FEWS user days

The FEWSPo system: actual state and new developments

7th November 2019 – Delft

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arpae
agenzia prevenzione ambiente energia emilia-romagna

This presentation

- FEWSPo “core business”
  - Numerical and statistical models for flood and drought forecasting
- New applications
  - Water quality
  - Eco-hydraulics models
  - Random forest application for estimation of threshold crossing probability

A national and interregional agreement among public administrations

Italian Department of Civil Protection

Po river basin Authority

Interregional Agency for the Po river basin

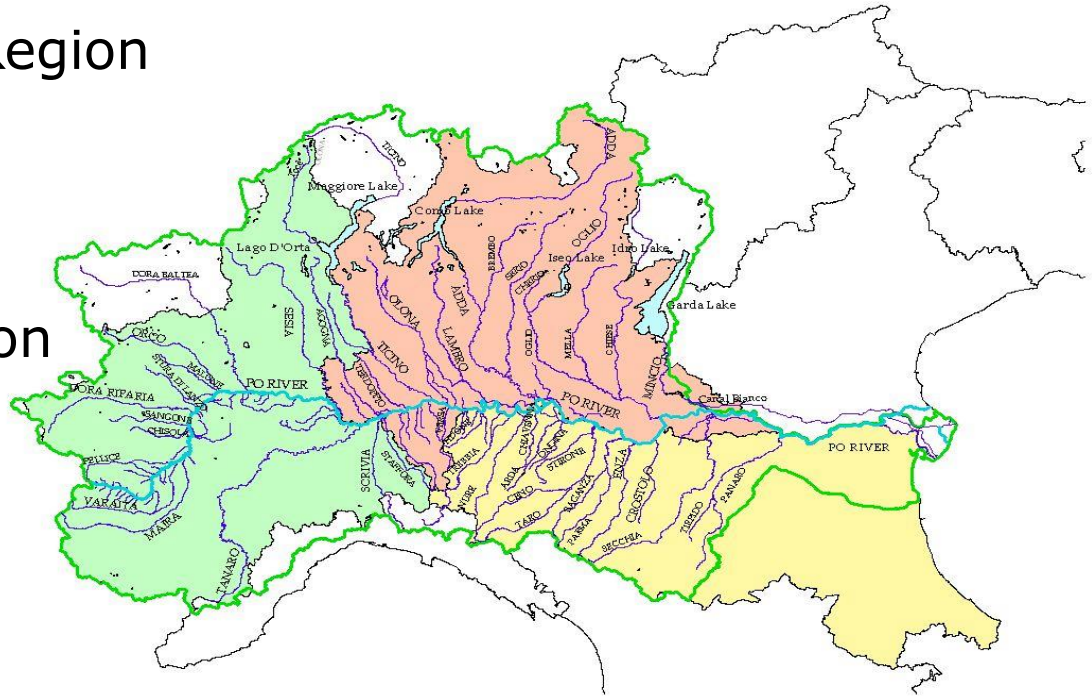
Emilia-Romagna Region

Lombardia Region

Piemonte Region

Valle d'Aosta Region

Veneto Region



The Italian Decree on Po floods

Direttiva PCM 08/02/2013

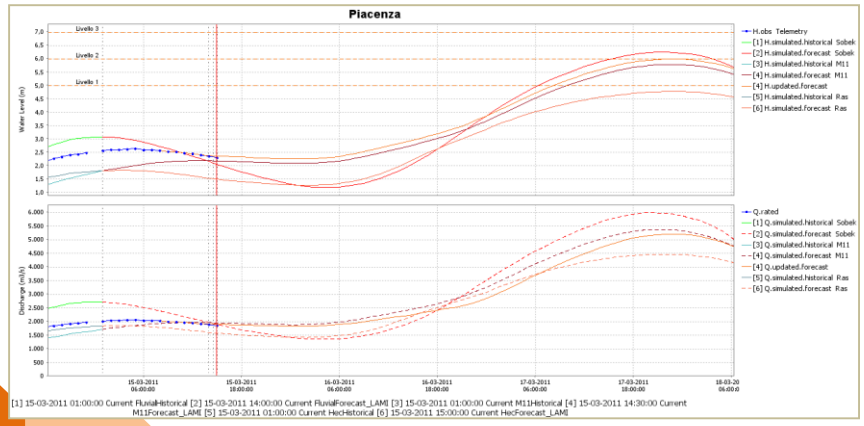
26-4-2013 GAZZETTA UFFICIALE DELLA REPUBBLICA ITALIANA *Serie genera*

DECRETI PRESIDENZIALI

DIRETTIVA DEL PRESIDENTE DEL CONSIGLIO DEI MINISTRI 8 febbraio 2013.

Indirizzi operativi per l'istituzione dell'Unità di Comando e Controllo del bacino del fiume Po ai fini del governo delle piene, nonché modifiche ed integrazioni alla Direttiva del Presidente del Consiglio dei Ministri del 27 febbraio 2004 e successive modificazioni.

to nazionale e regionale per il rischio idrogeolo
idraulico ai fini di protezione civile» e successive
cazioni ed integrazioni» e s.m.i, ed in particolare
5 concernente le misure di previsione e prevenzi
strutturale finalizzate al governo delle piene, ove
sto che nei bacini di interesse interregionale e na
in cui siano presenti opere di ritenuta iscritte nel R



4. Unità di comando e controllo dell'asta principale del Fiume Po.

L'UCC rappresenta l'autorità di protezione civile per il governo delle piene ed è costituita dai Presidenti delle Regioni, o da loro delegati, dal Ministro dell'Ambiente e della Tutela del Territorio e del Mare o da un suo delegato (che potrà essere un Sottosegretario o il Segretario dell'Autorità di Bacino a seconda del livello di rappresentanza)e dalla Presidenza del Consiglio dei Ministri - Capo del Dipartimento della protezione civile o suo delegato, che la presiede. La convocazione dell'UCC è effettuata dal Dipartimento della protezione civile su richiesta di

5. Modello previsionale per l'asta principale del Fiume Po.

La sede di Parma dell'AIPo, svolge le funzioni di centro previsionale per l'asta principale del fiume Po, coordinandosi con i Centri Funzionali Decentrati della Valle d'Aosta, del Piemonte, della Lombardia, dell'Emilia Romagna e del Veneto.

L'AIPo, con il supporto della struttura di ARPA-SIMC di Parma, Centro di Competenza per la modellistica idrologica, garantisce il funzionamento del sistema di modellistica idrologica e idraulica (FEWS *PO)* e l'allineamento degli analoghi sistemi di back-up operativi presso le Regioni e presso il Centro Funzionale Centrale del Dipartimento della protezione civile.

Il Dipartimento della protezione civile, l'AIPo, il Ministero dell'ambiente e della tutela del territorio e del mare, il Ministero delle infrastrutture e dei trasporti e le Regioni interessate assicurano le risorse finanziarie per la gestione e la manutenzione evolutiva dei sistemi modellistici, nonché provvedono all'attuazione delle attività previste

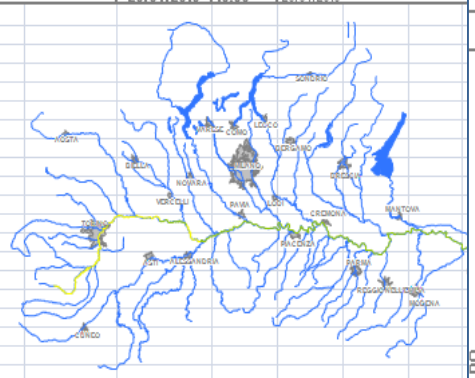
Flood event on Aprile 2013

BOLLETTINO PREVISIONE DI CRITICITÀ IDROMETRICA SUL BACINO DEL FIUME PO

Evento di Aprile 2013

Emissione n. 1 | Del 29/04/2013 | ore 13:00 | Inizio validità: ore 12:00 del 29/04/2013

Tab 1: PREVISIONE DI CRITICITA' SULL'ASTA PO



	STAZIONE	Progr. (km)	Livelli di riferimento 1	2	3	Criticità +24
1	Carignano	85.72	3.10	3.70	5.00	O
2	Torino	108.28	2.90	3.50	4.70	O
3	S.Sebastiano	136.73	3.50	4.00	5.50	O
4	Crescentino	151.14	3.60	4.00	5.00	O
5	Casale	184.37	-0.50	0.50	2.50	A
6	Ponte	208.40	2.70	3.30	4.80	O
7	Isola S.	230.57	5.50	6.50	8.00	A
8	Ponte Becca	263.21	3.50	4.50	5.50	A
9	Spessa Po	280.63	4.50	5.50	6.50	A
10	Piacenza	328.15	5.00	6.00	7.00	A
11	Cremona	374.72	2.20	3.20	4.20	A
12	Casalmaggior	423.94	3.60	4.60	5.60	A
13	Boretto	440.40	4.50	5.50	6.50	A
14	Borgoforte	472.11	5.00	6.00	7.00	A
15	Sermide	523.21	7.00	8.00	9.00	A
16	Pontelagosco	564.23	0.50	1.30	2.30	A
17	Polesella	576.77	5.60	6.60	7.60	A
18	Cavanella	615.00	3.00	3.40	4.40	A
19	Ariano	-	1.40	1.80	2.80	A

SCALA DELLE CRITICITA'

Assente	inferiore a livello 1	Ordinaria	compresa fra livello 1 e 2	Moderata	compresa fra livello 2 e 3	E

BOLLETTINO PREVISIONE DI CRITICITÀ IDROMETRICA SUL BACINO DEL FIUME PO

Evento di Aprile 2013

Emissione n. 1 | Del 29/04/2013 | ore 13:00 | Inizio validità: ore 12:00 del 29/04/2013

Tab 1: PREVISIONE DI CRITICITA' SULL'ASTA PO

	STAZIONE	Progr. (km)	Livelli di riferimento 1	2	3	Criticità +36
1	Carignano	85.72	3.10	3.70	5.00	M
2	Torino	108.28	2.90	3.50	4.70	M
3	S.Sebastiano	136.73	3.50	4.00	5.50	M
4	Crescentino	151.14	3.60	4.00	5.00	O
5	Casale	184.37	-0.50	0.50	2.50	O
6	Ponte	208.40	2.70	3.30	4.80	M
7	Isola S.	230.57	5.50	6.50	8.00	A
8	Ponte Becca	263.21	3.50	4.50	5.50	A
9	Spessa Po	280.63	4.50	5.50	6.50	A
10	Piacenza	328.15	5.00	6.00	7.00	O
11	Cremona	374.72	2.20	3.20	4.20	A
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13	Boretto	440.40	4.50	5.50	6.50	A
14	Borgoforte	472.11	5.00	6.00	7.00	A
15	Sermide	523.21	7.00	8.00	9.00	A
16	Pontelagosco	564.23	0.50	1.30	2.30	A
17	Polesella	576.77	5.60	6.60	7.60	A
18	Cavanella	615.00	3.00	3.40	4.40	A
19	Ariano	-	1.40	1.80	2.80	A

SCALA DELLE CRITICITA'

Assente	inferiore a livello 1	Ordinaria	compresa fra livello 1 e 2	Moderata	compresa fra livello 2 e 3	Elevata

BOLLETTINO PREVISIONE DI CRITICITÀ IDROMETRICA SUL BACINO DEL FIUME PO

Evento di Aprile 2013

Emissione n. 1 | Del 29/04/2013 | ore 13:00 | Inizio validità: ore 12:00 del 29/04/2013 | Aggiornamento

Tab 1: PREVISIONE DI CRITICITA' SULL'ASTA PO

	STAZIONE	Progr. (km)	Livelli di riferimento 1	2	3	Criticità +48
1	Carignano	85.72	3.10	3.70	5.00	O
2	Torino	108.28	2.90	3.50	4.70	O
3	S.Sebastiano	136.73	3.50	4.00	5.50	O
4	Crescentino	151.14	3.60	4.00	5.00	O
5	Casale	184.37	-0.50	0.50	2.50	O
6	Ponte	208.40	2.70	3.30	4.80	O
7	Isola S.	230.57	5.50	6.50	8.00	O
8	Ponte Becca	263.21	3.50	4.50	5.50	O
9	Spessa Po	280.63	4.50	5.50	6.50	O
10	Piacenza	328.15	5.00	6.00	7.00	O
11	Cremona	374.72	2.20	3.20	4.20	A
12	Casalmaggior	423.94	3.60	4.60	5.60	O
13	Boretto	440.40	4.50	5.50	6.50	O
14	Borgoforte	472.11	5.00	6.00	7.00	O
15	Sermide	523.21	7.00	8.00	9.00	A
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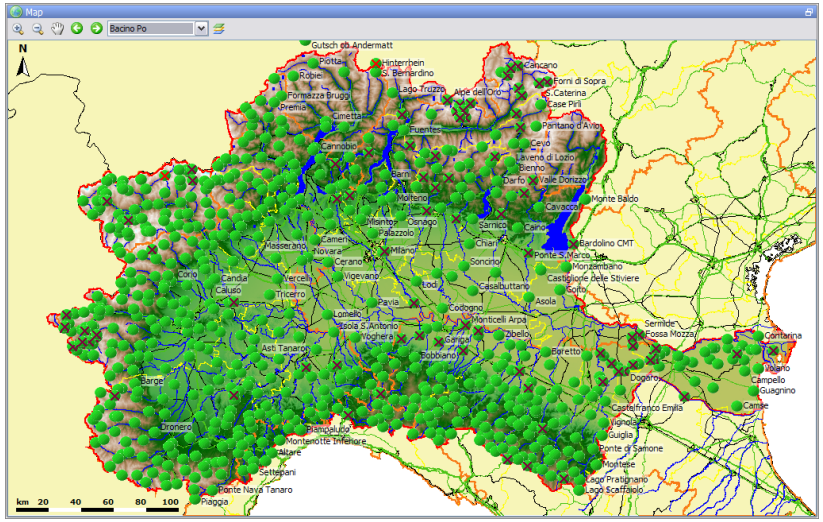
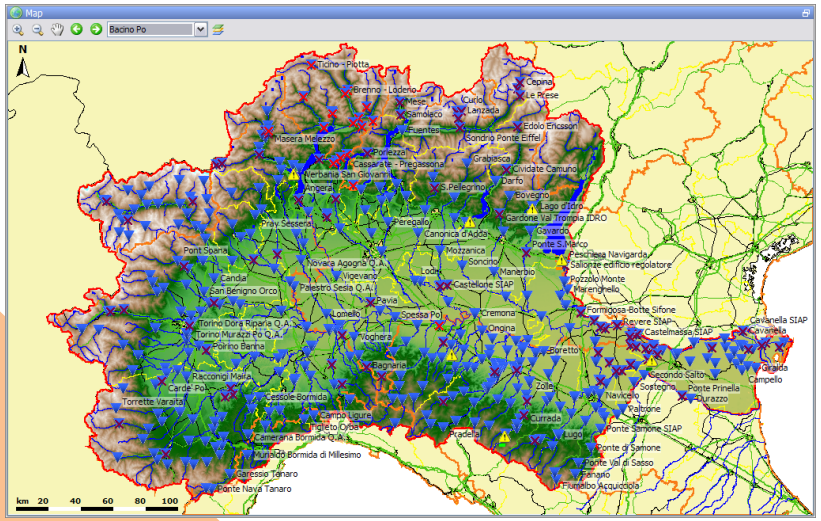
17	Polesella	576.77	5.60	6.60	7.60	A
18	Cavanella	615.00	3.00	3.40	4.40	A
19	Ariano	-	1.40	1.80	2.80	A

SCALA DELLE CRITICITA'

Assente	inferiore a livello 1	Ordinaria	compresa fra livello 1 e 2	Moderata	compresa fra livello 2 e 3	Elevata	superiore a livello 3

Observed data
(Rainfall, Temperature, Snow level, Water level, Discharge)



