.

Task 44.5: Generation and dissemination of easy accessible services

This task has not yet started.

List of meetings (attendance funded through the project)

7-12 Apr 2013, EGU General Assembly, Vienna Austria. Wim Som de Cerff (KNMI) – Presented at 'Climate Services' side event, 'Stakeholder engagement through the EUPORIAS project'

Key Points/Significant Results:

- WP45 does not formally start until November 2015 (month 36);
- Results of a literature review indicate that work of the Cost-Matrix from IRI, Columbia University and the weather roulette (Hagedorn) are well adapted to use in EUPORIAS;
- Stakeholders have already highlighted the importance of cost-benefit assessments to validate the usefulness of applying seasonal predictions in decision making.

Executive summary

This work package will start in month 36. Some preparatory work has been performed, including discussions at the October 2013 General Assembly, the recompilation of documents of interest, and discussions with project stakeholders in the first EUPORIAS Stakeholder Meeting and the water sector workshop.

Work package objectives

This work package will assess whether a market for climate services in Europe exists and whether this can be effectively and efficiently used by SMEs and other relevant stakeholders. A general methodology will be developed and it will be applied to specific key sectors to check the economic viability of climate service prototypes produced in WP42 of this project.

Summary of progress towards objectives

Task 45.1: Methodology to assess business opportunities of the climate services developed

The expected characteristics of the selected prototypes have been detailed in the descriptions of the prototypes (WP42) which are held on the project intranet. So some information is already available on the value of the chosen prototypes:

- Evidence of how the prototype can inform stakeholders decision-making process;
- Strategy for assessing the impact of the prototype on the decision made;
- Likelihood of generating other prototypes on the back of the proposed one;
- Likelihood of duplication and exportation of the prototype to other regions and sectors; and
- Likelihood that the prototype would have a life after the end of the project.

Literature has been reviewed specific to understanding the use of probabilistic information in decision making. Results of this review indicate that the work on the Cost-Matrix from the IRI (Brown et al., 2010) (Figure 28) and the weather roulette from Hagedorn (2008) are very well adapted to the EUPORIAS project.

Allocation Scheme	Costs or Benefits in Present Period (OND) for each Allocation Scheme			Costs in Future Period (JFM)					
				ABOVE NORMAL INFLOW		NORMAL INFLOW		BELOW NORMAL INFLOW	
	Municipal	Irrigation	Hydropower	Municipal	Irrigation	Municipal	Irrigation	Municipal	Irrigation
1: Normal releases for municipal and agriculture, no hydropower generation	*Baseline*				Spill floods fields ($0.5 million)	*Baseline*		Severe water rationing ($2 million)	Reduced planting ($1.5 million)
2: Normal releases for muncipal and agriculture, allow for hydropower generation			Hydro generation ($2 million in revenue)			Water rationing ($0.5 million)	Reduced irrigation ($0.5 million)	Severe water rationing ($2.5 million)	Reduced planting ($1.5 million)
3: Reduce releases for agriculture, maintain municipal, no hydropower	Political pressure from farmers (approx. $0.5 million)	Reduced irrigation ($0.5 million)		Political pressure from farmers ($0.5 million)	Spill floods fields ($0.5 million)	Political pressure from farmers ($0.25 million)		Water rationing ($0.5 million)	Reduced irrigation ($0.5 million)

LEGEND
Costs incurred when below the lower rule curve
Cost incurred not related to the rule curve
Benefit
Same as baseline

Figure 28: Example of the IRI cost matrix (Brown et al., 2010) – reduced version of full figure

Task 45.2: Application of the methodology to key sectors

During the water-sector specific workshop organised by AEMET, CETaqua and the Met Office (Madrid, March 2014), the stakeholders highlighted the importance of having cost-benefit assessments to validate the usefulness of applying seasonal predictions in decision making. A few reference studies were mentioned (WATER CHANGE project from CETaqua, Flood economic assessment in EBRO River Basin, etc).

References

Brown, C., K. M. Baroang, E. Conrad, B. Lyon, D. Watkins, F. Fiondella, Y. Kaheil, A. Robertson, J. Rodriguez, M. Sheremata and M. N. Ward, 2010. Managing Climate Risk in Water Supply Systems. IRI Technical Report 10-15, International Research Institute for Climate and Society, Palisades, NY, 133pp.

