

I requisiti degli operatori regionali per il monitoraggio del clima

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**Workshop del Forum Nazionale degli Utenti del
Programma Copernicus Climate Services**

Sala Polifunzionale della Presidenza del Consiglio dei Ministri –
via S .Maria in Via – ROMA

(*) Botarelli L., Tomozeiu R., Pavan V., Marletto V,
Antolini G., Tomei. F., Villani G., Pratizzoli W, Spisni, A., Volta A.

Introduzione

- Le azioni di adattamento, da sviluppare alla scala locale, per mitigare gli impatti del cambiamento climatico, sono basate sulla valutazione del “rischio”
- Per valutare gli impatti e migliorare il supporto ai “policymakers” sono necessari “Prodotti e Servizi” Climatici alla scala locale, con attenta gestione delle incertezze
- I Servizi Climatici alla scala locale aggiungono valore e rappresentano uno strumento fondamentale per le pubbliche amministrazioni e gli utenti locali

Alcuni esempi di “prodotti e servizi” climatici utili per gli utenti regionali



Previsioni di lungo periodo (mese-stagione) e Scenari di Cambiamento Climatico a scala locale applicati a:

- a) Agricoltura: Servizi di supporto all'Irrigazione (sistema ICOLT) alla scala locale
- b) Agricoltura: Scenari di fabbisogno idrico in un clima mutato, alla scala di bacino e locale
- c) Protezione Civile, gestione del Rischio Idrogeologico-Idraulico: Ottimizzazione dei sistemi di allertamento (EWS) mediante sviluppo di scenari di portata, definizione di soglie idrometriche (attuali e future) ecc...
- d) Gestione della risorsa idrica: Simulazione di scenari di portata fluviale a livello di bacino idrografico (caso del Po)

I REQUISITI DEGLI OPERATORI REGIONALI PER IL MONITORAGGIO DEL CLIMA

I servizi Copernicus possono essere destinati a:

- a. Operatori regionali-purveyors: per avviare o migliorare i loro servizi agli utenti finali (necessità di avere: ECV “core” da CDS e “derived” da SIS)
- b. Utenti finali anche esperti, ovvero consulenti aziende pubbliche e private (**necessità di avere dati e prodotti da “core” SIS e SIS da Operatori regionali-purveyors**)

CDS-SIS  **Op. Reg.-SIS**  **Utente finale**

ECV e Prodotti/servizi “core” necessari agli operatori regionali

ERA5 Climate Reanalysis Data

Reanalysis is a key contribution to the implementation of the EU-funded Copernicus Climate Change Service (C3S) delivered by the European Centre for Medium-Range Weather Forecasts (ECMWF).

Seasonal forecasts

Basati su dati di previsione stagionale “stato dell’arte”, a scala globale, prodotti e resi disponibili da diversi Centri Meteorologici e Climatici europei e presenti nel CDS di Copernicus

Modelli globali accoppiati per simulazioni di scenario climatico (simulazioni di ensemble, su una stessa “griglia comune”



ECMWF Home Chart dashboard Contact Search ECMWF Log in

About Forecasts Computing Research Learning

Type of level
 Model levels
 Potential temperature
 Potential vorticity
 Pressure levels
 Surface

ERA Interim Fields
 Daily
 Invariant
 Synoptic Monthly Means
 Monthly Means of Daily Means
 Monthly Means of Daily Forecast Accumulations

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ERA Interim, Daily

Please [login](#) before retrieving data from this dataset server.

Please note that the fields shown on this interface are a subset of the ERA Interim dataset. The complete dataset (including wave fields) is available via the batch access. The full list of fields can be found [here](#).

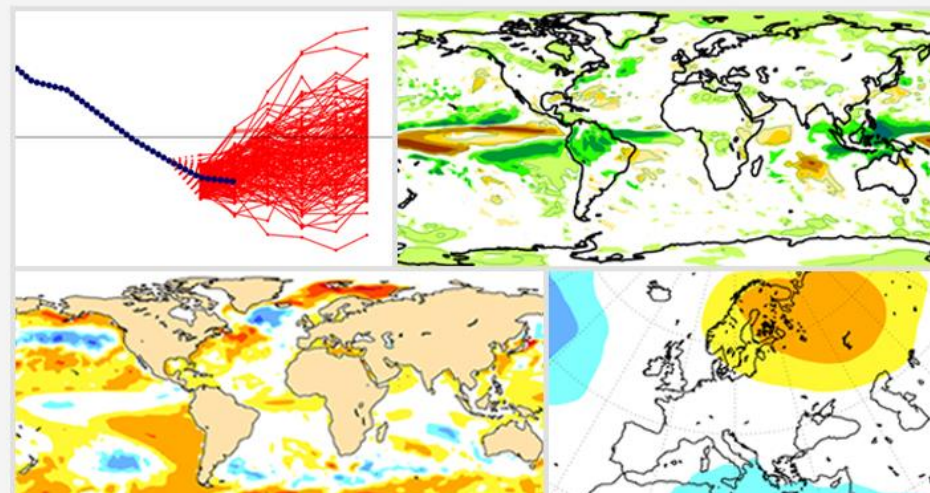
Select date
 Select a date in the interval 1979-01-01 to 2016-12-31
 Start date: [1979-01-01] End date: [2016-12-31]

Select a list of months

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Seasonal forecasts

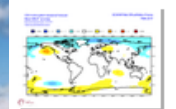
home » products



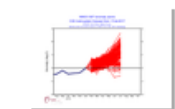
SIS PROJECTS

matching items

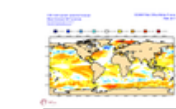
Centres: C3S multi-system



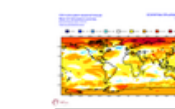
C3S multi-system MSLP



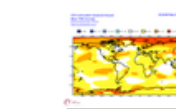
C3S multi-system NINO plumes



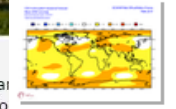
C3S multi-system SST



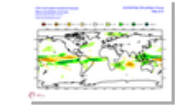
C3S multi-system T2m



C3S multi-system T850



C3S multi-system potential height



C3S multi-system precipitation

The Copernicus Climate Change Service (C3S) aims to provide information that will help societal and business sectors improve decision-making and planning regarding climate mitigation and adaptation. At the moment 7 proof of concepts projects are working with sectors to develop the C3S so that it meets the needs of these users. The projects include, 2 projects for the water sector, 2 for the energy, 1 for insurance, 1 for agriculture and 1 for both infrastructure and health sectors.

Dati presenti su Climate Data Store (CDS)

Stime di ECV, indicatori climatici e altre informazioni rilevanti sul passato, presente e futuro del sistema climatico accoppiato Atmosfera-Oceano, a scala globale, continentale e regionale.

In dettaglio si parla di: serie temporali omogeneizzate di osservazioni in situ e metadati associati, record di dati climatici rielaborati dai satelliti, uscita dal rianalisi globali e regionali, previsioni stagionali, output di modelli climatici,

Esempi di ECV	Unit
T850 hPa	°K
Z500 hPa	m
MSLP	hPa
Air temperature*	°C
Precipitation	mm
Relative humidity	%
Wind*	m/s
Gustiness*	m/s
Boundary layer height	m
Friction velocity (u^*) *	m/s
Temperature scale (T^*) *	-
Roughness length (z_0) *	M
Snowfall	mm
Global radiation	w/m ²
Direct shortwave radiation	w/m ²
Diffuse shortwave radiation	w/m ²
Snow cover	m

DA SIS: ECV secondari post-elaborati e post-elaborabili. Esempi tratti da URBAN SIS

Health	Air quality	Air pollutant concentration Air pollution exposure Air pollution health impact
	Heat stress	Hot days Heat wave duration Heat-related deaths
	Discomfort	Thom Discomfort Index Universal Thermal Climate Index Frequency of tropical nights
Energy	Energy consumption	Heating and cooling degree days
	Solar energy	Solar insolation
Infrastructure	Flooding	Local and surface runoff Intense precipitation
	Soil	Soil temperature
	Green infrastructure	Growing season length
	Transport infrastructure	Drought periods Frost days Zero-crossings
Non-sector specific	Temperature	Maximum, minimum, and average air temperature
	Snow cover	Snow cover depth

Gli approcci per:

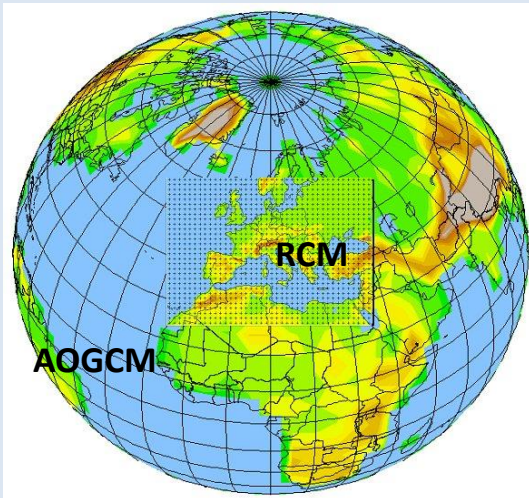
- La Regionalizzazione delle Previsioni di lungo periodo e degli Scenari Climatici globali per creazione di:
- ECV “down-scalate” a scala locale e ECV derivate per la creazione di Climate Services e la valutazione locale degli impatti

Attività operatori regionali. Esempio: downscaling deterministico e statistico

Modelli regionali (RCM) - modelli a fisica più completa innestati a una via (oneway) sui modelli di scala globale (*Downscaling Dinamico*)



