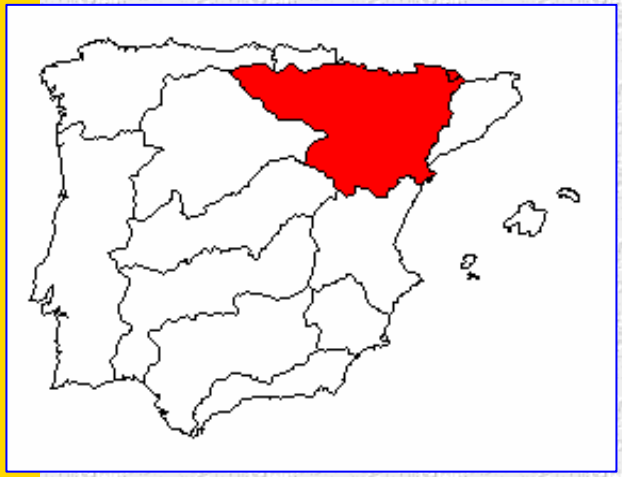
AUTOMATIC HYDROLOGIC INFORMATION SYSTEM (S.A.I.H.)

OF THE EBRO BASIN

OBJECTIVES OF THE S.A.I.H. SYSTEM

- Forecast and management of floods
- Optimisation and management of water resources
- Surveillance of water pollution levels
- Increase in dam security through real-time data.
- Improvement of meteorological and hydrological databases (water quantity and quality).

S.A.I.H. Ebro



Ebro basin

Basin area: 85.000 Km2

Works beginning: year 1989

Works ending: year 1997

Investment: 74.525.000 euros (91.600.000 $ USD)

S.A.I.H Ebro Description

The S.A.I.H structure comprises three hierarchic levels:

- -Control point or remote station (E.R.)(354)
- -Concentration point (P.C.)(14)
- -Basin Processing Centre (C.P.C.)

BASIN PROCESSING CENTER (CPC)

Management of:

A. Incidents generated by the S.A.I.H. Network itself.

B. Incidents related to operations of the "Confederación Hidrográfica del Ebro" (CHE).

This service works 365 days a year, 24 hours a day.

S.A.I.H Ebro Network Topology

S.A.I.H Ebro includes 354 remote stations:

64 dams

117 flow gauges in rivers

114 flow gauges in canals

53 rain gauges

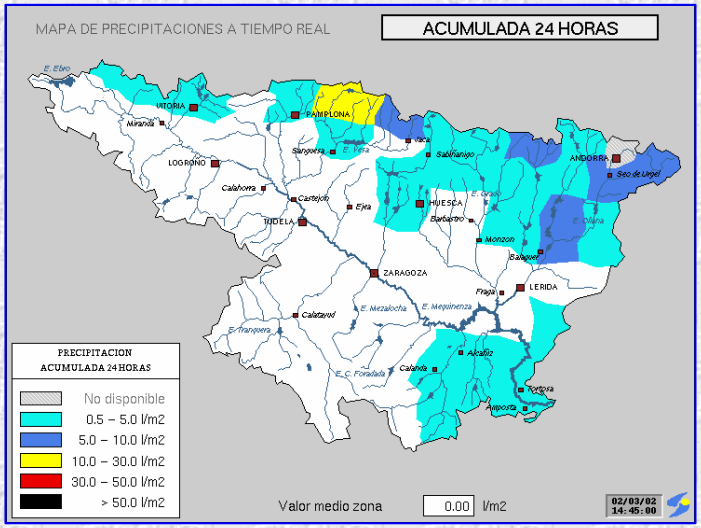
6 water quality sensors

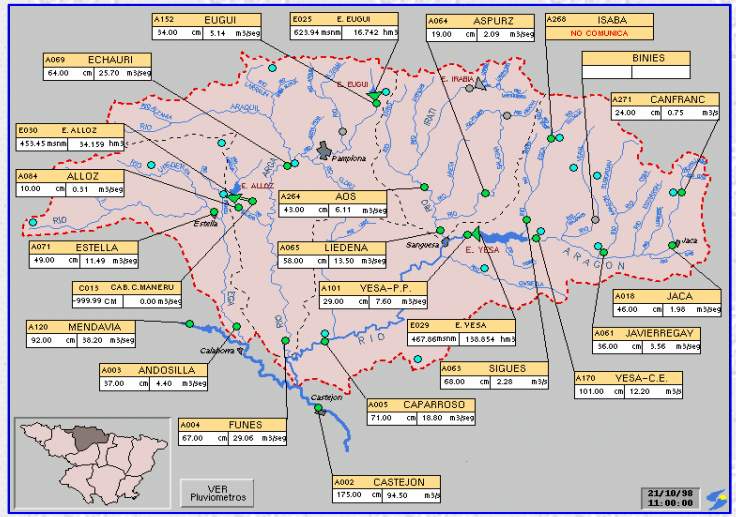
And 98 radio repeater stations.