Hagedorn, Renate and Smith, Leonard A. 2009. Communicating the value of probabilistic forecasts with Weather Roulette. Meteorological Applications, 16 (2). pp. 143-155. ISSN 1350-4827

List of meetings (attendance funded through the project)

None.

Lessons Learnt and Links Built

The evaluation of the business opportunities and the benefits in using climate services are the first priorities of the project stakeholders.

Coordination with the other work packages within RT4 (especially) WP42 is absolutely necessary.

3. Project management during the period

3.1. Consortium management tasks and achievements

The legal, financial and administrative management of EUPORIAS is carried out by the EUPORIAS project office set up at the Met Office. The responsibilities of the project office are laid out in the Consortium Agreement. Main consortium management tasks carried out this period are:

- Organising (with NACLIM and SPECS) a joint project kick-off meeting;
- Organising the annual 2013 General Assembly;
- Organising Management Board meetings (either via teleconference or co-incident with General Assembly);
- Develop and maintain an updated dissemination plan (Deliverable 4.2) and upload the dissemination activities into the participant portal;
- Implementing and maintaining the e-mail lists;
- Collect and upload all publications to the participant portal;
- Handling day-to-day requests from partners and project correspondence;
- Monitor project financial progress using specifically designed templates for data gathering;
- Handling, and designing, of confidentiality principles associated with the interviews with the stakeholders, ensuring alignment with Intellectual Property clauses in Consortium Agreement.

Consideration of gender aspects

The following statistics have been collected regarding the balance between men and woman working on the EUPORIAS project:

Table 6: Number of males and females working on EUPORIAS

	Male	Female	Total
No of people participating	71 (60%)	48 (40%)	119
No of work package leaders	17 (77%)	5 (23%)	22
No of Principal Investigators (PIs)	21 (78%)	6 (22%)	27

Many of the partners have gender action plans at the institutional level. During the second reporting period partners will be encouraged to engage with the activities within these plans.

Advisory Board

The members of the Advisory Board were agreed before the project started. They are Dr Steve Zebiak (International Research Institute, Columbia University, USA) and Filipe Lucio (WMO, Switzerland). Both have been kept informed as to the progress of the project. Dr Zebiak attended the

General Assembly in October 2013, and provided a comprehensive review of the project and its progress and direction, plus a set of recommendations that the project has adopted. Dr Zebiak was one of the three independent experts on the review panel for the selection of recommended prototypes.

3.2. Problems that have occurred and how they were solved or envisaged solutions

No major problems have occurred.

3.3. Changes in the consortium

There have been no formal amendments to the Grant Agreement and no changes in the composition of the consortium or to the contractual documents of the project.

SMHI's principal investigator (PI) Dr Colin Jones left SMHI in 2013. Colin was been replaced as EUPORIAS PI by Professor Lars Barring, with Dr Grigory Nikulin taking over the leadership of WP21. The Met Office changed the work package leader for WP23 from Dr Jemma Gornall to Dr Pete Falloon in November 2013. Laurent Pouget (CETaqua) has replaced Angels Cabello as work package leader of WP45.

The Met Office, IC3, SMHI and WFP have changed their authorised representatives.

These changes have been communicated to the European Commission.

An error has been identified with regard to the indirect cost method (ICM) of WFP that was declared in the EUPORIAS Grant Agreement. A current request to rectify this change has been made to the EC.

Once the project had started, it became obvious that FutureEverything (partner 22) had technical, visualisation and communication expertise that had not been properly exploited in the DoW. Therefore, additional funds were transferred from the Met Office to undertake additional responsibilities and activities primarily within WP4, WP11, WP43 and WP44. These include managing the project brand and website design, designing and contributing to the user experience of the first stakeholder workshop in Rome, and creating methods to convey uncertainty through visualisation that will be drawn on during the development of the prototypes. This has been approved by the general assembly of partners and the EC project officer.