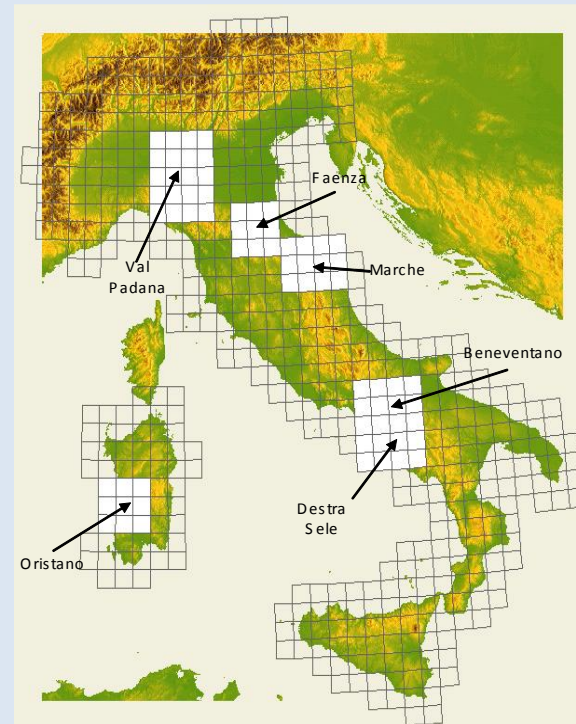
resolution 50 –cca5 Km



Downscaling Statistico (SDS)



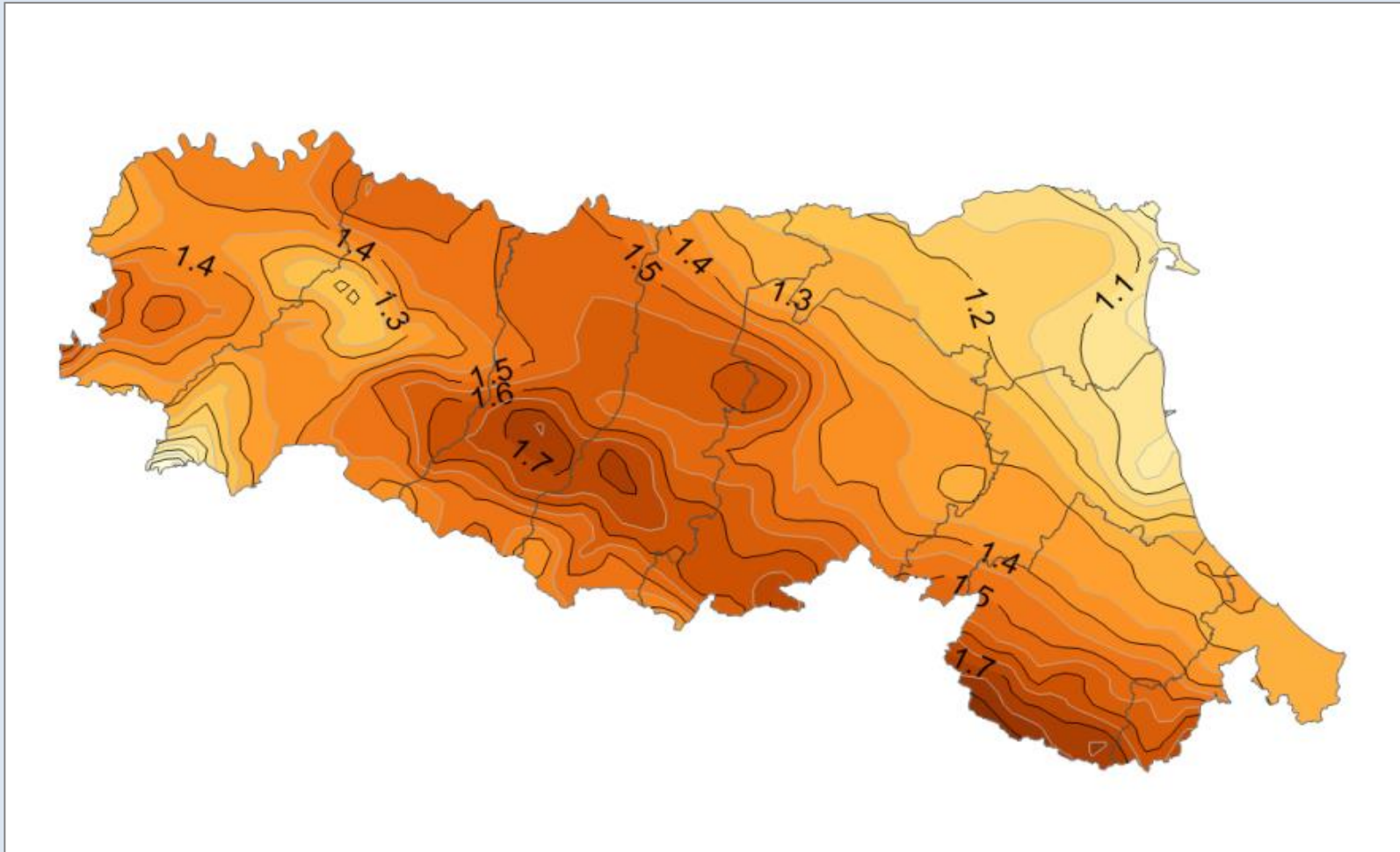
resolution: grid – point (a), station (b)



Seasona Forecast and Regional Climate Scenario

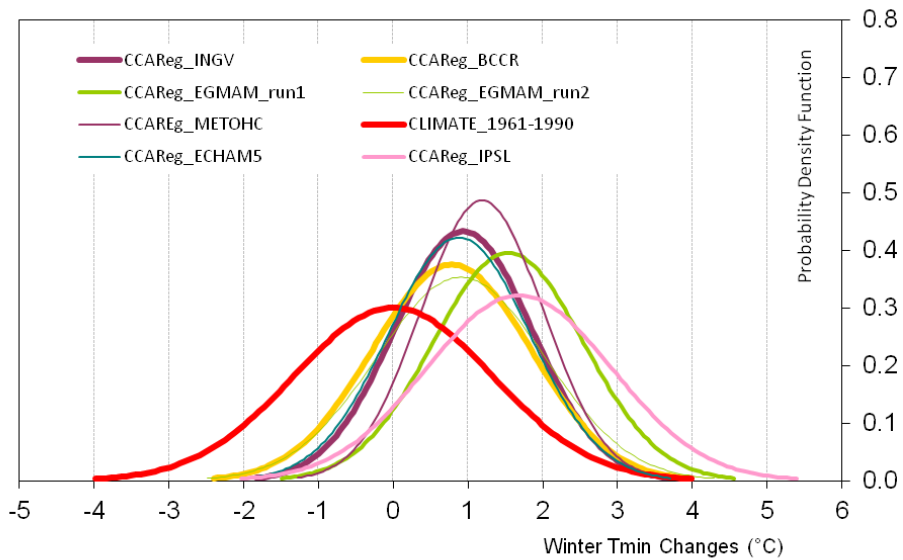
Applicazioni

Winter Tmax change – 2021-2050 with respect to 1971-2000
Scenario RCP45 (ERACLITO data set - ER)

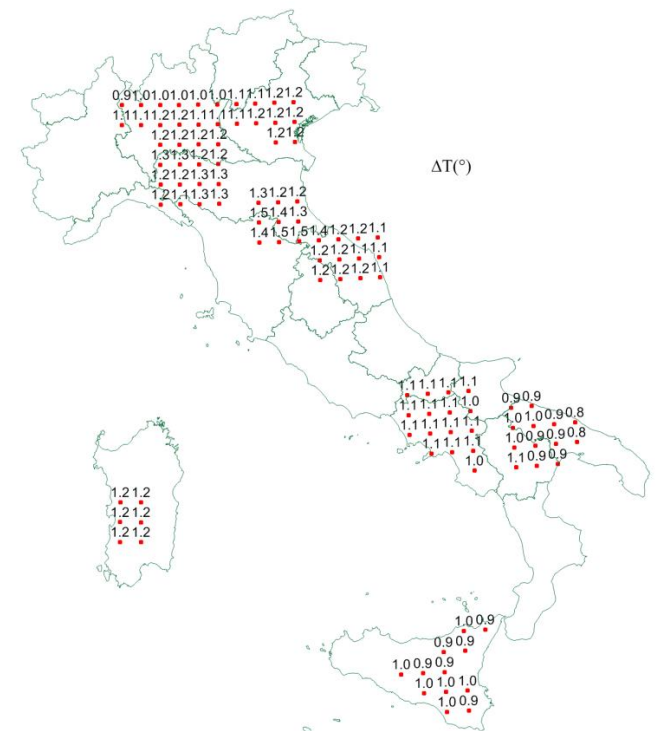


Applicazioni

Scenario A1B (2021:2050 -1961:1990)



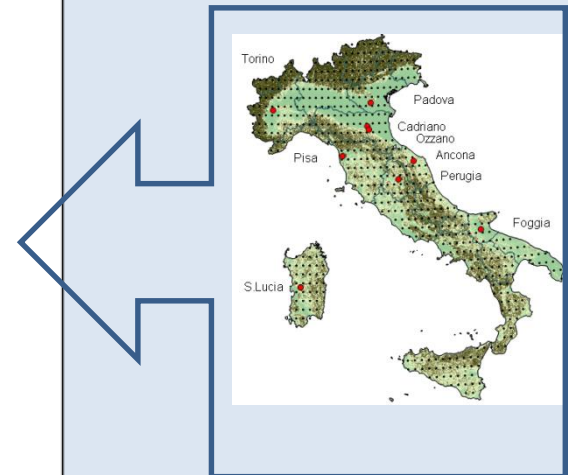
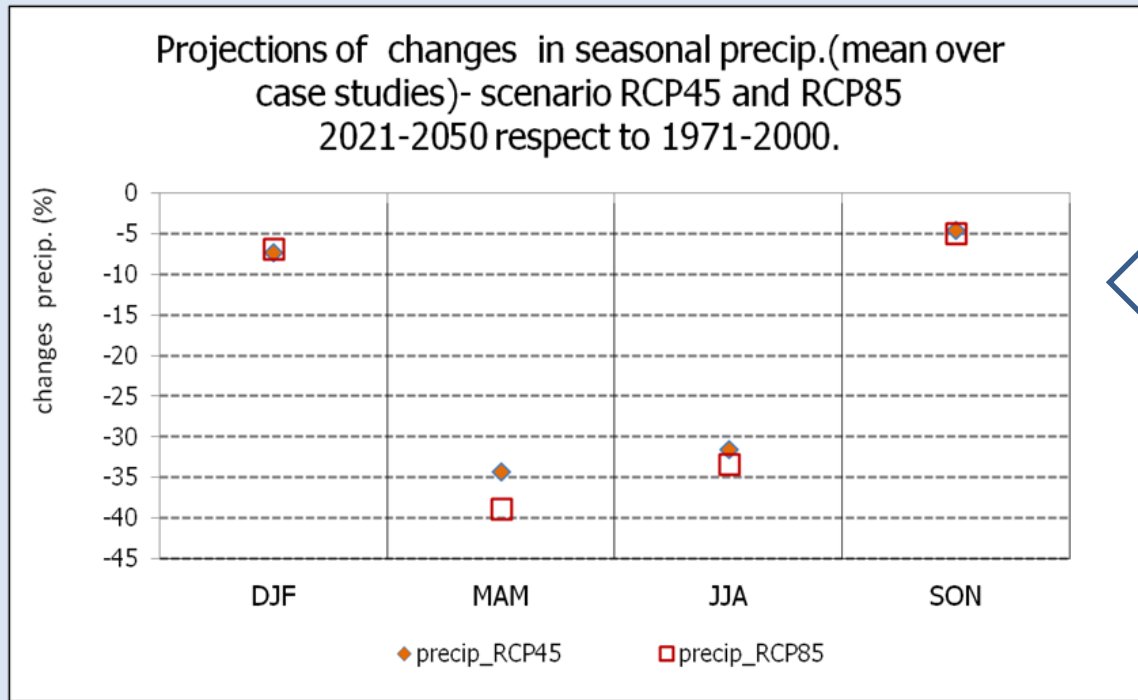
Changes winter Tmin (EM), scenario A1B
2021-2050 respect to 1961-1990



