Operational Climate Prediction Workshop 2

Lessons learnt from the Euporias project

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WORLD METEOROLOGICAL ORGANIZATION

OCP-2 - Barcelona
30 May -1 June 2018

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

- 9 Met Services, 5 Universities and 2 Research Instituts, 2 International Organisations, 6 Private Companies or Consultancy Offices,

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Objectives : 6 main objectives

1. **To develop and provide** a (reliable and secured) **impact prediction systems** for a small number of case studies (carefully selected). Testing and demonstrating Climate Services providing information from the climate side up to the impacts for decision makers operating on the S2D scales (RT4).
2. **To assess and document the lack of knowledge and the current vulnerabilities** of key sectors (e.g. water, energy, health, transport, agriculture, tourism), the specific users'needs in these area through a close collaboration with a stakeholder groups representing the key sectors. (RT 1).
3. **To develop a set of tools** tailored to the needs of stakeholders for downscaling and tailoring the climate information in order to provide specific impact predictions onto the S2D scales (RT2 et RT4).

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Objectives :

4. **To develop parameter transformation technics** of output of forecasting suites (especially from GPCs - Met Office and Meteo-France) into relevant variables directly usable to address specific users' needs (RT2).
5. **To develop a shared knowledge protocol** for promotion of the use of these new products (RT3 et RT4). This include the **uncertainty presentation and dissemination** for integration within the users' Decision System Supports allowing to take decision onto the S2D scales. This objective should contribute to an European leadership in the GFCS implementation, especially with respect of CSIS, CUIP and R&M developments.
6. **To assess and document the marketability of Climate Services** in Europe and the **value and the impact of the Climate Information** onto the Decision Making Processes (RT4).

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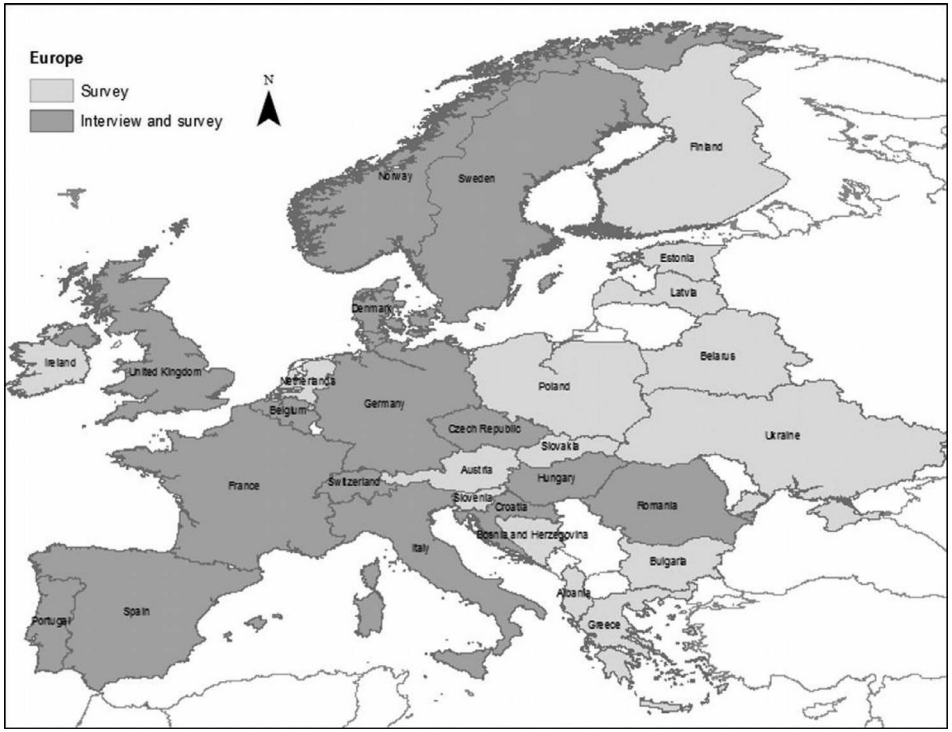
Landscape for Climate Services in Europe



- **Source of weather and climate information per type of data/information**
  - **NMHS main providers**
  - Governmental agencies and ECMWF,
  - Other sources less important
- **Frequency of use of different types of weather and climate data.**
  - **Seasonal forecast every months(but also every weeks and days)**
  - Decadal forecasts and Climate Change quite comparable (every year and more but … also some responses every days) i
- **Non use of Climate and Weather information**
  - **Information not relevant**
  - Lack of expertise to use the information
- **Handling uncertainty**
  - **Help to take a Yes/No decision**

