



## НАЦИОНАЛЕН ИНСТИТУТ ПО МЕТЕОРОЛОГИЯ И ХИДРОЛОГИЯ

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### *Hydro-meteorological Aspects of Natural Hazards Prediction in Bulgaria*

- National Hydro-meteorological Service (under the regulation 5 of the present Water Act)
- Independent research organisation (under the Law for the Bulgarian Academy of Sciences)

Natural disasters, including floods and their mitigation have always been part of the development of human society.

## *NIMH as hydromet service and expert body:*

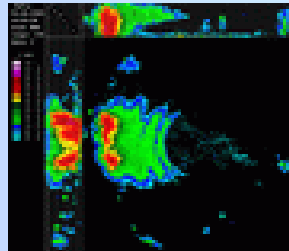
- *Structure : Headquarters in Sofia, Dept. of Meteorology, Hydrology, Weather forecasting, Chemical composition of Hydrosphere and Atmosphere, Information centre, others.*
- *Four branches in Plovdiv, Varna, Pleven, Kjustendil*
- *Observatories and hydro-meteorological stations all over the country (air temperature, precipitation, upper-air sounding, river flow and groundwater tables, etc.)*
- *Represent Bulgaria in the World Meteorological Organisation, EUMETSAT, EcoMet*
- *Provide wide range of expertise in the field of Hydrology and Meteorology, participate in a number of projects financed by the EC 4,5,6 and 7thFP, Phare, Intereg, Nato, World Bank and other international and national donors*

# Meteorological information used in weather prediction

Satellite and



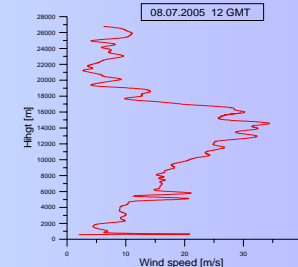
Weather radar data



Synoptic stations.

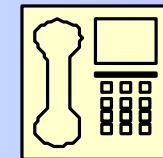
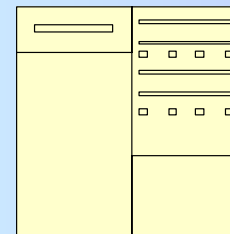
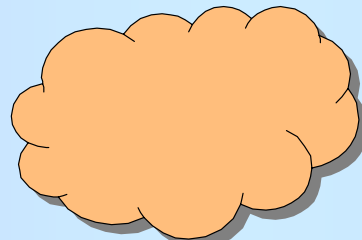
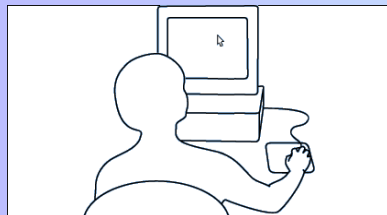


Aerological sounding



Numerical weather forecasting models

Forecaster/Synoptic on duty  $\Rightarrow$  FORECAST:



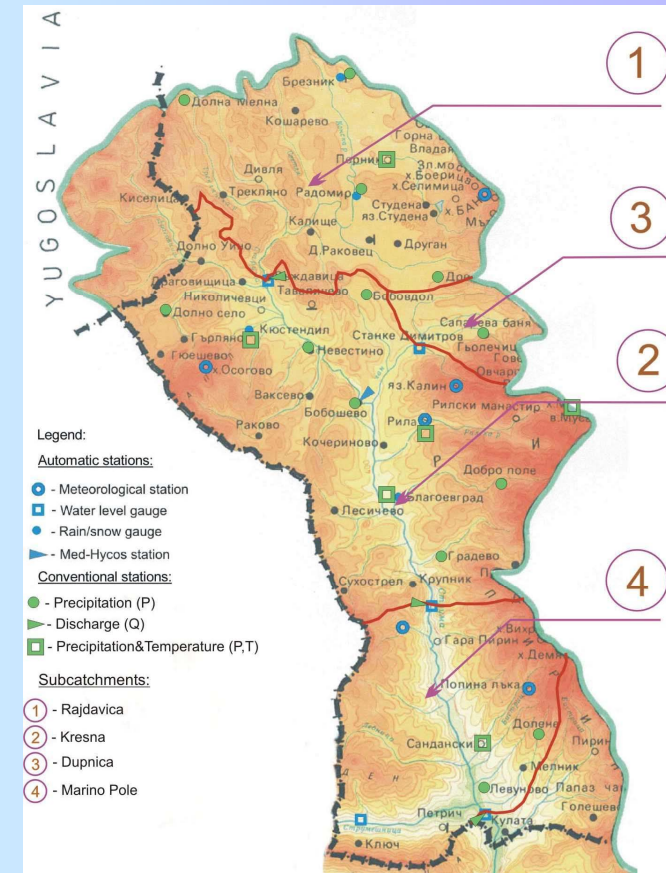
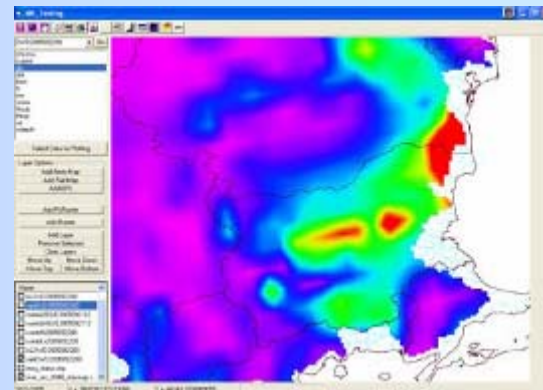
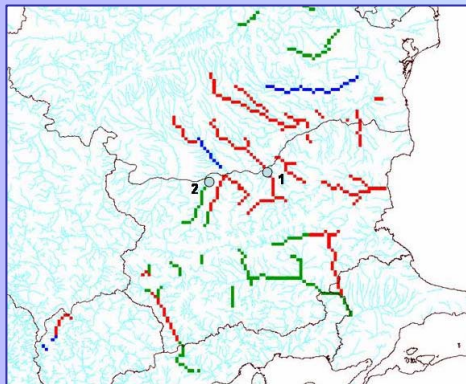
Dissemination, use for hydrological prediction

## Hydrological forecasting:

- Experience with HBV and MODCOU calibrated for Struma and Maritza basins in the frame of EC 5<sup>th</sup> FP – EFFS project, not available operationally.

### Summary of accuracy criteria achieved for HBV

Calibration period	Struma river sub-basins							
	Rajdavitza		Dupnitsa		Kresna		Marino pole	
	R2	AccDiff	R2	AccDiff	R2	AccDiff	R2	AccDiff
Obs. 1990-99	0.58	-21.8	0.263	-111.0	0.61	-12.1	0.54	-82.6
Obs. 2001-03	0.433	-6.3	0.044	89.8	0.502	-29.2	0.57	-55.5
Forecast t+24	0.31	7.1	0.16	-18.3	0.1	-130	0.43	-51.6
Forecast t+48	0.38	-2.	-0.13	-68	0.06	-107	0.46	-11.1



In September 2005, NIMH started to receive the EFAS buletines with indicative hydrological forecasts

## *Recent projects developping flood forecasting:*

- European Flood Alert System, JRC project, NIMH is a partner supporting its components:
  - European Flood GIS;
  - European Terrestrial Network for River Discharge
- Capacity improvement of flood forecasting in the Bulgarian – Turkish border region, Maritza and Tundja basins (Phare CBC, ongoing), NIMH is beneficiary twith the Ministry of Environment and Waters
- Capacity Improvement for Flood Forecasting and Flood Control in the Tr-Bg CBC Region, under the leadership of Danish Hydraulic Institute, NIMH is supporting the development of the flood forecasting sytem for Maritza river in DSI-Turkey

