Progress with the EUPORIAS project

Carlo Buontempo + all partners
Euporias Science coordinator
Met Office
carlo.buontempo@metoffice.gov.uk

EUPORIAS GA
Norkopping
01/10/2013

@euporias


EUPORIAS


ipma
INSTITUTO PORTUGUÊS
DO MAR E DA ATMOSFERA


Met Office


METEO
FRANCE


WAGENINGEN UR
For quality of life


Future
Everything


World Health Organization


LUND
UNIVERSITY


predictia
INTELLIGENT DATA SOLUTIONS


ENEA
Agenzia nazionale per le nuove tecnologie, l'energia
e lo sviluppo economico sostenibile


METEO
ROMANIA


UC
UNIVERSIDAD
DE CANTABRIA


Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu


SMHI

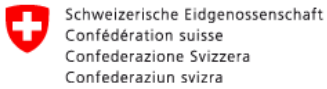

DHI


EDF


DWD


GOBIERNO
DE ESPAÑA
MINISTERIO
DE AGRICULTURA, ALIMENTACIÓN
Y MEDIO AMBIENTE


AEMet
Agencia Estatal de Meteorología


Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra


IC3R


World Food
Programme
wfp.org


TEC


Tourisme Transports Territ
Environnement Conseil


UNIVERSITY OF LEEDS

EUPORIAS

Structure and objectives

- Stakeholder centrality
- Promote use through demonstration
- Final outcome is a small set of fully operational end-to-end climate services and their documentation

- The prototypes will be identified based on:
  - » Demonstrated skill in impact predictions
  - » Well identified stakeholder(s)
  - » A portfolio of relevant decisions

EUPORIAS

EUPORIAS' structure

Three main blocks:

RT1: understand

- •Users needs and current use of S2D
- •Sector specific vulnerability

RT2: improve

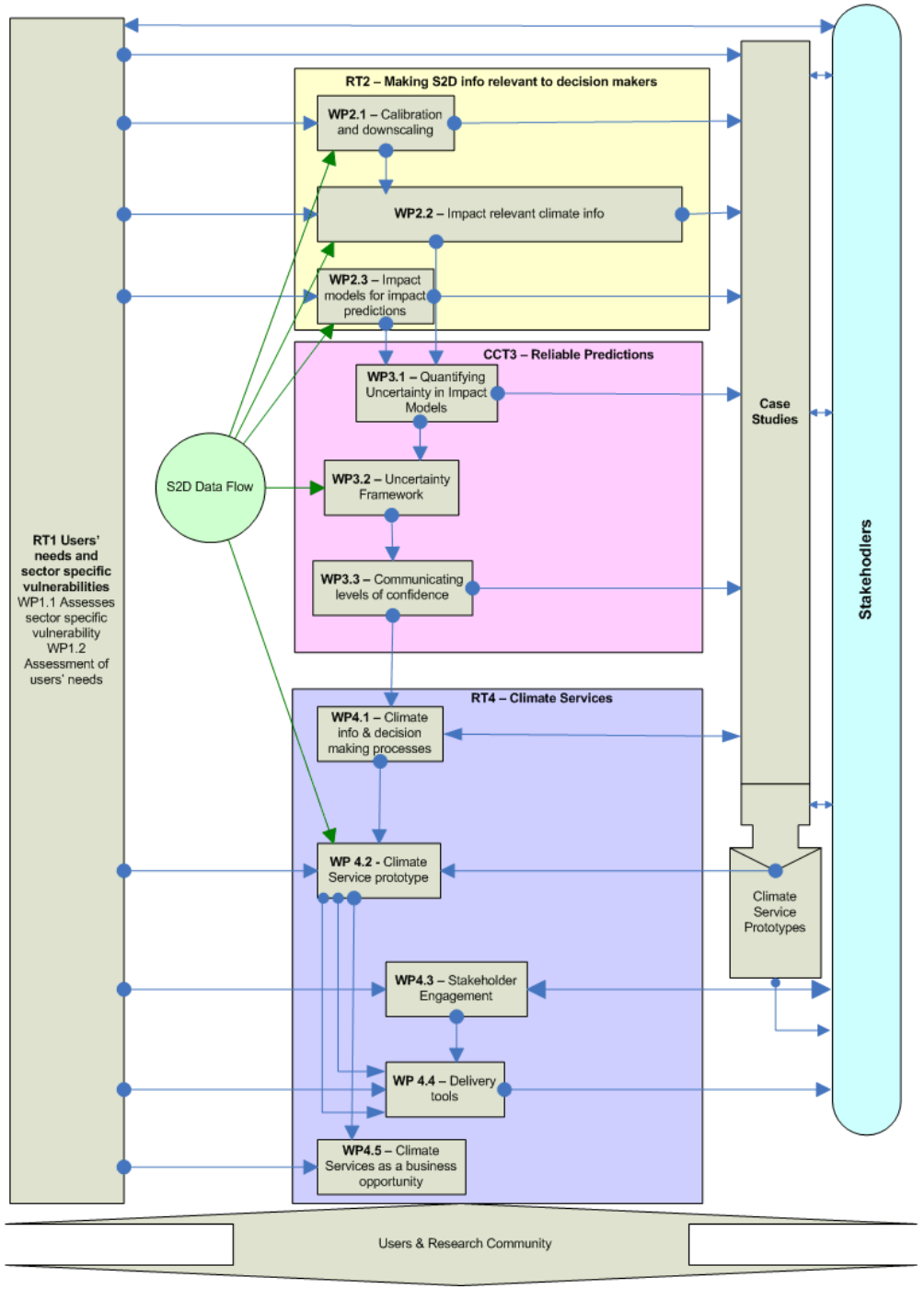
- •Decision-relevant scales: downscale
- •Decision-relevant parameters: impact models and post-processing

CCT3: Uncertainty

- •Impact models' uncertainties
- •Combining uncertainties
- •Communicating level of confidence

RT4: engage and demonstrate

- •Decision making process
- •Climate service prototypes
- •Delivery and engagement
- •Business opportunity



SEVENTH FRAMEWORK PROGRAMME


EUPORIAS
GOBIERNO DE ESPAÑA
MINISTERIO DE MEDIO AMBIENTE Y MEDIO RURAL Y MARINO
CONFEDERACIÓN HIDROGRÁFICA DEL EBRO
CHEbro
NVE
ELFORSK
ELFORSK – SWEDISH ELECTRICAL UTILITIES' R&D COMPANY
Savoie Mont Blanc
simplement merveilleux
nationalgrid
suez
eDF
Cargill
World Meteorological Organization
Weather • Climate • Water
ALVAC
bfg Bundesanstalt für Gewässerkunde
AGENCE DE L'EAU ADOUR-GARONNE
ETABLISSEMENT PUBLIC DU MINISTERE DU DEVELOPPEMENT DURABLE
eau seine NORMANDIE
REN
añarbe aguas urbanas
Allianz
Ministério da Agricultura, Mar, Ambiente e Ordenamento do Território
DGADR Direcção-Geral de Agricultura e Desenvolvimento Rural
Terna
MSB
Swedish Civil Contingencies Agency
MINISTERIO DE FOMENTO
ÁGUAS DE PORTUGAL
AMORIM
Swiss Re
LÄNSSTYRELSEN ÖSTERGÖTLAND
edp
NORTHUMBRIAN WATER
SEVENTH FRAMEWORK PROGRAMME
Aigües de Barcelona
SOGRAPE VINHOS
SKOGFORSK
RhôneAlpes
rhonealpes-tourisme.com

The EUPORIAS Journey

Year 1

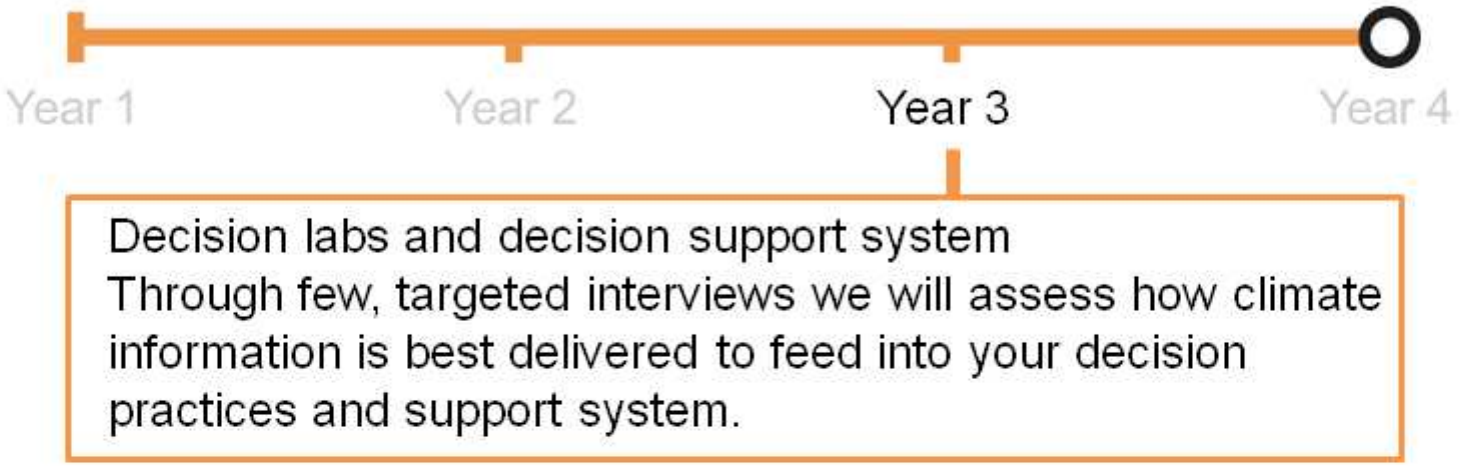
Workshop:
Learning about seasonal and decadal predictions, and how you can use this information to take decisions.
Helping us identify the research priorities for the project.

Short interview:
Allowing us to better understand how climate information is currently used by your organisation and sector.

The EUPORIAS Journey

Email consultation about the development of the next generation of climate services.
Opportunity for sectoral advocacy.
By engaging with us once or twice a year you will be kept informed of the development of the impact model and you will help us to shape the climate service prototypes.