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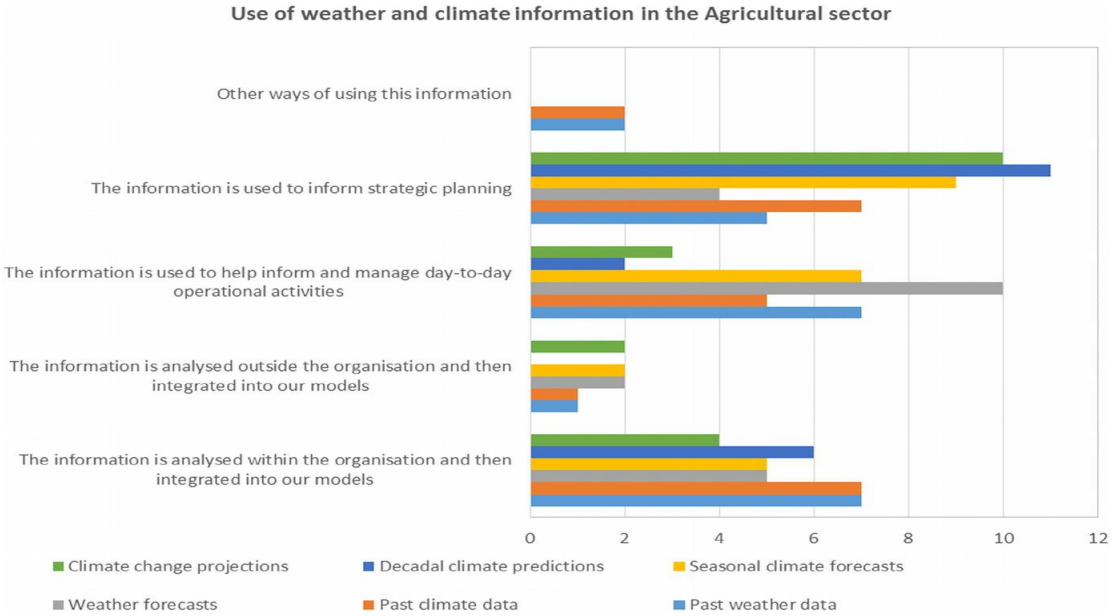
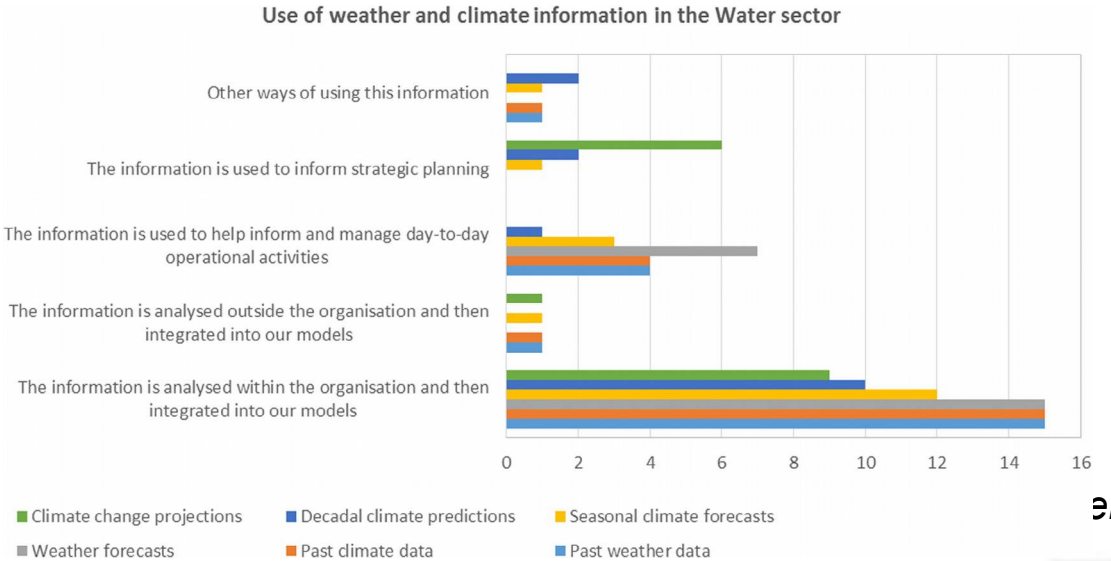
Use of Climate information in different sectors





Main sectors explored

- Agriculture
- Energy
- Health
- Forestry
- Transport
- Water resources

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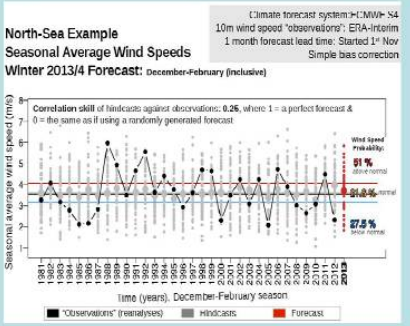
Selected prototypes and associated Impact forecasts

Resilience

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)

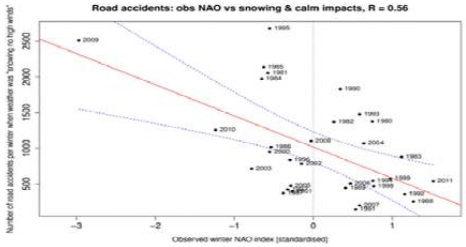


Caption: Example of climate forecast data that will contribute to the RESILIENCE prototype, to address the needs of specific planning and operational decisions for energy system management.