### Other ongoing works of young engineers:

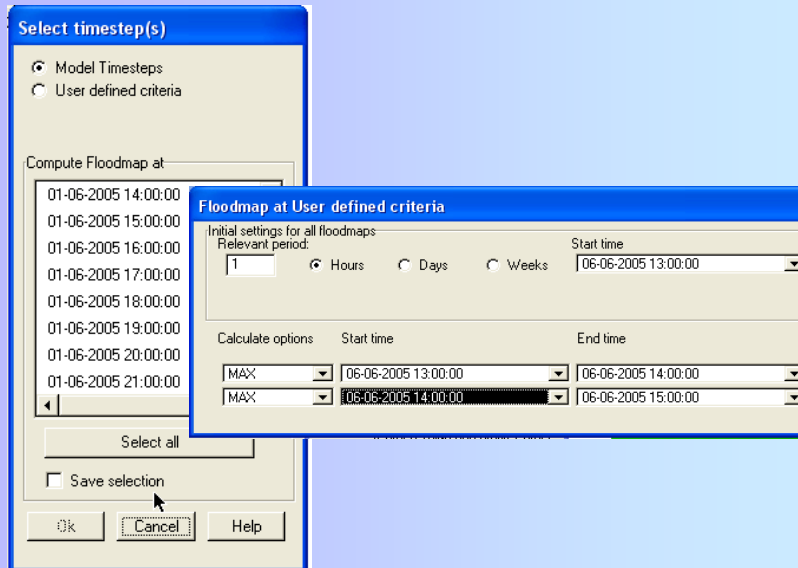
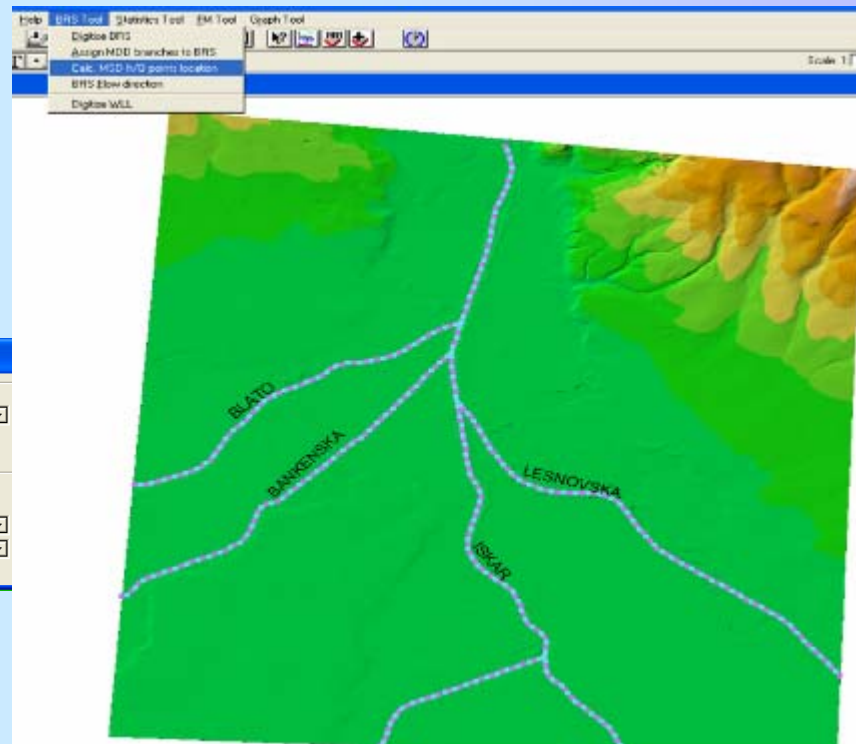
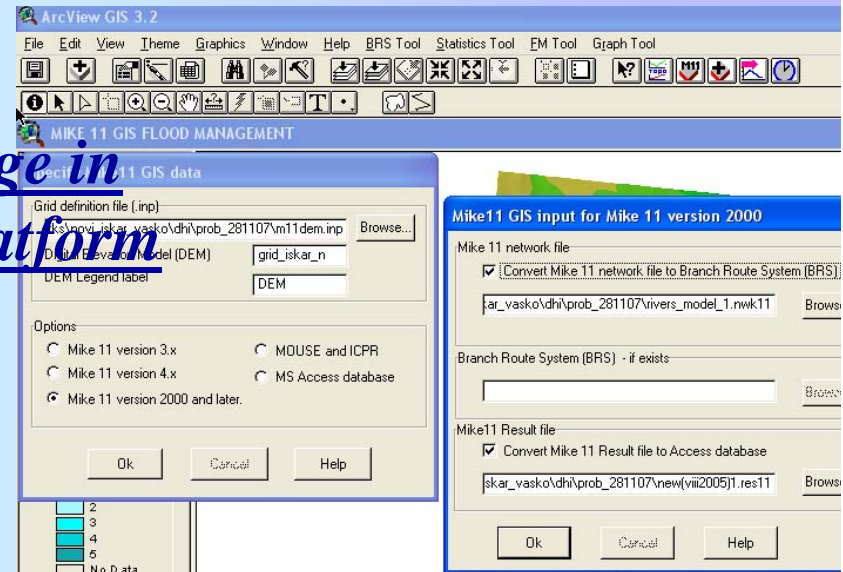
- GIS tools and hydraulic modeling usage in flood simulation via DHI MIKE 11 platform (on the example of Novi Iskar Area);
- MODCOU – ISBA balanced type models applications for Maritza basin, NIMH Plovdiv, fully developed model;
- Neuron networks applications in flood forecasting, setting up flood alert thresholds (for areas not covered by basin dedicated data collection and forecasting systems)