Proiezioni di Tmin inverno, scenario emissivo A1B,

Applicazioni

Scenari di cambiamento climatico nelle precipitazioni
2021:2050-1971:2000, (Modello CCAReg_CMCC, scenari:RCP45 &RCP85
)



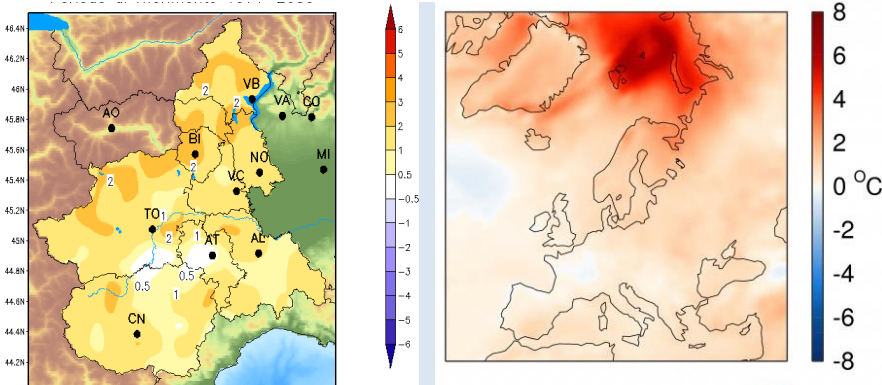
(E-Obs data set)

Average surface air temperature monthly maps

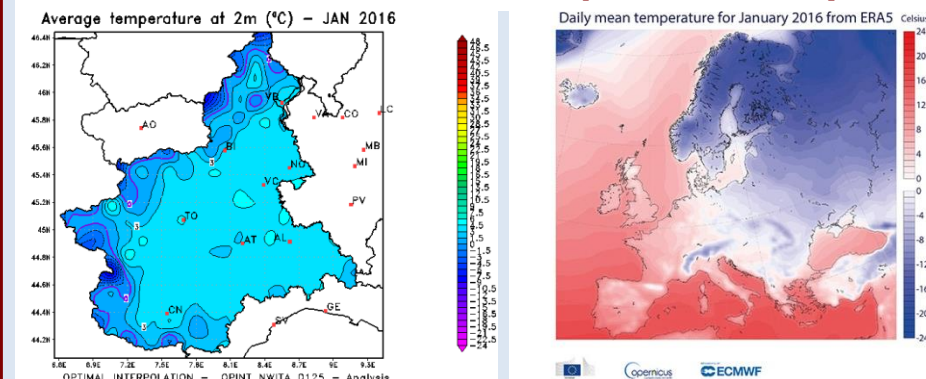
Climate reanalysis

Seasonal forecasts

2016 2m temperature anomaly



Jan 2016 2m temperature analysis



Updated climatology

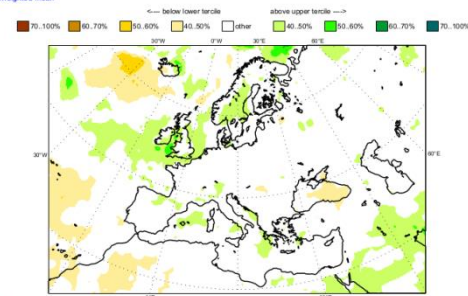
- Large-scale and local-scale climatology assessment comparison
- Seasonal forecast verification
- Reliable and uniform climatology

High resolution and high frequency operational reanalysis

- Prompt severe events dynamic understanding
- Reliable first guess for local surface parameter analysis
- Reference climatology at EU level

C3S multi-system seasonal forecast
Prob.(most likely category of precipitation)
Normal forecast start: 01/02/17
Unweighted mean

ECMWF/Met Office/Météo-France
MAM 2017



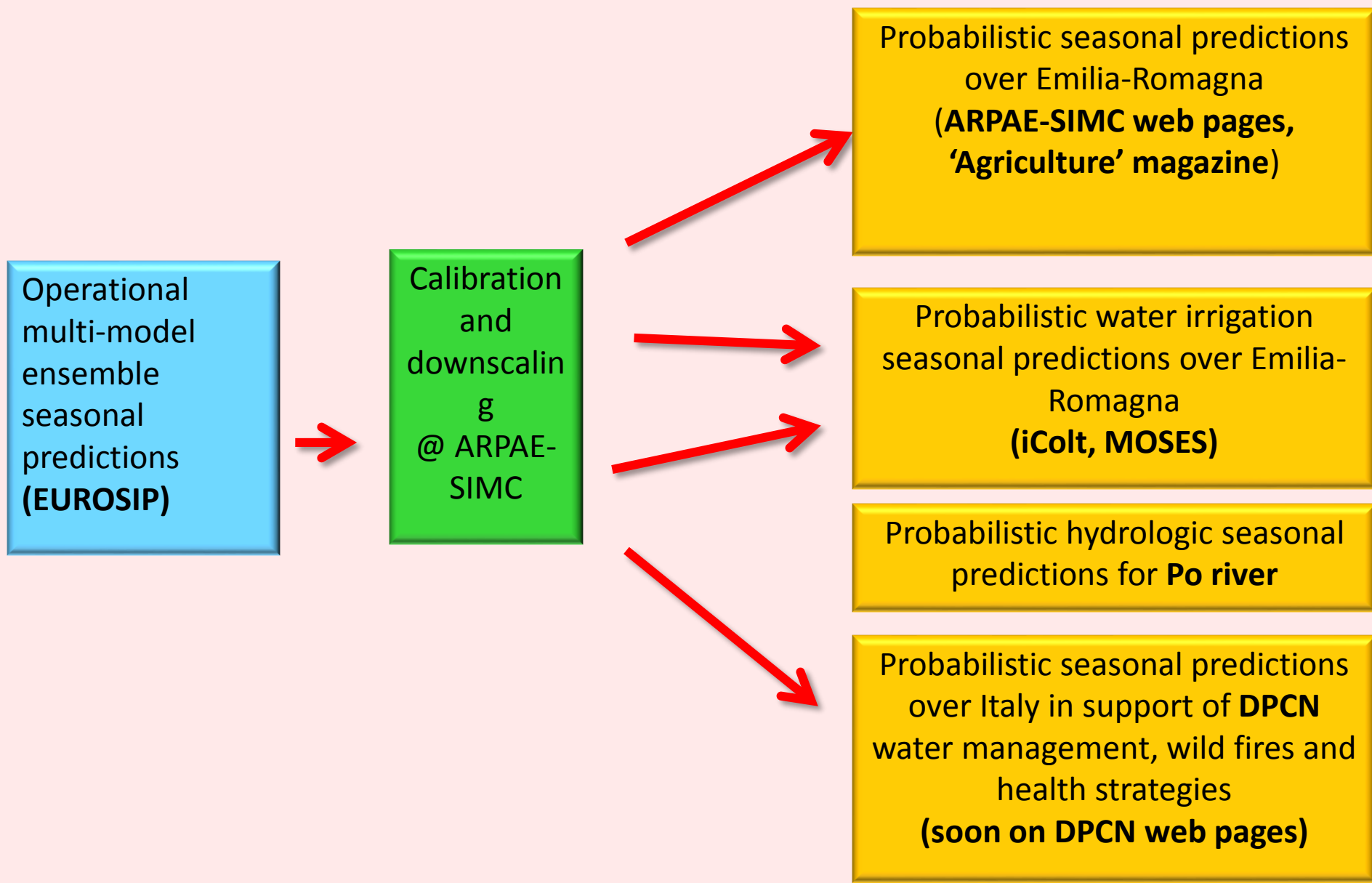
Multimodel seasonal forecasting

- More reliable forecasts including variability due to model dependence
- Developing of climate services at regional/local scale (water resource management, energy production, health warning for pollution-pollen-heat waves, forest fires...)