Winter conditions for UK Transport

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)



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

- **Energy (Resilience)**
  - ➢Energy management at the European Scale (IC3),
  - ➢Energy demand and supply (via Temperature and Wind forecasts),

- **Transport (Sprint)**
  - ➢Impact of winter conditions on transport (UK),
  - ➢Air, Rail, … transport impacts (via forecasted Climate Conditions)

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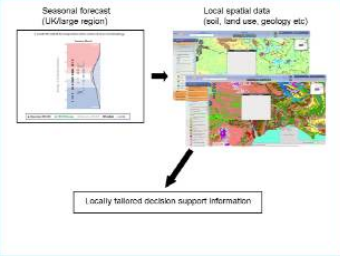
Selected prototypes and associated Impact forecasts

Land management tool

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

Stakeholder: Clinton Devon Estates www.clintondevon.com

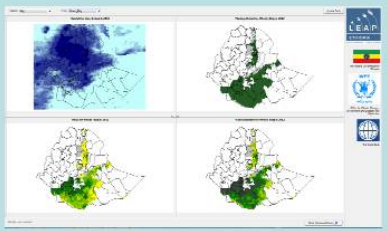


Clinton Devon Estates (CDE) is a major regional land owner in the South-West UK, with responsibility for 25,000 acres of land. Its areas of business cover farming, sustainable forestry, conservation management, deer management, commercial and residential property and businesses including the region's premier equestrian venue. CDE's decision making depends critically on-land and weather conditions, covering timescales from hours to decades.

LEAP- Ethiopia's National Food Security Early Warning System

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/



- **Agriculture (LMTool)**
  - Land Management (UK)
  - Winter Crop Cover planting (via forecasted Climate Conditions, especially Rain)

- **Food Security (LEAP)**
  - Livelihood Early Assessment and Protection (Ethiopia)
  - Crops (via especially Rain and Drought monitoring and forecasting)

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Selected prototypes and associated Impact forecasts

River Flow forecasts for water resource management in France

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

Downscaled near surface temperature and precipitation coming from the Météo France operational system for seasonal forecasting will feed the SIM suit (a refined SVAT model at an 8-km resolution coupled with a river flow routing module) to produce probabilistic forecast of river flows with different lead-times and for specific stations along the rivers. River flow forecasts are tailored to fit critical thresholds, for crucial seasons for which decision making processes are established.

- **Water Resource (RIFF)**
  - Low-Flow and Reservoir Refilling period management (MF)
  - River-Flow and Soil Wetness Index forecasts (via Temperature and Rainfall forecasts)