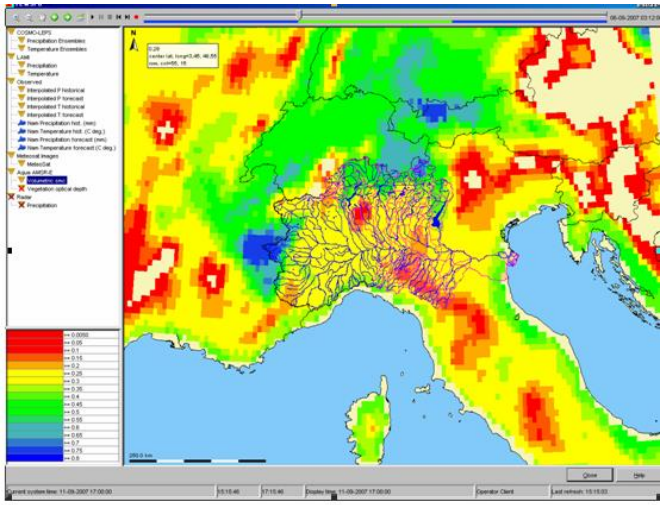


Telemetry network:

~ 1250 Rain gauges
~ 950 Termometer
~ 700 Water level gauges
~ 170 Snow level gauges

Observed data
(Rainfall, Temperature, Snow level, Water level, Discharge)

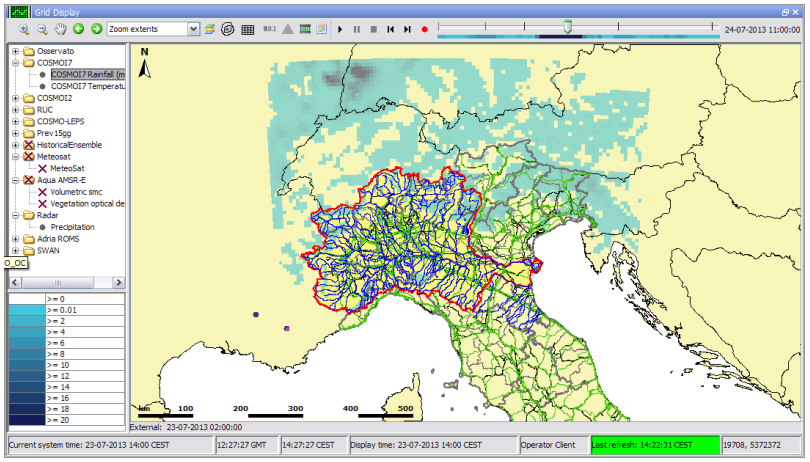
Radar and satellite
(Precipitation fields, Soil moisture)



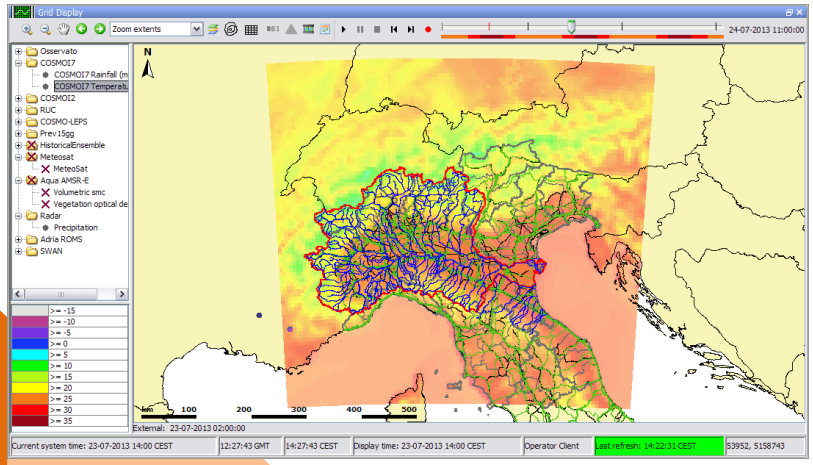
Radar:
All radar images are combined providing unique image of precipitation fields every 30 min.

Satellite:
Images from
MeteoSat
Aqua - AMSRE

Meteorological models (Rainfall and temperature fields from deterministic and ensemble models)



COSMOI5 – 5km resolution, 76 hours lead time, two time a day

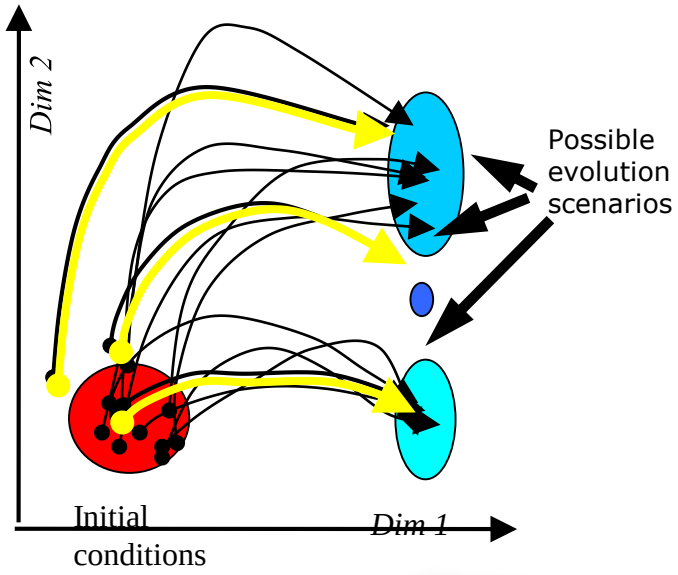


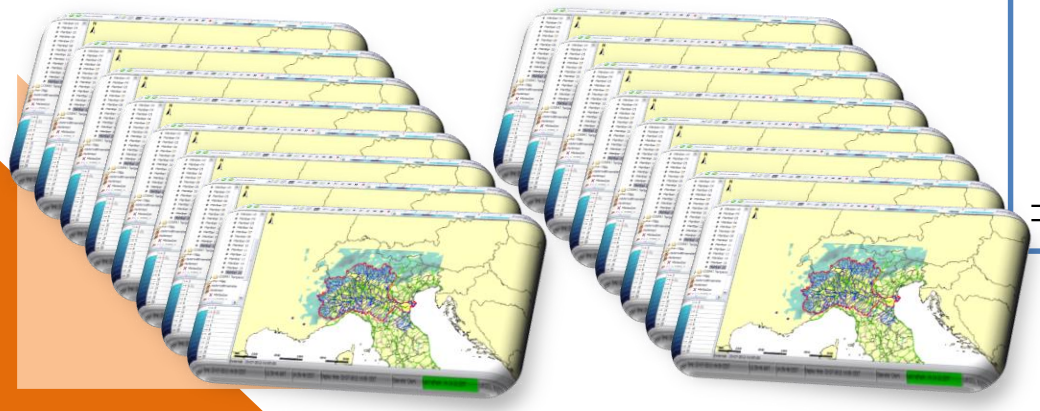
COSMOI2 – 2km resolution, 48 hours lead time, two time a day

COSMORUC – 2km resolution, 16 hours lead time, 8 time a day

COSMO LEPS – Probabilistic 16 members, 5 days lead time

Meteorological models (Rainfall and temperature fields from deterministic and ensemble models)





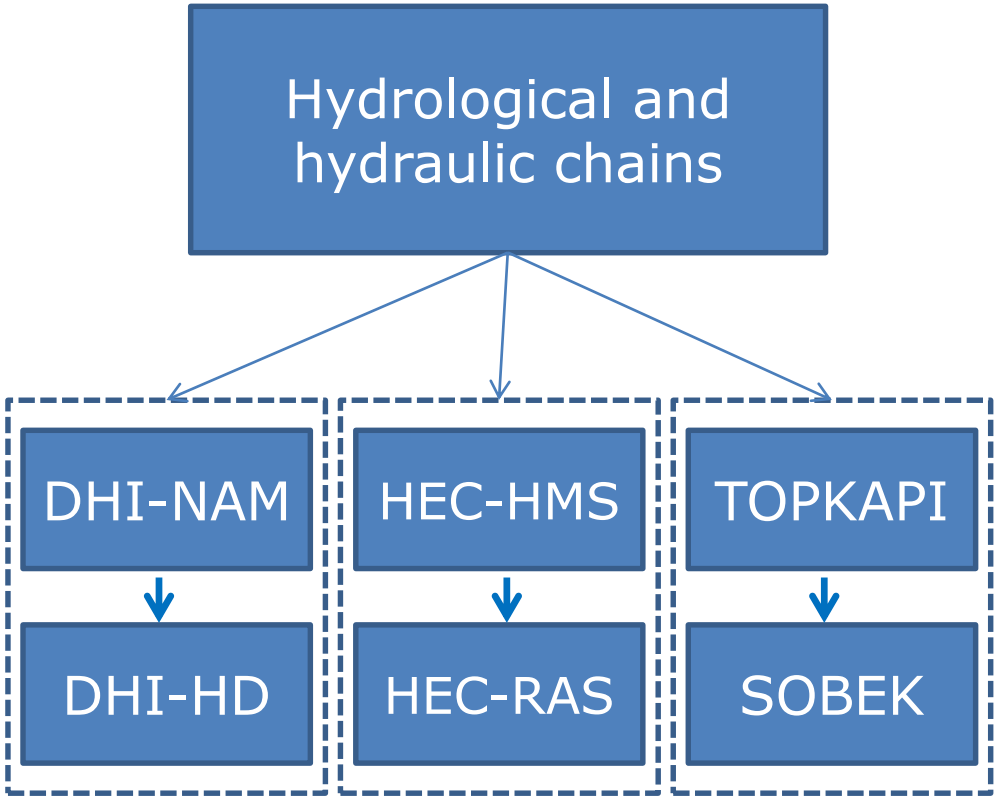
The EPS Model

Ensemble Prediction System (EPS-LEPS)

Atmosphere is a chaotic system and small errors in initial conditions (different states of the atmosphere) and numerical forecast model uncertainties can lead to different results

⇒16 scenarios

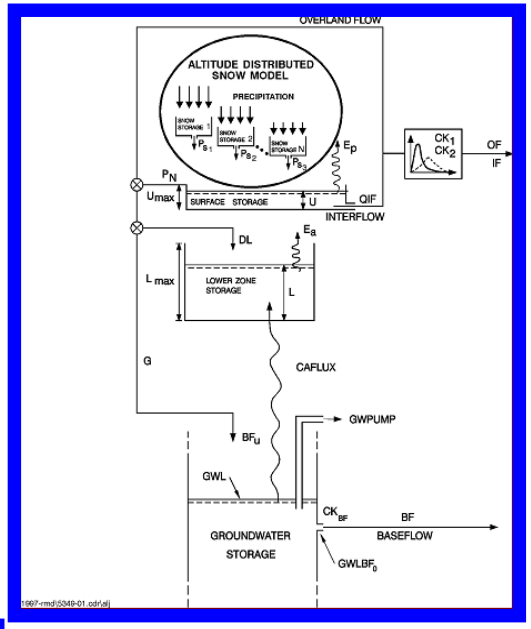
Hydrological and hydraulic chains

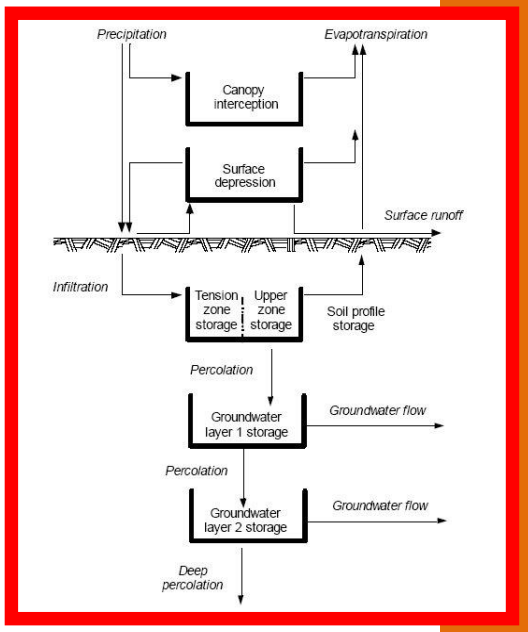


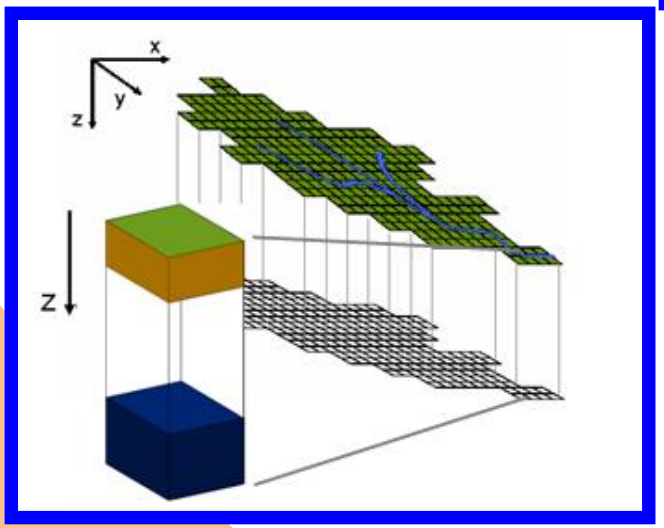
The applied techniques are attractive because they take in account the effects of uncertainty on hydrological forecasts, offering an approach to a probabilistic prediction and improving tha same hydrological accuracy as well.