Produzione di Climate Services a scala regionale e locale

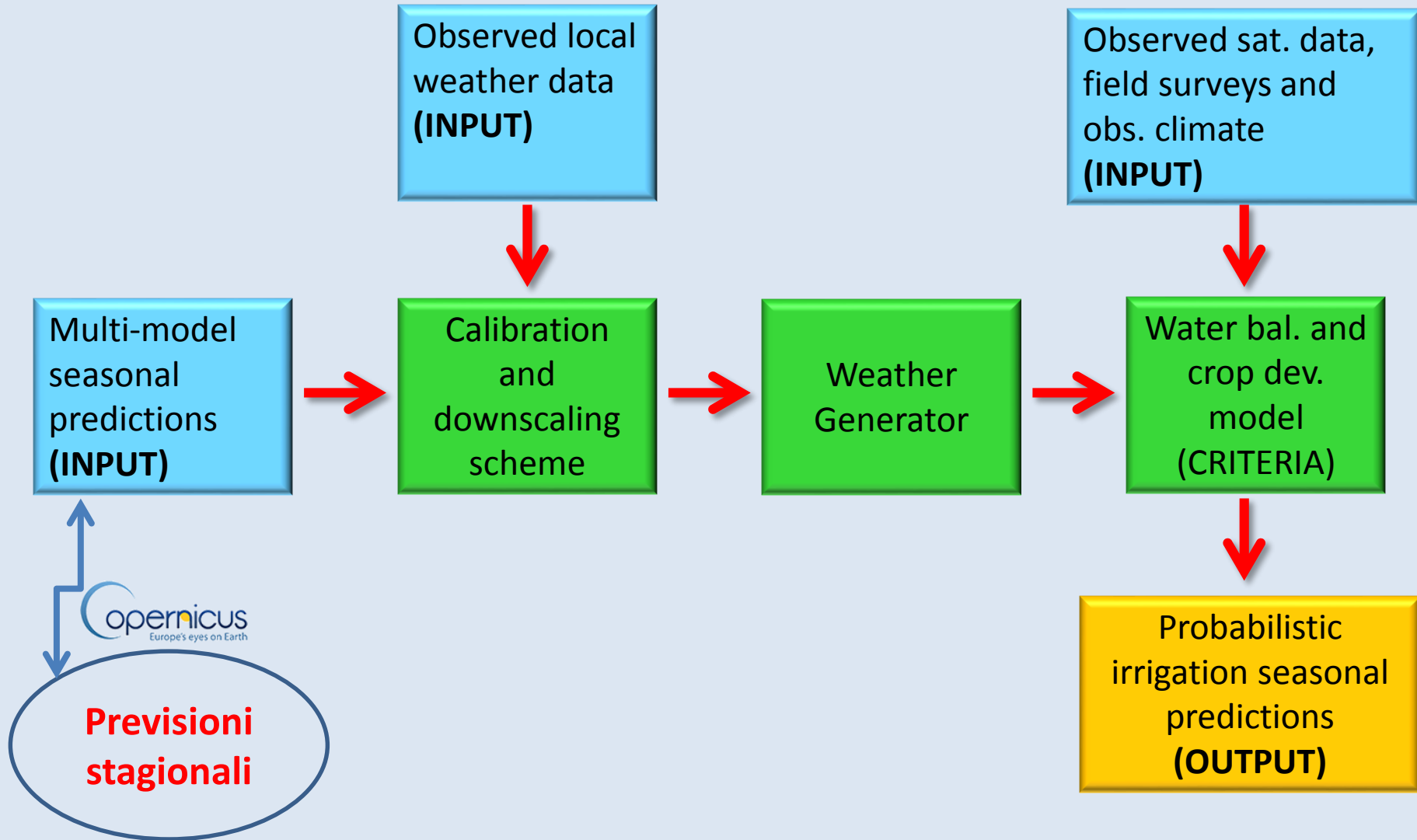
Tipologia di Servizi Climatici a scala stagionale

Arpae-SIMC



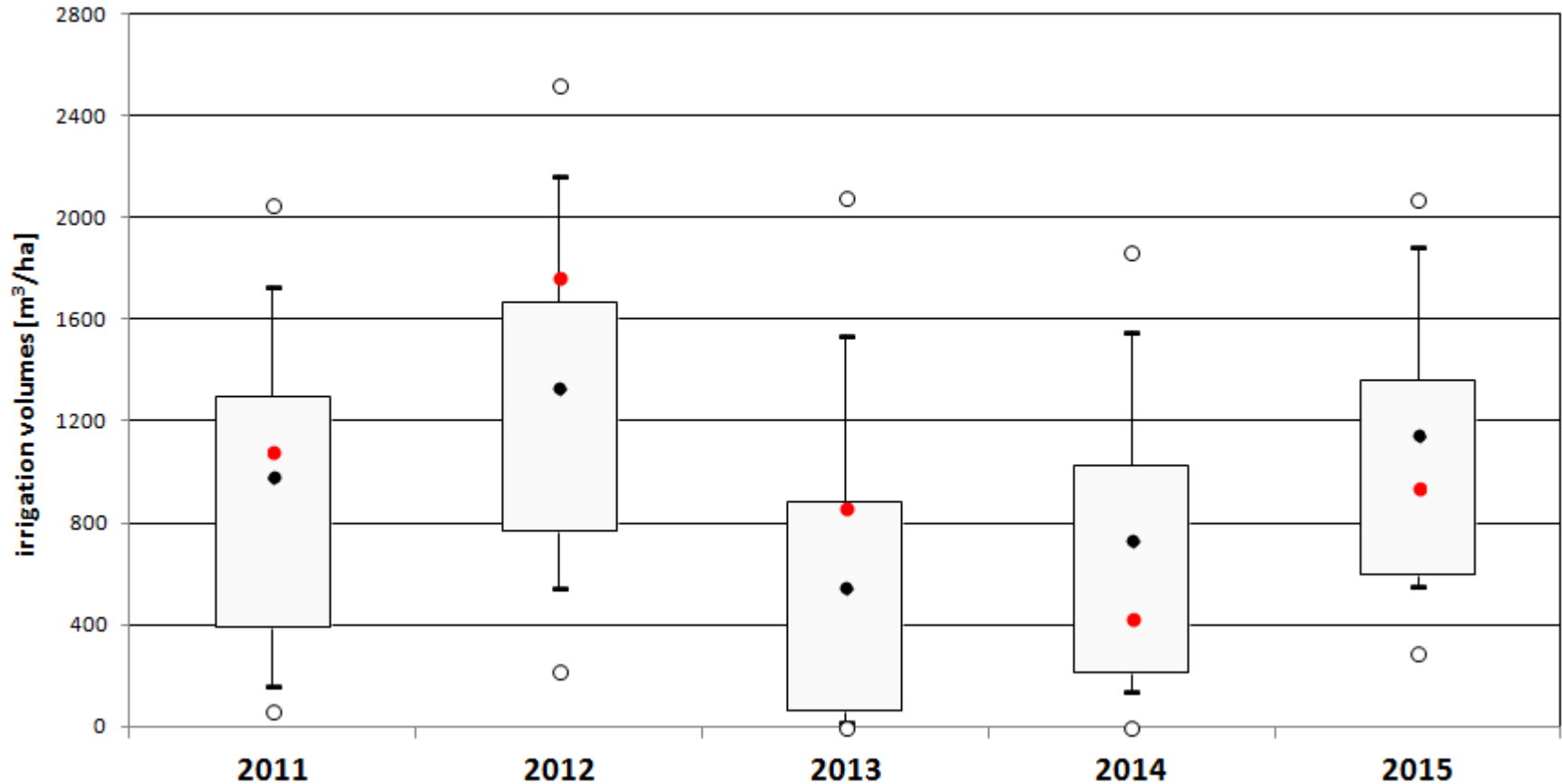
Previsioni Stagionali – per Irrigazione

IL SISTEMA Icolt

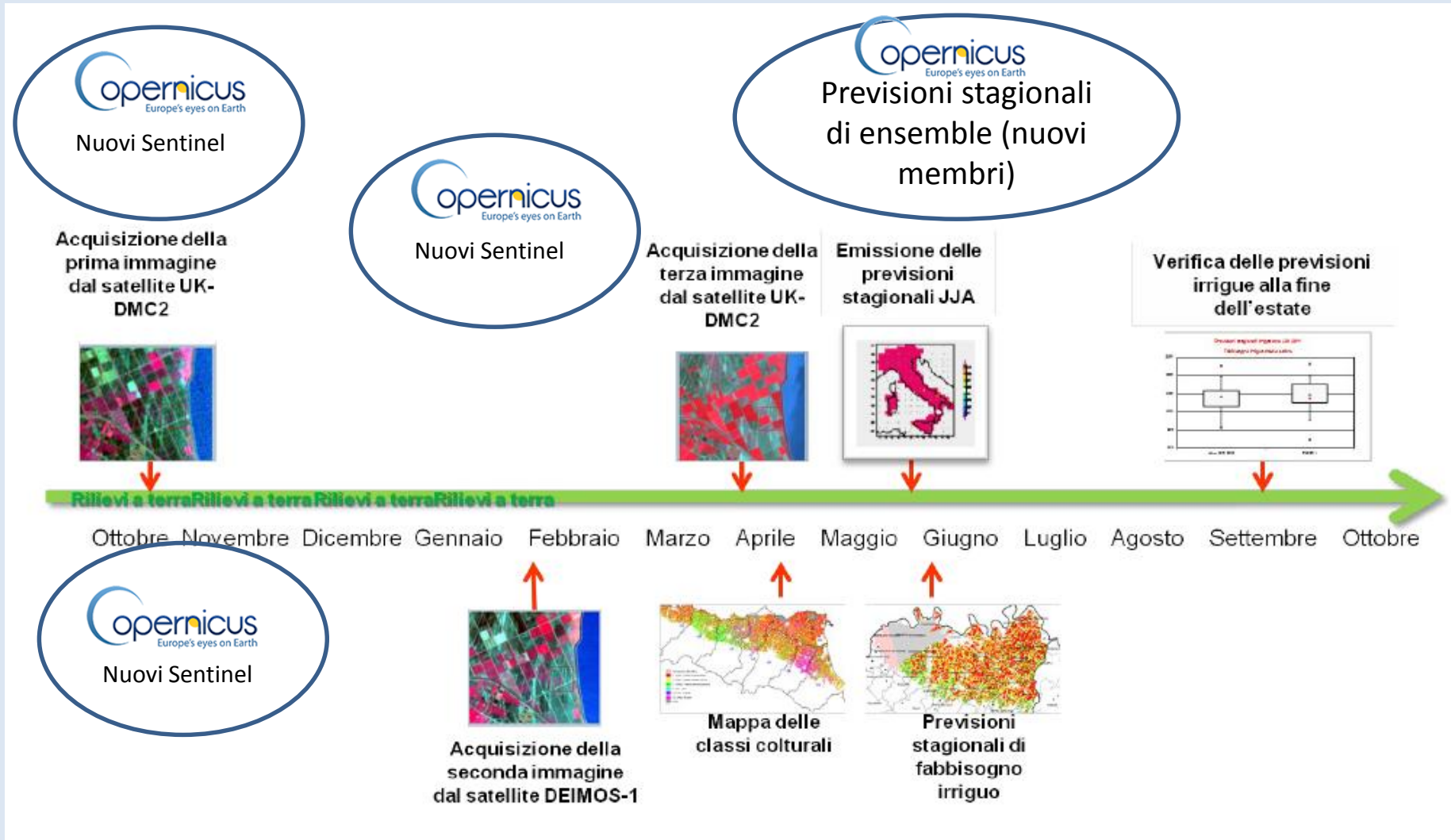


iColt irrigation seasonal forecasts (attuale)