Seasonal discharge multi-model forecast system

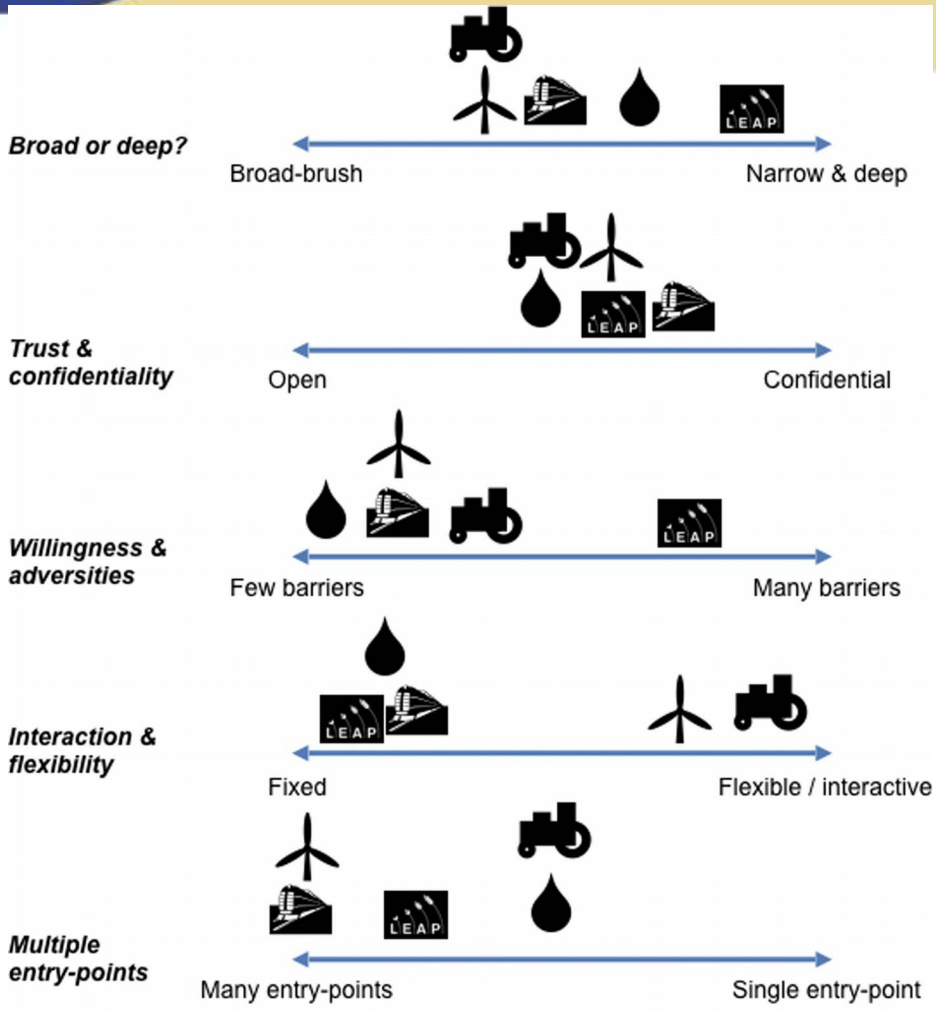
Objective: The objective of this prototype is to provide the hydropower industry with high quality discharge forecasts at the seasonal scale of to assist them in decision making and planning of operations.

Stakeholder: ELFORSK (www.elforsk.se)

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.

- **Water Resource**
  - Hydro-Power (SMHI)
  - River Discharge (via temperature and rainfall forecasts)

Euporias Prototypes and Climate Service developments



A schematic representation of how EUPORIAS prototypes relate to the top level challenges identified in the development of Climate Services

- **Broad or Deep ?**
- **Trust and Confidentiality**
- **Willingness and Adversities**
- **Interaction and Flexibility**
- **Multiple entry poinst**

Main Challenges : Broad or Deep ?

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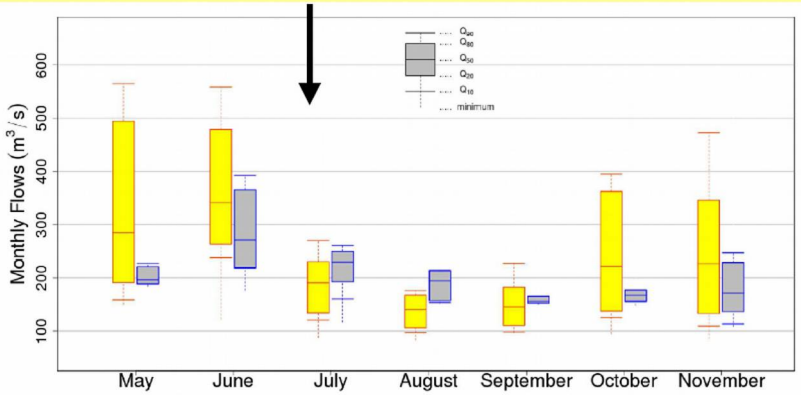
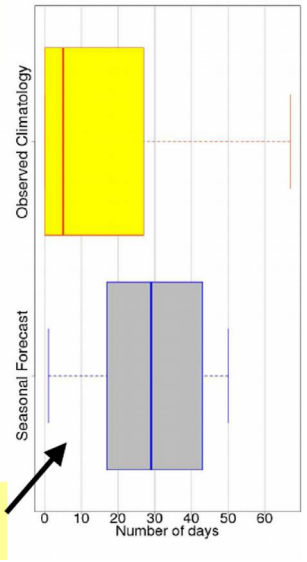
Monthly mean river flow forecast (grey boxplot) compared to climatology (yellow boxplot) for the next seven months.