The EUPORIAS Journey

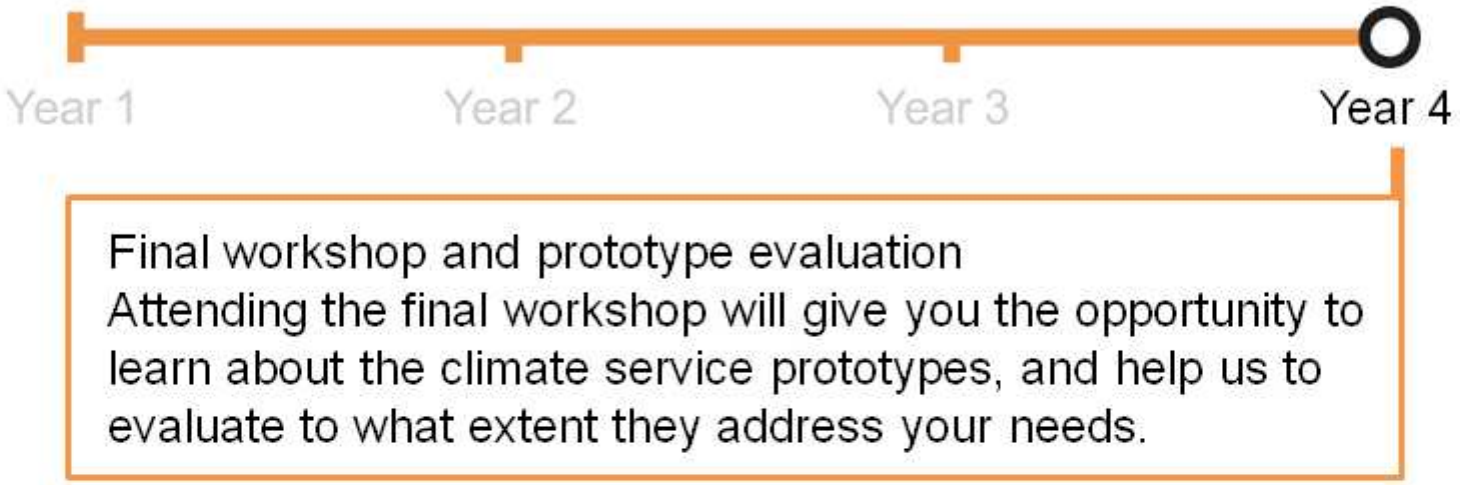


Among the challenges :

Demonstration of the impact of the use of the climate information onto the Decision Making Processes : Some proposal already done (discussion on the way)

Key information for the demonstration of the value of Climate Services

The EUPORIAS Journey



Prototype Selection crucial :

A « small » set of dedicated prototypes will be achieved through the project and will serve as demonstration of Climate Services provision (to be replicated and/or exported)

The EUPORIAS Journey

Year 1

Workshop:
Learning about seasonal and decadal predictions, and how you can use this information to take decisions.
Helping us identify the research priorities for the project.

Short interview:
Allowing us to better understand how climate information is currently used by your organisation and sector.

EUPORIAS

Stakeholder meeting

1. Identify key vulnerabilities for each of the key sector (food security & forestry, energy, water, health, transport, tourism,..)

2. Assess the market penetration of S2D technology in these sectors and identify the main perceived obstacles limiting its use.

3. Identify the most critical important users' needs which are shared by more than one sectors. This will inform the development of S2D and impact models.

4. Inform about the current status of S2D technology: how are the predictions made; what can and can't be predicted; what are the main sources of uncertainties; how has this information been used in other cases

EUPORIAS

- User relevant parameter differ from sector to sector but temperature and precipitation are among the parameters most required
- Seasonality of the requirements
- Appetite to improve large scale predictability rather than granularity.
- There is still a huge need for *education and training*.

Remarks

- Language barrier when talking about minimum *level of (un)certainty* and decisions.
- *Lack of information on what is already available*
- Need for sector specific workshops on S2D and their use. (e.g. water, energy, wine production, tourism and health).
- Areas of possible development: users-defined indices, integration with other sources of information, statistical-dynamical downscaling, integration with existing early warning systems.

WP12 workshop on 'Climate services providers & users' needs'

- Aim of the workshop: to elicit knowledge from climate services providers regarding the use of S2D in Europe;
- ≈ 30 participants from various European climate services providers (including GPCs : ECMWF, Met Offices, Meteo-France) + other stakeholders;

- Main findings:
  - Current users of seasonal information (operational/ strategic level) mainly related to the energy, insurance, or transport sectors
  - Majority use lead time predictions of a month up to a season; seasonal forecasts users mainly linked to the energy sector;
  - No use of decadal forecasts.

WP12 workshop main findings (cont.)

- Barriers to the use of S2D: Low skill & predictability; limited capacity and relevance/usability of data available; accessibility/communication of information;
- Solutions to overcome barriers: training and communication; improve skill and predictability (including diagnosis of the current predictability); public financing;
- ....

- Workshop report available at: www.euporias.eu

WP12 interviews with stakeholders & users of S2D

- Interviews: in-depth knowledge of S2D users' needs across European sectors (≈ 100 interviews with stakeholders);

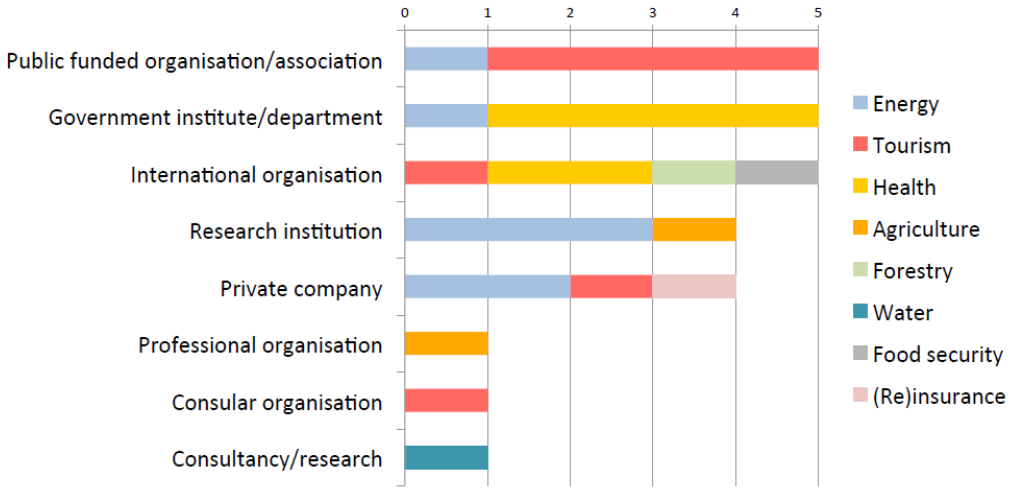
- Covering a range of sectors: energy, water, health, agriculture, tourism, insurance, forestry, & emergency response/roads;
- Better understanding of organisations/sectors needs with regard to their decision-making processes and use of weather/climate information in the organisations;
- Interviews will be conducted until the end of 2013; preliminary report on users' needs to be released at the end of October;
- Data from interviews will help inform other EUPORIAS WPs and produce scientific/academic outputs.

3. Number of interviews with EUPORIAS stakeholders & other potential users

Sector	Interviews conducted	Interviews transcribed	Other interviews planned/scheduled	Total interviews
Energy	7	7	12	19
Agriculture	5	3	6	11
Forestry	2	1	5	7
Health	7	6	0	7
Tourism	8	7	8	16
Insurance	2	1	3	5
Water	6	1	6	12
Emergency response & roads	1	0	5	6
Food security	1	1	0	1
Meteorology	0	0	2	2
Total	**39**	**27**	**47**	**86**

Interviews transcribed (n=27): Stakeholders (n=15) & other users (n=12)

- Type/sector of organisations interviewed:



RT2 highlights

- A preliminary set of Climate Impact Indices (CII) has been selected mapped and analyzed using E-OBS and KNMI's Web mapping Server
- domain and years have been selected for downscaling over eastern Africa and the first dynamical downscaling of S4 and EC-EARTH over eastern Africa has been completed.
- Workshop on initialisation of impacts models for seasonal predictions

Impacts Models

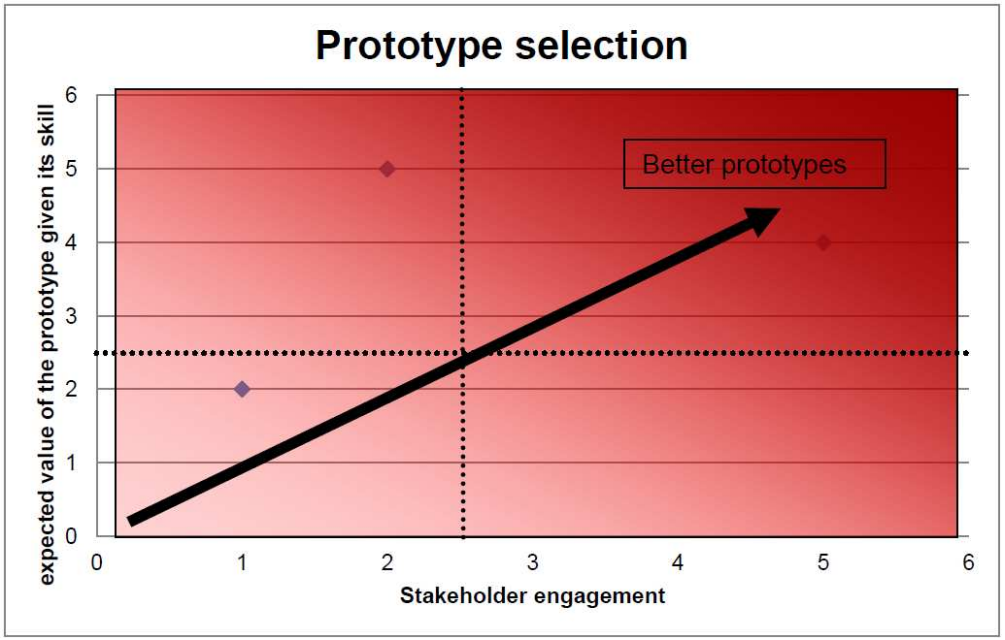
Sector	*Model*	*Scale*	*Resolution*	*Forecast Variables*
Agriculture	JULES/ JIM *Met Office*	Global	0.5 degree, 1.25*1.874 degree and 2 degree versions	Crop Yield Crop NPP River flow
	GLAM crop model *Leeds*	Regional (e.g. all of India, semi-arid West Africa, China)	Typically 0.5 degree to 2.5 degree grid cells.	Crop yield Crop biomass.
	LPJmL *WU*	Global	0.5 degrees	Crop Yield River discharge Reservoir volume
	CGMS *WU*	Regional	25km	Crop yield
Hydrology	VIC *WU*	Regional	0.25 degrees	River discharge Water Temperature
	MORDOR *EDF*	North Atlantic/ Europe	2.5 degrees	River flow
	E-HYPE *SMHI*	Europe	215 km2	River Discharge
	Coupled models for decision making at the river basin agency level *CETaqua*	River basin	Various	River flow System reliability
	SIM *Météo-France*	National	8km	River Flow Soil Wetness Index

Impacts Models cont..