Emilia-Romagna average – red dot simulated & observed actual summer weather



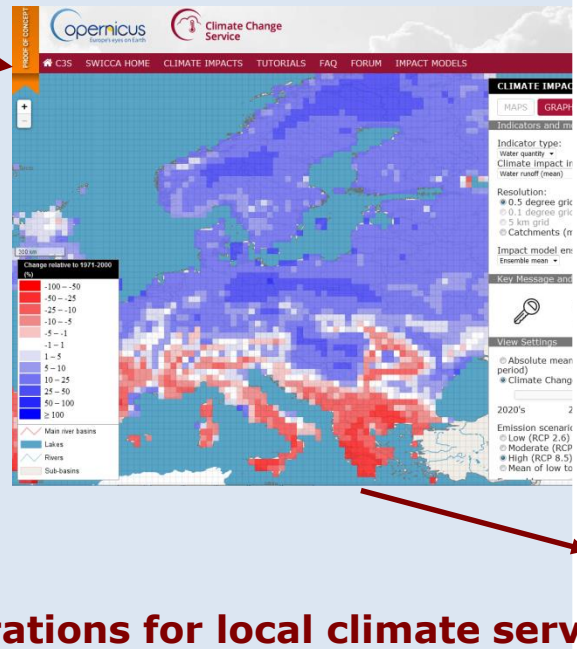
Previsioni Stagionali – per Irrigazione IL SISTEMA Icolt attuale e possibili up-grade



Regional Climate Scenario and climate services

[Data Services](#)
[Sectoral Information System](#)
[The Climate Data Store](#)

- Water**
- Energy**
- Agriculture & Forestry**
- Health + Infrastructure**
- Insurance**



PERICOLO DI INCENDIO BOSCHIVO

Zona	2019/07					2019/07					30/01 - 05/02		06/02 - 12/02		
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- **Reliable base and useful demonstrations for local climate services development**
- **Common climate impact scenarios and indicators**
- **Environmental indicator evaluation in a changing climate**
- **Reference for adaptation plans (national, regional, local level)**
- **Efficacy increasing in the policy level involvement (reputation!)**
- **Improvement in the climate change and impact public communication**

Data Services

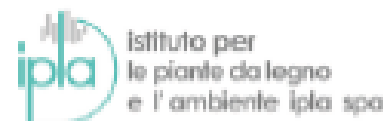
Sectoral Information System

The Climate Data Store



BOLLETTINO

PERICOLO DI INCENDIO BOSCHIVO



BOLLETTINO N	DATA EMISSIONE	VALIDITA'	AGGIORNAMENTO	SERVIZIO A CURA DI	AMBITO TERRITORIALE
23/2017 Pag. 6/8	23/01/2017	10 giorni	24/01/2017	Arpa Piemonte - Dipartimento Sistemi Previsionali	Regione Piemonte

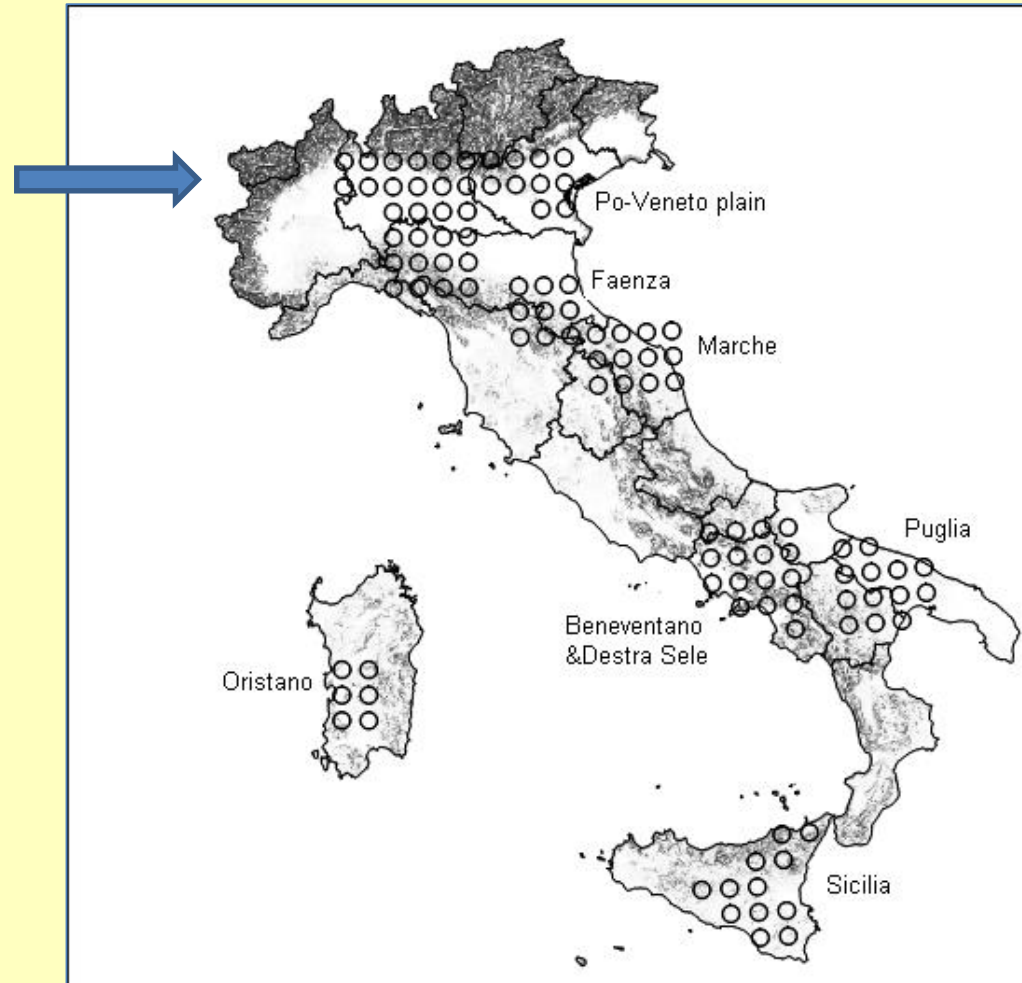
Zona	dom 22	lun 23	mar 24	mer 25	gio 26	ven 27	sab 28	dom 29	lun 30	mar 31	mer 01	30/01 - 05/02	06/02 - 12/02
5	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. nella media
6	Yellow	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red		
7	Blue	Red	Yellow	Red	Blue	Red	Red	Red	Red	Red	Yellow		
8	Yellow	Red	Red	Red	Blue	Red	Red	Red	Red	Red	Yellow		
9	Blue	Blue	Blue	Blue	Red	Red	Red	Red	Red	Red	Green		
10	Green	Blue	Red	Red	Red	Red	Red	Red	Red	Red	Blue	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. nella media
941	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Yellow	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. nella media
11	Yellow	Red	Yellow	Red	Red	Red	Red	Red	Red	Red	Yellow	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. nella media
12	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. nella media
13	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Yellow		
4	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Prec. poco sopra la media Temp. sopra la media	Prec. nella media Temp. nella media
45	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Orange		
24	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. poco sopra la media
25	Red	Red	Green	Yellow	Red	Red	Red	Red	Red	Red	Red		
28	Yellow	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red		
29	Yellow	Blue	Yellow	Green	Red	Red	Red	Red	Red	Red	Red		
26	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. poco sopra la media
27	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red		
30	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red		
913	Yellow	Red	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Red		
911	Yellow	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Prec. sopra la media Temp. sopra la media	Prec. nella media Temp. poco sopra la media

Our case studies and impacts: project AGROSCENARI

Case studies: Po plain,
Faenza, Marche, Puglia,
Beneventano, Oristano and

Impacts on different cultivars
such as::

- viticulture,
- olive growing,
- grain crops,
- intensive horticulture under irrigation
- grain growing for zootechnical and intensive fruit growing.

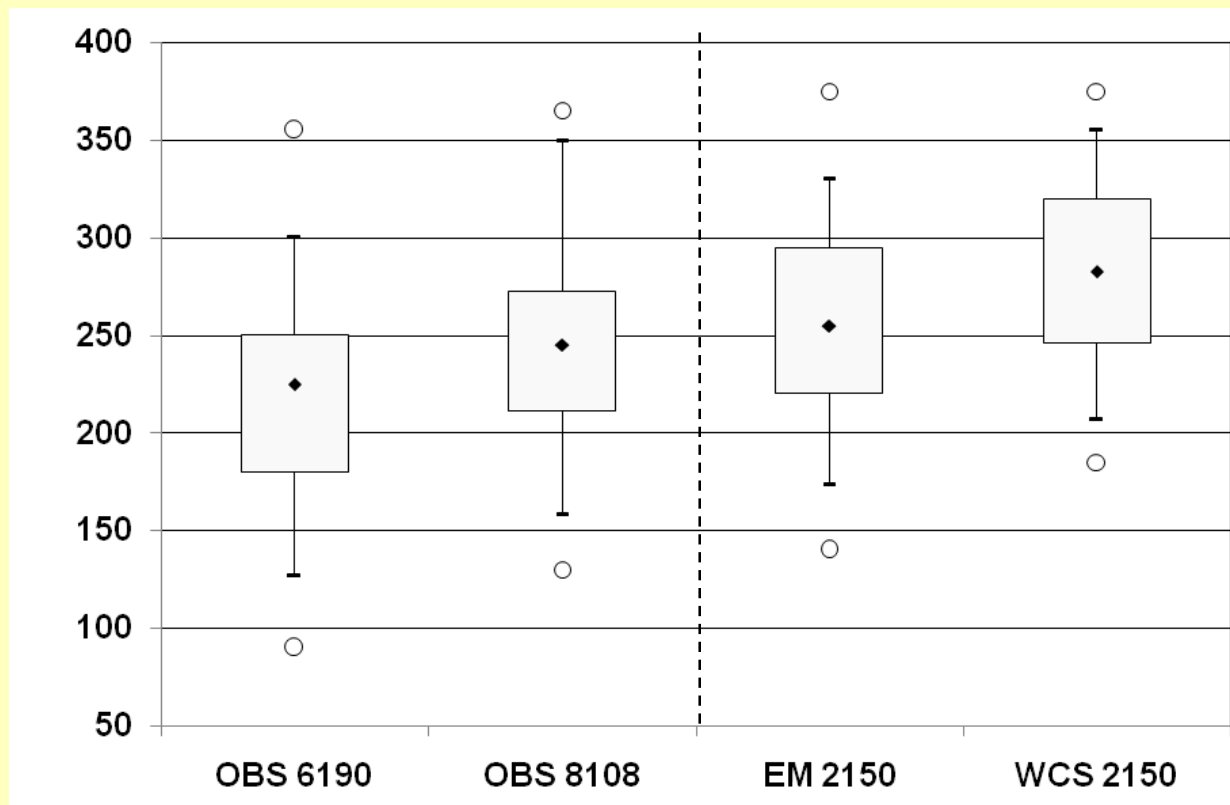


(Source of data: Meteorological and Climatological Research unit for agriculture – Agricultural Research Council, CRA – CMA, resolution 35km)