Forecast of the number of days of low flow (grey boxplot) compared to climatology (yellow boxplot), integrated over the whole dry season

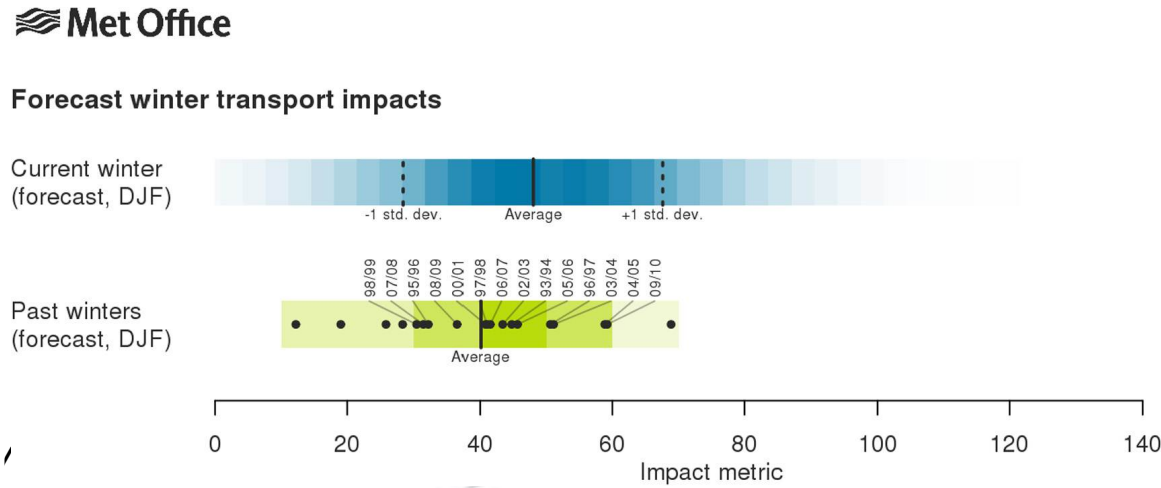


Water Resource (RIFF)

- The targeted end users respond to different drivers and economic stakes.
- The RIFF focuses first on only one stakeholder, EPTB Seine Grands-Lacs (SGL) (rather than delivering a crosssector service)
- This allows an assessment of the usefulness of the prototype,

Transport (Sprint)

- Different impact metrics are considered (Palin et al., 2016) for road (salt usage), railway (weather-related incidents), and air transport (de-iced BA aircrafts @ Heathrow)
- Broad strategy for utility issue leading to use NAO forecasts
- Additional issue is the data confidentiality



Main Challenges : Trust and Confidentiality

- **Transport (Sprint)**

➢ Some stakeholders want their operational data to be keep confidential, while for others it is about not openly publishing the actual forecast for their impact (before they got a chance to analyse it and make their decisions based on that forecast).

➢ EUPORIAS deliverables required some flexibility in presenting project outcomes while still respecting confidentiality

- **Water Resource (RIFF)**

➢ Good example of the need to rapidly learn how to build a trusting collaboration with the users to jointly define a tailored service adapted to their needs

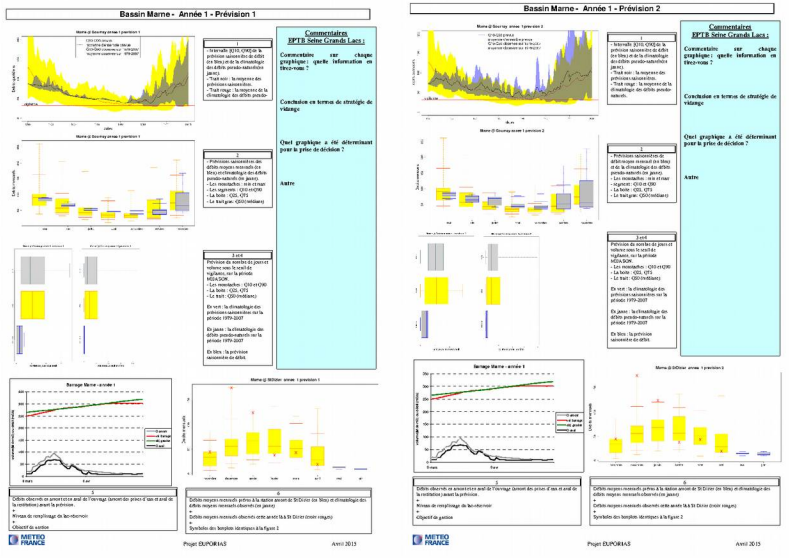
➢ Trust-building phase is a necessary step for the evaluation of how seasonal predictions implemented (for RIFF) affect the final decision and the benefit of using it thanks to a specific protocol so call “Placebo Protocol” (Viel et al., 2016)