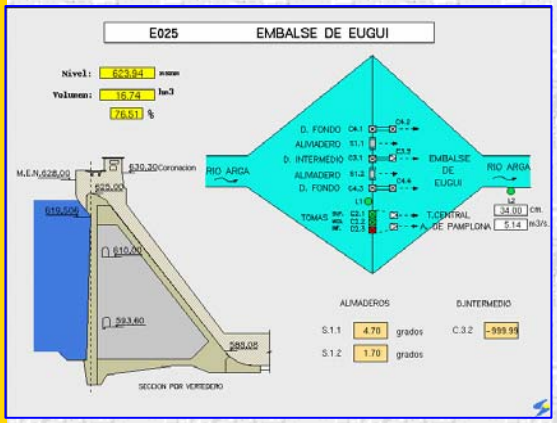
How S.A.I.H Ebro works:

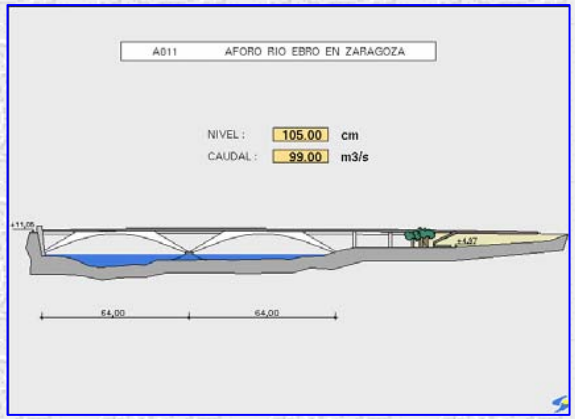
- Remote stations collect and process the sensorized data.
- Concentration points receive data from the remote stations every 15 minutes.
- Concentration points transmit the stored data to the Basin Processing Centre.