Future scenarios: 2021-2050, A1B

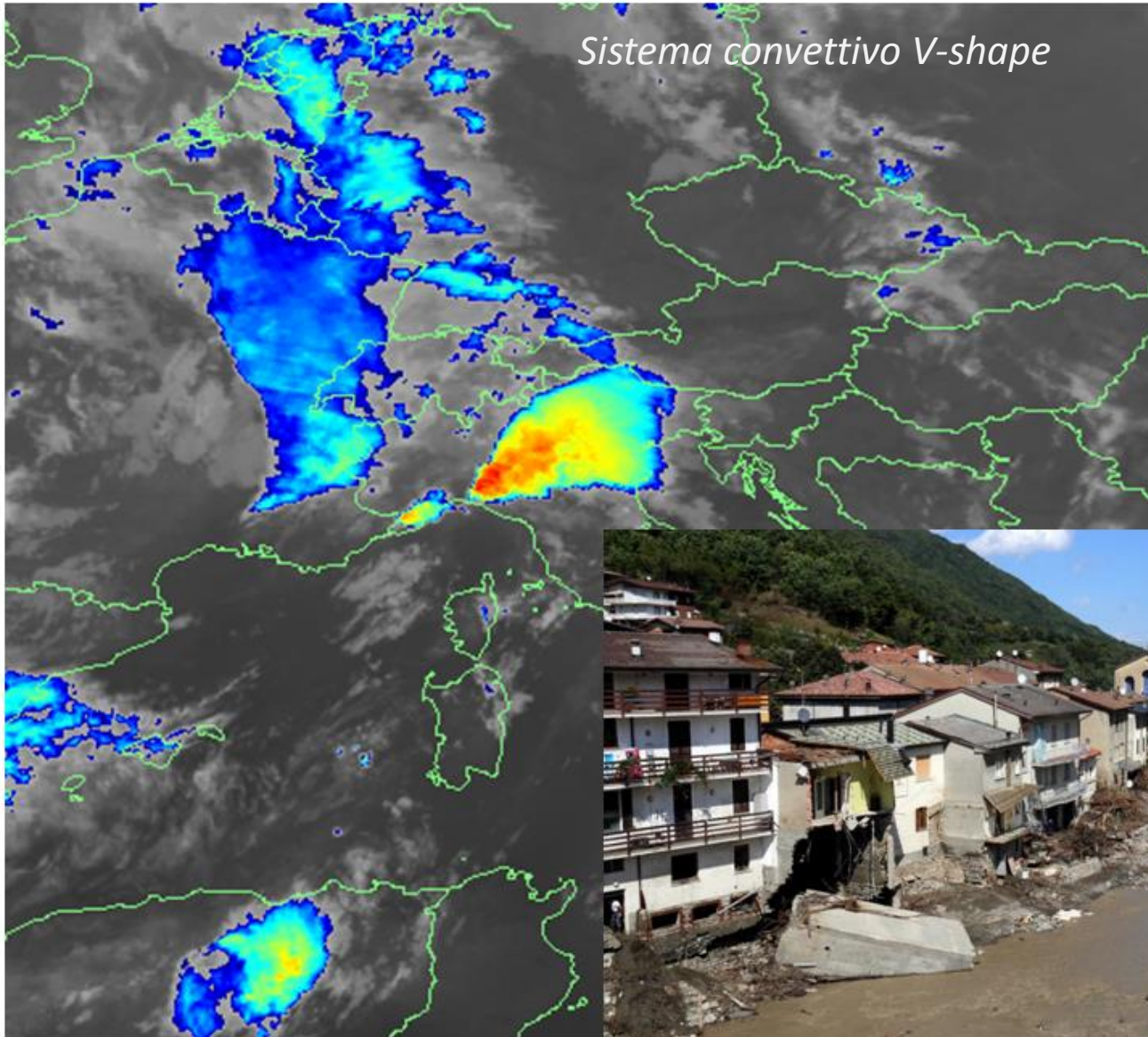
Scenari di fabbisogno irriguo

- ▶ Irrigation demand scenario
- ▶ kiwifruit, 2021-2050, Faenza area



Val Trebbia/Nure Flood: 14/9/2015

Sistema convettivo V-shape

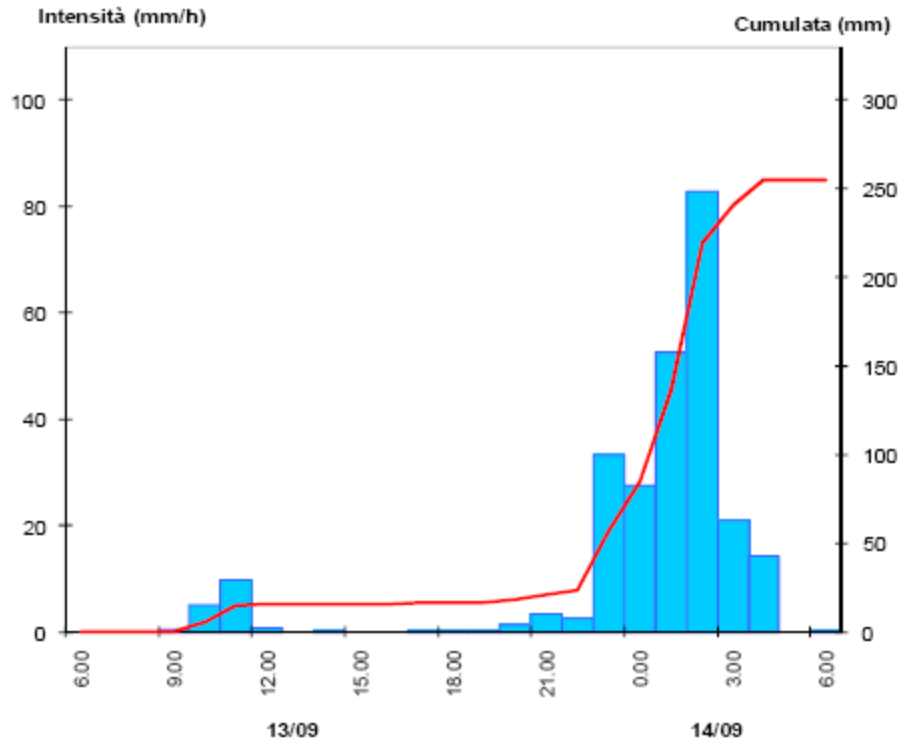


EN IR 10.8 14/09/2015
Alluvione Val Trebbia/Nure

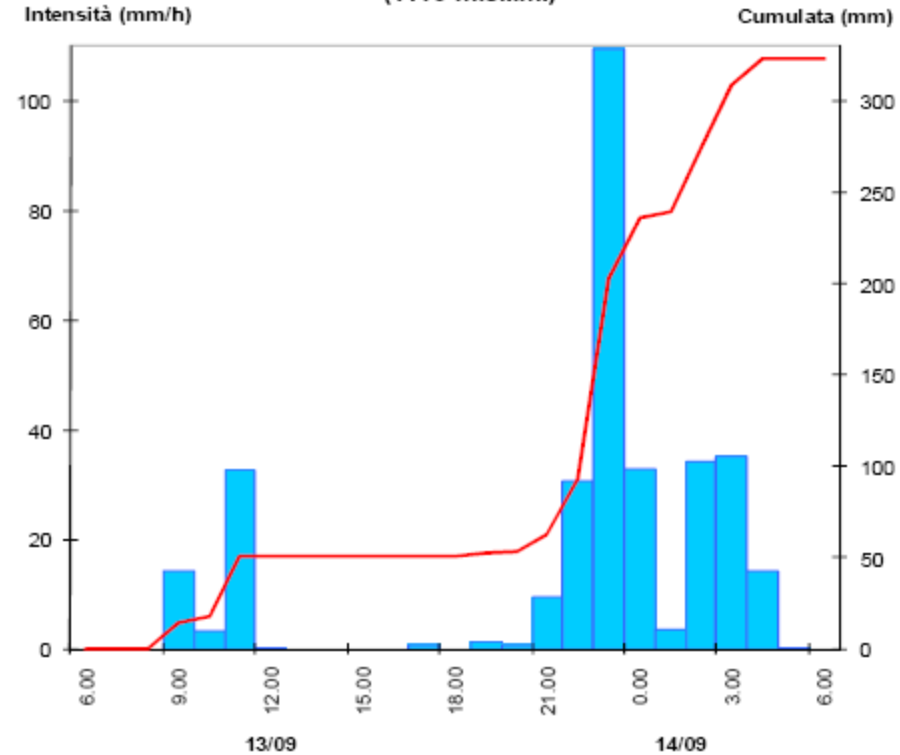


Precipitation observed

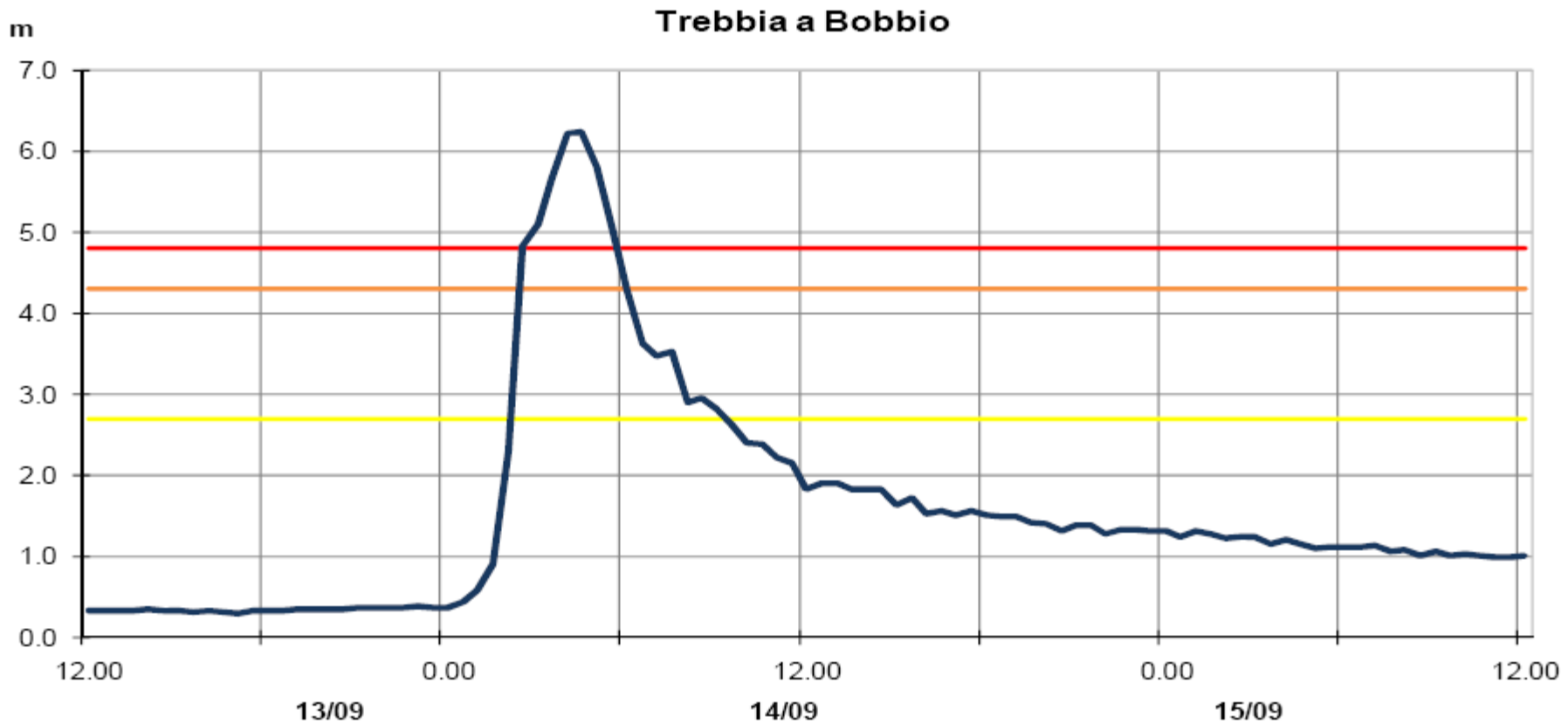
TREBBIAVALSIGIARA
(462 m.s.l.m.)



BARBAGELATA
(1116 m.s.l.m.)



Hydraulic level over threshold 3!



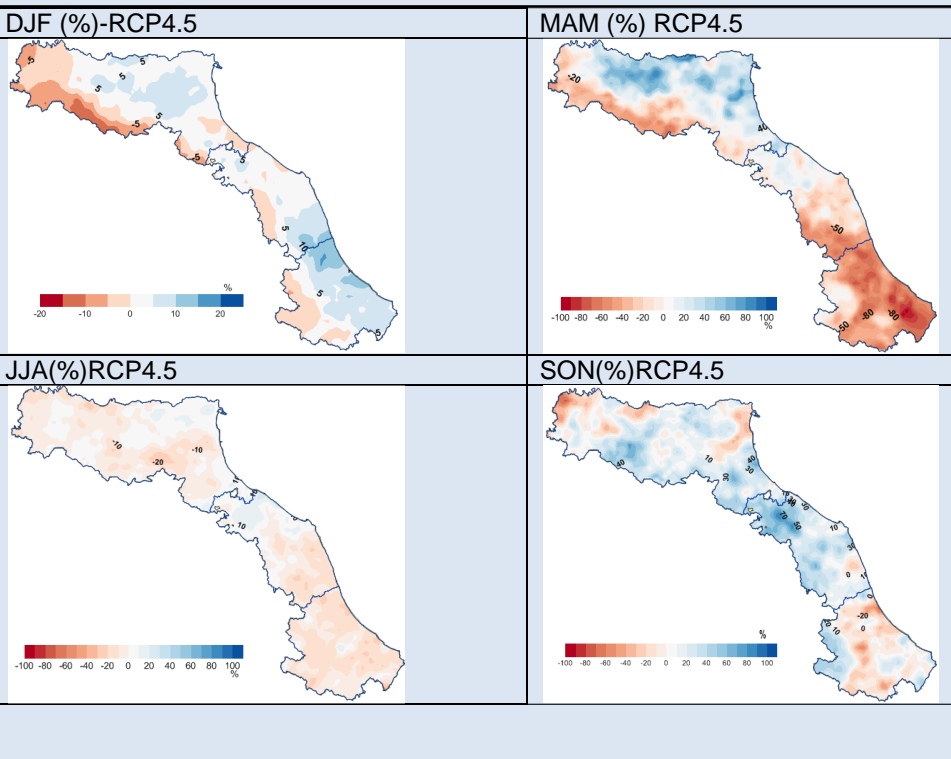
Projects LIFE PRIMES: PReventing floodg risks by Making rESilient communities