# Some examples!

## GIS tools and hydraulic modeling usage in flood simulation via DHI MIKE 11 platform

(on the example of Novi Iskar Area);:

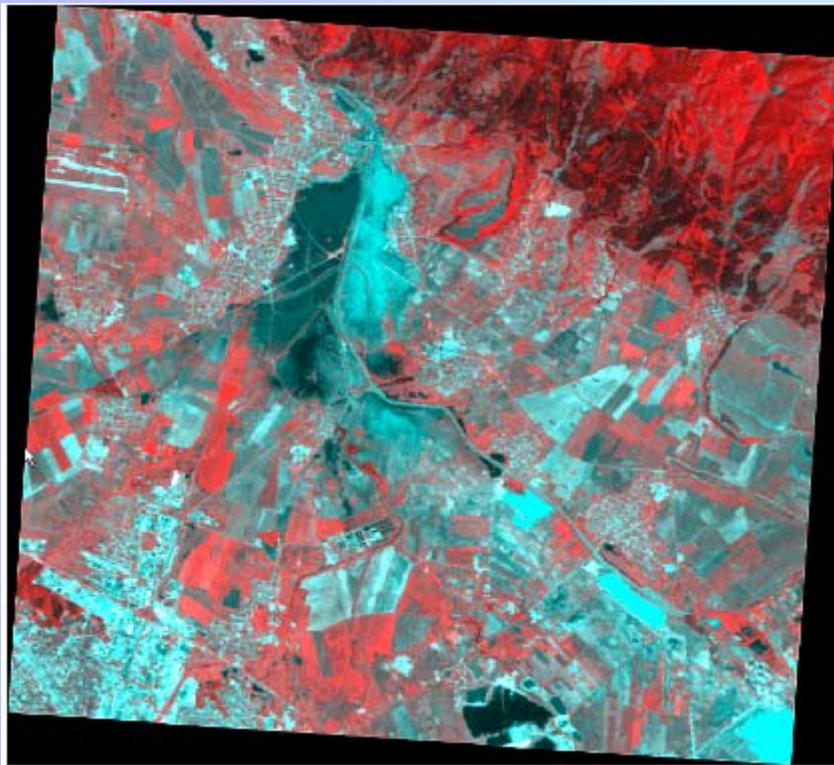
- HD simulations using DHI Mike11 platform.
- Create flood map step by step