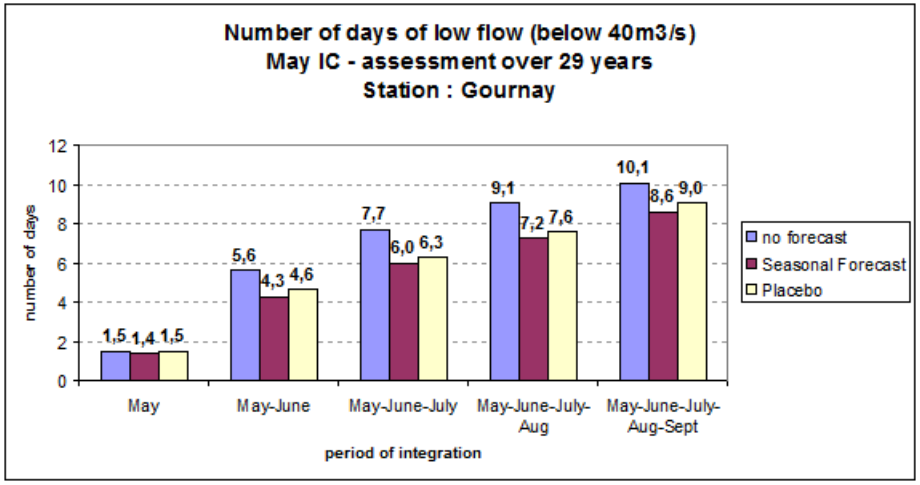
➢This experiment was probably the most efficient user engagement tool : speeding up many aspects of the project (service design, timing, knowledge exchange and recognition of seasonal forecasting limitations). It also positively influence the user uptake of the products.

Some Challenges

- Placebo protocol

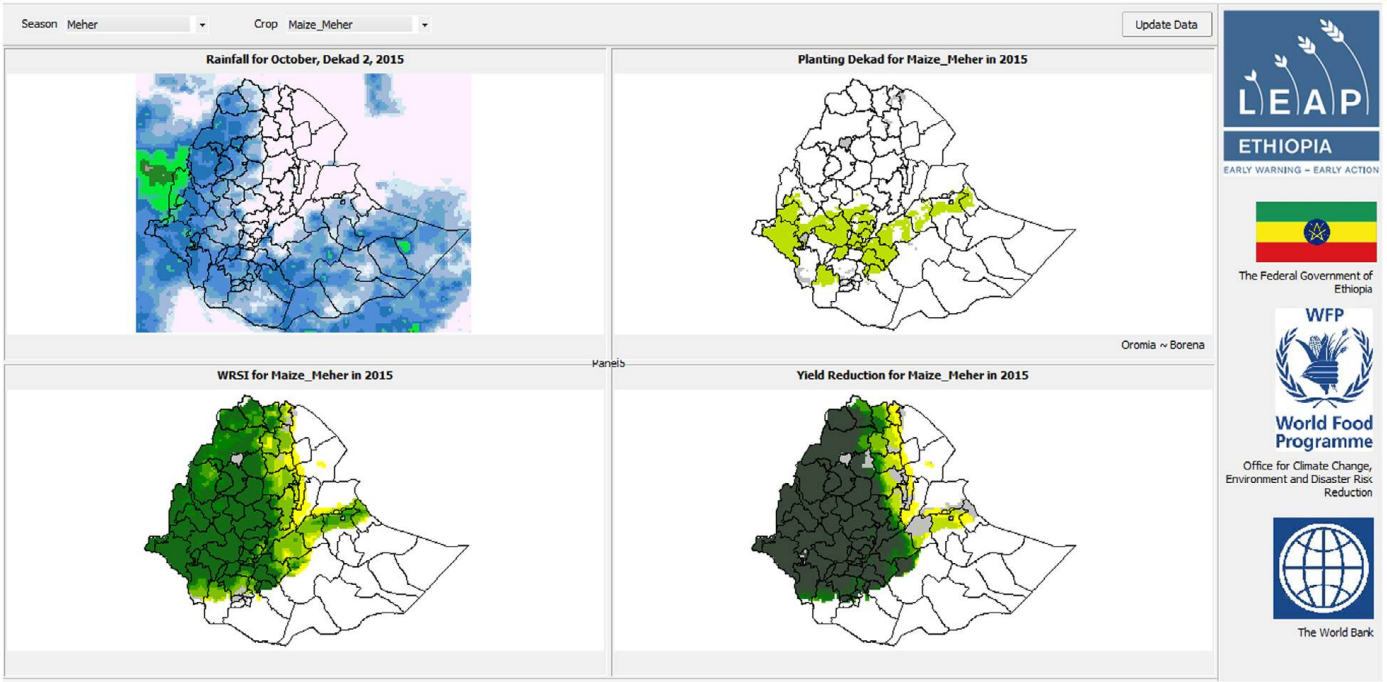
Example of seasonal forecast and placebo (right and left, or vice versa…) for the same year.





The metric is applied for four periods of integration, from 1 month (May) to 5 months (May to September).. The best decisions would lead to "zero day below the threshold"

Main Challenges : Willingness and Adversities ?