3.4. List of project meetings, dates and venues

During the first reporting period, the following meetings organised by the EUPORIAS project, were held:

Table 7.1: Full project meetings

Date	Meeting Title	Venue
6-9 November 2012	Project kick-off meeting (First General Assembly)	Barcelona, Spain
6th pm, 8 November 2012	ECOMS kick-off meeting	Barcelona, Spain
1-3 October 2013	Second General Assembly	Norrköping (SMHI), Sweden
23 May 2013	Management Board meeting	WebEx

Table 7.2: Work package meetings

Work Package	Meeting	Date	Venue
WP2, T2.2	(MS1) first ECOMS Board meeting to discuss priorities for European S2D	4-5 March 2013	Exeter (Met Office), UK

	climate service activities		
WP2, T2.1	SPECS-EUPORIAS coordination meeting	10-11 December 2012	Exeter (Met Office), UK
WP2	SPECS General Assembly	15-17 October 2013	De Bilt (KNMI), The Netherlands
WP3	Coordination of social sciences work package (WP12,33,41) and natural science WPs (WP23,31,32) (UNIVLEEDS, Met Office, FutureEverything)	12-13 December 2012	Leeds (UNIVLEEDS), UK
WP3	Coordination with UC and their involvement in project, including data availability	19 June 2013	Santander, Spain
WP3	Coordination with KNMI and their involvement in project including glossary of terms	11 July 2013	De Bilt (KNMI), The Netherlands
WP3	Coordination with Meteo-France including model availability	25 September 2013	Toulouse (Meteo-France), France
WP3	Coordination with IPMA and UL-IDL and their involvement in project	21 November 2013	Lisbon, Portugal
WP12, T12.3	To discuss interviews with experts (post workshop with European Climate Service providers)	15 March 2013	De Bilt (KNMI), The Netherlands
WP12, T12.3	Webinar regarding interviews with experts (guidance and training on interviews)	15 May 2013	Online Webinar
WP12, T12.5	To discuss development of the surveys	23 January 2014	Online Webinar
WP21, T21.2	East Africa meeting: dynamical downscaling (coincident with Euro-CORDEX meeting)	9 January 2013	Hamburg (DWD), Germany
WP22, T22.2	Focus on choosing CIIs and prepare for D22.1 “Maps of preliminary CIIs for seasonal forecasts and hindcasts”	2-3 February 2014	Zurich (Meteo-Swiss), Switzerland
WP23	Planning conference	4 April 2013	Teleconference
WP23, T23.2; WP31	Workshop on initialisation of impact models for seasonal prediction	5 June 2013	Exeter (Met Office), UK [some partners telephoned in for afternoon session]
WP32	Workshop SPECS/EUPORIAS – verification of seasonal forecasts	13 November 2013	Barcelona, Spain
WP32, T32.1	UC-AEMET activity coordination meeting	1 April 2014	Santander, Spain
WP33, T33.1 & T33.2	Discussion around T33.1 and T33.2	29 July 2013	Teleconference
WP33	Workshop on ‘uncertainty’ (Met Office, UNIVLEEDS, FutureEverything)	28 November 2013	Manchester, UK
WP33, T33.3	Discussion around T33.3	31 March 2014	WebEx
WP42 & WP43	Kick-off meeting: including beginning of prototype development	26-27 March 2014	Manchester, UK
WP44, T44.2	Attended WP42 kick-off meeting as supporting the development of the prototypes will contribute to the goals of WP44	26-27 March 2014	Manchester, UK
WP1, T1.1	Project management meeting with FE and UNIVLEEDS (in parallel with science meeting)	12-13 December 2012	Leeds, UK
WP1, T1.1	Project management meeting with FutureEverything	15 January 2013	Manchester, UK

Note: All work packages held work package meetings at the two General Assemblies. These are not explicitly listed in the table above

Table 7.3: Stakeholder and climate provider workshops organised by the project

Date	Meeting Title	Venue
22-23 January 2013	First Stakeholder Conference (WP11)	Rome (ENEA), Italy
15 March 2013	European climate services providers' workshop (WP12)	De Bilt (KNMI), The Netherlands
18 March 2014	Water sector stakeholder workshop (CETaqua, AEMET, Met Office)	Madrid, Spain
23 January 2013	Internal stakeholder task team meeting (after stakeholder conference)	Rome (ENEA), Italy
15 March 2013	Internal stakeholder task team meeting (after climate service providers' workshop)	De Bilt (KNMI), The Netherlands

Note: there have been many meetings between partners and their stakeholders, including conducting the interviews in WP12. These are not necessarily listed in the tables here

All other meetings, conferences and workshops (not organised by EUPORIAS) attended by partners through funding from EUPORIAS are listed within each associated work package. Many partners carried out outreach and promotional activities (such as formally presenting EUPORIAS at conferences) using funds from other sources. These activities are listed in the dissemination table through the Participant's Portal.