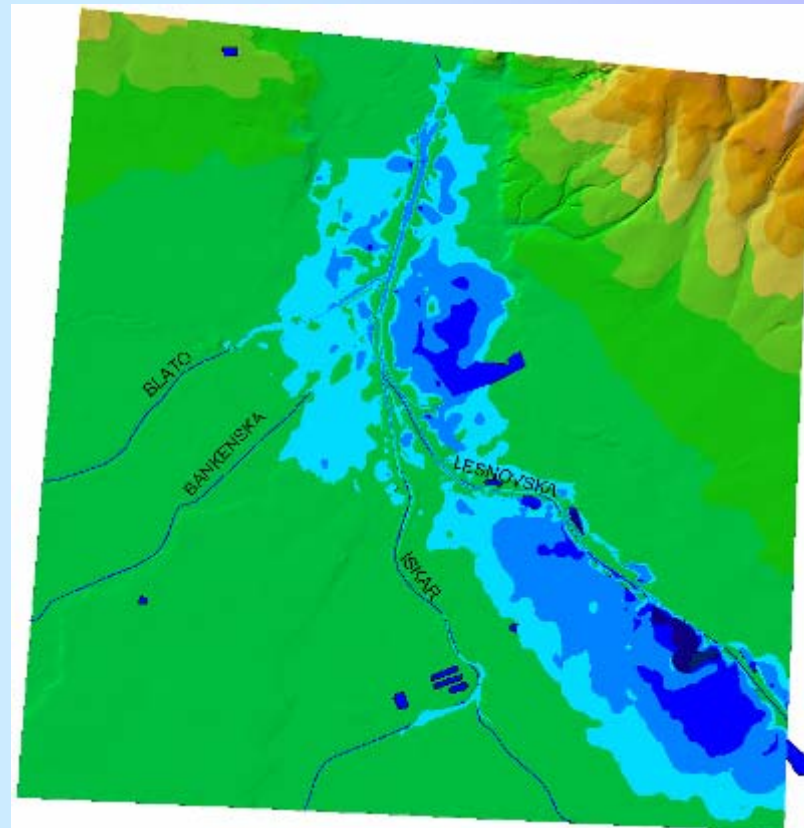
*Some examples!*

*Flooded territory and damage assessment for locality Novi Iskar at River Iskar:*

Rectified satellite image, Summer 2005; Resac - ASDE



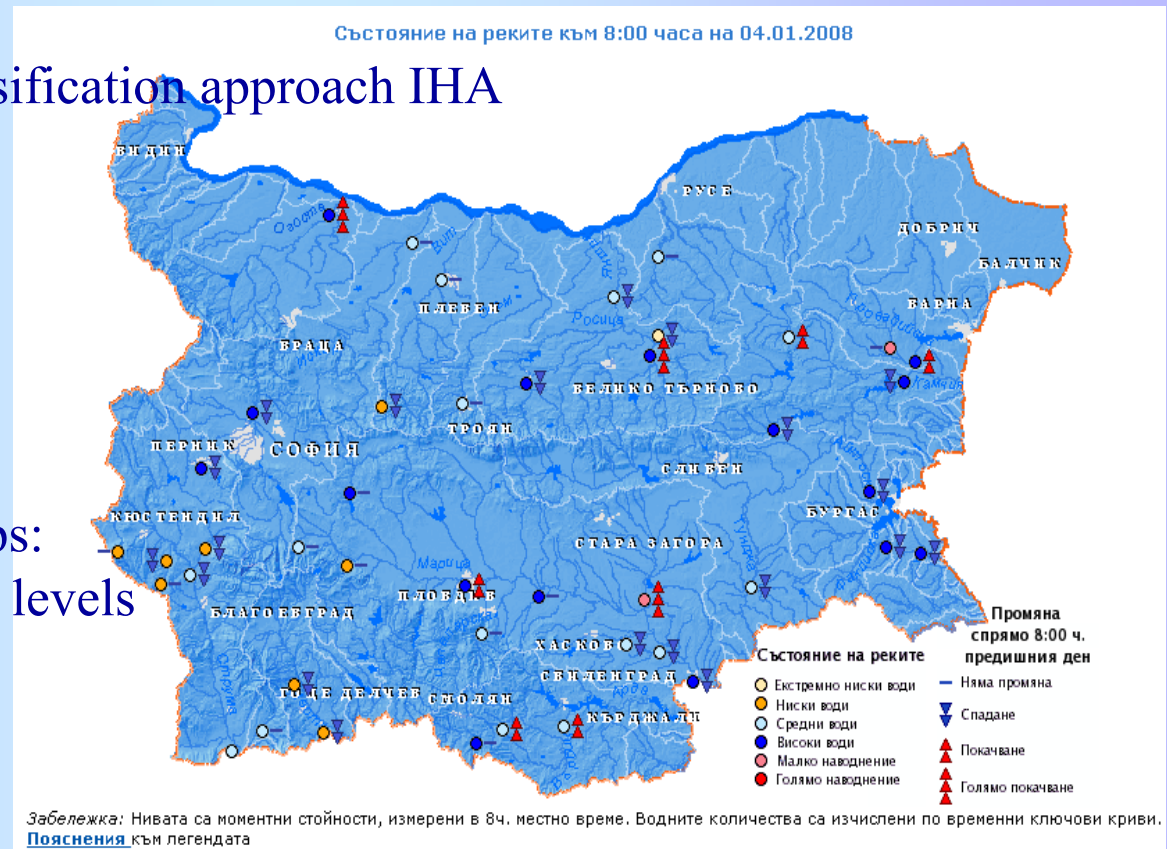
Mike 11 GIS application for the same flood; NIMH