Sector	*Model*	*Scale*	*Resolution*	*Forecast Variables*
Forestry	GUESS Storm-Ips *Lund*	Europe	0.5 degrees or lower	Risk of damage to forest
Health	Temperature related mortality statistical model *IC3*	Europe	NUTS2 administrative regions	Mortality

Prototype Selection

- Discussion on the Prototype Selection
- Agreement about the criteria
  - Predictability and impact
  - Stakeholders
  - Project perspectives
  - Legacy
- Agreement for a selection committee (3 members outside of Euporias Partners)
- Guideline for selection disseminated
- Prototype application deadline by mid-December



METEO FRANCE
Toujours un temps d'avance

WP2.1 Calibration and Downscaling

Objectives : to develop and apply statistical downscaling methods for use with seasonal forecasts. Downscale standard climate variables from large scale to ~10 km over France in order to drive a SVAT model and river-routing system.

2 methods have been tested to downscale T and rain from 2.5°to 8 km :

- 1. A "simple" downscaling method adapted from a method used for the medium range ensemble riverflow forecast (ROUSSET-REGIMBEAU 2007)
- 2. A more refined method (DSCLIM, PAGE 2009) based on weather type / analogs

Results : Method 1 is used. Method 2 does not bring enough improvements in regards to its complexity. Other methods could be tested in the further work of this WP.

METEO FRANCE
Toujours un temps d'avance

WP2.1 Calibration and Downscaling

Objectives : to develop and apply statistical downscaling methods for use with seasonal forecasts. Downscale standard climate variables from large scale to ~10 km over France in order to drive a SVAT model and river-routing system.

2 methods have been tested to downscale T and rain from 2.5°to 8 km :

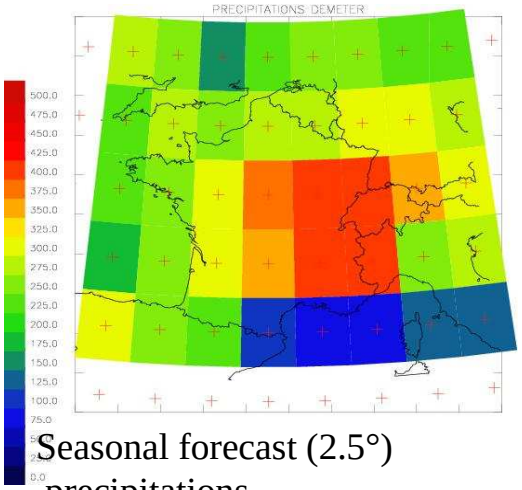
- Click to add logo

METEO FRANCE
Toujours un temps d'avance

WP2.1 Calibration and Downscaling

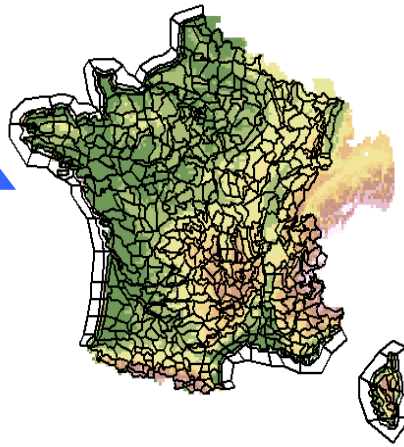
- **Method 1** : Adaptation of the downscaling used for the medium range ensemble riverflow forecast (ROUSSET-REGIMBEAU,2007)

Standardized precipitation anomalies

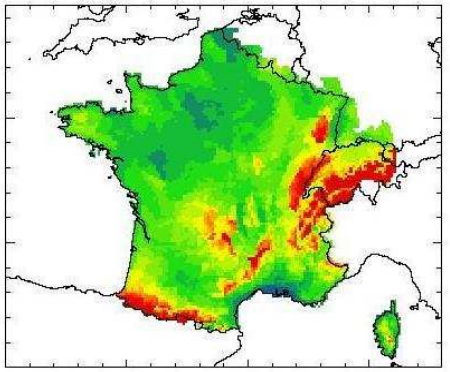


Seasonal forecast (2.5°) precipitations

Interpolation (1/r2) on SYMPOSIUM areas

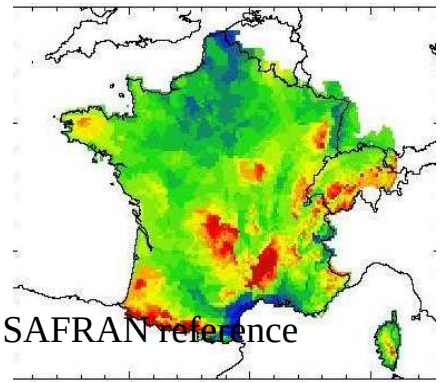


Downscaling and ajustment according to the SAFRAN reference grid altitude



Precipitations on 8*8 km2 grid

Good agreement



SAFRAN reference

Rousset-Regimbeau F., Habets F., Martin E., Noilhan J., 2007. ensemble streamflow forecasts over France. ECMWF Newsletter, No.111, ECMWF, Reading, UK, 21-27

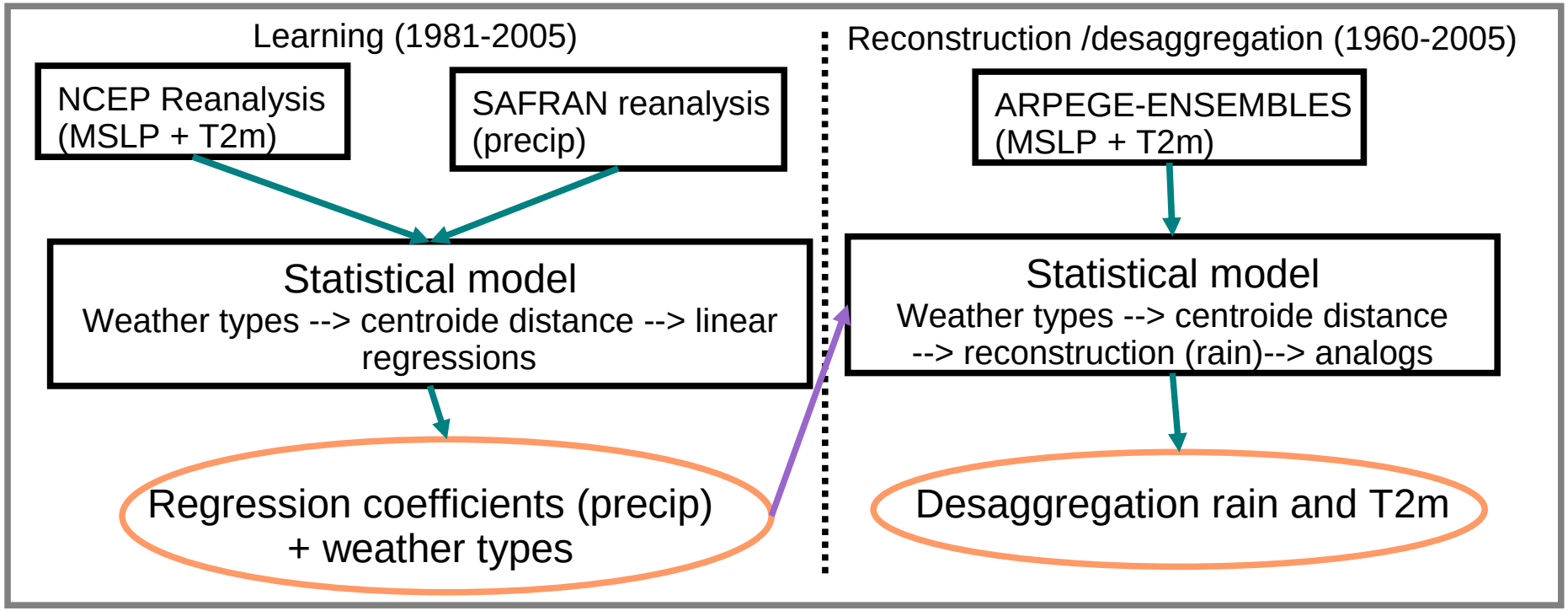
Click to add logo

EUROPIAS

METEO FRANCE
Toujours un temps d'avance

WP2.1 Calibration and Downscaling

Method 2 : statistical downscaling based on weather types / analogs : DSCLIM



Pagé, C., L. Terray et J. Boé, 2009 : dsclim : A software package to downscale climate scenarios at regional scale using a weather-typing based statistical methodology. Technical Report TR/CMGC/09/21, SUC au CERFACS, URA CERFACS/CNRS No1875, Toulouse, France