- **Food Security (LEAP)**

➢ Expectation that this could provide tangible benefits to the activities of both the Ethiopian Government and key international relief and development actors, .

➢ The Cost Benefit Analysis shows that the introduction of LEAP Forecast could save $125m over a period of eight years compared to a scenario without forecasts, and provides a clear economic rationale for the introduction of such improvements within LEAP.

➢ As an outcome, in 2016 WFP renewed its dialogue with the Government of Ethiopia to promote a more systematic use of seasonal forecast products

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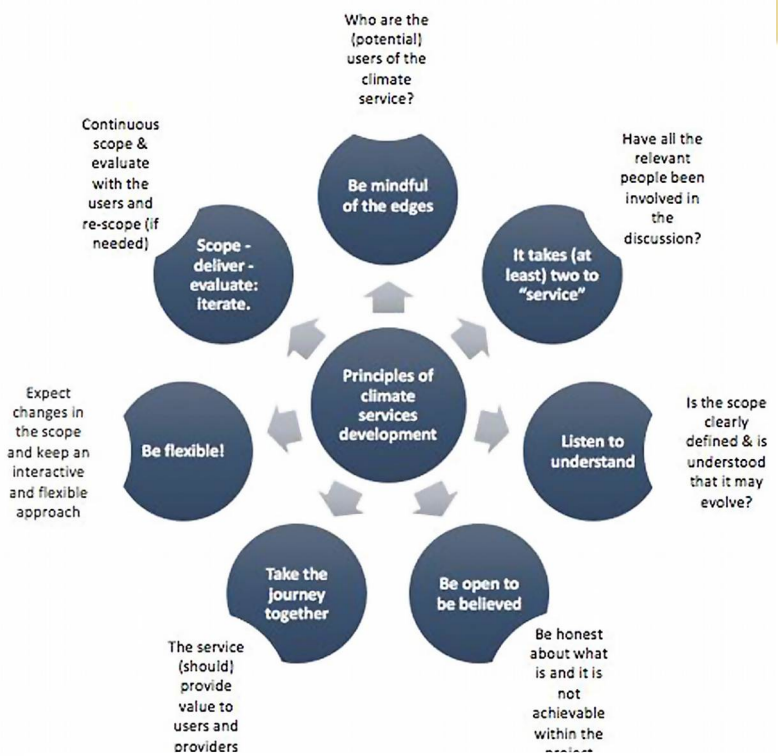
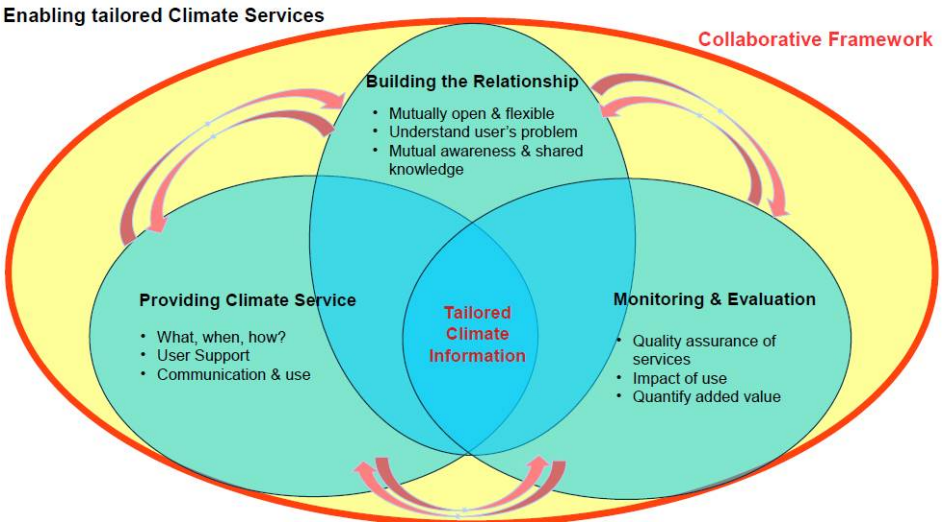
Main Challenges : Interaction and Flexibility





General Framework proposed by the TT-TCI of CCI-16 for the developmenent of tailored Climate Services