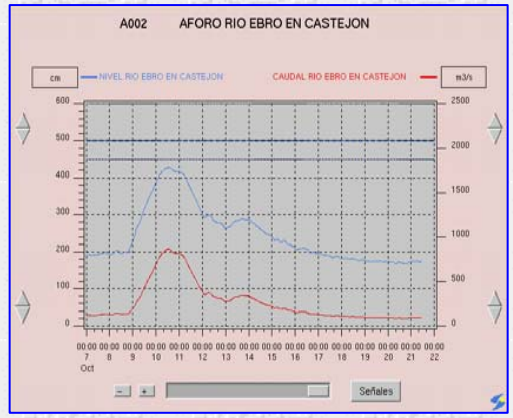
Examples of S.A.I.H. Utilities





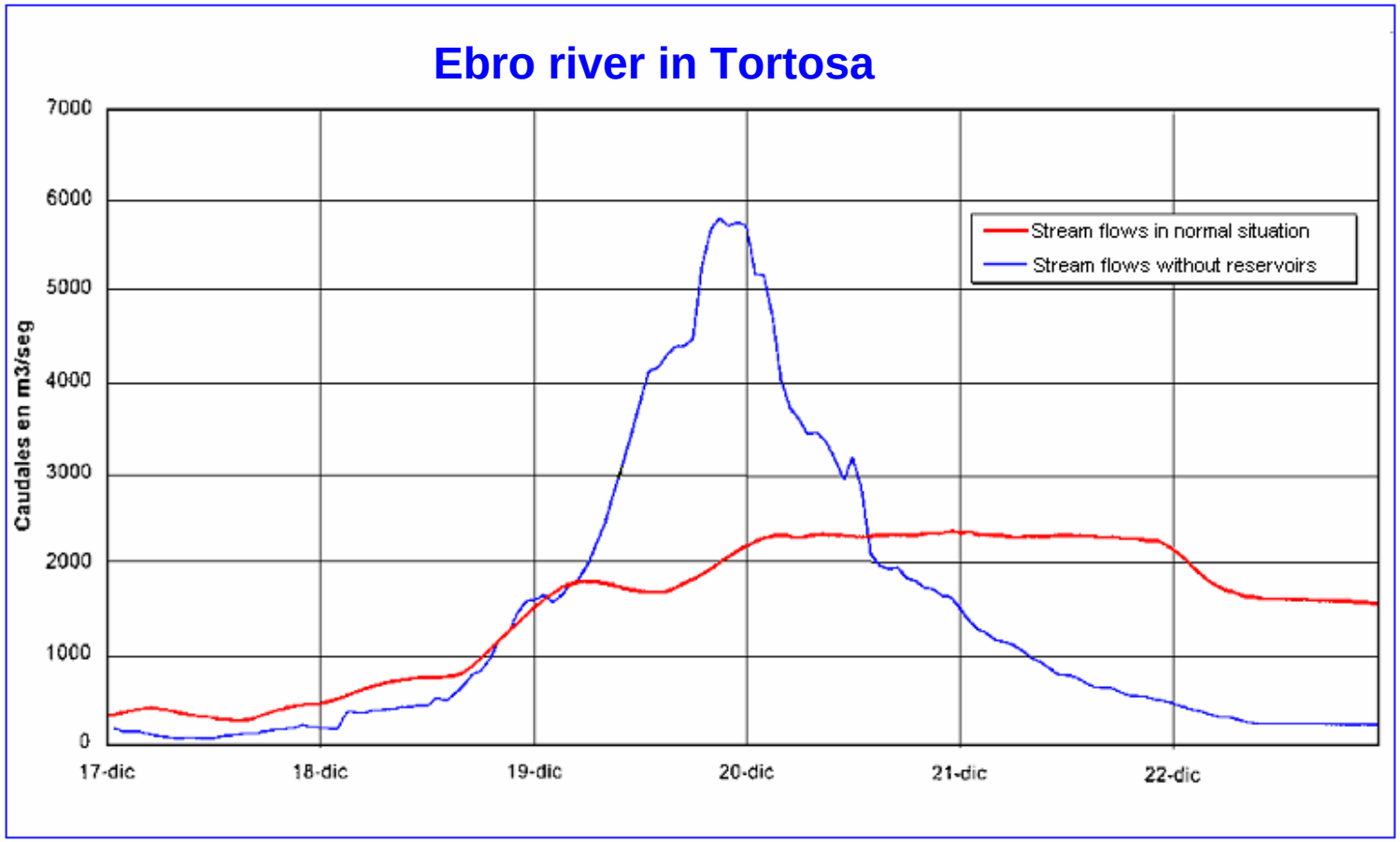






EXAMPLES OF FLOOD LAMINATION

December 17 - 22th, 1996



Conclusions

- **Very useful in extreme situations thanks to the real time data collection system:**

  ⇒ It allows the adoption of optimised dam operation policies

- **Repayed investment: Lamination floods decreases the cost of damages.**

- **Essential tool for water resources management**

S.A.I.H Network is on the Internet since November 2002

www.saihebro.com

The objetives of the S.A.I.H web are:

- Giving access to S.A.I.H real time data to:
  - ✓The "Confederación Hidrográfica del Ebro" staff.
  - ✓Companies, Universities, farmer communities, media, individuals, etc.
- Spreading S.A.I.H information on the Internet.

3. Available information on the website

There are two kinds of information:

- **General information** : every user may consult real-time data every hour.

-**Specific information (only registered users)** : In addition to general information, some users can have access to further information (real-time data every 15 minutes and historical data).

Available information for users

Reservoirs	Rivers	Channels	Rainfall gauges
Level	Level	Level	Rain
Volume	Flow	Flow	
% of capacity			
Flow out of reservoirs			

Website data is updated every hour.
Databases store the last 7 days of collected information.

MINISTERIO
DE MEDIO AMBIENTE

Secretaría de Estado de Aguas y Costas

Confederación Hidrográfica del Ebro

Ebro River Basin Decision Support System

SAD

A Real Time Flood Forecasting System

Ebro river basin Decision Support System (SAD)

Objectives:

- Providing an operational flood forecasting and management tool for the Ebro basin.

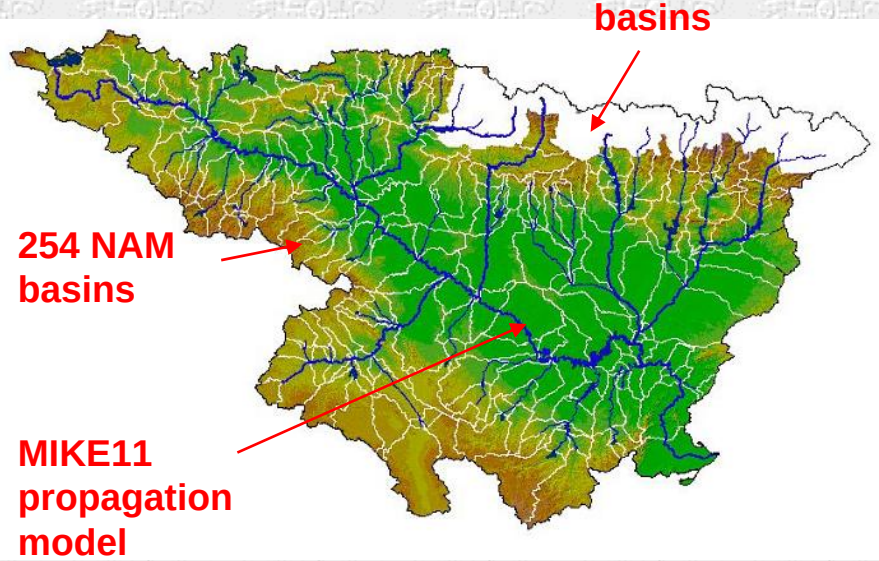
- Assisting the flood management decision-making process by simulating different dam operations.