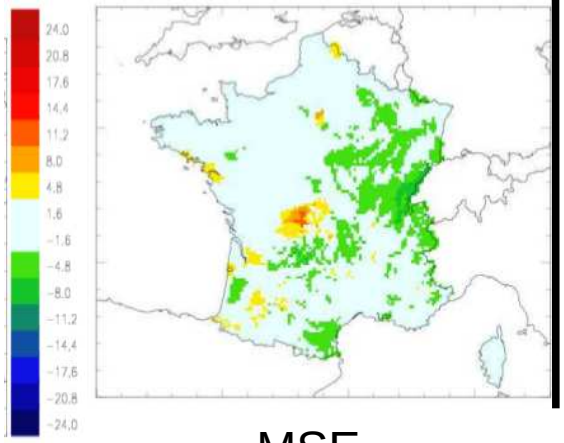
- Click to add logo

EUPORIAS

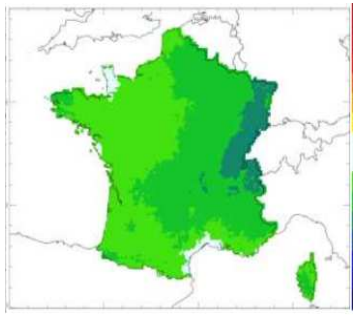
METEO FRANCE
Toujours un temps d'avance

WP2.1 Calibration and Downscaling

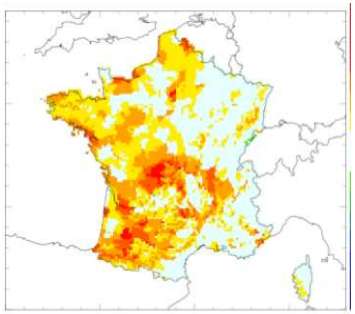
Results :



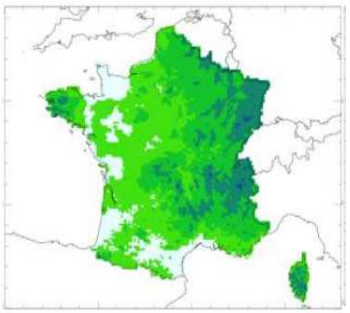
MSE



amplitude



bias



corelation

Maps of Student variables of MSE and MSE decomposition terms for 3-months mean T between method 2 (DSCLIM) and method 1 (« simple »).

CCL : method 2 is more complex but does not bring enough improvements except for the bias term

Method 1 is kept, but other methods could be tested in further work

- Click to add logo

EUPORIAS

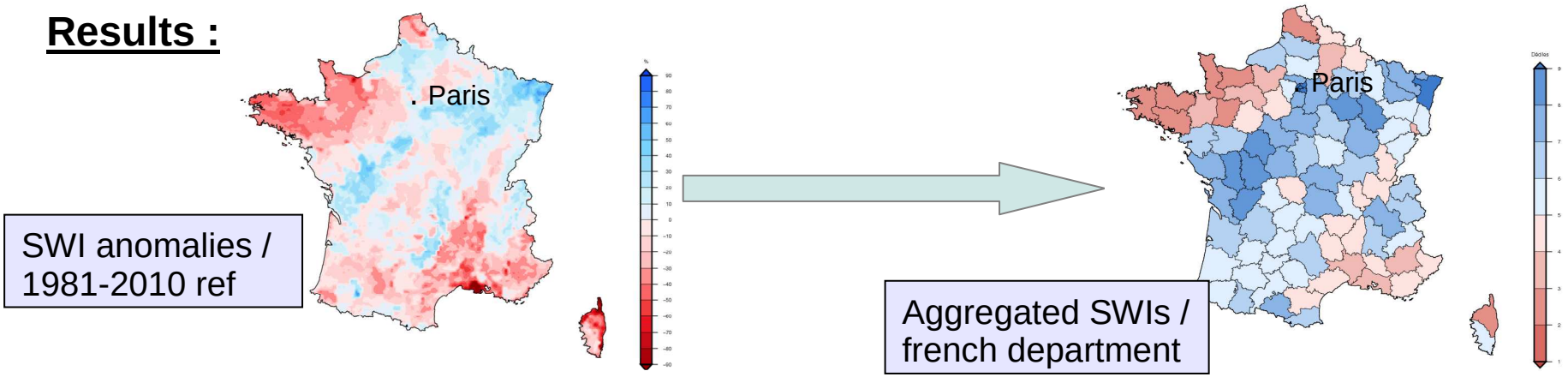
METEO FRANCE
Toujours un temps d'avance

WP2.2 Impact relevant climate information indices (CII)

Objectives : to use new products elaborated over France in the WP21. CIIs will target user-needs of the energy and water ressource domains, tailored to the different stakeholders with operational perspectives at national or local scale.

User-needs : One stakeholder (French Ministry of Ecology) reveals to be interested by an department-integrated Soil Wettness Index (SWI) over France in order to support decisions taken during National Drought Comittee or to be part of a drought warning system.

Results :



- Click to add logo

EUPORIAS

METEO FRANCE
Toujours un temps d'avance

WP2.2 Impact relevant climate information indices (CII)

Objectives : to use new products elaborated over France in the WP21. CIIs will target user-needs of the energy and water ressource domains, tailored to the different stakeholders with operational perspectives at national or local scale.

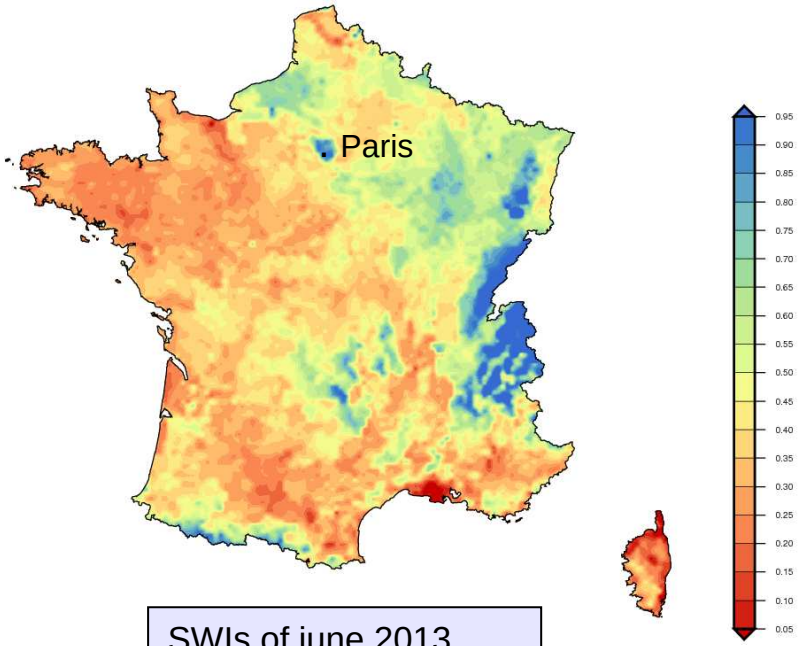
User-needs : One stakeholder (French Ministry of Ecology) reveals to be interested by an department-integrated Soil Wettness Index (SWI) over France in order to support decisions taken during National Drought Comittee or to be part of a drought warning system.

- Click to add logo

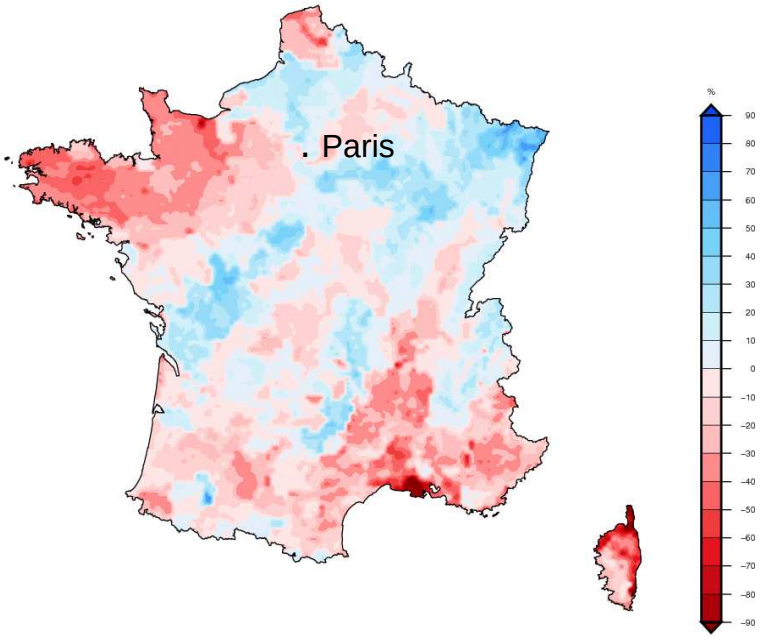
METEO FRANCE
Toujours un temps d'avance

WP2.2 Impact relevant climate information indices (CII)

What we have currently : montly SWI or monthly SWI anomalies over France at a 8 km resolution