3.5. Project planning and status

During the early months, mechanisms were agreed and implemented in order for the coordination team/project office to review and monitor the financial and scientific progress of EUPORIAS. These include rigorously challenging any requests to delay deliverables and milestones, and a review process before the submission of deliverable reports. Six monthly financial updates are required from each partner in order to monitor how partners are spending the project funds compared to the budgets they provided at the project start. Financial templates were issued by the project office to ensure the detail of information gathered is consistent. Details include the number of people working on the project, travel activities etc.

Quarterly progress reports are written by the project office. These provide summaries of the latest status of each work package, along with the submitted deliverables, key meetings and conferences attended, submitted and published papers and publications, any management information, and a forward look of key project activities and upcoming events.

The Management Board has formally met once so far, and this meeting was held in May 2013 via Webex. There have been no major issues to discuss, therefore no meeting has been held since then. Major decisions, such as agreeing the prototypes to be developed, have been made by the full general assembly.

Looking ahead, the following significant activites and meetings are planned for the next few months:

- Annual General Assembly at Meteo-France, Toulouse France, 20-22 October 2014 – with 22nd being a joint meeting with FP7 SPECS;
- Hands-on training workshop on seasonal forecasting: data access, bias correction and downscaling – run by UC, Santander Spain, 8-12 September 2014 - Although run through SPECS, this workshop is designed for the stakeholders and impacts communities of the ECOMS projects. It includes training in the use of tools use as the ECOMS-UDG;

- Workshop on provider-user interaction which will focus on bridging the gap between users and providers of climate services – Autumn 2014 – invitation only;

- WP12 completes its activities in the autumn 2014 – culminating in a report summarising the users' needs for S2D predictions based on all activities within the work package, and a subsequent workshop with S2D climate prediction developers;

3.6. Impact of possible deviations from the planned milestones and deliverables

Although a number of deliverables and milestones have been delayed, there is no detrimental or significant impact on the project and its progress. The reasons for these delays are described in the work package reports. The list of deliverables submitted during this period is provided here (with links to the publically available deliverable reports).

In the DoW, the plan was to run a series of case studies (i.e. mock-ups), and use these to inform the selection of the prototypes. This approach was changed as it was not practical within the time constraints and with the resources that the project has – so we used previous experience of stakeholder interaction to design a criteria for selection of the few prototypes that would be developed. Rather than abandon the original DoW plans completely, a two-tier approach was agreed with the project partners. Whenever possible and practical the prototype proposals that were not selected will be developed into sector-specific 'case studies'. These case studies will have a lower level of effort dedicated to them, and will be outreach activities, thus continuing to pursue interactions with the project stakeholders.

3.7. Change to legal status of beneficiaries

In October 2012, the EC confirmed that FutureEverything were granted SME status. The Grant Agreement had been fully executed at this time. The SME status was back-dated to 31 December 2011. The associated change in Indirect Cost Method (ICM) was made in the PDM/URF database. This did not require an amendment to the Grant Agreement.

In July 2013, the Universidade de Lisboa (which includes UL-IDL, partner 13) and Universidade Técnica de Lisboa merged into a single mega university, called Universidade de Lisboa. Fundação da Faculdade de Ciências da Universidade de Lisboa (FFCUL) is a branch of the University which manages research grants and acts as the legal front institution of multiple research units including UL-IDL. UL-IDL has made a request to the EC that the EUPORIAS project be run under FFCUL, as it has chosen to do with other R&D projects. This therefore requires a transfer of UL-IDL's PIC for this project to the FFCUL PIC.

3.8. Development of project website

The EUPORIAS public website (http://www.euporias.eu) is one of the main communication tools used by EUPORIAS as detailed in the project's dissemination plan. The layout of the website has been described in the work package 43 section. It is essential to keep the website dynamic and current. Therefore, there is a news tab which shows latest project news and results, events and meetings, a weekly digest of other climate-related news items and recent tweets.

There is a rigorous review process carried out by an agreed small number of partners before articles and summaries are uploaded onto the website to ensure consistency of messages and language. When a peer-reviewed paper is published or a deliverable report is submitted, an accompanying summary aimed at the lay person is posted on the site, as well as the report and paper itself. One of the most recent additions is a set of pages detailing the prototypes that have been chosen for development.