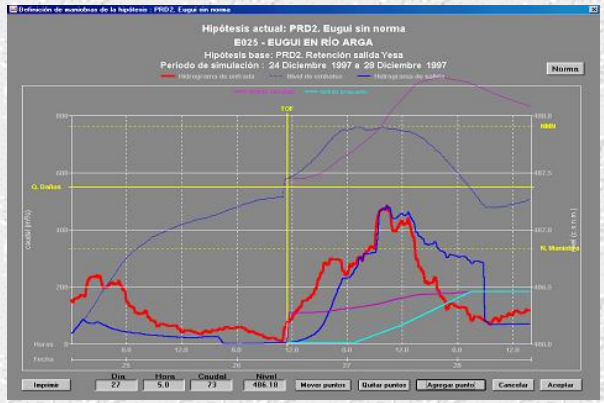
SAD is a simulation system that consists basically of:

- Two hydrologic models that allow to modelize the hydrological cycle in order to estimate flows in basins. The ASTER model is used for pyrenaic basins and the NAM model for the rest of basins.

- A river modelling tool (MIKE 11) for the flood wave propagation in rivers and reservoirs.

- A dam operations module that serves as a support for the decision-making process.





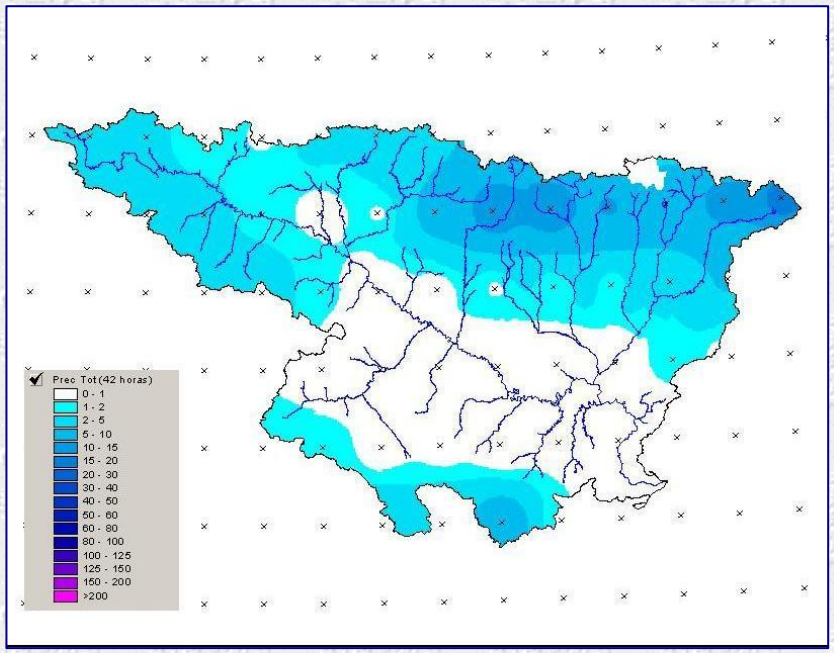
MODEL INPUTS:

1.- Real time collected data from SAIH remote stations:

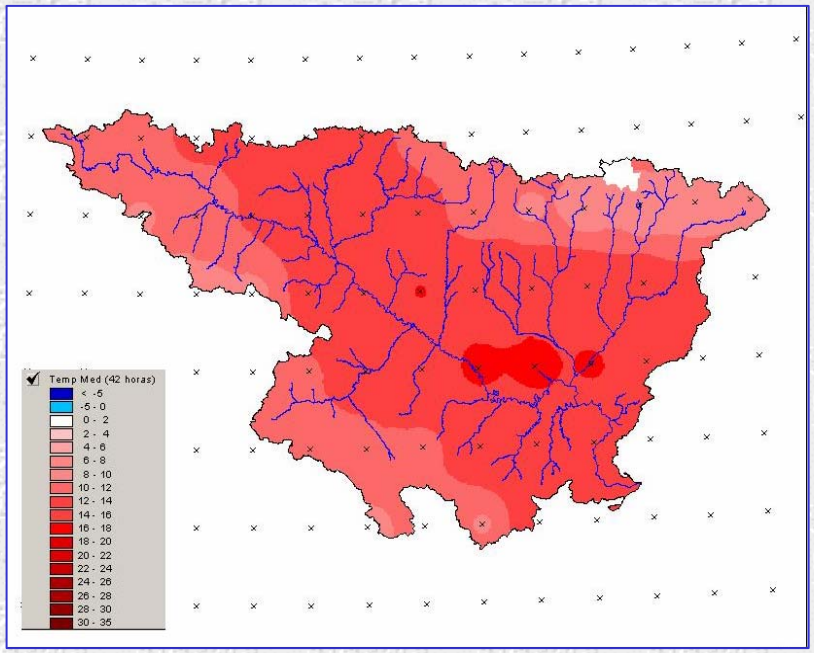
Precipitation, temperature, stream flows ,reservoirs levels and outflows.