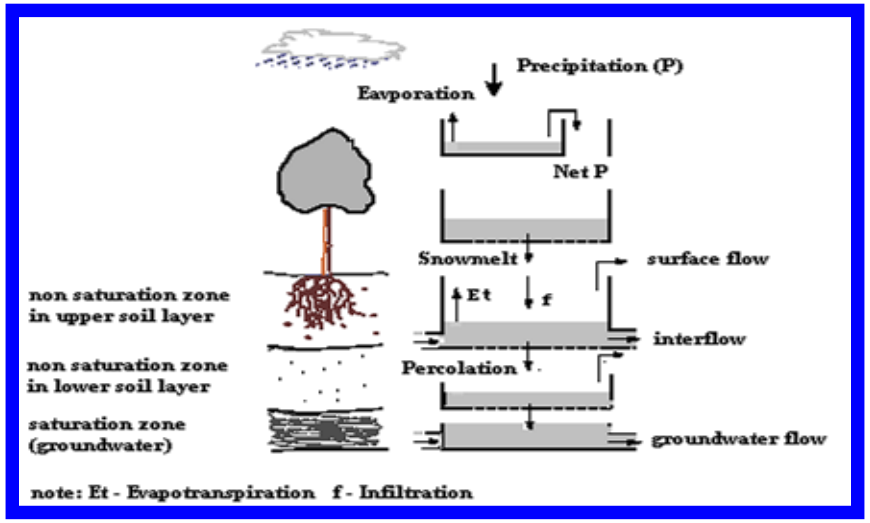
Hydrological models

- HEC – HMS
- DHI – NAM
- TOPKAPI



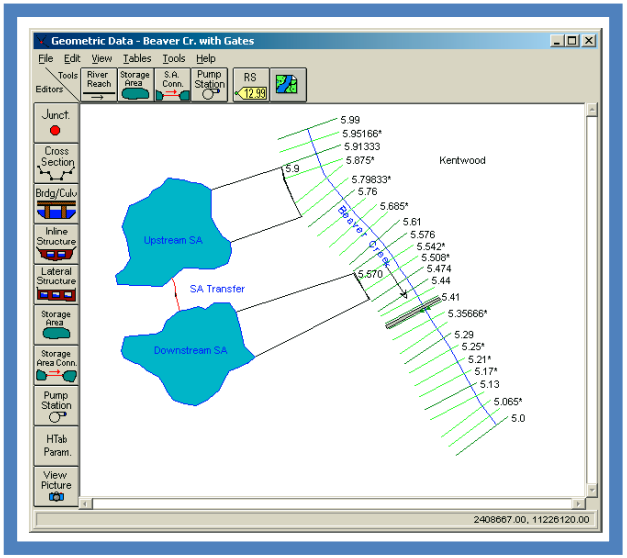


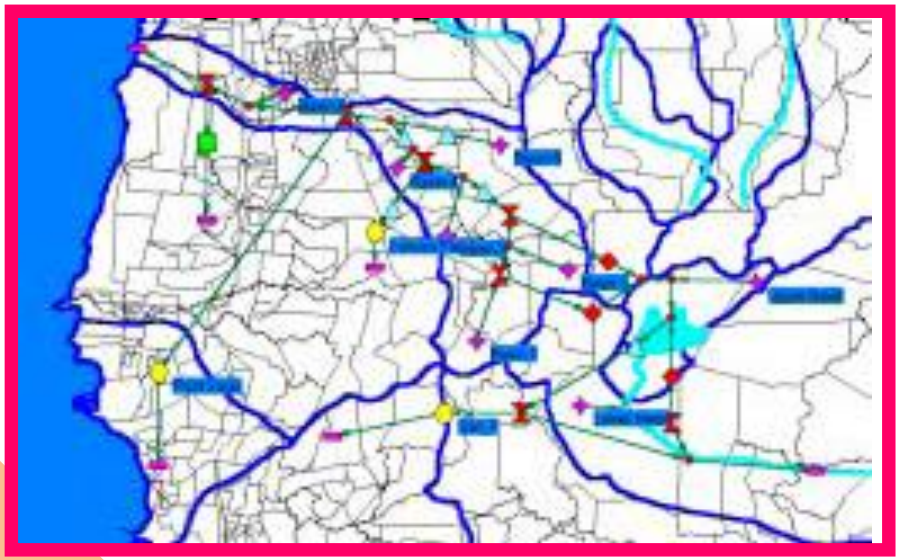


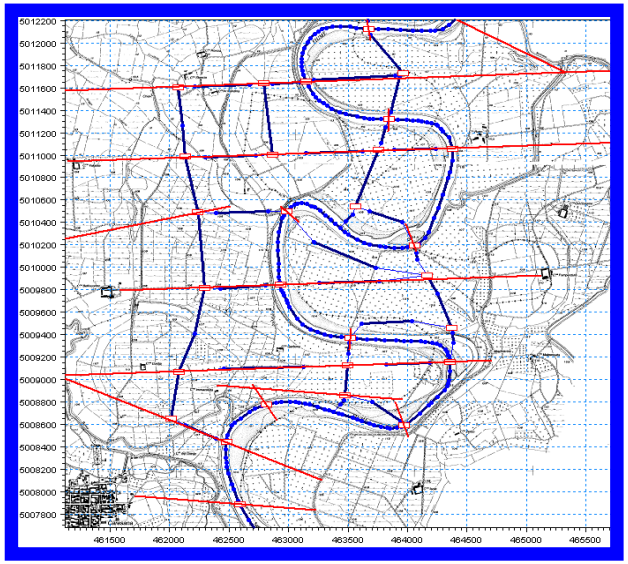


Hydrodinamic models

- HEC – RAS
- DHI – M11
- Delf Hydraulics - Sobek

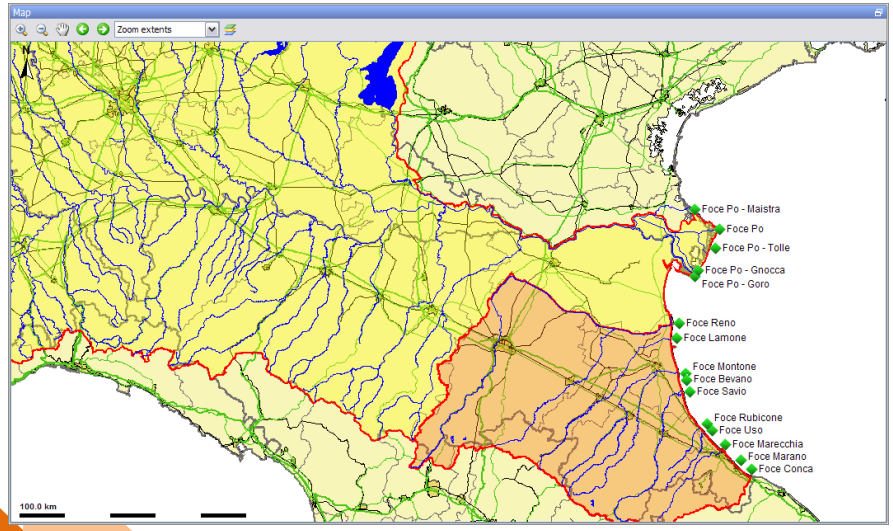


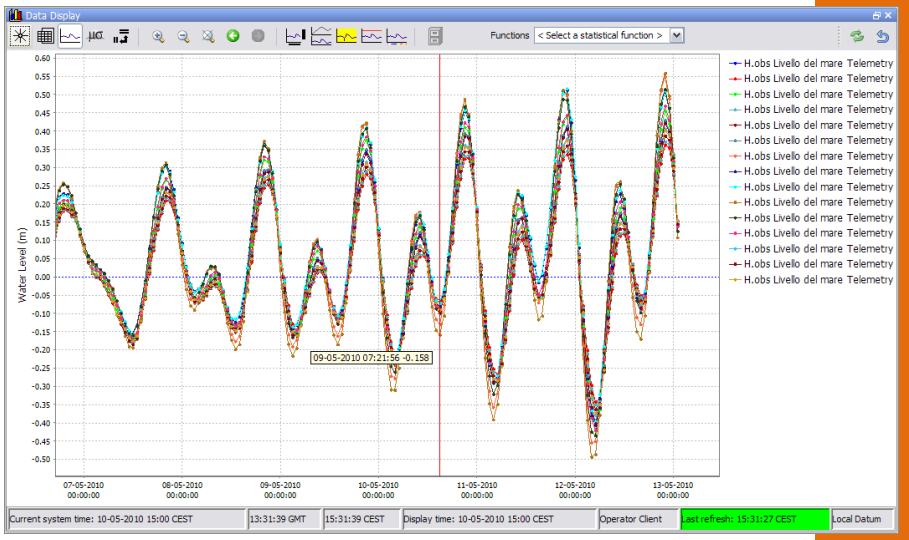




Downstream boundary conditions

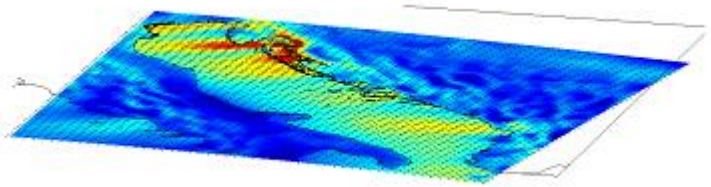
- Sea levels (ADRIA-ROMS model)





Adria-Roms

meteorological forces

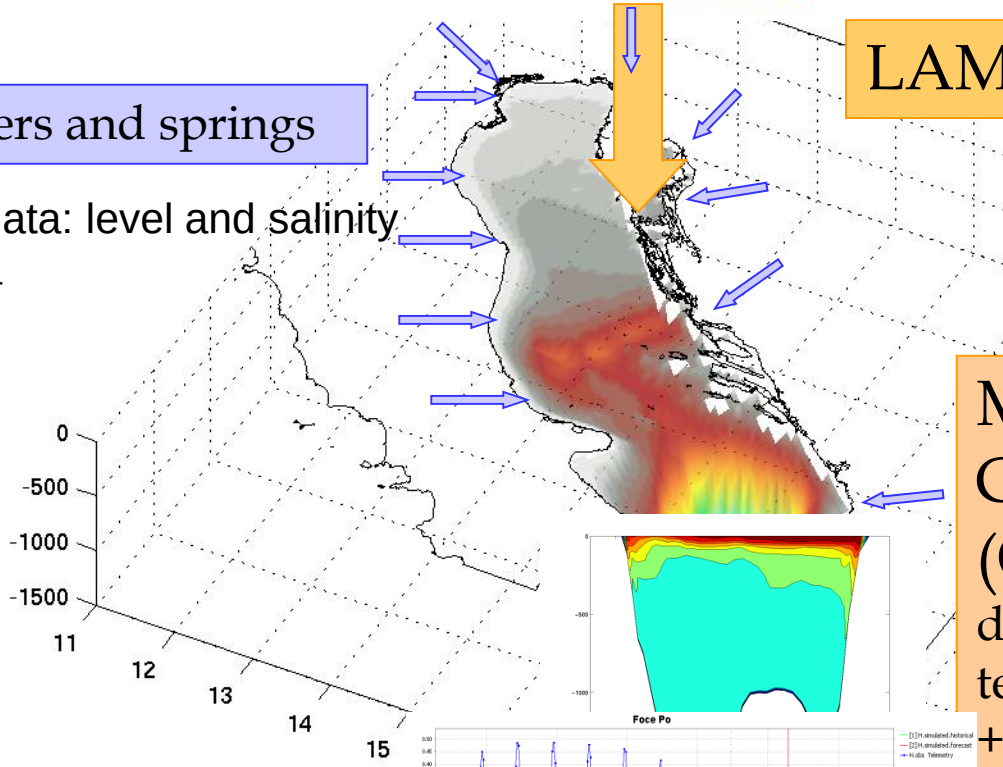


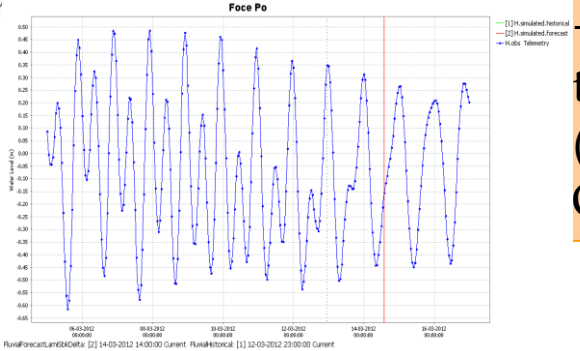
- wind 10 m
- mean sea level pressure
- air temperature 2 m
- dew temperature 2 m
- total cloud cover
- net short-wave radiation

LAMI

48 rivers and springs

48 data: level and salinity data





Model nested in Global Circulation Model of Mediterranean Sea

Mediterranean GCM (OPA-MFSTEP)

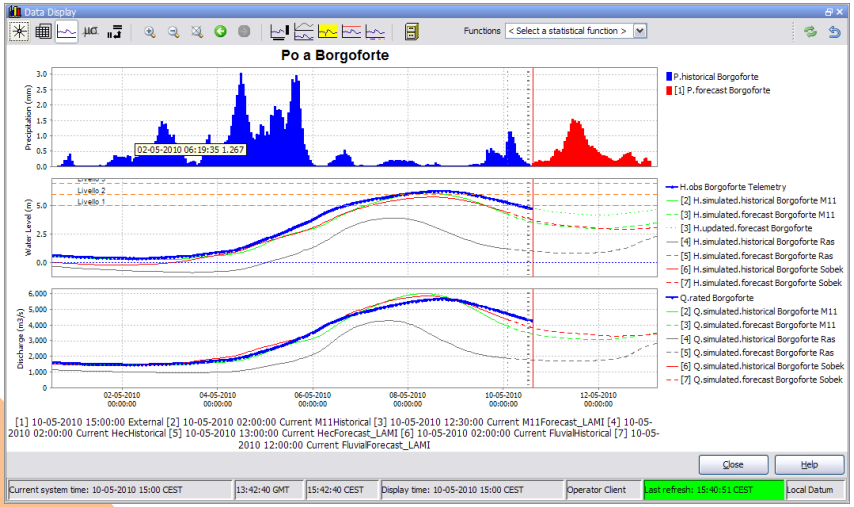
daily forecasted temperature and salinity

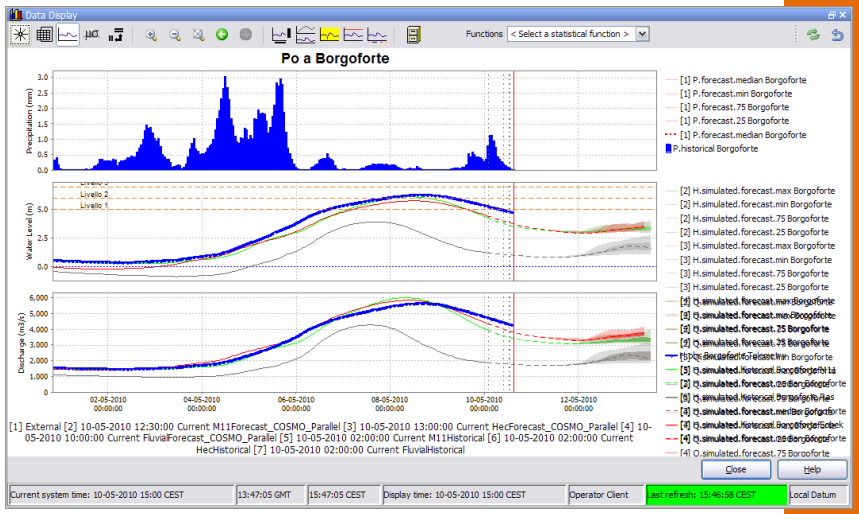
+

tidal elevation and currents (M2, S2, O1, K1) from QUODDY model

Forecast output

- Water level and discharge at each river station
- Performance indicators (BIAS,MAE,RMSE,MSE,NS…)
- Results elaboration (post correction, AR models ecc.)

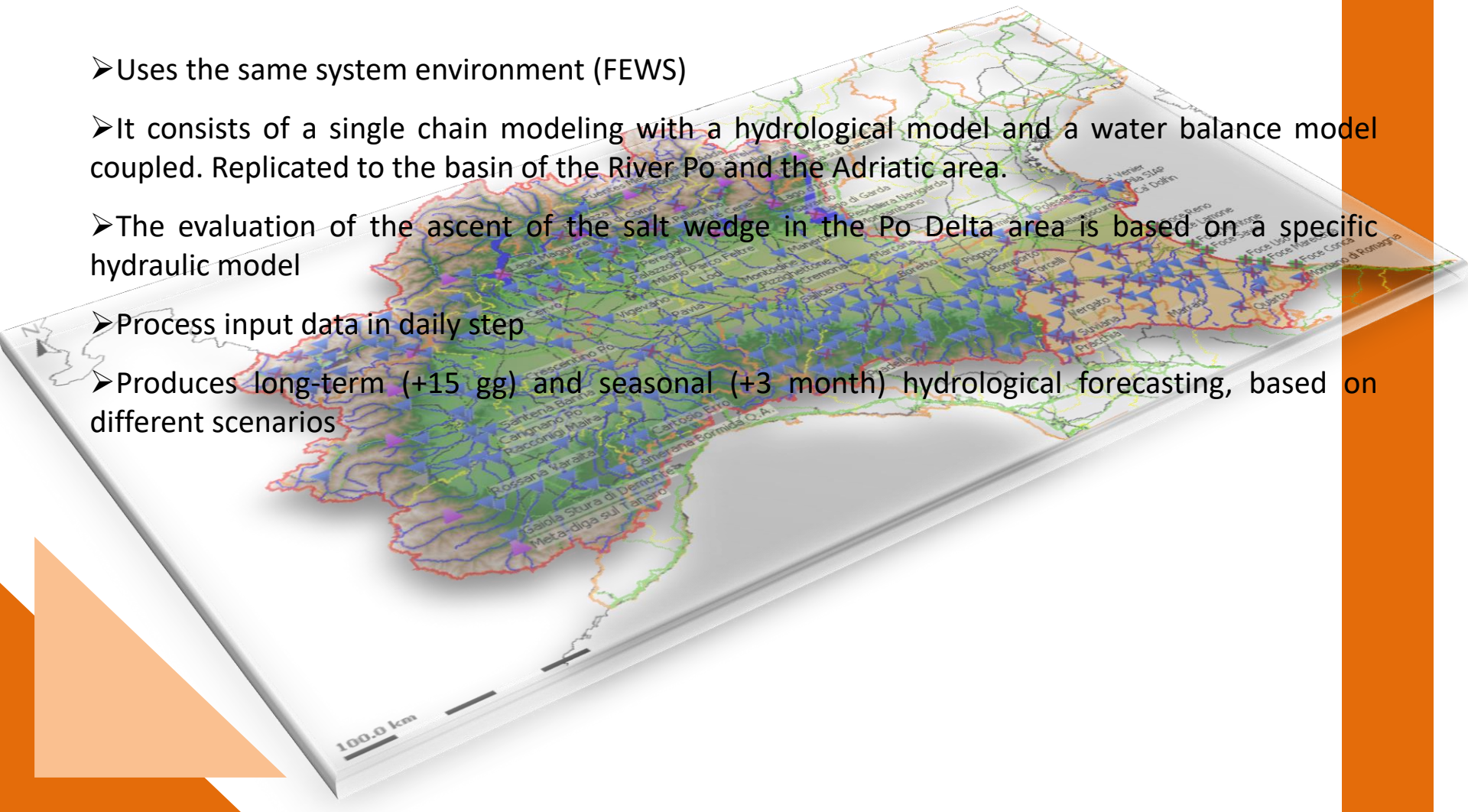




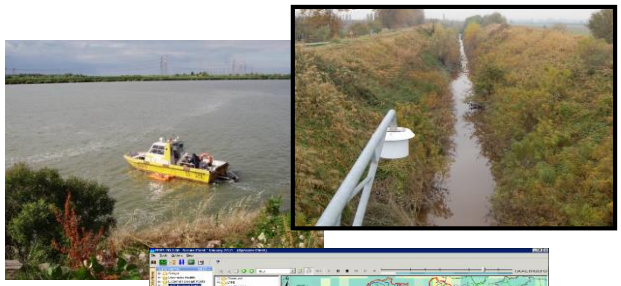
DEWS – Drought Early Warning System

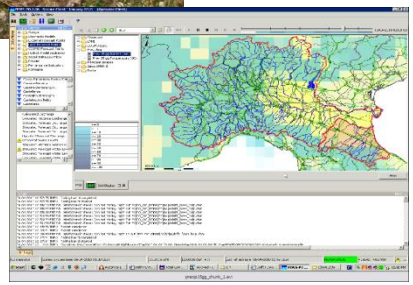
Comparison with Flood Early Warning System