3.9. Information on co-ordination activities

Tools for communication within the consortium

The project partners use a restricted partner-only WIKI site (https://euporias.wikidot.com/) managed by the project office as a platform for exchanging documents and supporting information flow (Deliverable 1.1). For example, WP23 store all their meeting notes and discussions, plus descriptions of the impacts models that have been chosen. Each prototype has a page where all discussions, processes, outcomes and lessons learnt are documented in order to be of use to the other prototypes and other associated work packages. The WIKI facilitates the project management and administration as it contains financial reporting templates, tools and summaries, deliverable and milestone templates, guidelines on the use of EUPORIAS and EC logos and guidelines of the open access of journals and papers. There is also a page advertising relevant conferences, symposiums and working group meetings.

Short progress reports are written every three months in order to keep partners informed (see Section 3.5). Regular requests are made for partners to update their lists of publications and dissemination activites, and make the project office aware of any papers that are either in preparation or are under peer-review. A set of group mailing lists have been set up (i.e. one per work package), to ensure that e-mail correspondence reaches all appropriate individuals.

Co-operation within ECOMS

The ECOMS initiative was launched along with the start of the EUPORIAS, NACLIM and SPECS projects. The first ECOMS Board meeting took place in February 2013 and the conclusions of that meeting are summarised in a publically available white paper (Deliverable 2.1), which provides recommendations from ECOMS on the priorities for Horizon 2020 (specifically Societal Challenge 5) in the field of climate modelling and climate service development, underpinned by observations.

Co-operation with other projects, programme and scientific communities

Over the last 18 months EUPORIAS managed to develop several collaborations with other projects, research programmes and activities. The most obvious collaborations are those with the organisations that are part of ECOMS. Strong linkages exist with SPECS (as is testified by the joint-tasks forces, frequent joint-meetings etc.) and the previous set of climate services projects such as ECLISE and CLIM-RUN. EUPORIAS has now started to proactively engage on a scientific level with NACLIM.

Some of the concepts around users-providers interactions, which are being tested within EUPORIAS, are already influencing the design of other projects and activities which the recent ECSP meeting in Hamburg demonstrated.

Table 8: Examples of cooperation with other projects, programmes and scientific communities

Network or Programme	EUPORIAS link	EUPORIAS partner involved
ECSP	Co-chair	Chris Hewitt (Met Office)
FP7 HELIX	Member of the stakeholder board	Carlo Buontempo (Met Office)
FP7 SPECS	Member of the joint task-team on data management and ECOMS-UDG	Carlo Buontempo (Met Office), Antonio Cofino (UC)
COPERNICUS	Member of expert team	Chris Hewitt (Met Office), Lars Bärring (SMHI)
COST-Action VALUE	Input into the controlled vocabulary and the glossary	Carlo Buontempo (Met Office)

CSP	Member of coordinating group	Chris Hewitt (Met Office)
WMO GFCS	Lead writer	Chris Hewitt (Met Office)

3.10. Statement on the use of management resources

The Met Office has not used as much resource as originally planned for its project office. This is partly because time for a project administrator was budgeted for. This administrator role has not been necessary. The under-utilisation of budget has released time for the project office to provide extra support for the ECOMS and dissemination and outreach activities. Also a small amount of budget has been transferred to FutureEverything.

Appendix 1 – Summary of effort for each work package

The following suite of tables summarise the number of person months spent by each partner on each work package during this project period.

These tables have been removed for the purposes of this version.

Appendix 2 – Publications

The following tables summarise the publications that have been generated as a result of the project.