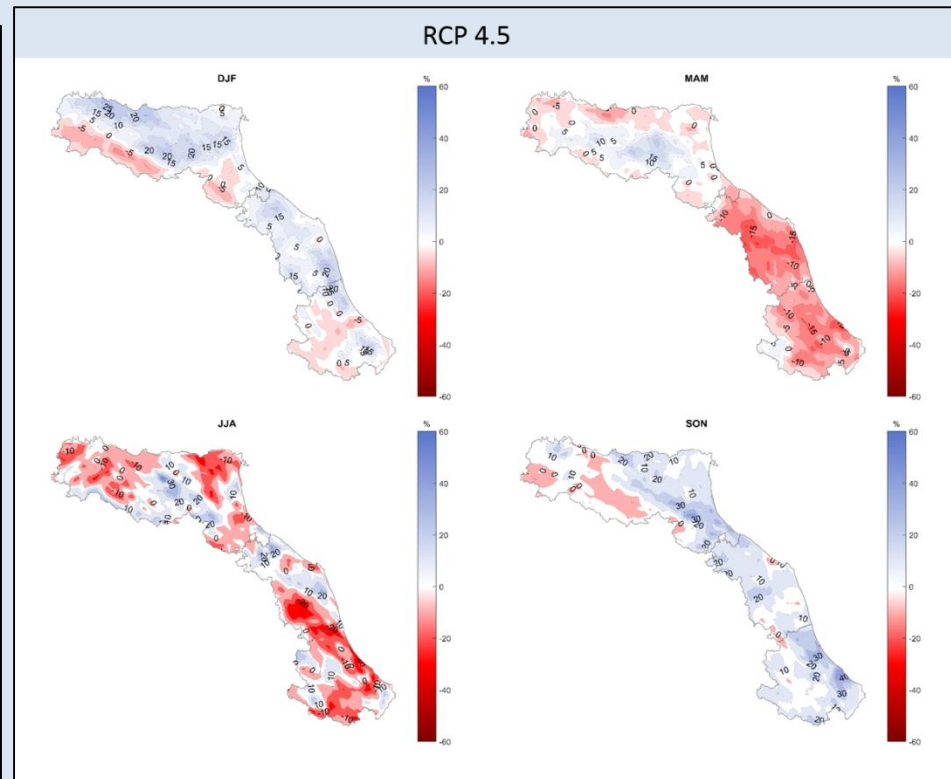
- E' un progetto Life + project finalizzato a costruire comunità più resilienti, attraverso azioni di adattamento al climate change, in particolare i sistemi di EWS per la prevenzione del rischio idraulico.
- Selezionati un set di indici climatici (**downscaled ECV!**) focalizzati sugli estremi di precipitazione e temperatura e i loro cambiamenti tra il 1961-2015 (presente) e il 2021-2050 (futuro). Gli scenari locali sono stati costruiti a partire da RCP4.5 and RCP8.5 – collaborazione Arpae-Simc/CMCC-CIRA



Comparison Stat. Down. & Dynam. Down. Change of intense precipitation 95mo perc 2021-2050 with respect to 1981-2010 (RCP4.5)