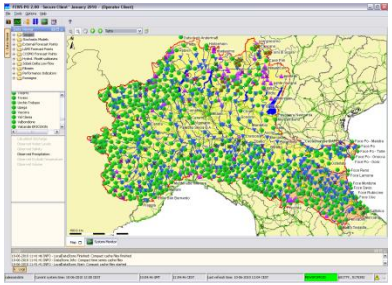
- Uses the same system environment (FEWS)
- It consists of a single chain modeling with a hydrological model and a water balance model coupled. Replicated to the basin of the River Po and the Adriatic area.
- The evaluation of the ascent of the salt wedge in the Po Delta area is based on a specific hydraulic model
- Process input data in daily step
- Produces long-term (+15 gg) and seasonal (+3 month) hydrological forecasting, based on different scenarios



DEWS – Drought Early Warning System







PRECIPITATION
TEMPERATURE
LEVEL/DISCHARGES
PIEZOMETRIC HEAD

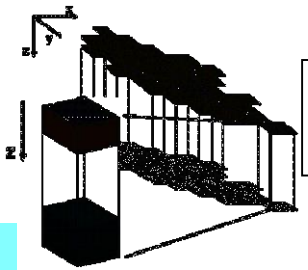
Observed/Telemeasure

LM + 15 days/Seasonal Forecasts + 3 months

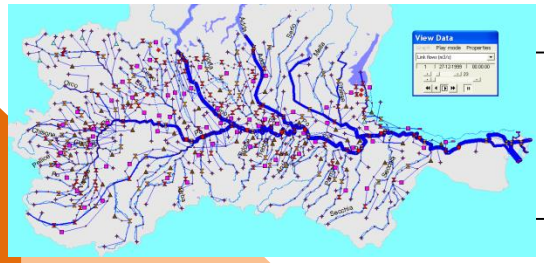
METEOROLOGICAL MODELS

VALIDATION, INTERPOLATION AND DATA TRANSFORMATION (DEWS)

the system takes care



TOPKAPI Rainfall-runoff model



RIBASIM Water balance model

Seasonal and long term meteorological products

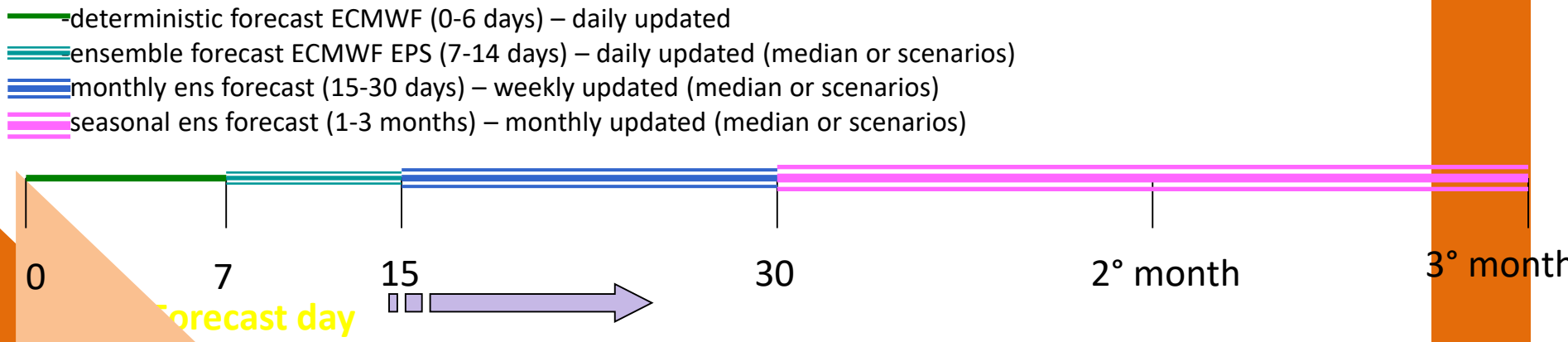
Meteorological centre of ARPA EMR gives an elaboration of ECMWF forecasts feeding the hydrological chain:

1. Are composed of precipitation and temperature fields, given by seasonal and long term forecast products

2. The spatial domain is northern Italy with a grid step from 16 (deterministic) to 35 (seasonal) km, daily precipitation and 6 hours for temperature.

3. The daily detail of seasonal forecasts is given by a statistical post processing, that is a weather generator.

The process contains an harmonization of computational grids and data assimilation.

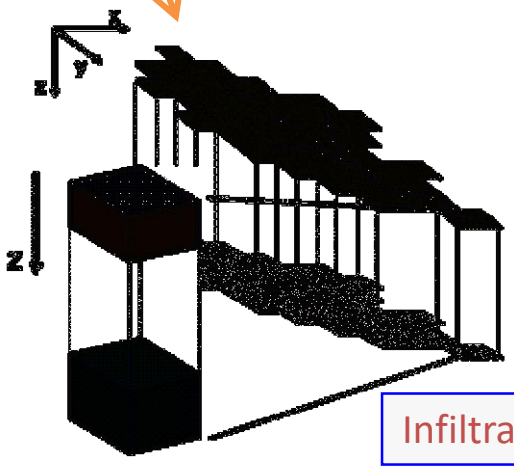


Hydrological model TOPKAPI

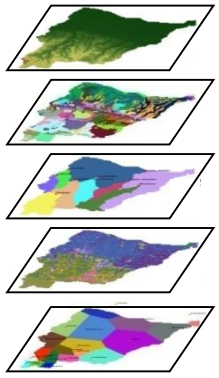
Hydrological, **distributed** and **physically based model**

Starting from a meteorological input and from physical and morphological characteristics of the river basin, it represents discharge hydrograph.

It is not necessary to describe in an accurate mode the river section geometry, but it is sufficient to give a schematic representation of it.



Thematic cartography:



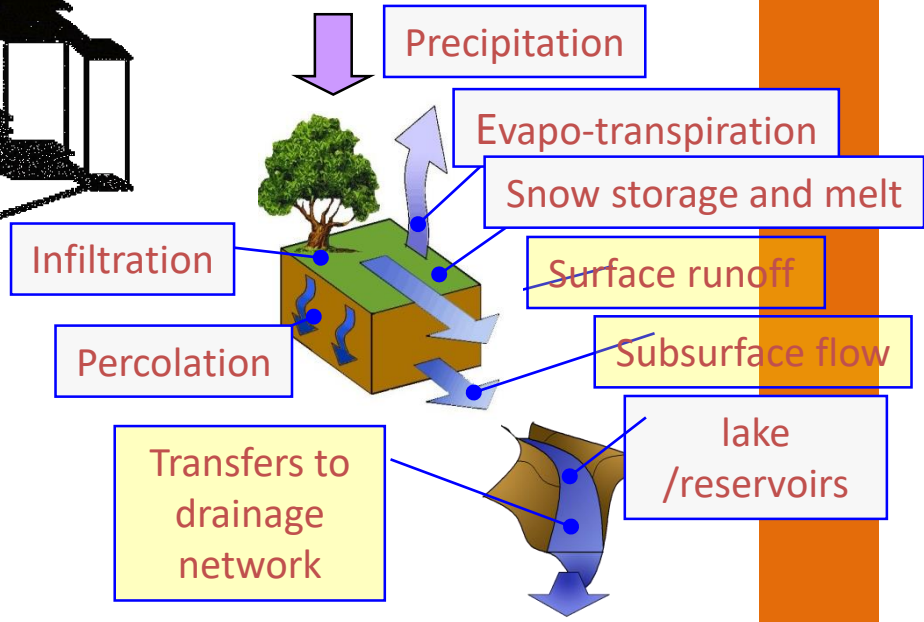
Digital Elevation Model

Soil types

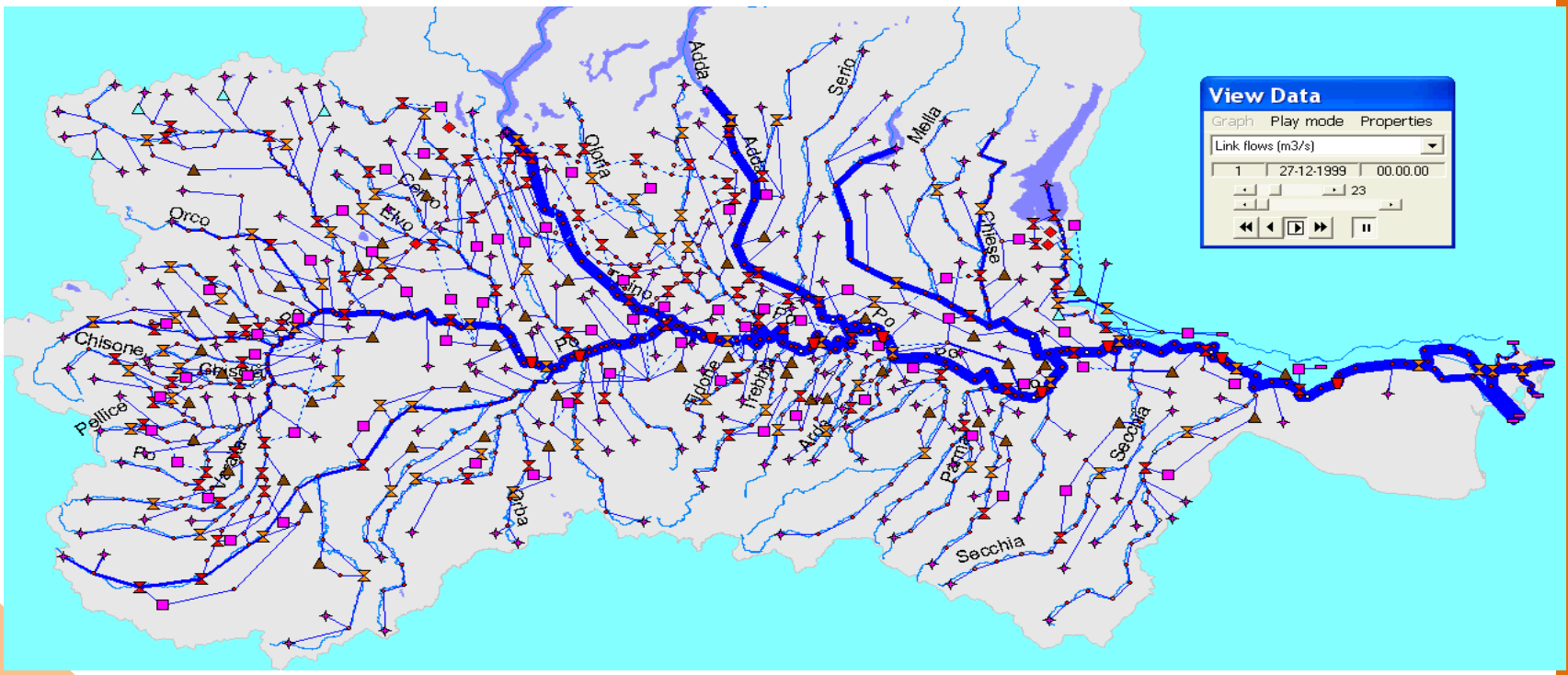
Drainage soil coefficients

Soil use and plant coverage

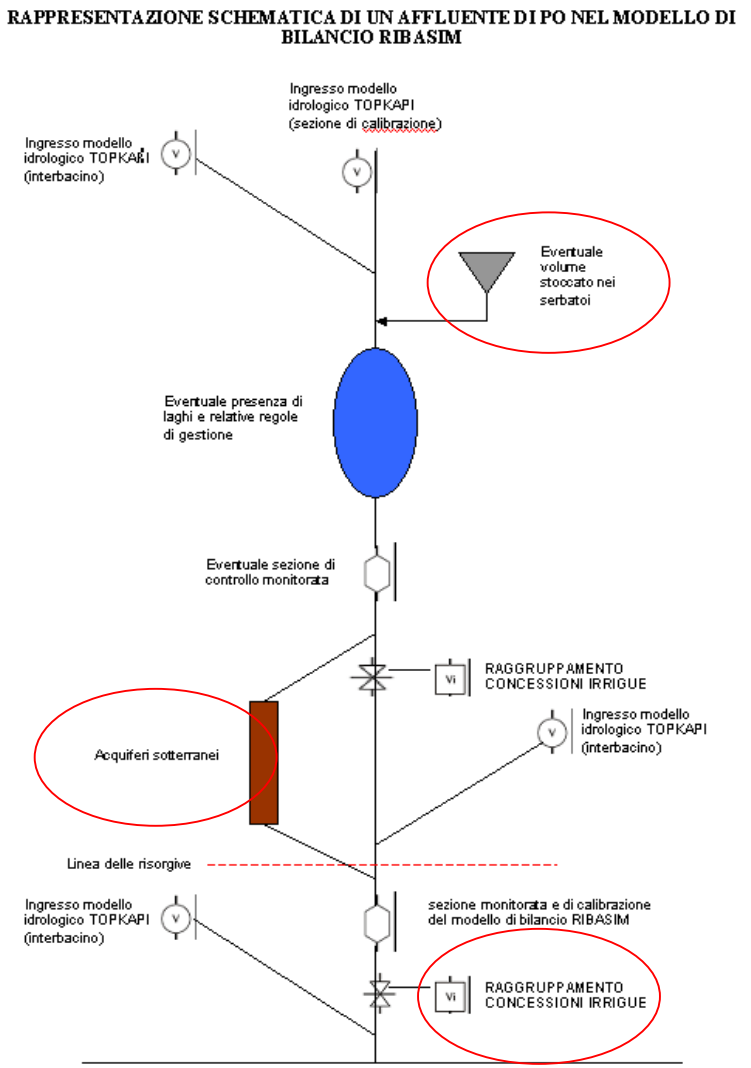
Mean monthly temperatures (PET)



The water balance model : RIBASIM (RIver BAsin SIMulation)