SWIs of june 2013



SWI anomalies of june 2013 / 1981-2010 ref

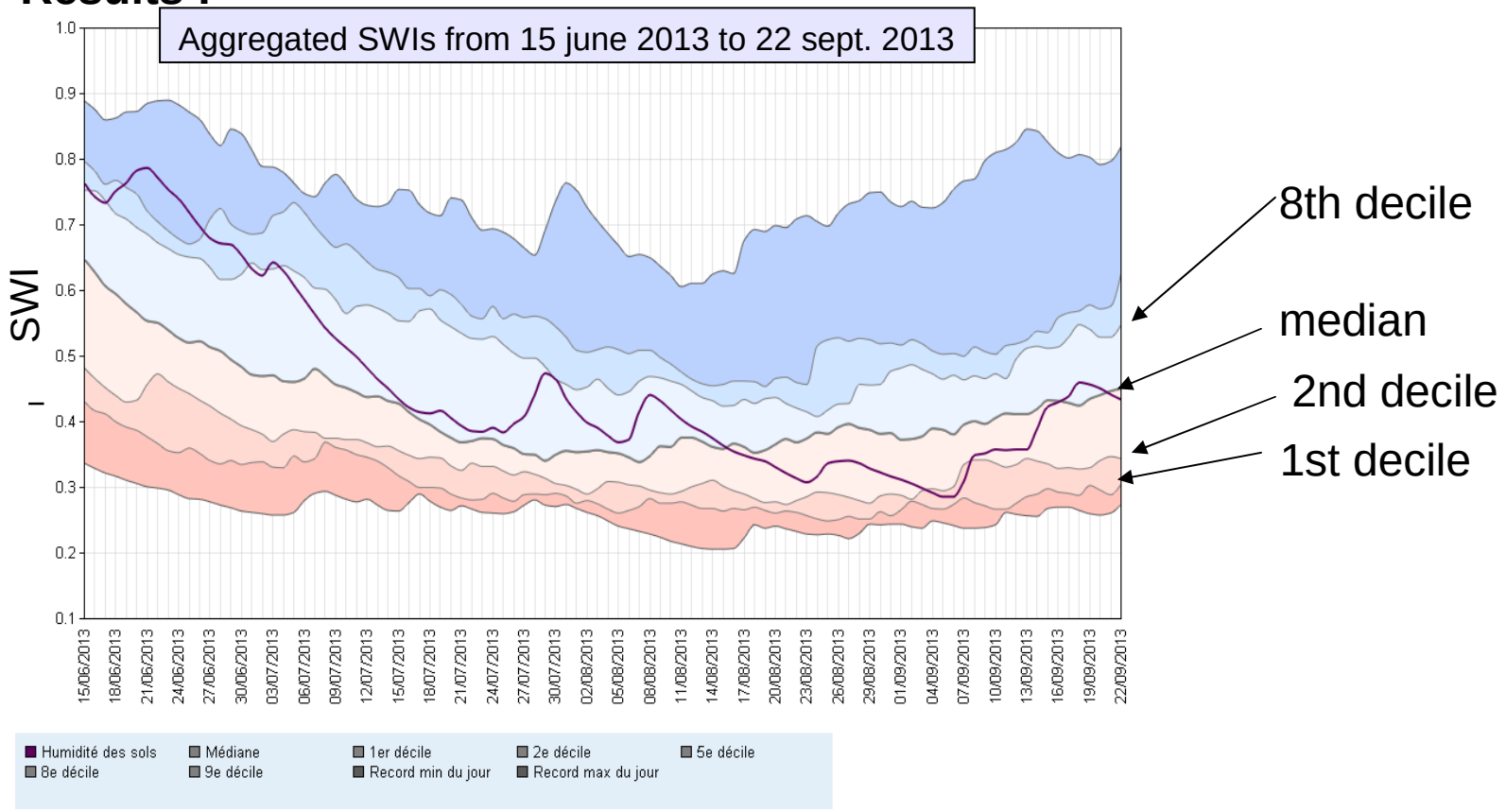
- Click to add logo

EUPORIAS

METEO FRANCE
Toujours un temps d'avance

WP2.2 Impact relevant climate information indices (CII)

Results :



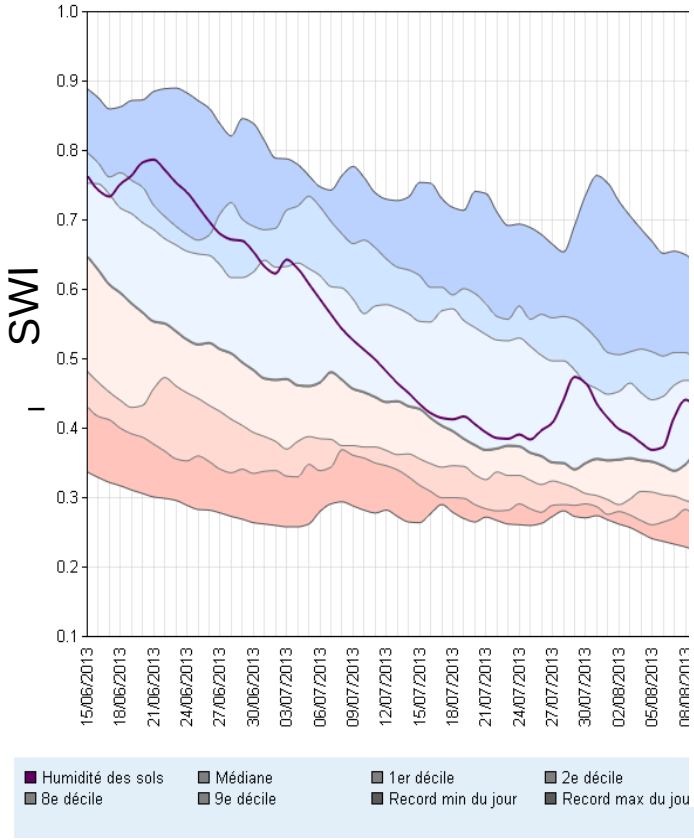
- Click to add logo

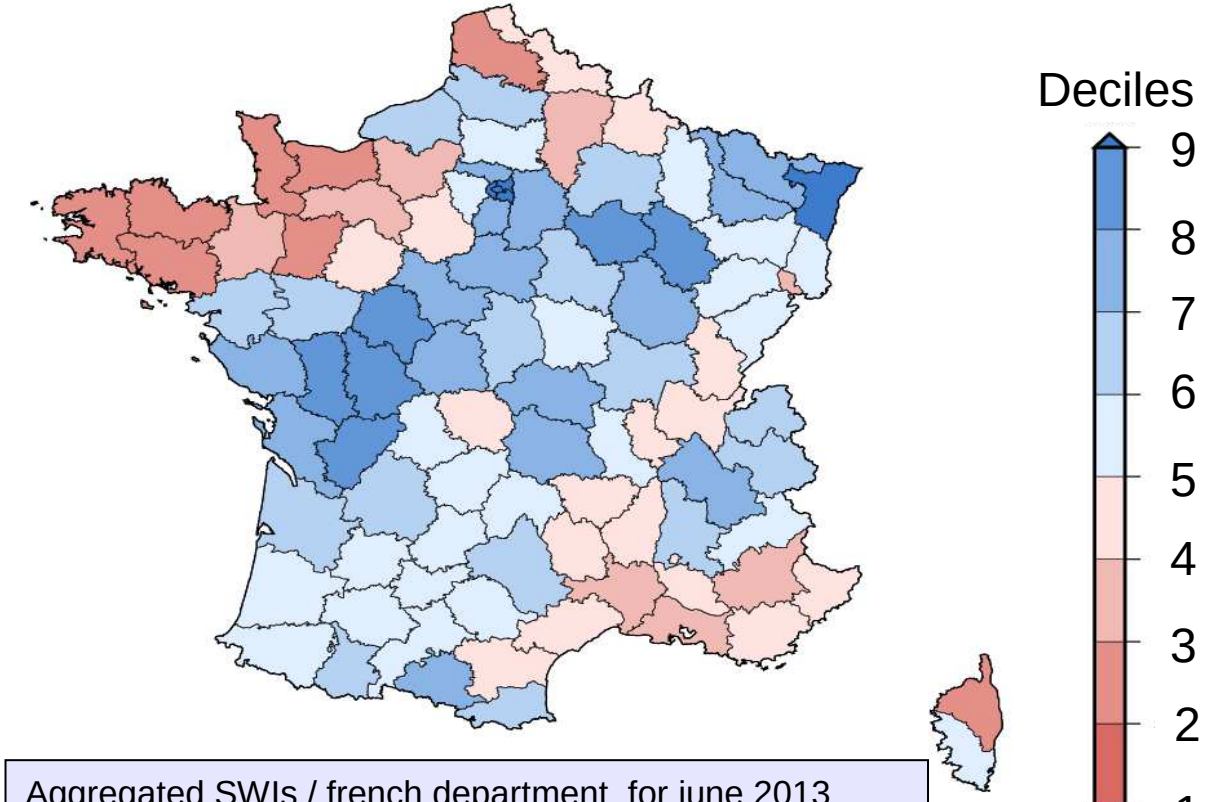
EUPORIAS

METEO FRANCE
Toujours un temps d'avance

WP2.2 Impact relevant climate information indices (CII)

Results :





Aggregated SWIs / french department for june 2013

- Click to add logo

EUPORIAS

METEO FRANCE
Toujours un temps d'avance

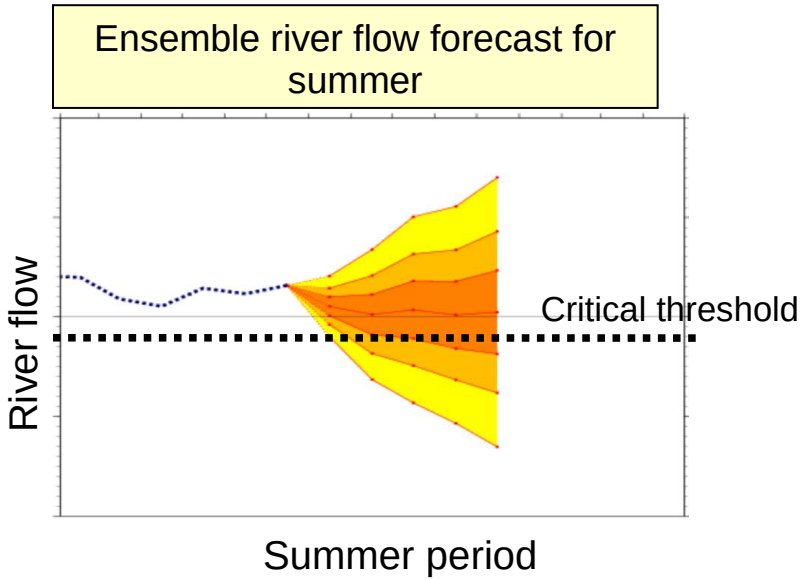
WP2.3 Impact models for impact predictions

Objectives : provide / facilitate impact predictions relevant to stakeholders

User-needs : french stakeholders of the water ressource domain need predictions of exceeding river flow critical thresholds in summer (low-flow period) or in winter (to anticipate the reservoir filling).