MODEL INPUTS:

2.- Rainfall and temperature forecast for the next 48 hours (provided from the Meteorological National Institute)

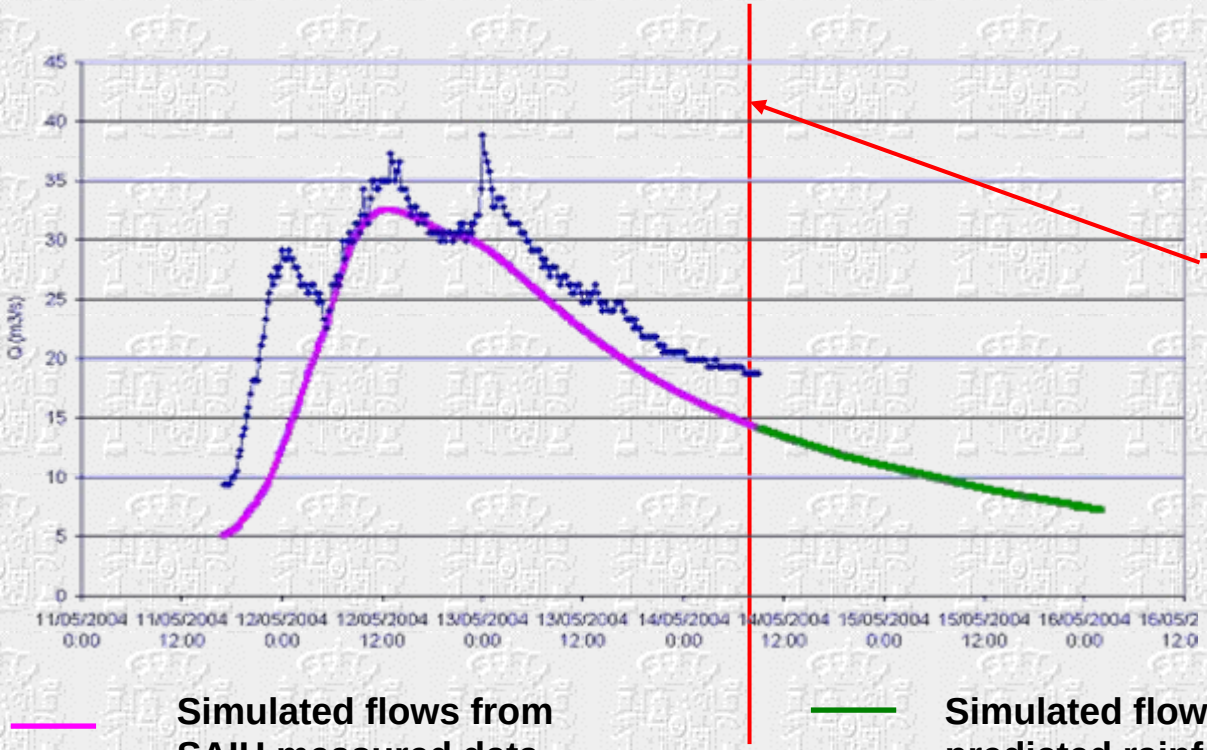


48 hours rainfall forecast map for the 26 may 04



48 hours temperature forecast map for the 26 may 04

HOW SIMULATIONS WORKS?



Simulated flows from SAIH measured data

Simulated flows from predicted rainfall in 48 hours

By using:

- Measured rain, * temperature (as inputs for the hydrologic models)
- Hydrologic and hydraulic models
- Observed flows for comparison and updating routine

By using:

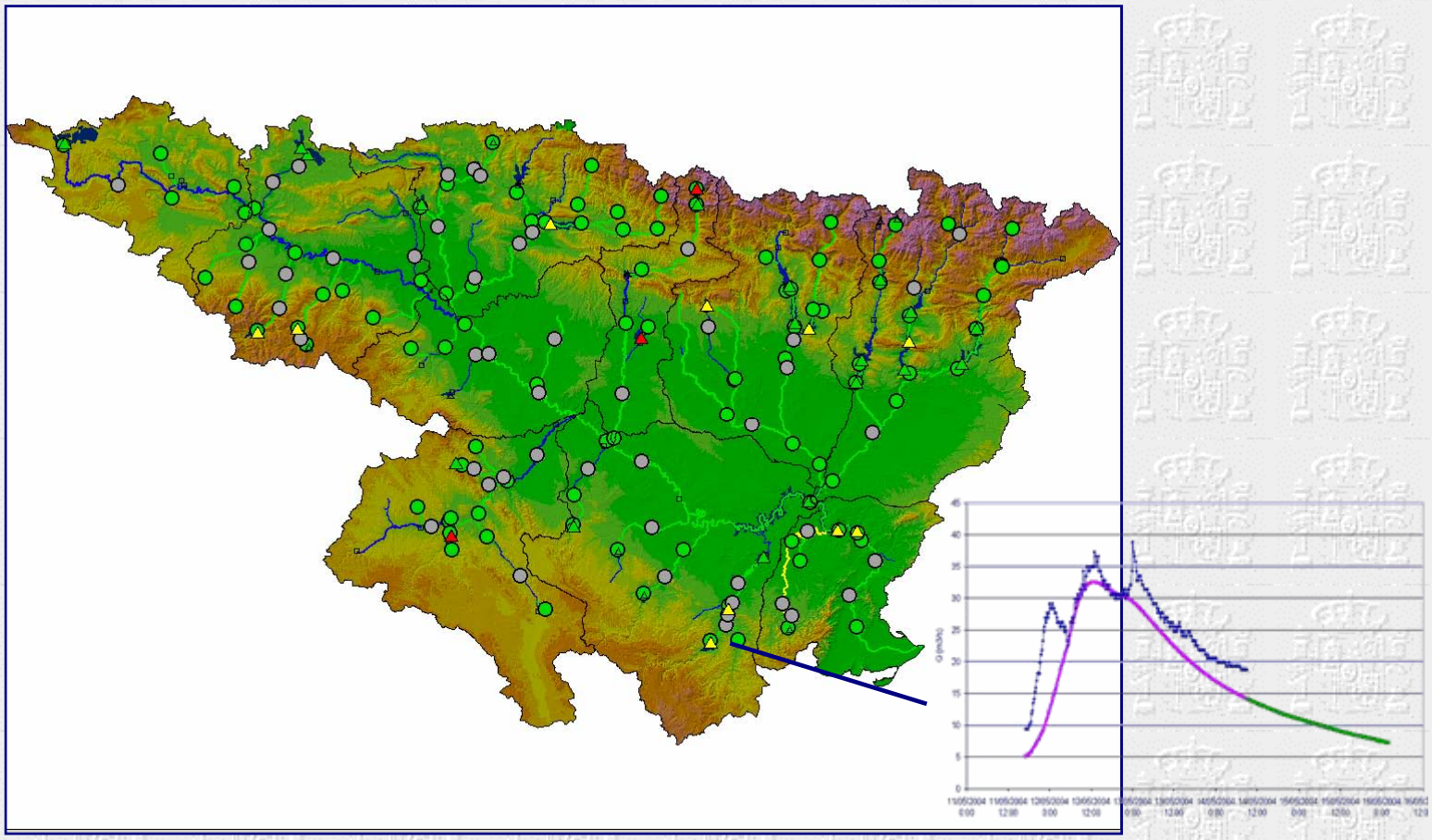
- Forecast of rainfall and * temperature (as inputs for the hydrologic models)
- Hydrologic and hydraulic models

* Only for snow basins

MODEL OUTPUTS:

1.- Forecasted levels and flows in river gauge stations

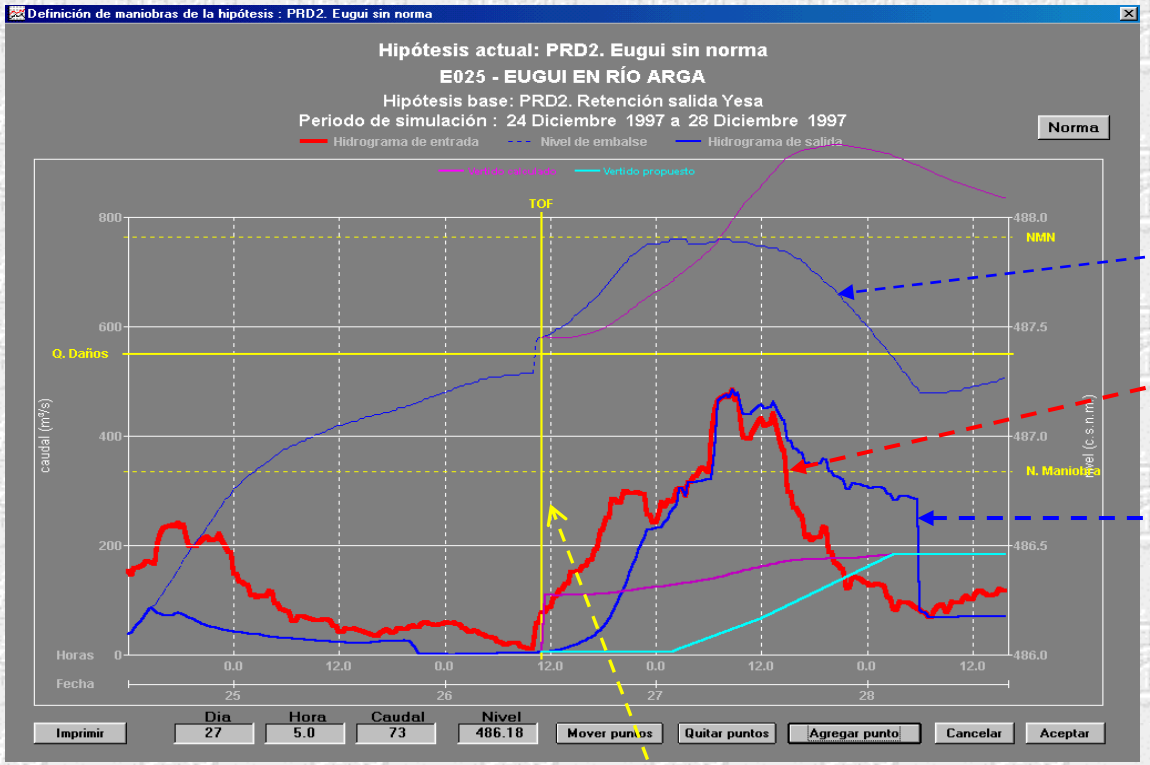
2.- Forecasted flows in other interesting points.



MODEL OUTPUTS:

3.- Future reservoir inflows and outflows.

4.- Future reservoir levels.



Reservoirs levels

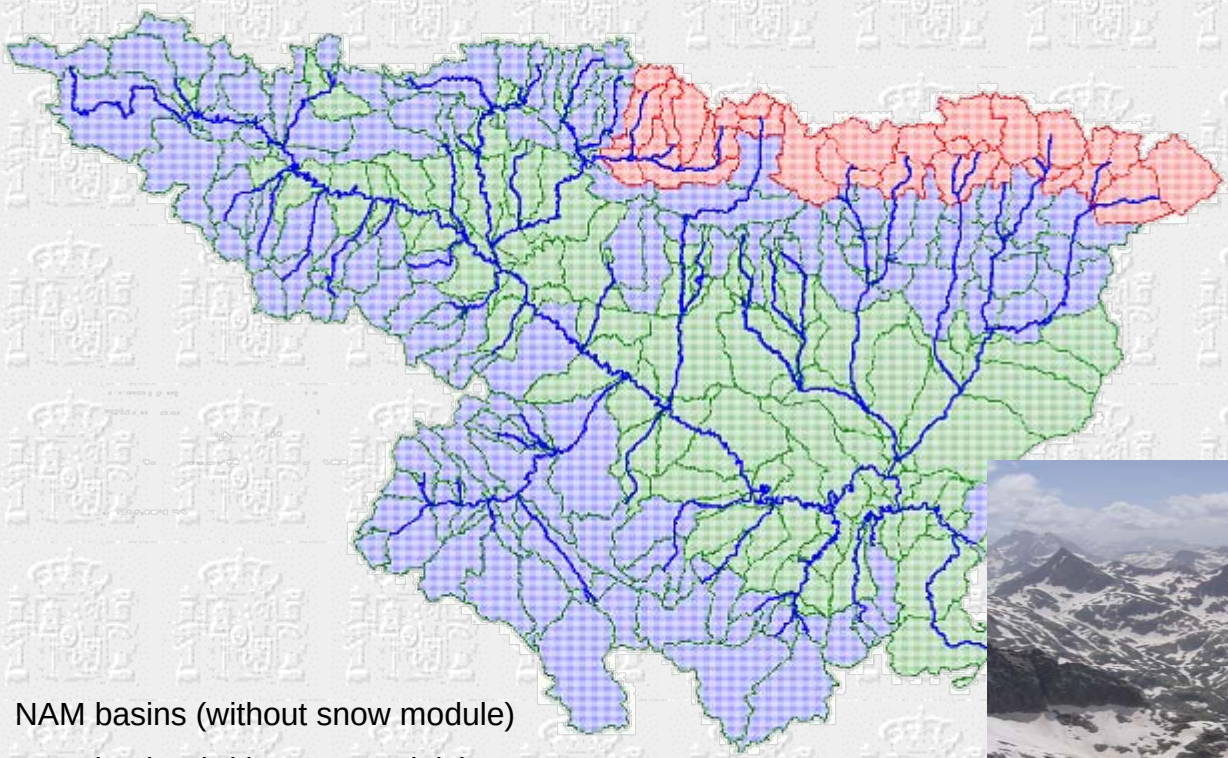
Reservoirs inflows

Reservoirs outflows

Time of forecasting

MODEL OUTPUTS:

5.- Snow package and derived flows from the snowmelt in 183 basins.