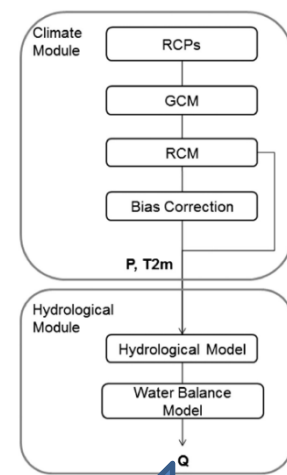
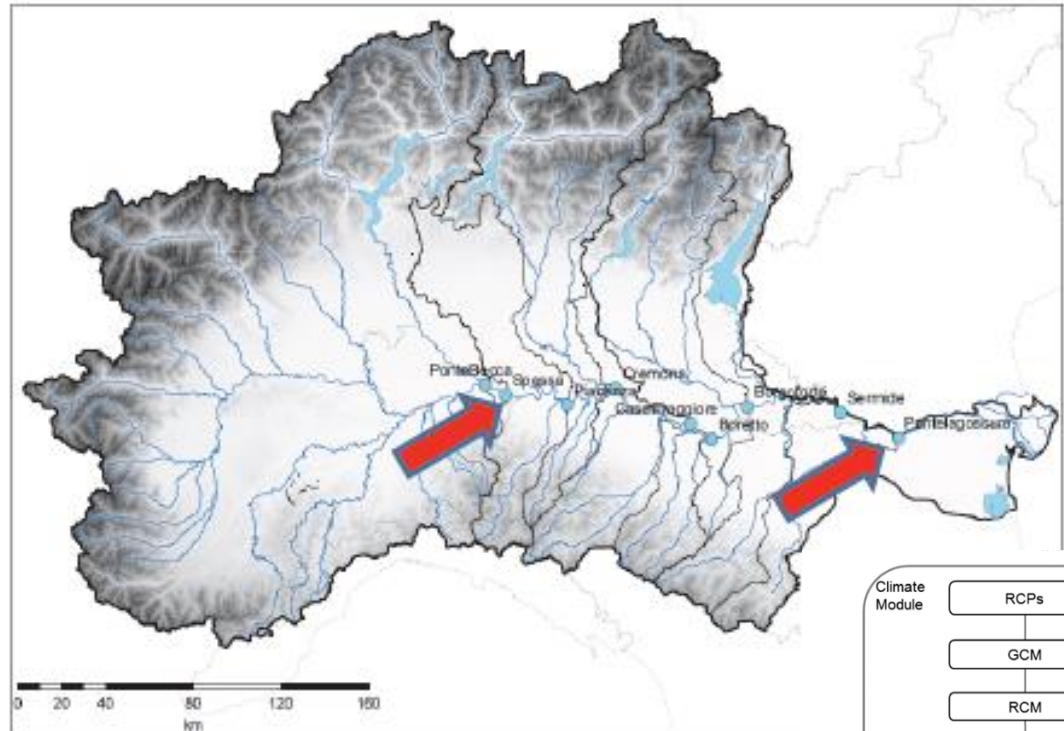
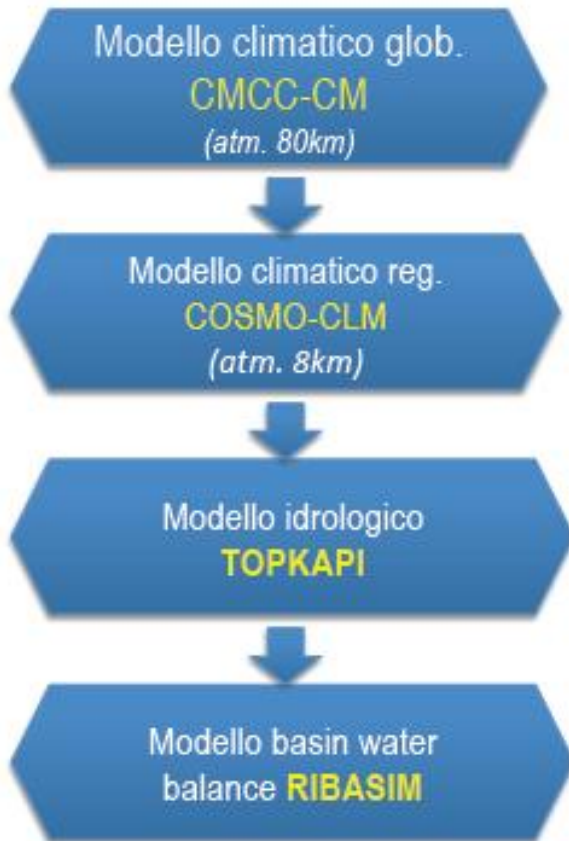
Stat.Down (Arpae-Simc)



Dynam. Down (CMCC-CIRA)
Cosmo-CLM

Scenari climatici: anomalie di portata [%] del Po

(collaborazione CMCC e ARPA E.R.)

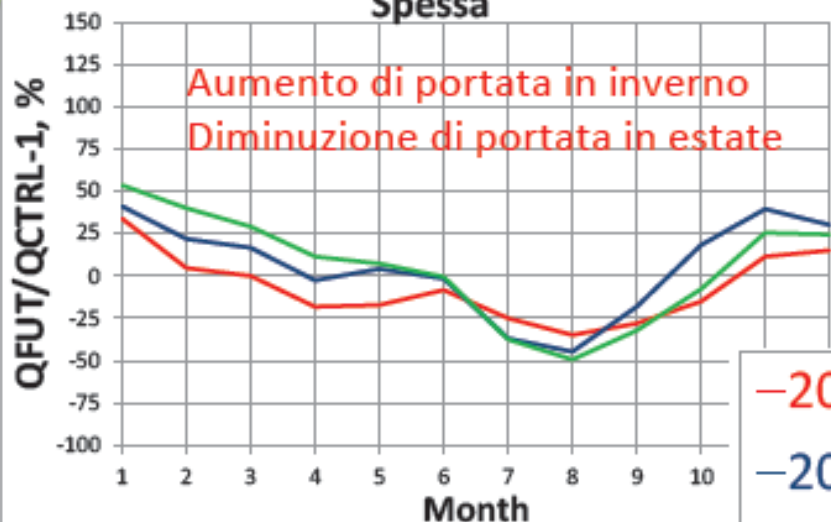


Scenari climatici: anomalie di portata [%] del Po

(collaborazione CMCC e ARPA E.R.)

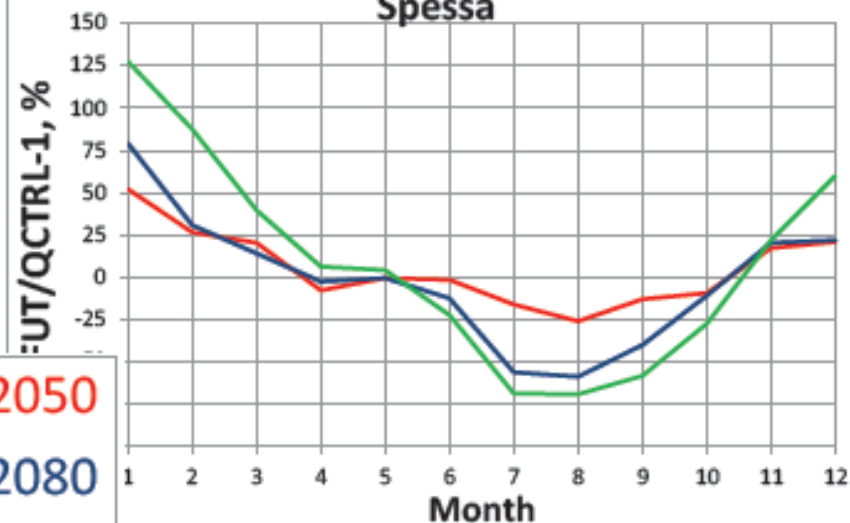
RCP 4.5

Spessa



RCP 8.5

Spessa

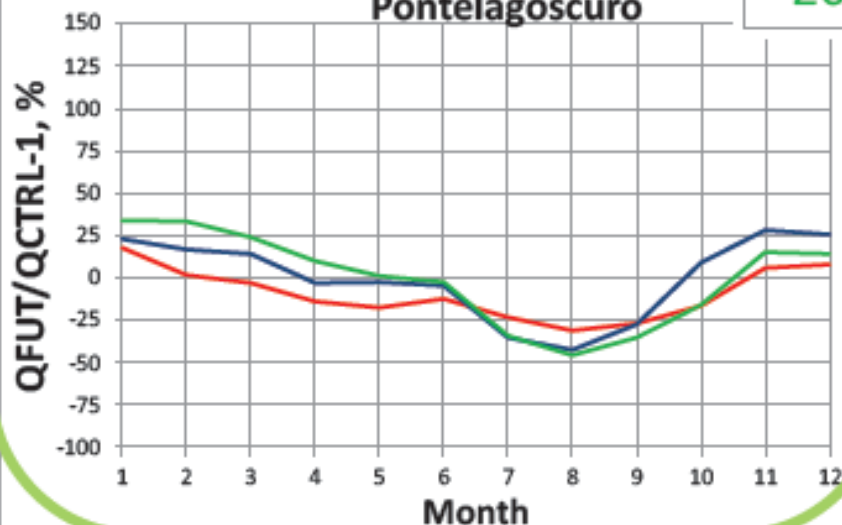


— 2021-2050

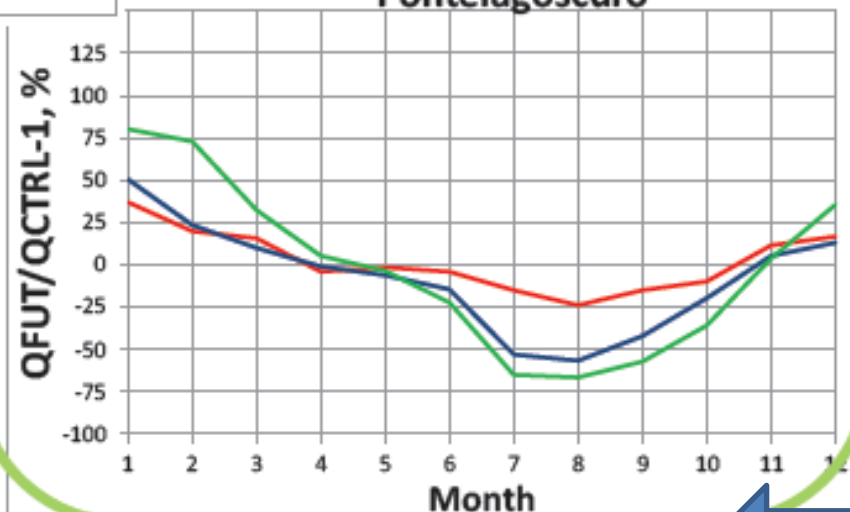
— 2051-2080

— 2071-2100

Pontelagoscuro



Pontelagoscuro



- Input dettagliato per il downscaling

Modello meteorologico Harmonie-Arome

- Dati meteorologici di contorno per
 - periodo storico: UERRA
 - proiezioni climatiche: RCP8.5
 - Fisiografia dettagliata

Modello idrologico HYPE

- Fisiografia dettagliata
- Irrigazione (dati locali)

Modello di qualità dell'aria MATCH

- Dati di emissione (dati locali e come ricaduta CAMS/EMEP)