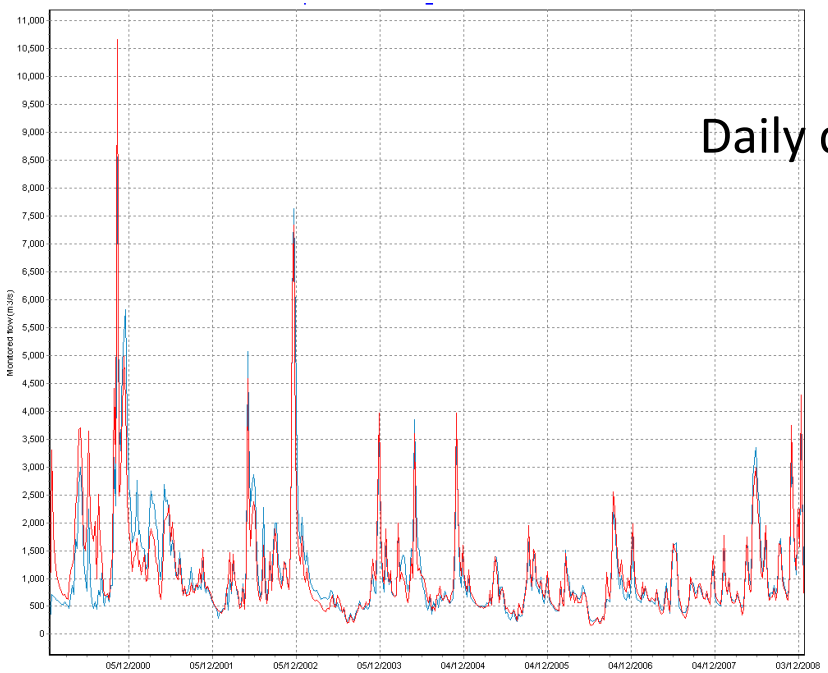


Schematization of Ribasim

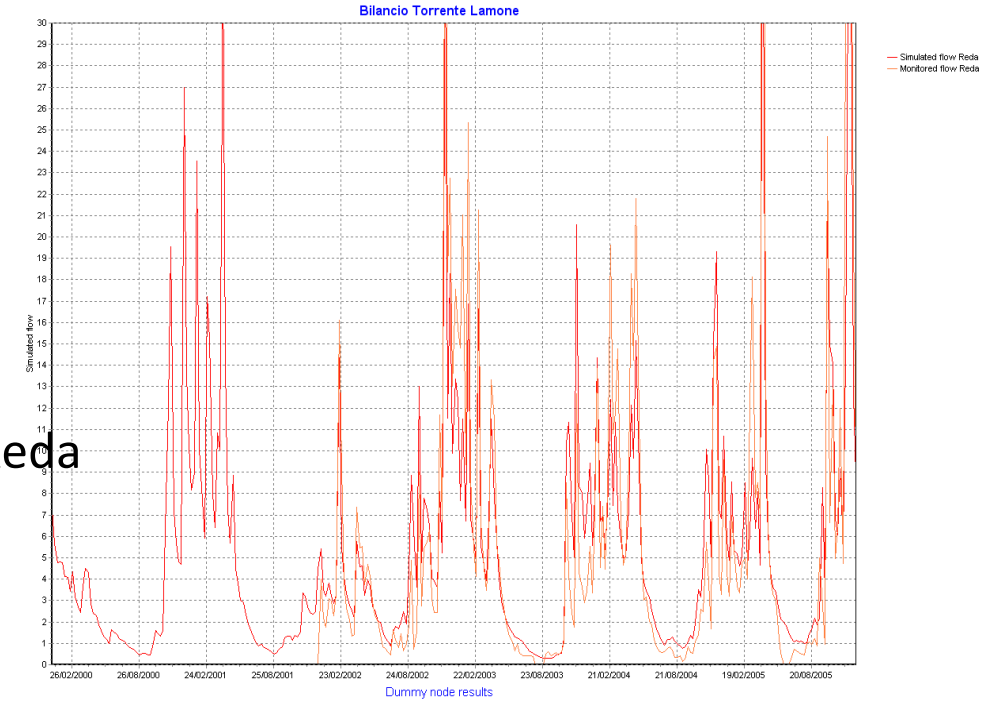


- Ribasim gets in input TOPKAPI outflow related to the mountain part of the basin.
- RIBASIM calculates water balance on the basis of different elements of the system, such as groundwater component, agricultural demand, hydropower demand, target low flow in the river..

Calibration of the model RIBASIM

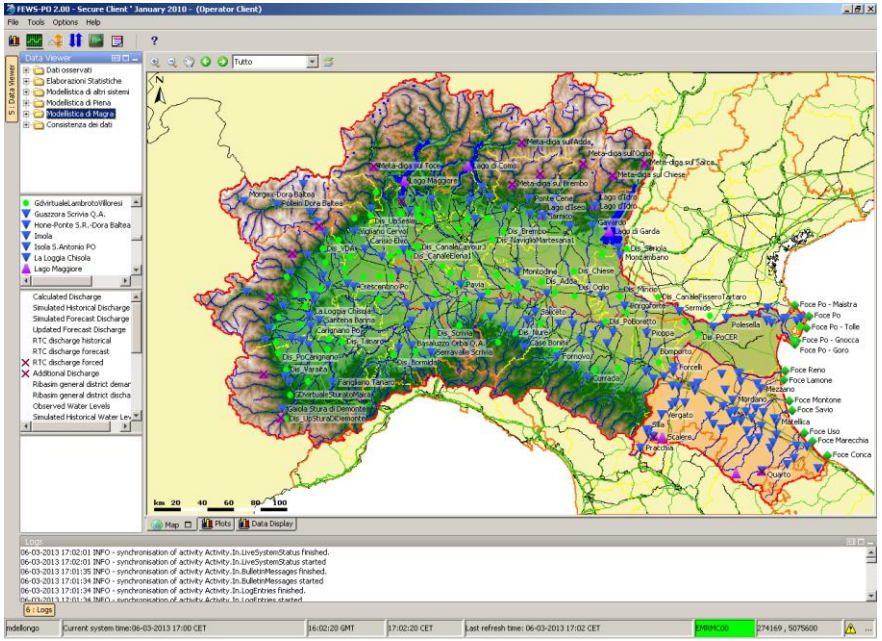


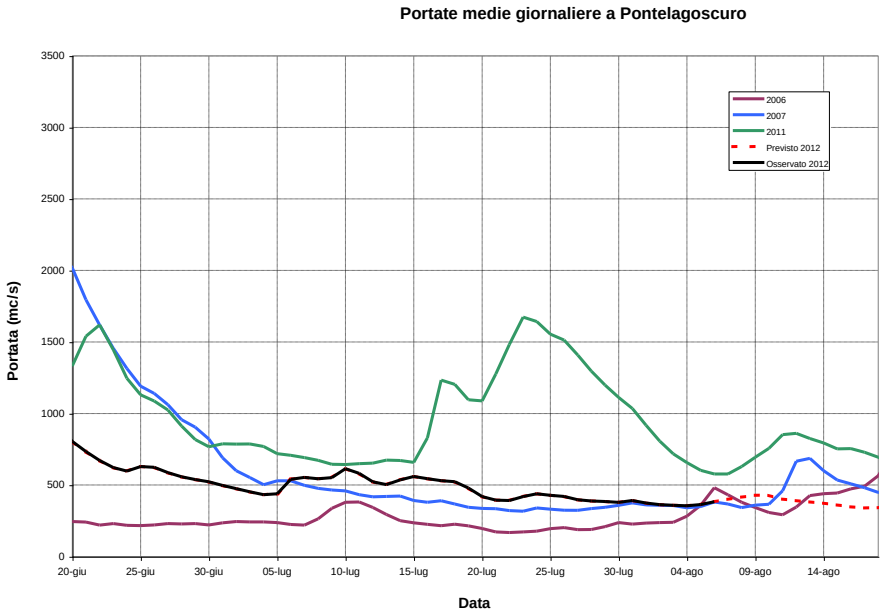
Daily discharge of Po River to Boretto station



Lamone at Reda

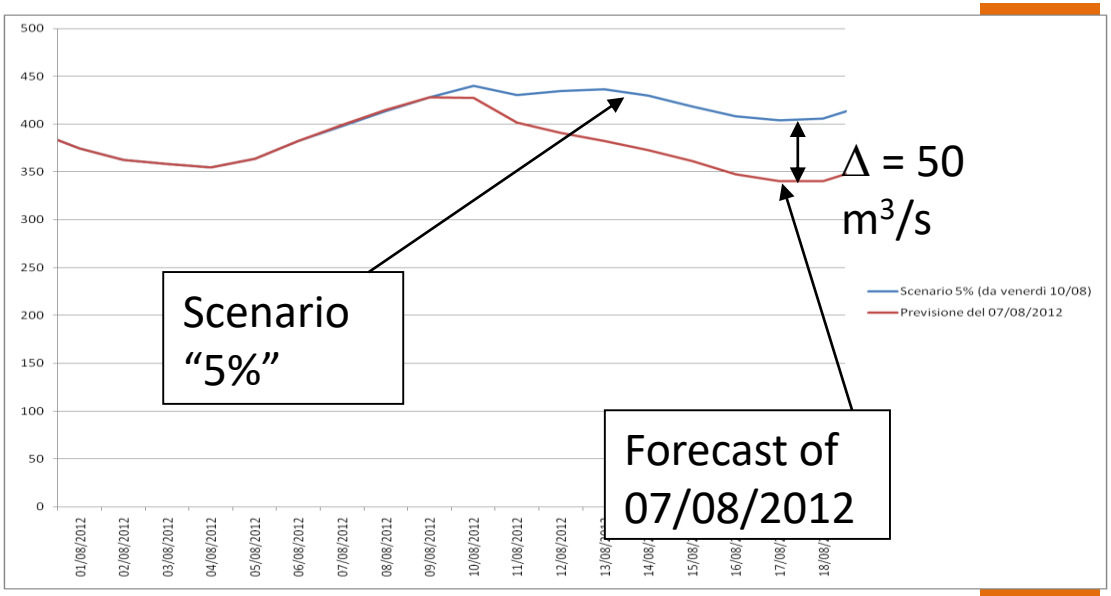
Real time application during summer drought 2012



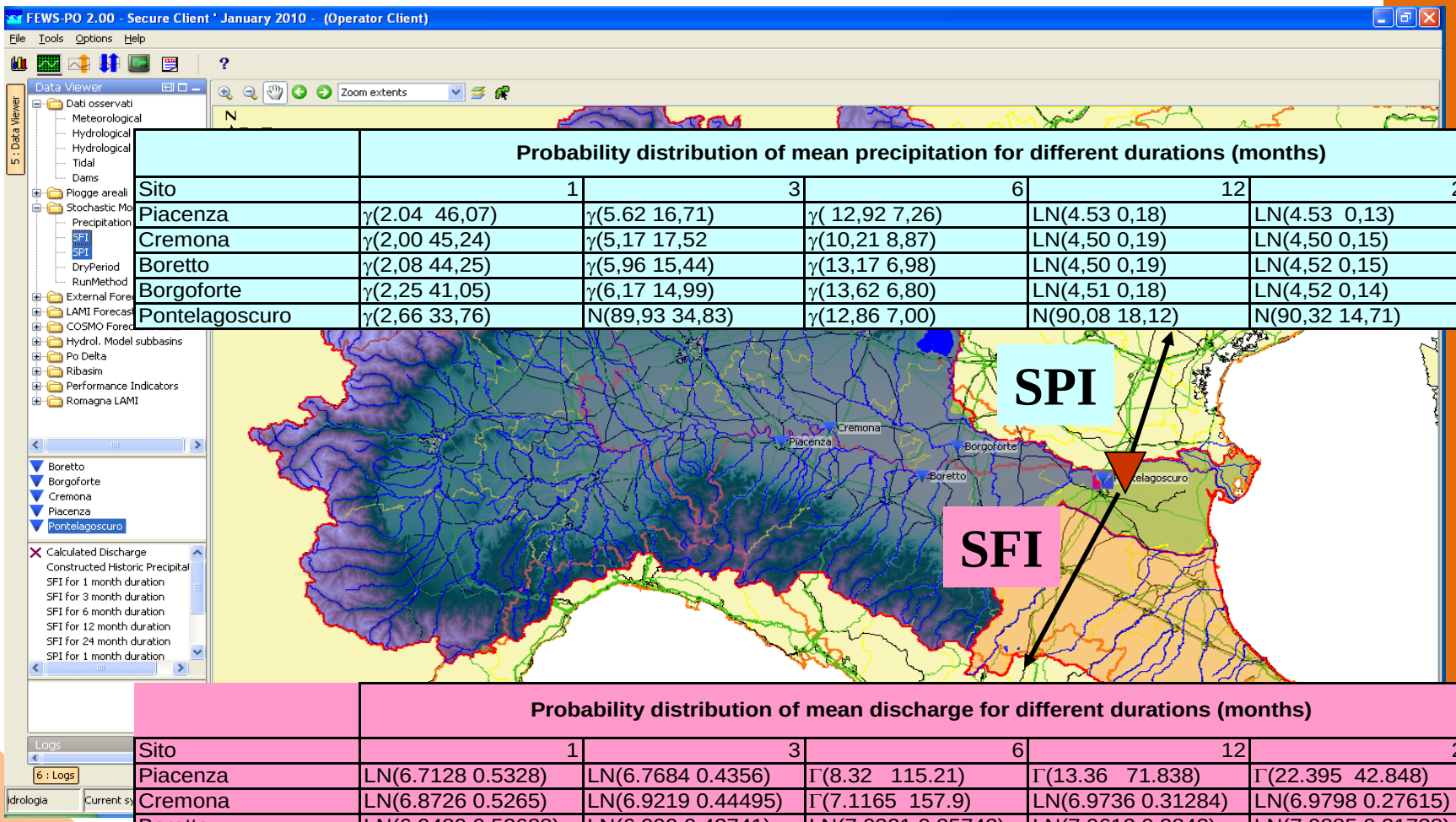


Scenario simulation (+5% lake release, -5% in terms of agricultural withdrawals - forecast)

"Cabina di regia"



Standardized Precipitation Index and Standardized Flow Index
PRECIPITATION AND FLOW ANOMALY



	Probability distribution of mean precipitation for different durations (months)				
Sito	1	3	6	12	24
Piacenza	γ(2.04 46,07)	γ(5.62 16,71)	γ(12,92 7,26)	LN(4.53 0,18)	LN(4.53 0,13)
Cremona	γ(2,00 45,24)	γ(5,17 17,52	γ(10,21 8,87)	LN(4,50 0,19)	LN(4,50 0,15)
Boretto	γ(2,08 44,25)	γ(5,96 15,44)	γ(13,17 6,98)	LN(4,50 0,19)	LN(4,52 0,15)
Borgoforte	γ(2,25 41,05)	γ(6,17 14,99)	γ(13,62 6,80)	LN(4,51 0,18)	LN(4,52 0,14)
Pontelagoscuro	γ(2,66 33,76)	N(89,93 34,83)	γ(12,86 7,00)	N(90,08 18,12)	N(90,32 14,71)

	Probability distribution of mean discharge for different durations (months)				
Sito	1	3	6	12	24
Piacenza	LN(6.7128 0.5328)	LN(6.7684 0.4356)	Γ(8.32 115.21)	Γ(13.36 71.838)	Γ(22.395 42.848)
Cremona	LN(6.8726 0.5265)	LN(6.9219 0.44495)	Γ(7.1165 157.9)	LN(6.9736 0.31284)	LN(6.9798 0.27615)
Boretto	LN(6.9489 0.52688)	LN(6.999 0.43741)	LN(7.0321 0.35742)	LN(7.0612 0.2842)	LN(7.0885 0.21738)
Borgoforte	LN(7.0921 0.50307)	LN(7.1407 0.40986)	LN(7.1716 0.33051)	LN(7.193 0.25849)	Γ(24.795 54.993)
Pontelagoscuro	LN(7.1909 0.49337)	LN(7.2349 0.4019)	LN(7.26 37 0.25411)	LN(7.2851 0.25411)	LN(7.2996 0.19968)

Stochastic modelling

Frequency analysis of droughts

Run method (Yevjevich, 1967)

SECONDARY RETURN PERIOD

This method is based on daily discharge Q
Given a threshold level qD, for example $q_{95\%}$, q90%
A drought is identified by 3 components:

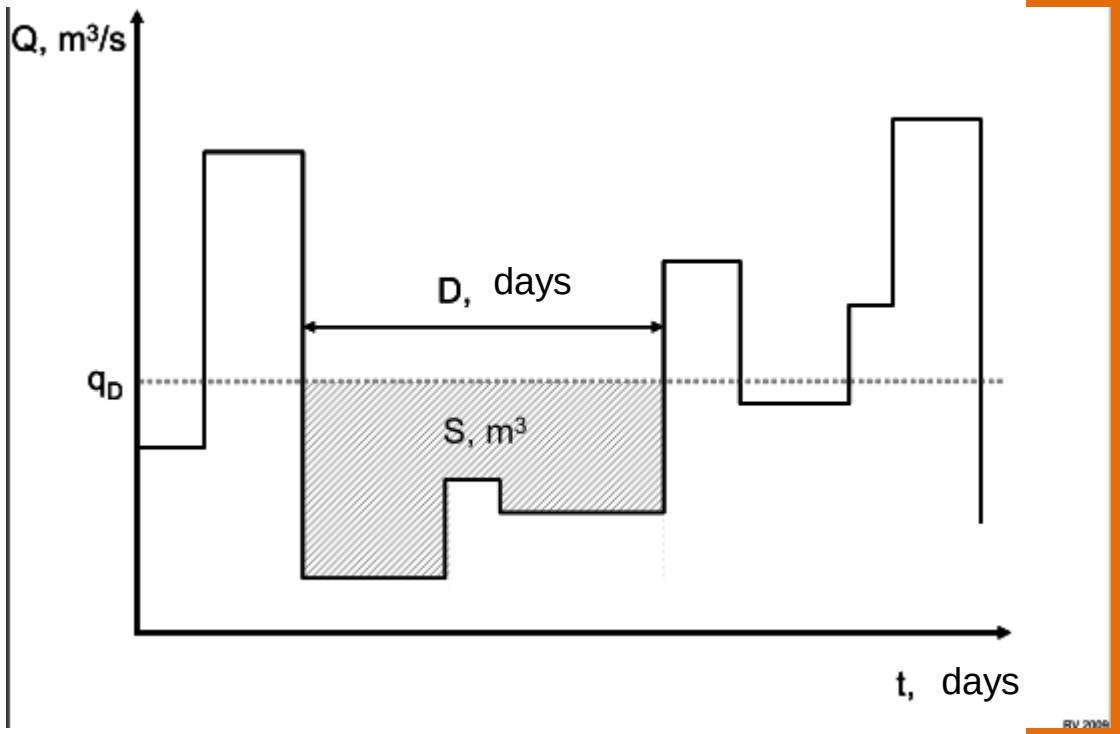
D = drought duration : q≤q_D

S = drought severity

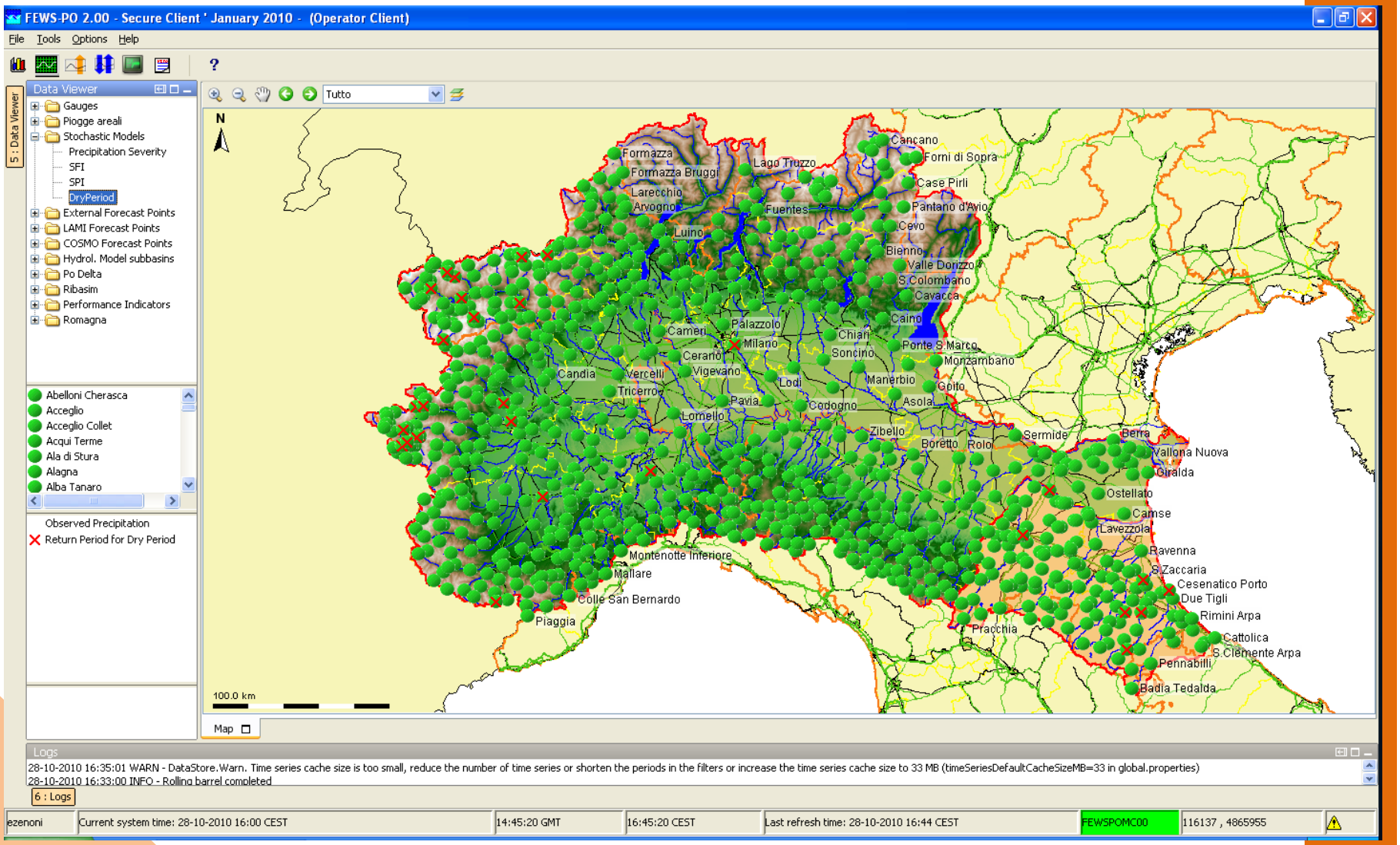
$$S = \int_0^D (q(t) - q_D)\,dt$$

I = drought intensity

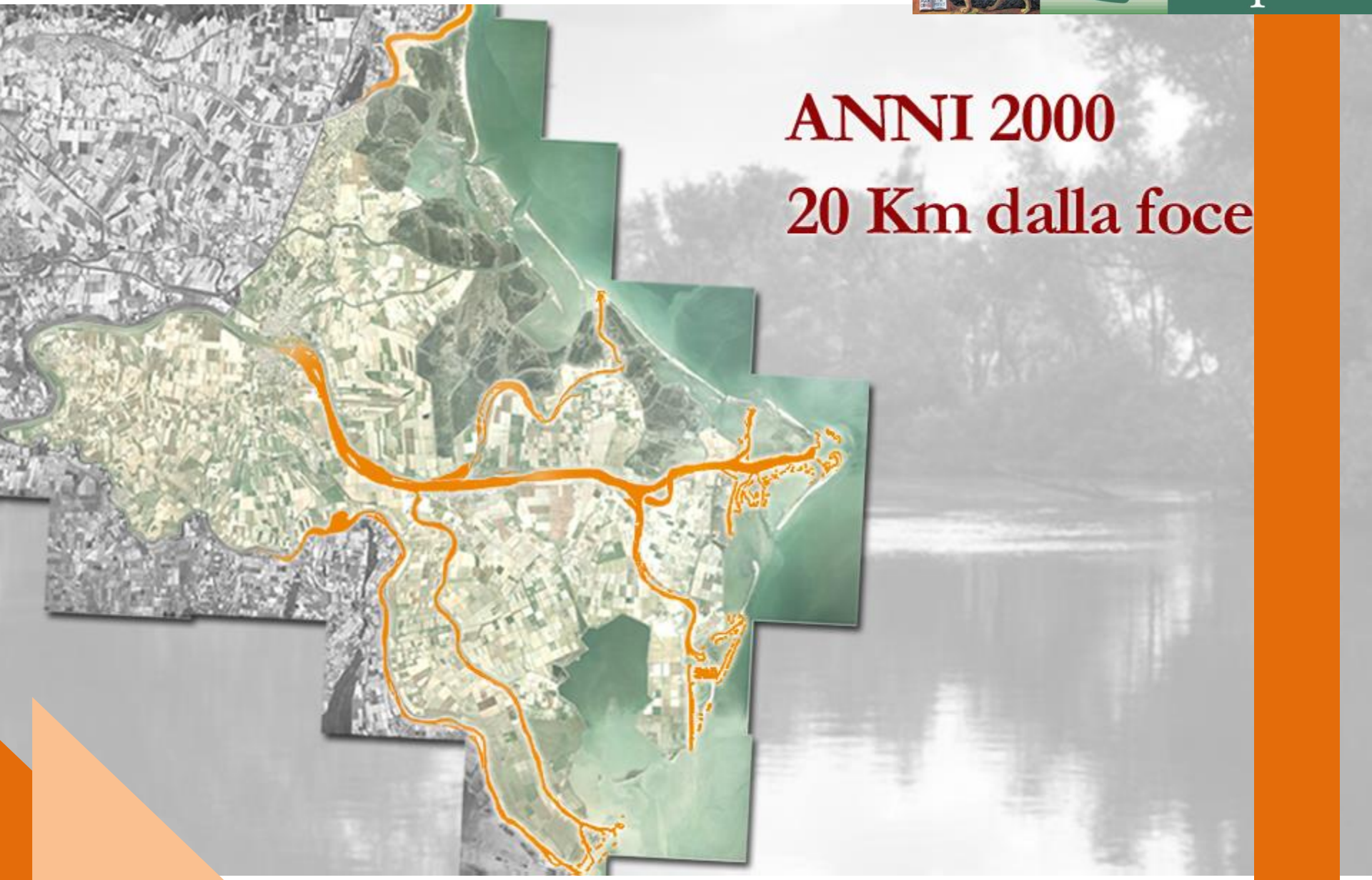
$$I = \frac{1}{D}\int_0^D (q(t) - q_D)\,dt$$



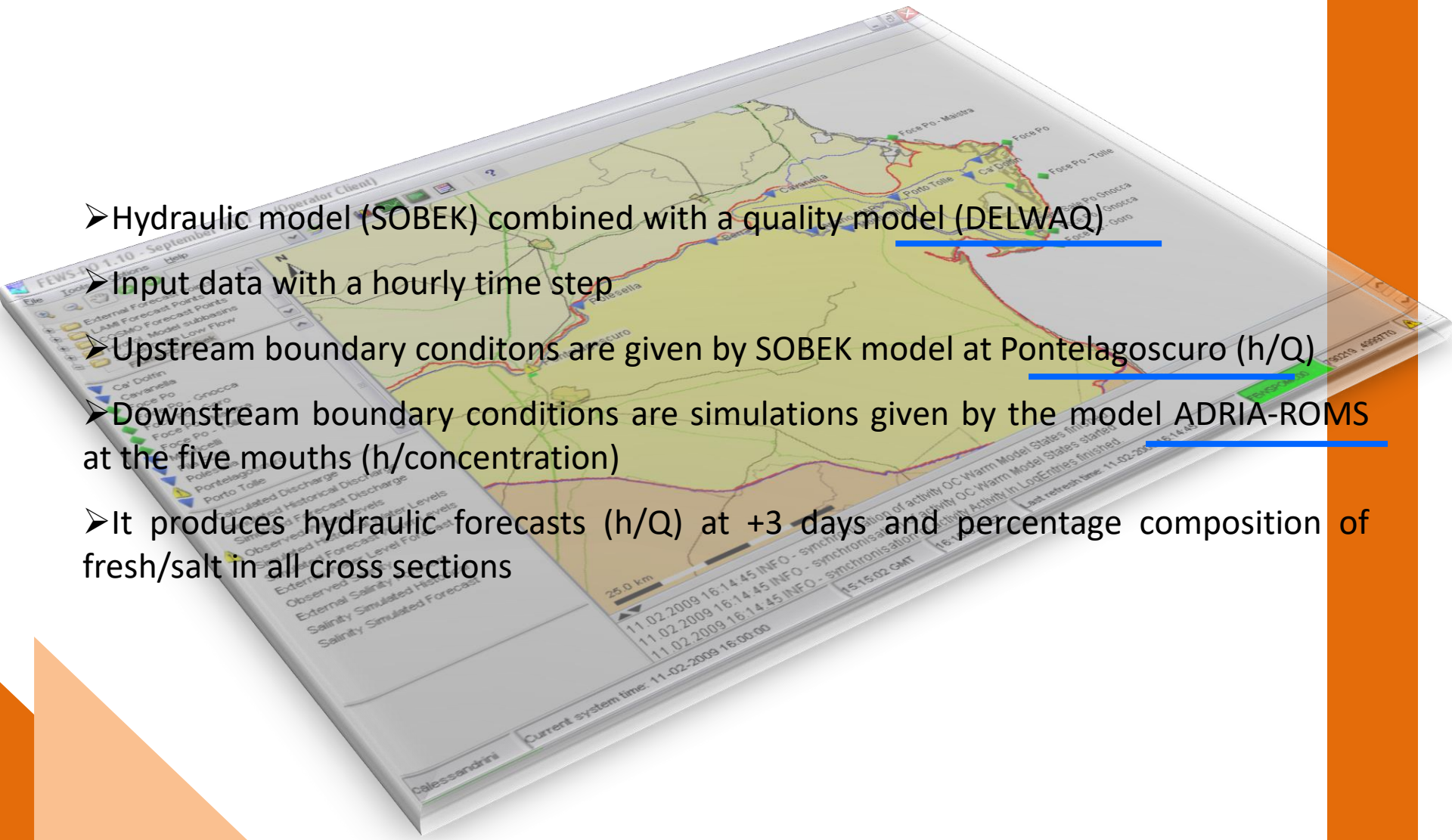
Statistical analysis of consecutive days with no rain



Salt intrusion



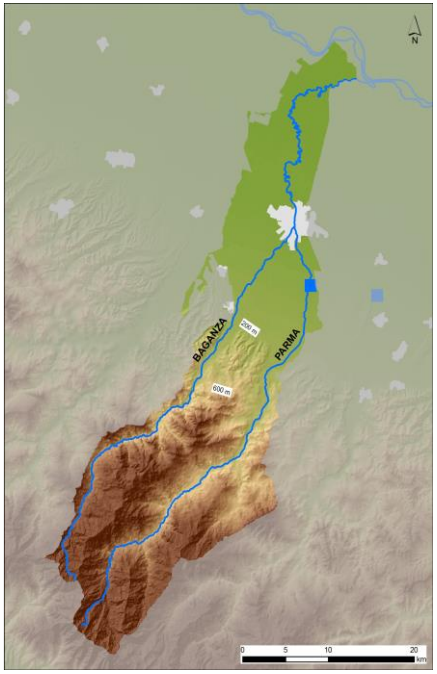
“Sobek Delta” model – continuous model



- Hydraulic model (SOBEK) combined with a quality model (DELWAQ)
- Input data with a hourly time step
- Upstream boundary conditons are given by SOBEK model at Pontelagoscuro (h/Q)
- Downstream boundary conditions are simulations given by the model ADRIA-ROMS at the five mouths (h/concentration)
- It produces hydraulic forecasts (h/Q) at +3 days and percentage composition of fresh/salt in all cross sections

CLARA project: PWA service

PWA (Parma river basin Water Assessment) service aims to supply a climate service in order to include climate change in planning and emergency actions in the selected area of the Parma river basin.



The user will be able to query:

Water quality

Habitat

Sediment transport

Water resources management

Water quality: DELWAQ analysis

The aim is to analyze the nutrient concentration evolution in the Parma river basin using numerical models.

- Database of chemical – physical – morphological and hydrological parameters
- Analysis of diffuse and point sources in the basin.

Parameters considered:

- Nitrogen
- Phosphorus

These parameters are fundamental for life and their biogeochemical cycle has been deeply compromised by anthropogenic actions that in very high values can lead to eutrophication.

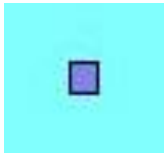
Data

The water quality service is based on the analysis of two macronutrients: nitrogen (N) and phosphorus (P). The anthropic loads have been estimated evaluating the main impactful sectors into the basin. The data used, regarding year 2010, are obtained consulting ISTAT (Italian National Institute of Statistic) and include agricultural, zootechnical and human compartment.