First results and proposal : Seasonal Forecast instead of Climatology improves river flow prediction for spring and summer in some areas in France (Singla et al., 2012)

→ Provide a probability to reach critical thresholds defined by stakeholders and leading to decision



- Click to add logo

METEO FRANCE
Toujours un temps d'avance

WP2.3 Impact models for impact predictions

Objectives : provide / facilitate impact predictions relevant to stakeholders

User-needs : french stakeholders of the water ressource domain need prediction of reaching river flow critical thresholds in summer (low-flow period) and in winter (to anticipate the reservoir filling) with a lead time of at least 1 month.

→ Using a hydrometeorological suit feeding by seasonal forecast to provide relevant predictions of river flows

- Click to add logo

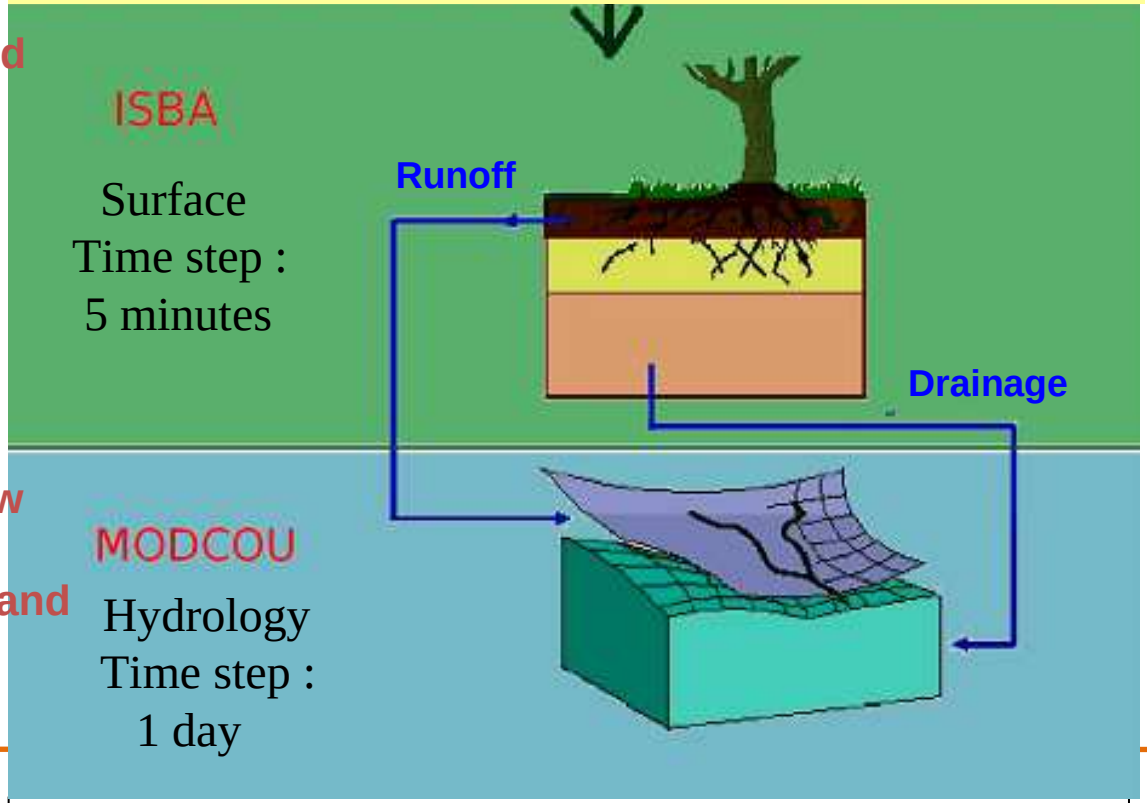
EUPORIAS

METEO FRANCE
Toujours un temps d'avance

WP2.3 Impact models for impact predictions

Seasonal Forecasts
(Ensemble forecast 9 members)
Temperature, Precipitation
Wind, Humidity, Pressure, Radiation (IR+Global)

Water and Energy budget



River flow for ~900 stations and Aquifers

The hydrometeorological suite

- **Météo-France Arpège** model used in the ENSEMBLES project and Operationnal Forecasting suite (System 3)
- **SAFRAN-ISBA-MODCOU (SIM)** validated over all France (Habets *et al*, 2008) and operational since 2004.

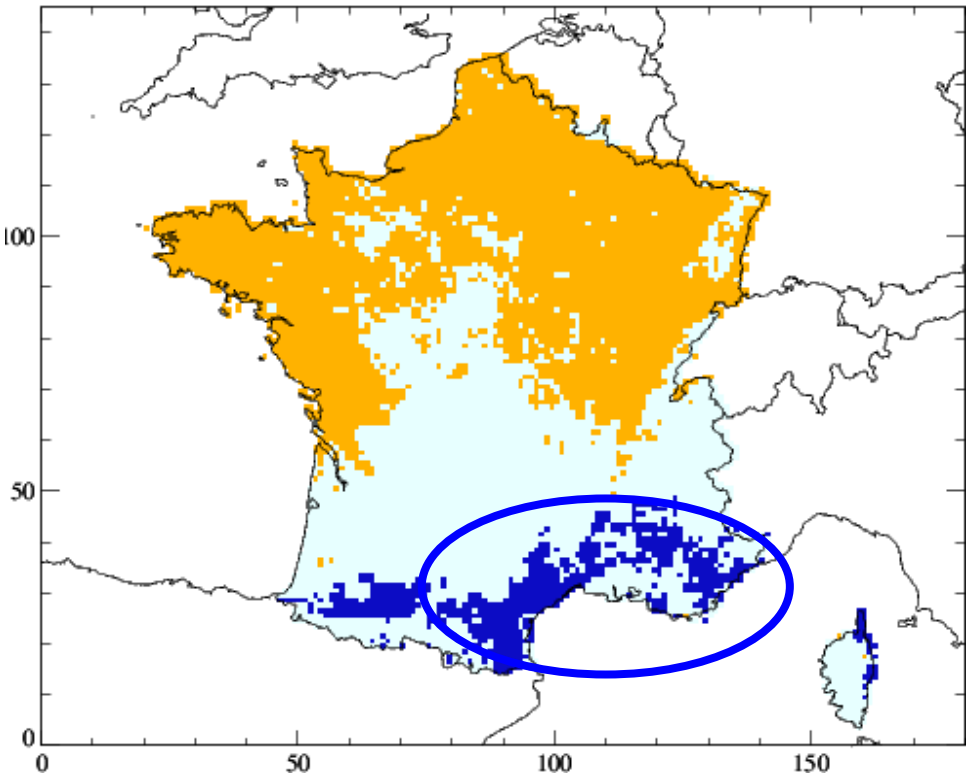
METEO FRANCE
Toujours un temps d'avance

Results for Spring (MAM)

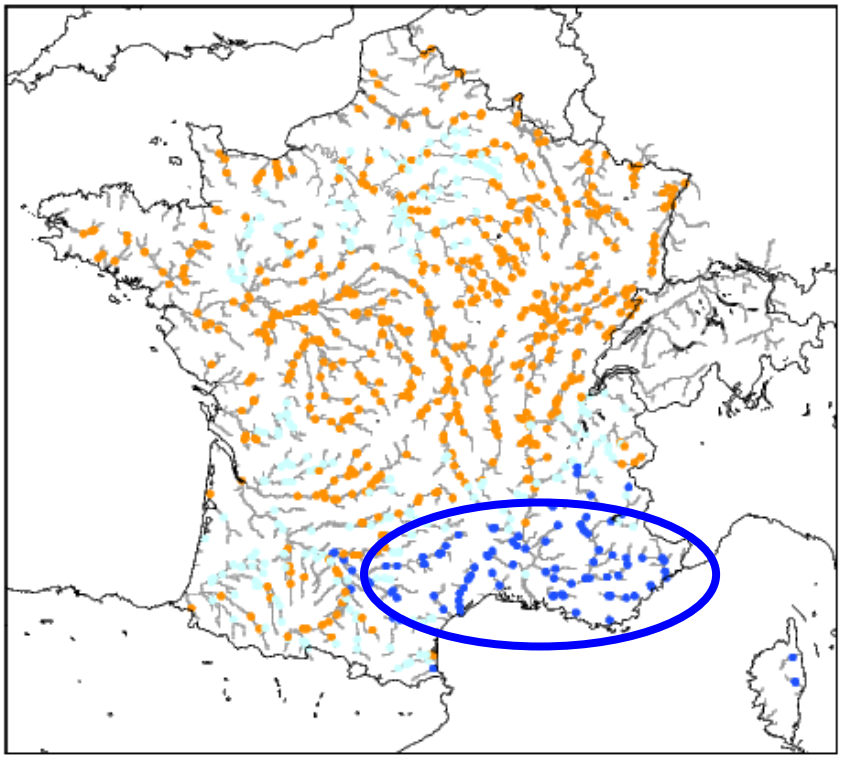
Comparison of correlations between Hydro-SF and RAF – IC 1st of February

(Singla *et al.*, 2012)