Table A2.1: Peer reviewed publications

D.O.I.	Title	Author(s)	Title of Periodical or Series	Number, date or frequency	Publisher	Date of Publication	Relevant Pages	Open Access
10.1002/2013 EOI110002	Using climate predictions to better service society's needs	Hewitt, C., Buontempo C., Newton, P.	EOS	Vol 94, Issue 11	American Geophysical Union	12/03/2013	105-107	No
10.1146/annurev-environ-022112-112828	Actionable knowledge for environmental decision making: broadening the usability of climate science	Christine, J. Kirchhoff, Maria Carmen Lemos, Suraje Dessai	Annual review of environment and resources	Vol 38, Issue 1	Annual Reviews Inc.	17/10/2013	393-414	
10.4172/2329-6755.1000e111	Assessing skill for impacts in seasonal to decadal climate forecasts	Pete Falloon, David Faraday	Journal of Geology and Geosciences	Vol 2, Issue 3	OMICS Publishing Group	27/07/2013	N/A	Yes
10.1002/2013 JDO20680	Validation of forty-year multi-model seasonal precipitation forecasts: the role of ENSO on the global skill	R Manzanas, M.D. Frías, A.S. Cofiño, J.M. Gutiérrez	Journal of Geophysical Research: Atmospheres	N/A	American Geophysical Union	01/01/2014	N/A	
10.1002/wcc.290	Climate services for society: origins, institutional arrangements, and design elements for an	Catherine Vaughan, Suraje Dessai	WIRES Climate Change	2014	John Wiley and Sons Inc.	01/05/2014	N/A	

	evaluation framework							
10.3390/ijerph 110504555	Climate services to improve public health	Jancloes, M., Thomson, M., Máñez Costa, M., Hewitt, C., Corvalan, C., Dinku, T., Lowe, R., Hayden, M.	International Journal of Environmental Research & Public Health	Vol 11, Issue 5	IJERPH	25/04/2014	4555-4550	Yes
	Dengue outlook for the World Cup in Brazil: an early warning model framework driven by real time seasonal climate forecasts	Lowe, R., Barcellos, C., Coelho C. A.S., Bailey T.C., Coel E.G., Jupp T., Graham R., Massa Ramalgo W., Sá Carvalho M., Stephenson D. B., Rodó, X.	The Lancet Infectious Diseases	Vol 14, No 7	Elsevier	Although not published until July 2014, submitted and approved for publication in first reporting period	619-626	Yes

Table A2.2: Article/Section in an edited book or book series

D.O.I.	Title	Author(s)	Title Book (Series)	Volume	Publisher	Date of Publication	Relevant Pages	Open Access
	Energy and climate action: Improving European society's resilience to climatic variations	Hewitt, C., Buontempo C., Newton, P.	Pan European Networks - Government	May 2013, Issue 6	Pan European Networks	23/05/2013	236-237	No

Table A2.3: University Publication/Scientific Monograph

D.O.I.	Title	Author(s)	Title of Periodical or Series	Volume	Publisher	Date of Publication	Relevant Pages	Open Access
	On the use of seasonal to decadal predictions for decision-making in Europe	Soares, M.B., Dessai, S.	Sustainability Research Institute Papers	No 62	University of Leeds	01/05/2014	N/A	Yes

Table A2.4: Paper in Proceedings of a Conference/Workshop

Title	Author(s)	Proceedings	Date of Publication	Publisher	Start and End Dates of Conference/Workshop	Open Access
Using climate information to understand the spatio-temporal heterogeneity of a chikungunya outbreak in the presence of widespread asymptomatic infection	Dommar, C., Lowe, R., Robinson1, M., Rodó, X.	American Geophysical Union Fall Meeting 2013	09/12/2013	American Geophysical Union	01/05/2014 – 13/12/2013	Yes
Rainfall runoff model for prediction of waterborne viral contamination in a small river catchment	Gelati, E., Dommar, C., Lowe, R., Polcher, J., Rodó, X.	American Geophysical Union Fall Meeting 2013	09/12/2013	American Geophysical Union	01/05/2014 – 13/12/2013	Yes
A novel visualisation tool for climate services: a case study of temperature extremes and human mortality in Europe	Lowe, R., Ballester, J., Robine, J., Hermann, F.R., Jupp, T.E., Stephenson, D.B., Rodó, X.	American Geophysical Union Fall Meeting 2013	09/12/2013	American Geophysical Union	01/05/2014 – 13/12/2013	Yes
Environmental and socio-economic change in Thailand: quantifying	Rodó, X., Lowe, R., Karczewska-Gilbert, A.,	American Geophysical Union Fall	09/12/2013	American Geophysical Union	01/05/2014 – 13/12/2013	Yes

spacio-temporal risk factors of dengue to inform decision making	Cazelles, B.	Meeting 2013				
The visualisation and communication of probabilistic climate forecasts to renewable energy policy makers	Doblas-Reyes, F., Steffen, S., Lowe, R., Davis, M., Rodó, X.	American Geophysical Union Fall Meeting 2013	09/12/2013	American Geophysical Union	01/05/2014 – 13/12/2013	Yes