Water quality: DELWAQ analysis

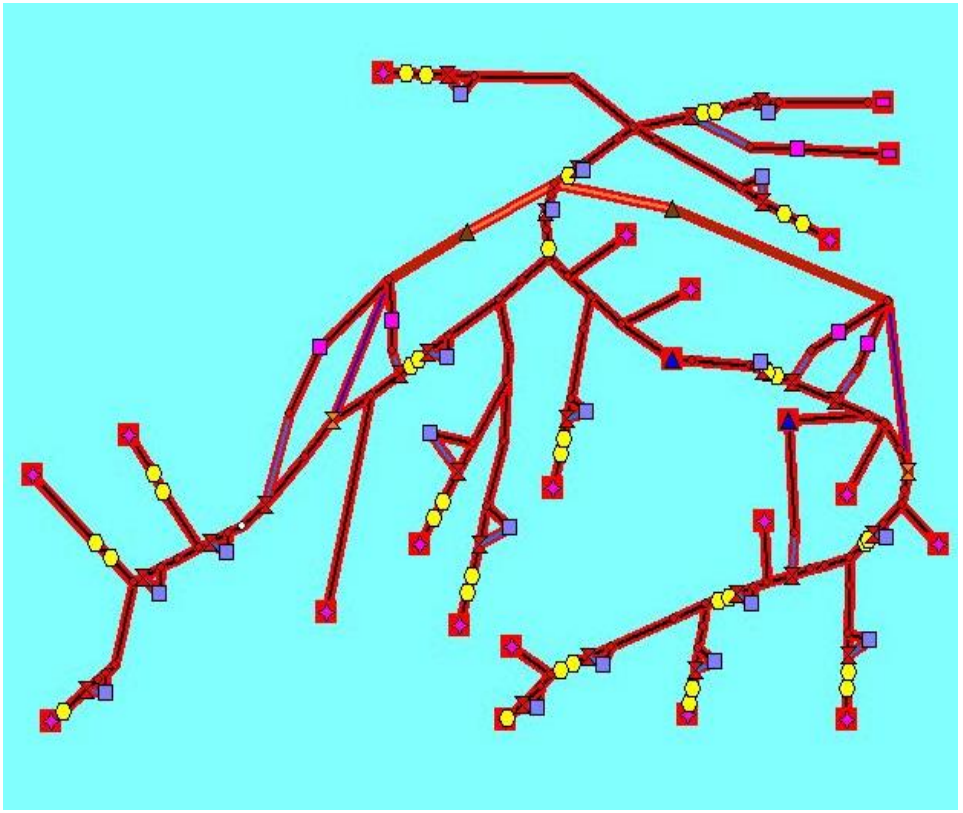
Ribasim DELWAQ model is a component of Ribasim model that allows to evaluate the spread of pollutants in the basin. It is used to evaluate the trend of N and P into the system, therefore it allows to distribute the N-P loads over the fields. Relating the rainfall and discharges with the pollutant load, it's possible to define the water quality.

AIR: Advanced IRrigation node



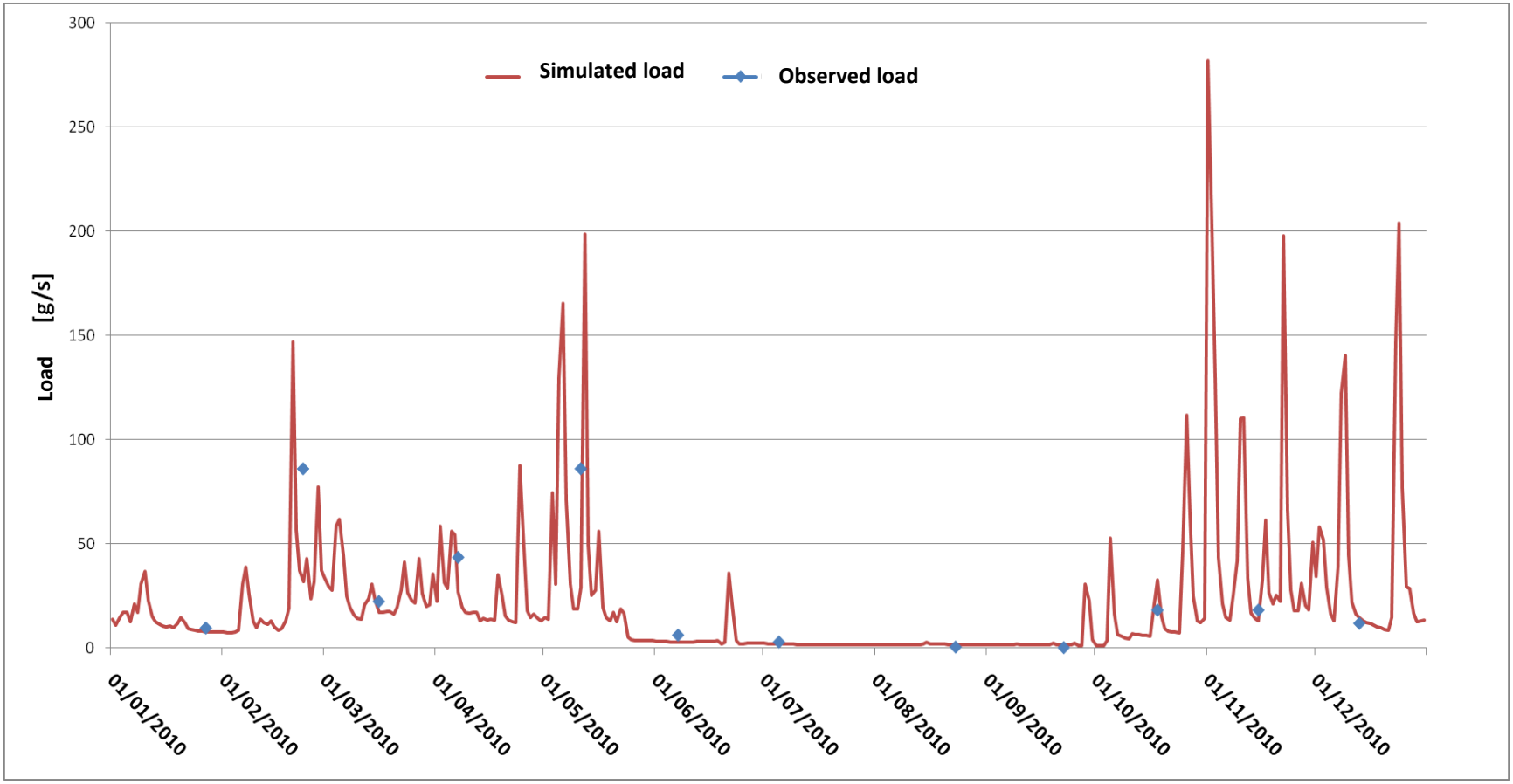
Pws: Public Water Supply node

IND_Pws: INDustry Pws node



Observed data – Simulated data

Nitrogen load at Ponte Dattaro (Parma river), year 2010



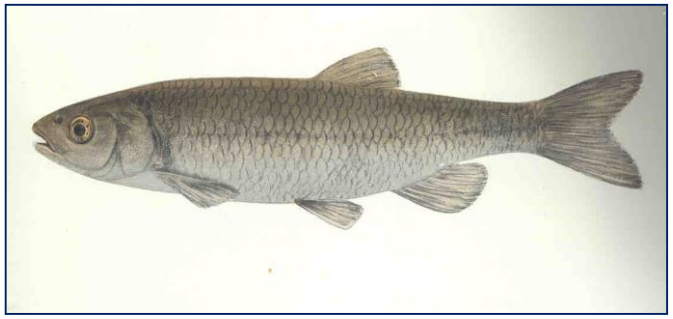
Weighted Usable Area - WUA

The target is to evaluate the change of habitat suitability in a portion of the Parma river, for the adult life stage for three different fish species.

The data used are:

- stream flow series
- Weighted Usable Area (WUA) - Q curves

Barbus plebejus



Leuciscus cephalus

Salmo trutta

N.B.: the only discriminating factor considered is the STREAM FLOW

WUA - Q curves

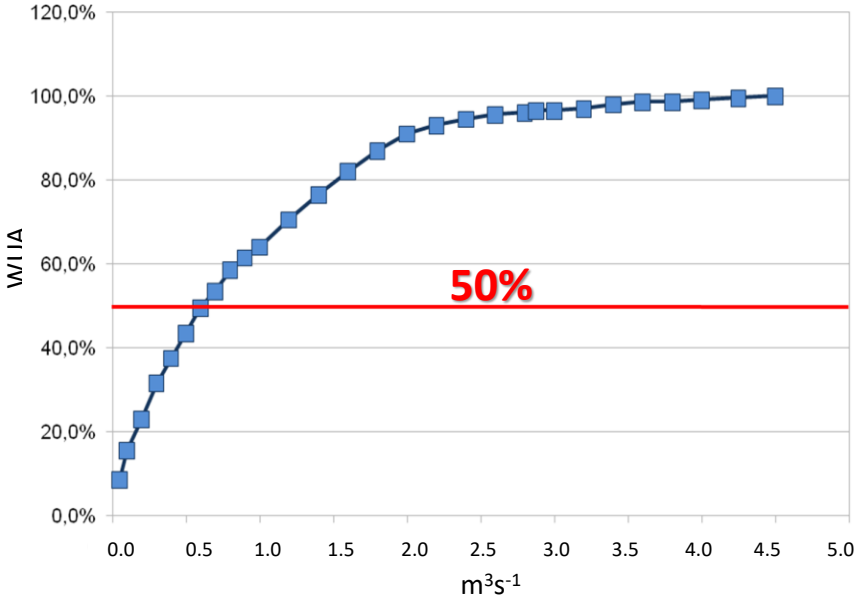
The WUA - Q curves (Weighted Usable Area - Flows) used to evaluate habitat suitability, derive from a "*Minimum Flow*" study led by ARPAE and R.E.R. (Emilia-Romagna Region) using the PHABSIM software. The WUA-Q relate discharge with the available habitat area. These curves are site and species-specific.

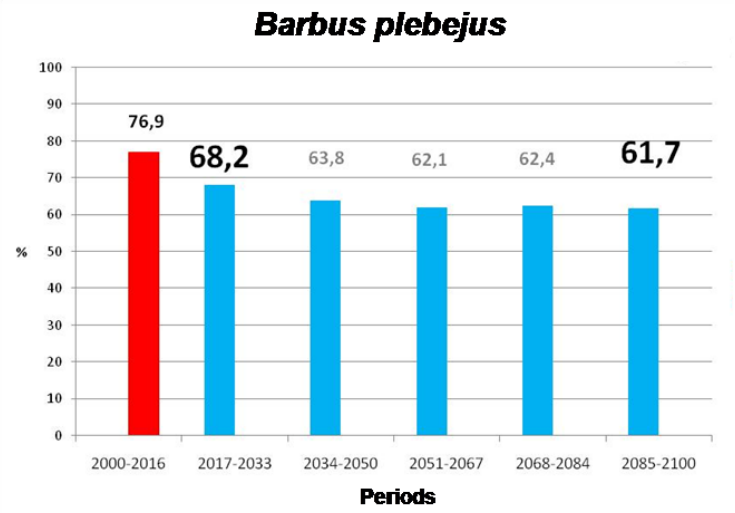
$$WUA(Q) = \int_A f(v,d,ci)\ dA$$

- *WUA (Q)* is the physical habitat at the streamflow Q
- *dA* is an incremental area
- *A* is the total area at the streamflow Q
- *v* is the velocity
- *d* is the depth
- *ci* is an index for the channel characteristics

WUA

The WUA curves show the habitat suitability for the target species, considering the discharge variations. It is possible to find out a suitable habitat, from an hydraulic point of view, when the WUA is greater than 50%. This value represent the discriminating limit between potential suitable and potential non-suitable habitat.





Maintaining the identified threshold value is possible to evaluate not only the present conditions but also climate change scenarios conditions.

Eco-hydraulic model for the habitat of the birdlife along the Po river

The model allows to analyze habitat availability of avian species linked to aquatic environment, particularly for one phase of life: **nesting**.

Common Tern *Little Tern*

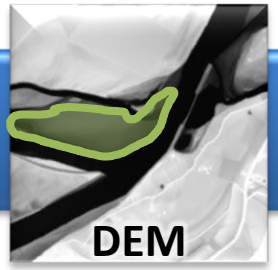
"IUCN Red list"

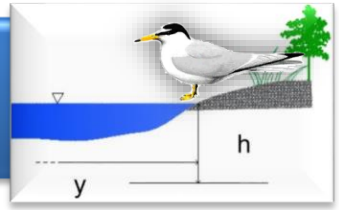
Model structure

Hypothesis

- Fixed bottom

Components





- Hydro-morphological
- Biological

Elaboration

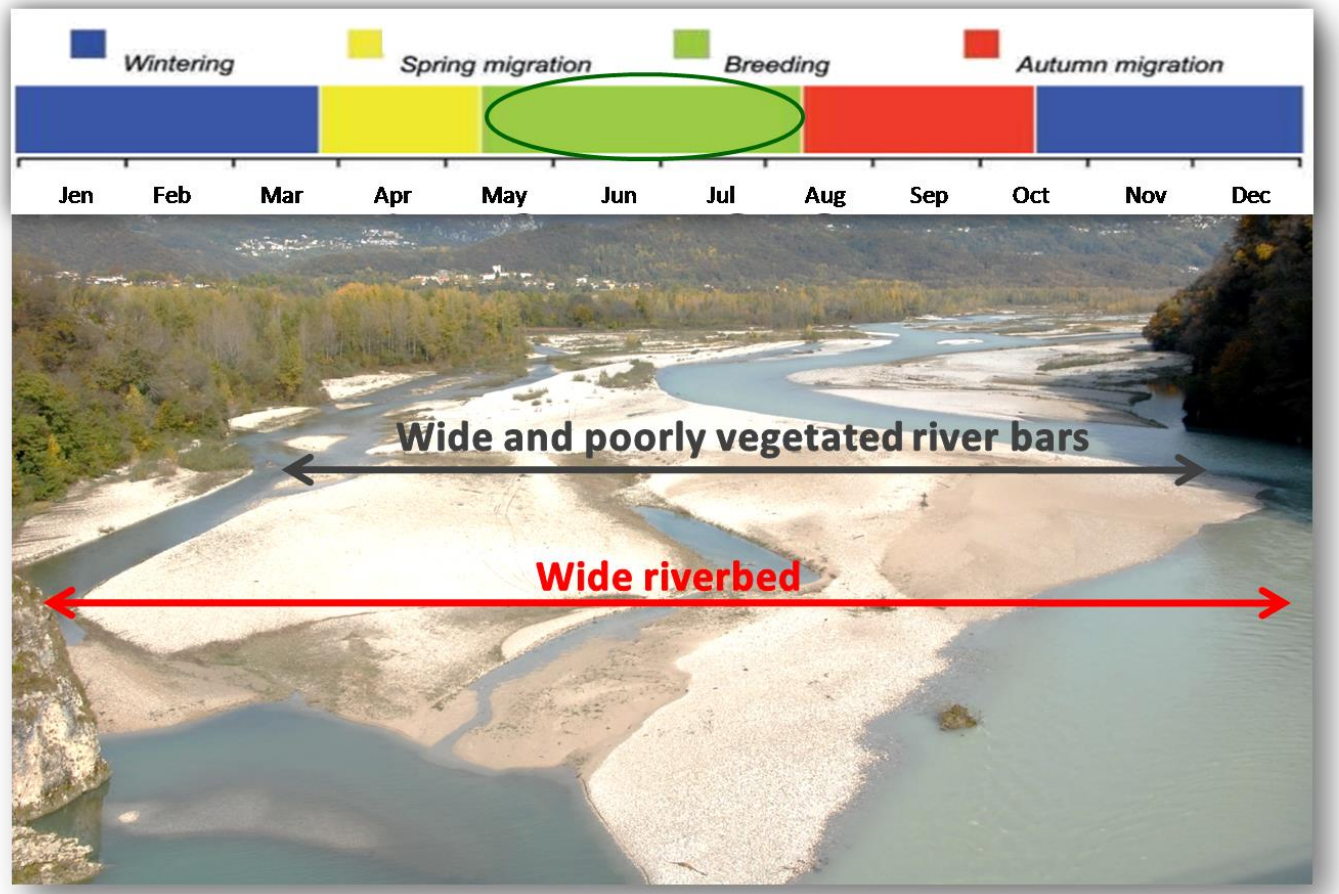
Results

- Habitat conditions

When and where?