SWI



River Flow



Regions where Hydro-SF is significantly better than RAF

Regions where Hydro-SF is equivalent to RAF

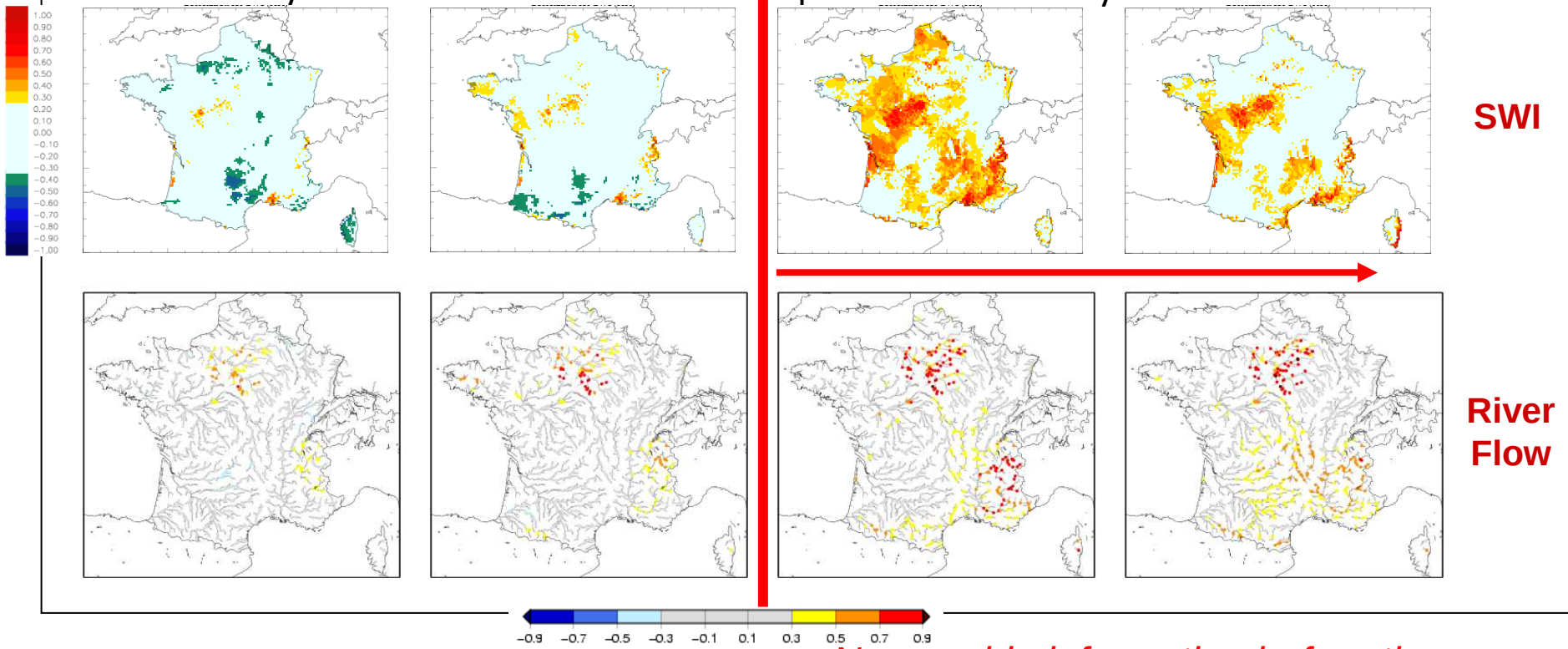
Regions where RAF is significantly better than Hydro-SF

EUPORIAS

METEO FRANCE
Toujours un temps d'avance

Results for Summer (JJA)

- Correlation for SWI and River Flows over the 1979-2007 period (HYDRO-SF / ARPEGE-S3) for different IC for the summer forecast (JJA)
- February March April May



Correlations > 0.3 significant.
Clear improvement between March and April

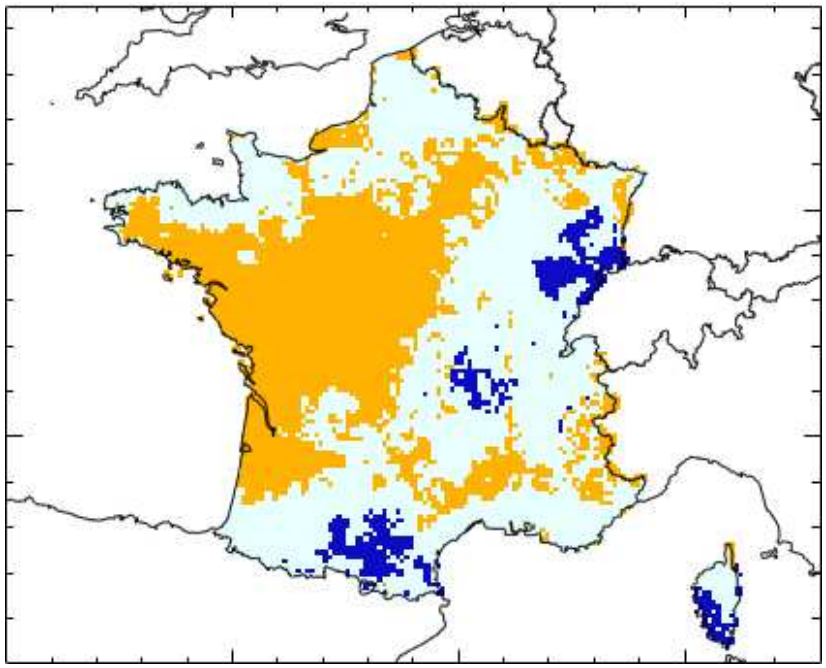
No useable information before the beginning of April

EUPORIAS

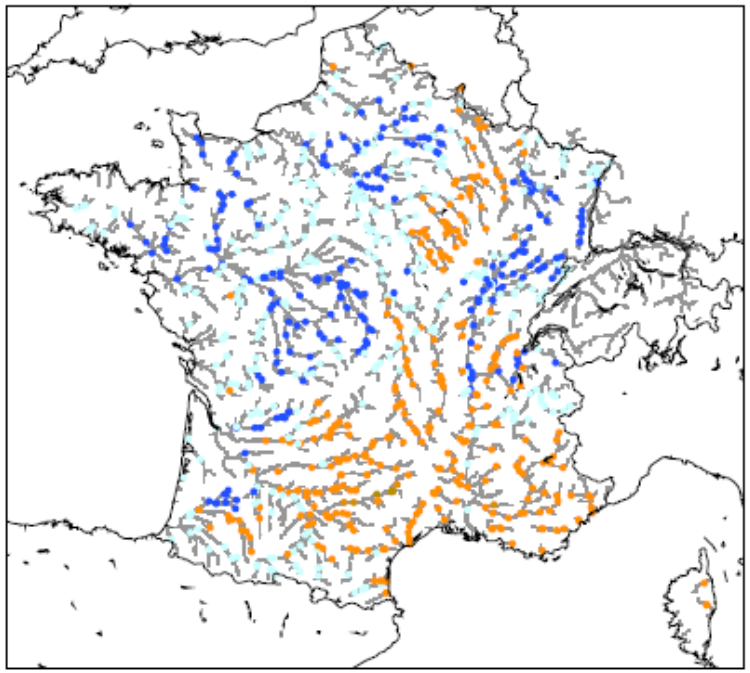
METEO FRANCE
Toujours un temps d'avance

Results for Summer (JJA)

Comparison of correlations between Hydro-SF (April IC) and RAF



SWI



River Flow

Regions where Hydro-SF is significantly better than RAF

Regions where Hydro-SF is equivalent to RAF

Regions where RAF is significantly better than Hydro-SF

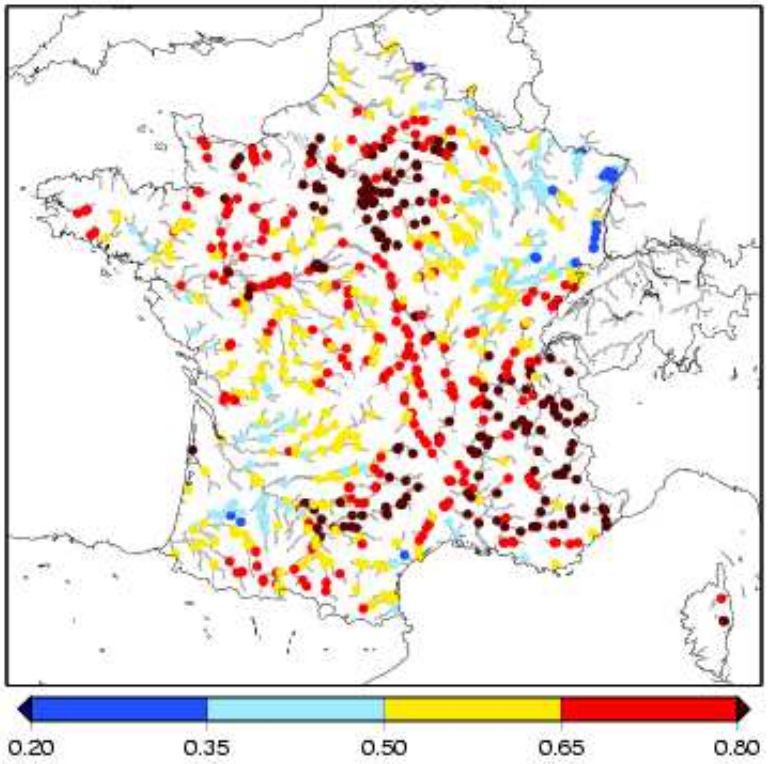
EUPORIAS

METEO FRANCE
Toujours un temps d'avance

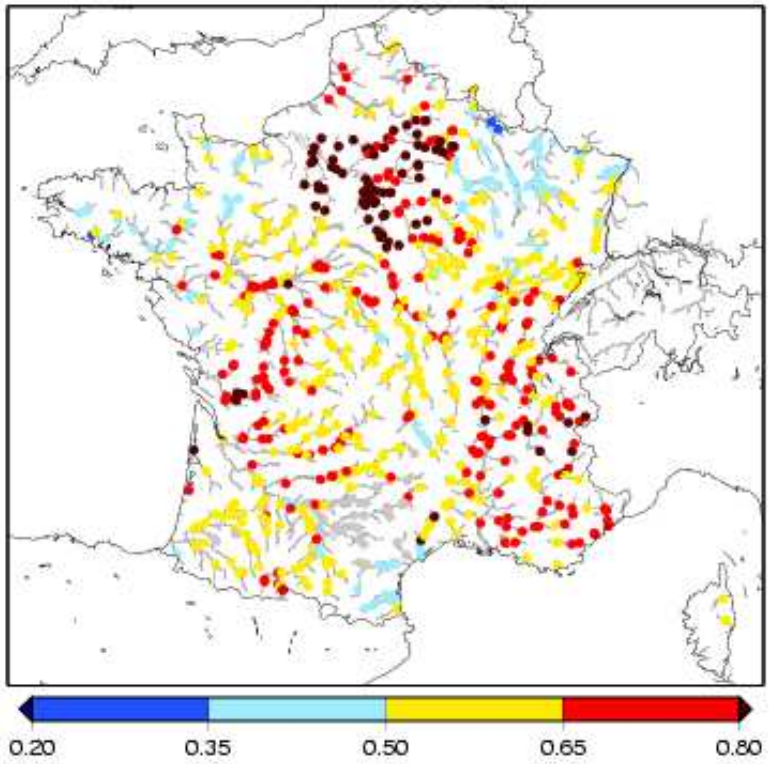
Results for Summer (JJA)