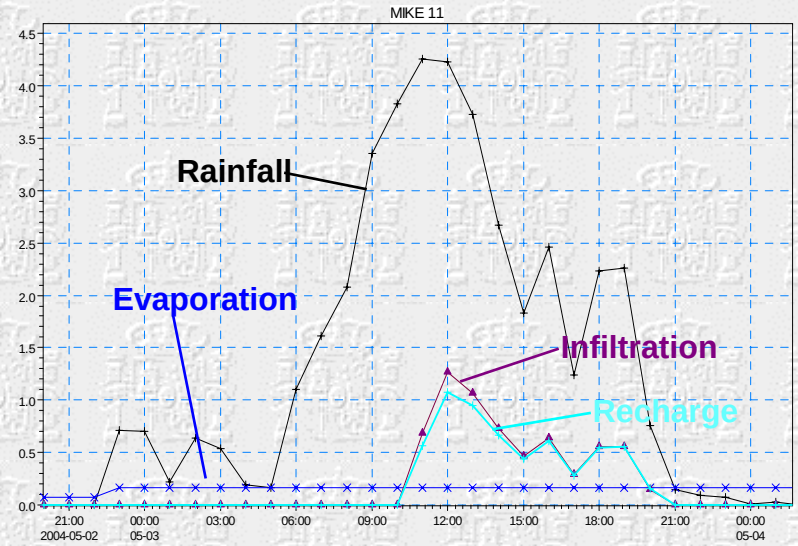
NAM basins (without snow module)

NAM basins (with snow module)

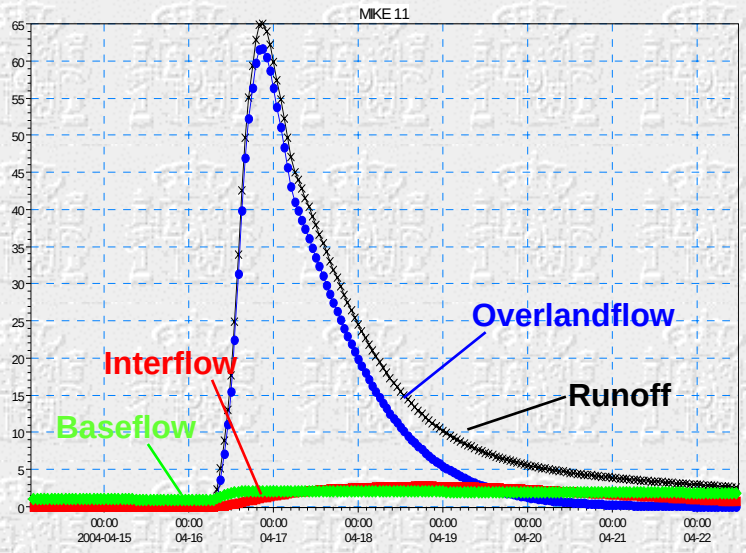
ASTER basins (with snow module)

MODEL OUTPUTS:

6.-The hydrologic status of the Ebro basin: components of hydrologic cycle such as evaporation, infiltration, interflow, baseflow, overlandflow ,water store in the different deposits...



mm/hours



m^3/s

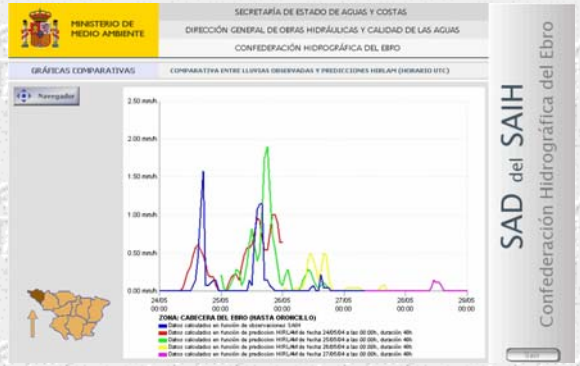
WEBSITE OF SAD:

Restricted users can consult the results of the SAD system simulation:

Forecasted flows in river gauge stations and other interesting points

Animated maps of rainfall forecasting

Evolution of the forecasted rainfall throughout the simulation period



The comparison between observed and predicted rainfall