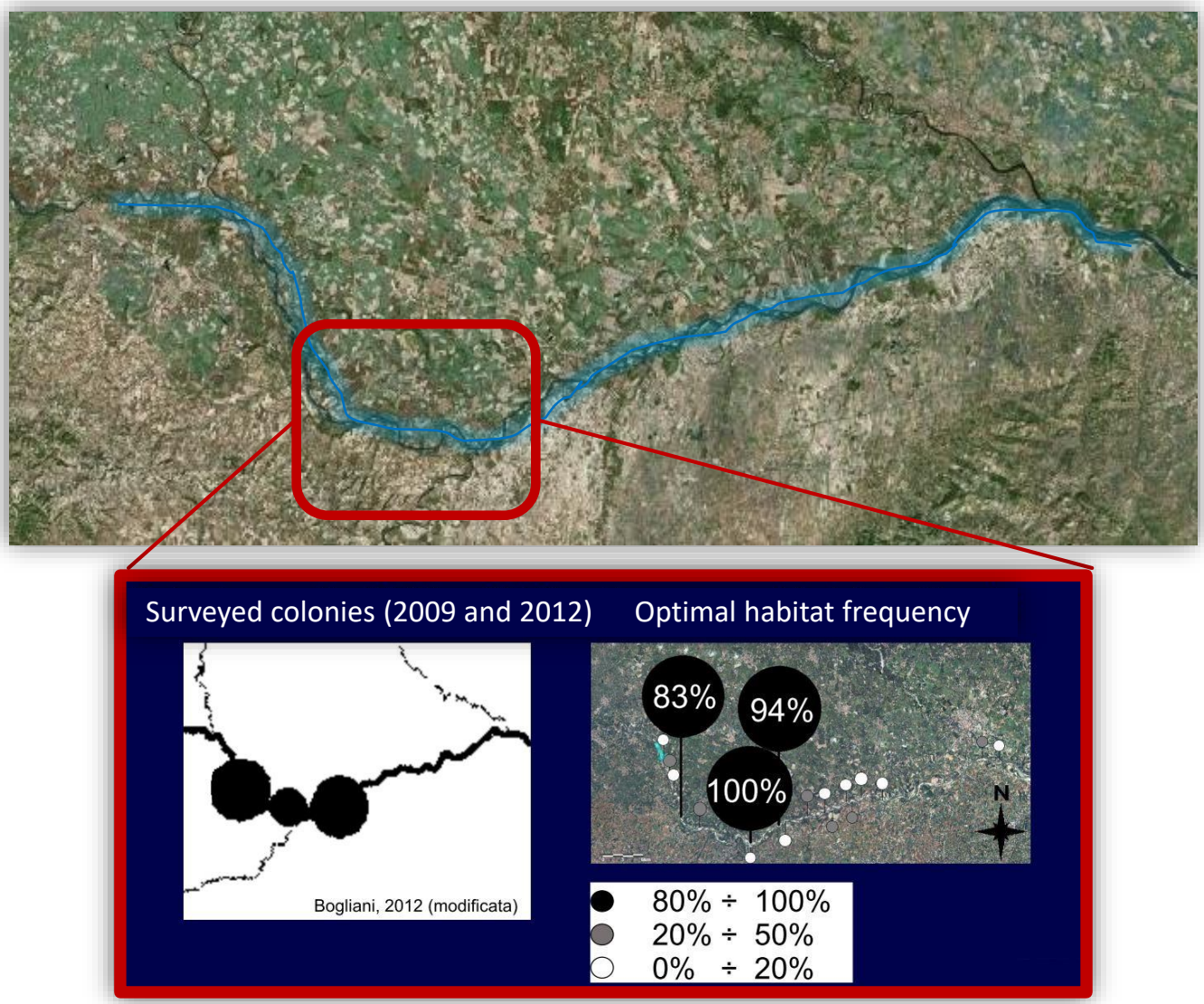
Necessary condition for species reproduction

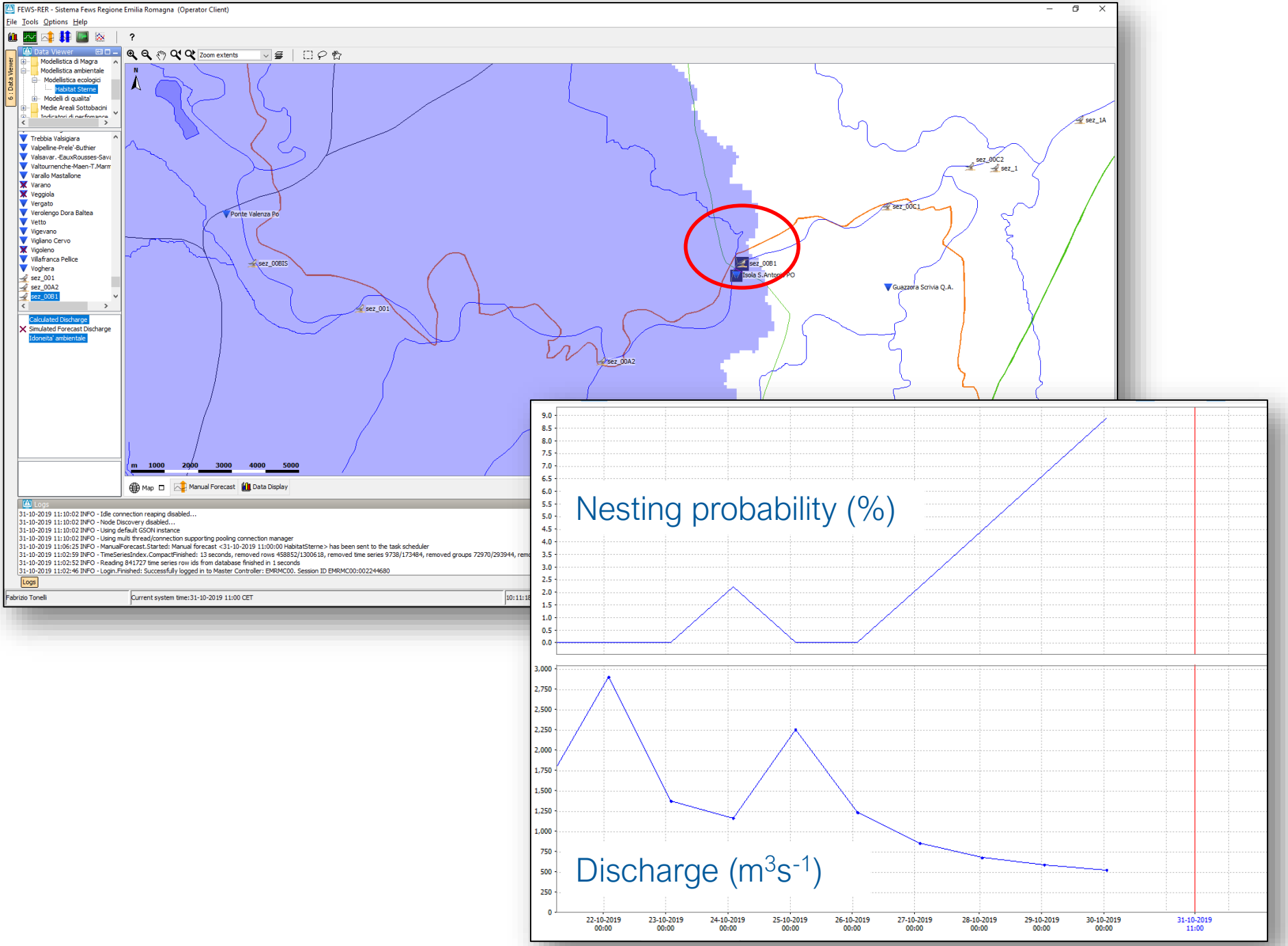
The potential **suitable area** for nesting has not to be flooded for a **continuous** period of at **least 45 days** (laying period + breeding period)



Results

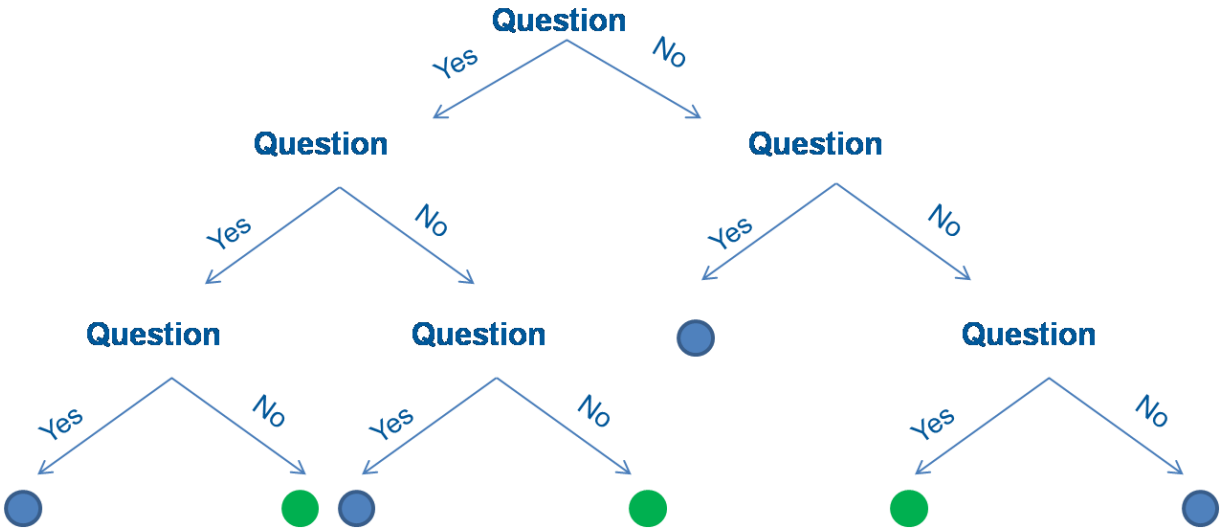
Comparison between observed and simulated




FEWS-RER - Sistema Fews Regione Emilia Romagna (Operator Client)
File Tools Options Help
Data Viewer
Zoom extents
Modellistica di Magra
Modellistica ambientale
Modellistica ecologici
Habitat Sterne
Modelli di qualita'
Medie Areali Sottobacini
Trebbia Valsigiara
Valpelline-Prele'-Buthier
Valtournenche-Maen-T.Marm
Varallo Mastallone
Varano
Veggiola
Vergato
Verolengo Dora Baltea
Vetto
Vigevano
Vigliano Cervo
Vigoleno
Villafranca Pellice
Voghera
sez_001
sez_00A2
sez_00B1
Calculated Discharge
Simulated Forecast Discharge
Idoneita' ambientale
Ponte Valenza Po
sez_00BIS
sez_001
sez_00A2
sez_00B1
Isola S.Antonio PO
Guazzora Scrivia Q.A.
sez_00C2
sez_1
sez_00C1
sez_1A
m 1000 2000 3000 4000 5000
Map
Manual Forecast
Data Display
Logs
31-10-2019 11:10:02 INFO - Idle connection reaping disabled...
31-10-2019 11:10:02 INFO - Node Discovery disabled...
31-10-2019 11:10:02 INFO - Using default GSON instance
31-10-2019 11:10:02 INFO - Using multi thread/connection supporting pooling connection manager
31-10-2019 11:06:25 INFO - ManualForecast.Started: Manual forecast <31-10-2019 11:00:00 HabitatSterne> has been sent to the task scheduler
31-10-2019 11:02:59 INFO - TimeSeriesIndex.CompactFinished: 13 seconds, removed rows 458852/1300618, removed time series 9738/173484, removed groups 72970/293944,
31-10-2019 11:02:52 INFO - Reading 841727 time series row ids from database finished in 1 seconds
31-10-2019 11:02:46 INFO - Login.Finished: Successfully logged in to Master Controller: EMRMC00. Session ID EMRMC00:002244680
Logs
Fabrizio Tonelli
Current system time:31-10-2019 11:00 CET
Nesting probability (%)
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
Discharge (m3s-1)
3,000 2,750 2,500 2,250 2,000 1,750 1,500 1,250 1,000 750 500 250 0
22-10-2019 00:00
23-10-2019 00:00
24-10-2019 00:00
25-10-2019 00:00
26-10-2019 00:00
27-10-2019 00:00
28-10-2019 00:00
29-10-2019 00:00
30-10-2019 00:00
31-10-2019 11:00

Random Forests

A random forest is basically an ensemble of decision trees. Random forests also provide a natural way of assessing the importance of input variables. It allows to associate a probability of occurrence to the results obtained.

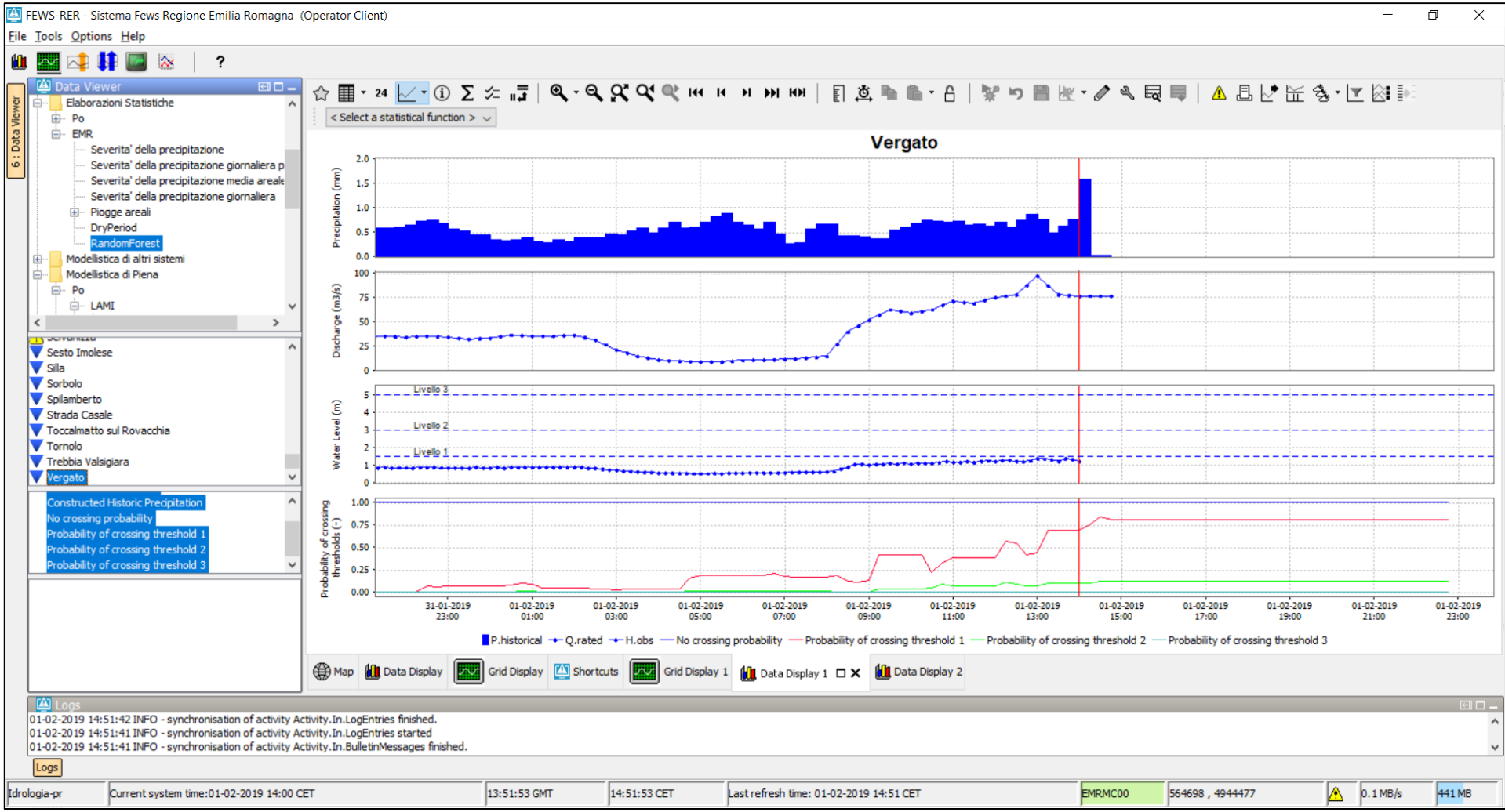


Benefits of Random Forests:

- Accuracy
- Runs efficiently on large data bases
- Gives estimates of what variables are important in the classification
- Generates an internal unbiased estimate of the generalization error as the forest building progresses

Random Forests

FEWS implementation



Thank you for your attention

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