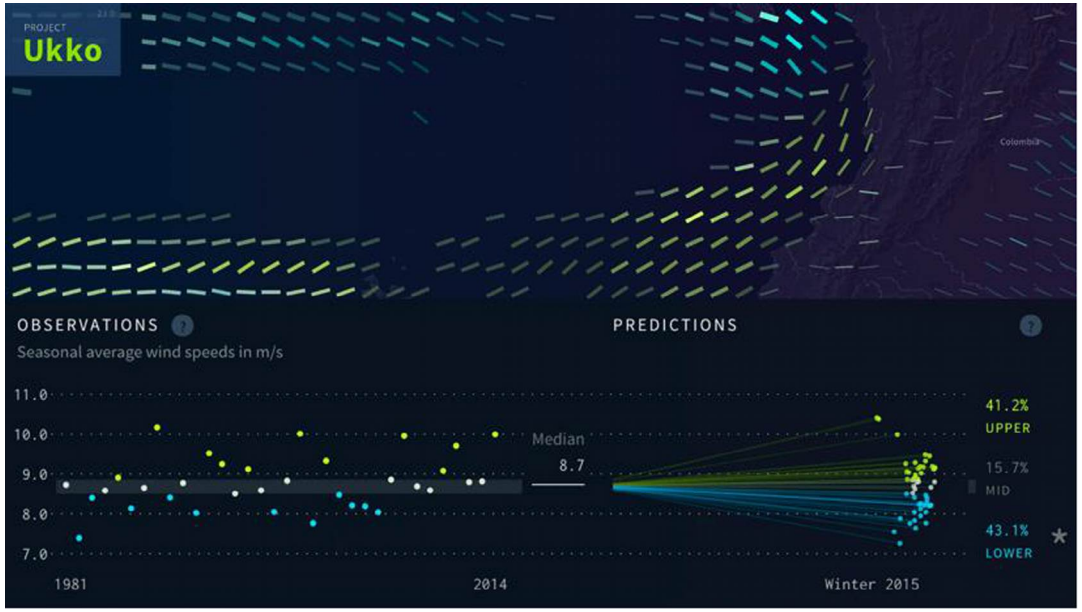
- **Land Management (LMTool)**

➢ TheLMTool was developed taking into consideration the principles of climate services development (see www.euporias.eu/symposium) which emerged from ECOMS initiative.

➢The LMTool was iteratively co-developed (January 2014/May 2016) with farmers and land managers in that region through a range of activities (i.e. workshops, interviews, surveys and feedback forms) informing on the tool (cf. Falloon et al. 2018). .

➢ Another benefit of this close interaction with the farmers was to help the project team to understand the (potential) value of the LMTool to the farmers,

Main Challenges : Multiple entry points



- **Energy (Resilience)**

➢ Despite the narrowing of the scope on wind power generation, the proposition (understanding and quantifying the wind resource), is key to multiple user profiles in the wind energy sector both in pre- and post-construction stages of wind farms.

➢ Narrowing of the end-user profile and scope of such a prototype is essential and driven by the question ‘Who is the user? It’s a key lesson

➢ Hudge work to switch from a visualisation tool to a decision support tool,

➢ Understand the decision-making process undertaken by the end-user is crucial to support and improve decision-making.

As a tentative conclusion

From Euporias

- The experience of EUPORIAS suggests that the interaction with the users during the development of a climate service cannot be sporadic and cannot simply occur at the beginning (e.g. service definition) and at the end (e.g. service evaluation) of the service development
- Allocating sufficient time to the dialogue with the user and to the consequential change in the domain definition and scope of the services being developed is essential to the success of these services.
- On top of the objective benefits that users could gain from a climate services tailored to their needs, the access to climate expertise during the development of the service represents an important added value to users.
- Top-down management practices are not necessarily the most suitable for developing climate services. Adopting a flexible management approach (e.g. Agile) can be an advantage in an environment where changes in scope in response to users feedback are to be expected.
- User representation (or lack thereof) in the governance structures of climate service projects and the way in which these projects are linked to downstream business opportunities have a direct impact on their ultimate usefulness to society.

Co-Design and Co-Production are essential to develop tailored Climate Services for Decision Making

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As a tentative conclusion

About Tailored Climate Services

- **The products and associated uncertainty must be tailored to the targeted DMP**
  - Relevant impact information (without forgetting vulnerability and exposure)
  - Critical decisional thresholds
  - Risk assessment
  - Evaluation of the added value in Decision Made (usefulness and value)
- **The nature of the CS depends on the capabilities of the stakeholder**
  - Advanced vs basic stakeholders
  - Location of the information with respect of the DMP
  - Operational implementation
- **The provision of a support to stakeholders is crucial for the best possible use of tailored information**
  - Organisation of the user support and associated technical resources
  - Capacity Building (dual/twin CB) and shared knowledge
  - Advanced vs basic stakeholders

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- **More information and details**

- **Lessons from Euporias**

https://www.sciencedirect.com/science/article/pii/S2405880716300796

- **Overview of the climate service users (and providers) in Europe**

https://www.sciencedirect.com/science/article/pii/S2405880717300018

- **the design specialism in the development of targeted user-interfaces**

https://www.sciencedirect.com/science/article/pii/S2405880716300814