ROC scores (JJA) for the River Flow tercile categories

(Hindcast system 3 : 1979-2008)



Upper Tercile



Lower Tercile

EUPORIAS

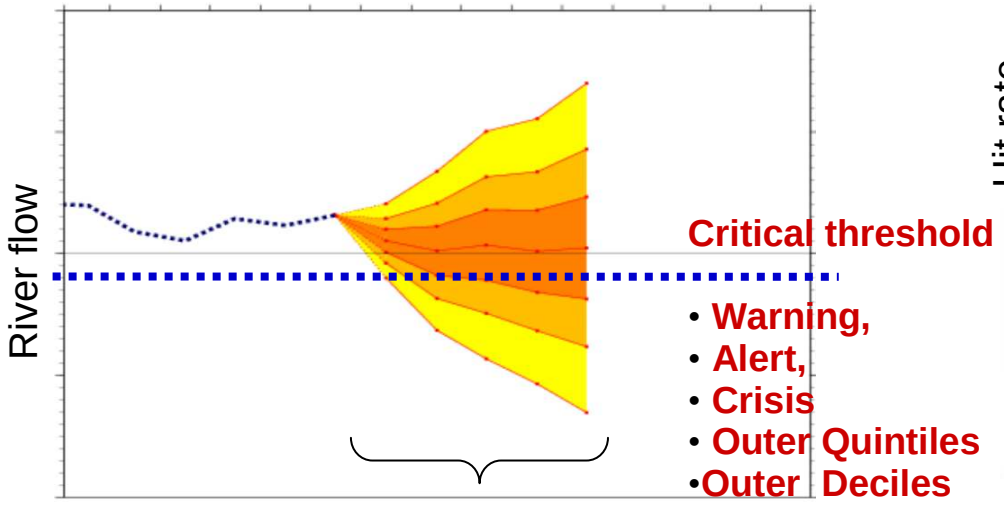
METEO FRANCE
Toujours un temps d'avance

WP2.3 Impact models for impact predictions

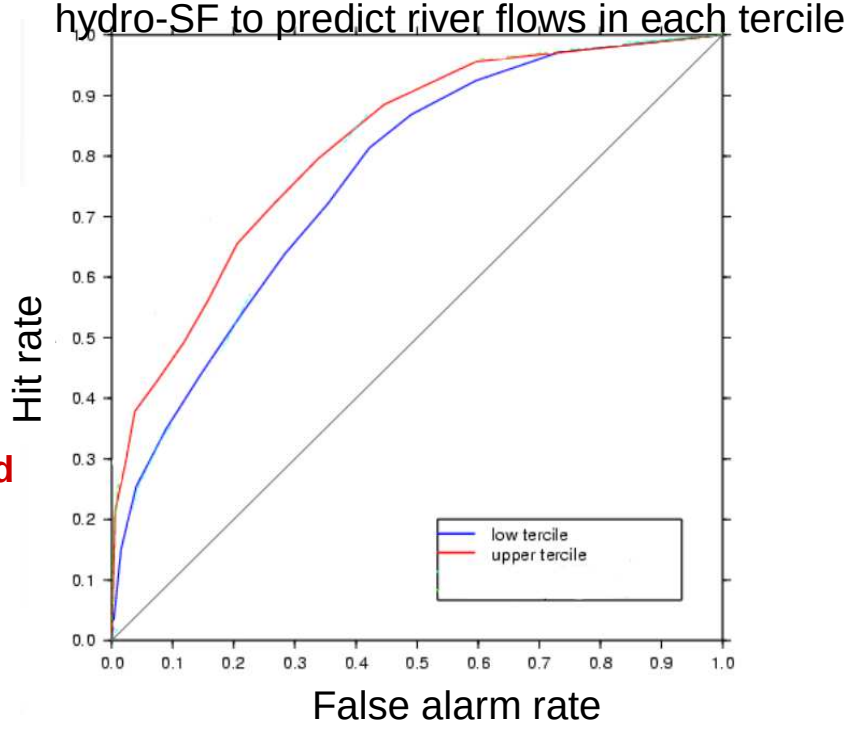
Proposal:

Provide a probability to be Above or Below a threshold leading to decision (through stakeholders discussion)

Plume curves showing probabilistic forecast and critical threshold



ROC curves showing the performance of hydro-SF to predict river flows in each tercile



Taking care of the Predictability and the Skill

- Click to add logo

EUPORIAS

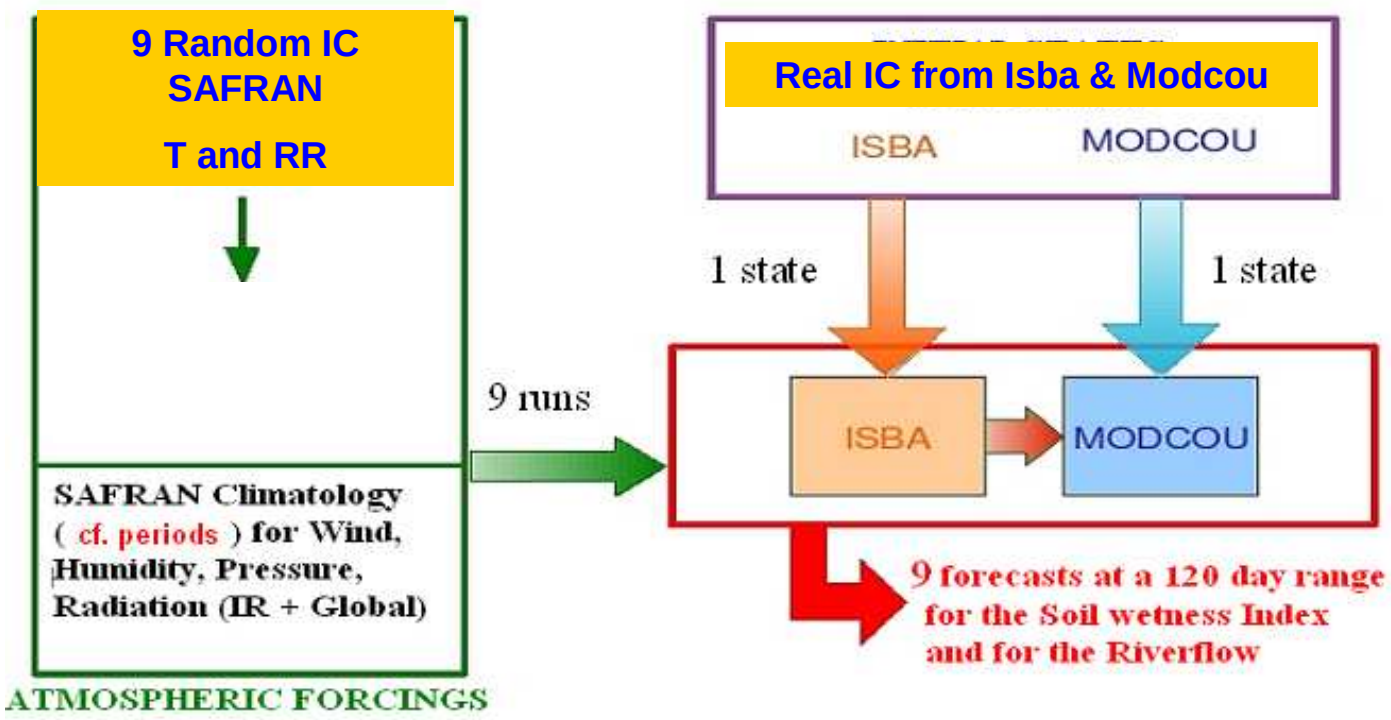
METEO FRANCE
Toujours un temps d'avance

- Key question to address for the development of Climate Services : Is Climate information really impact onto the Decision Making Processes ?
- Needs to go beyond the verification of the products
- Proposed method : **Placebo concept – provide additional forecast**
  - ✓ **With no more information than the climatology (on average)**
  - ✓ **Allowing to replay past events and DMPSs**
  - ✓ **Indistinguishable from the seasonal forecasting information**

Preliminary view on the WP4.1

METEO FRANCE
Toujours un temps d'avance

- Placebo concept : proposed method - **Additional forecast**



HYDRO-SF

RAF

- Period from 1958 to 2005 (ENSEMBLES) – 9 members
- Period from 1979 to 20012 (System3) – 9 or 11 members

- Proposed Protocol for demonstrating the usefulness and the impact of the Climate information onto the DMPs:
  - **Providing 2 set of hindcasts (set 1 and set 2) to our stakeholders**
  - **Years not in chronological order**
  - **Stakeholders "replaying" 30 years of decisions (they have more than 30 years of archive on the decision made)**
  - **Comprehensive analysis of the Decision made**
    - ✓ **Set 1 , Set 2 and Past decisions**
    - ✓ **Note the need to define what is a "good" decision, an "acceptable" decision and a "bad" decision**

THANK YOU!

How can EUPORIAS help SPECS

- Provide up to date information on users requirements and needs
- Develop our understanding of the sector-specific information cascade: from predictions to impacts, from impacts to decisions.
- Refine our understanding of the propagation of the uncertainty through the whiole chain.
- Provide a fast loop to check the value of new prediction techniques to decision-makers.

Wish-list:
what do we want from SPECS:

- A short but comprehensive summary of the **level of predictability** for temperature and precipitation in Europe on seasonal to decadal time-scales.
- A standard approach to measure and to present the **skill** of seasonal prediction systems in Europe.
- Help us defining the most appropriate **metrics** to assess the skill of the impacts predictions.
- **Make yourselves available** for meeting with the users
- A set of **fact-sheets** (2 pages max) describing some essential key concepts (e.g. How does a seasonal prediction work and why?).
- Inputs into the definition of a short a **glossary** of key terms (e.g. uncertainty, bias, skill and predictability) to be shared between the two projects.