## Some examples!

### Neuron networks applications in flood forecasting, setting up flood alert thresholds (for areas not covered by basin dedicated data collection and forecasting systems)

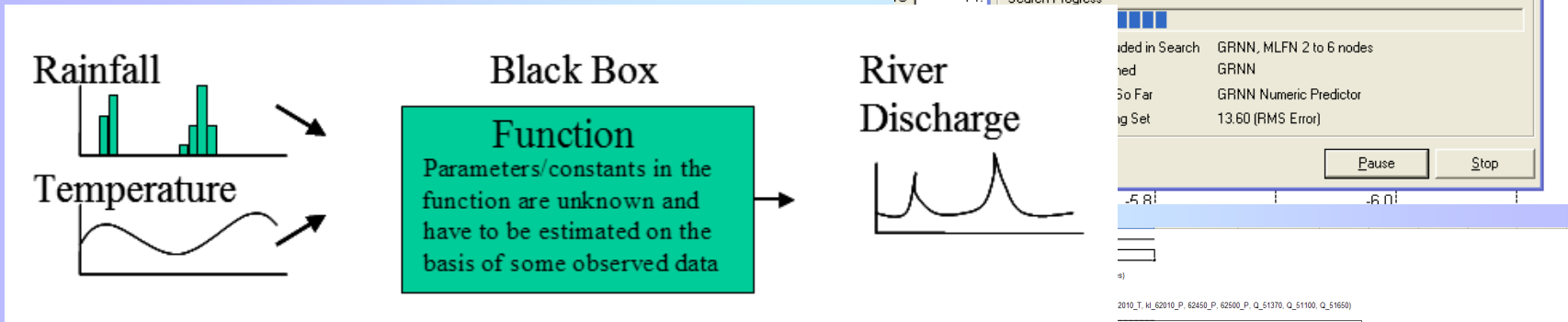
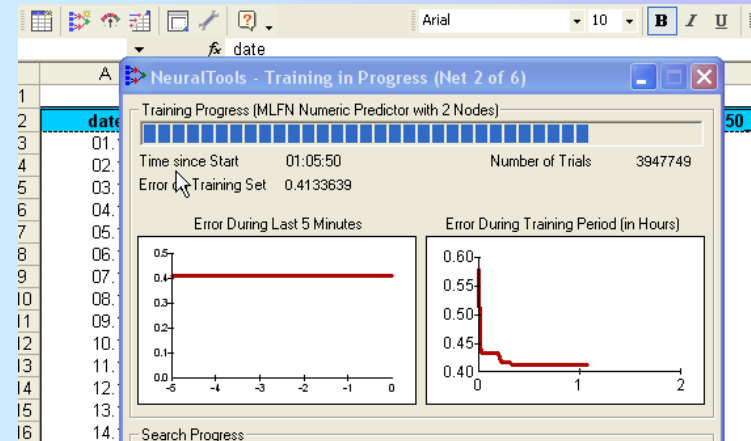
- Adaptation of statistical classification approach IHA within 5 status groups:
  - Extremely low waters
  - Low waters
  - High flow pulses
  - Small floods
  - Large floods
- Developing tendencies groups:
  - expected decrease of water levels
  - moderate water rise
  - sudden hazardous water rise



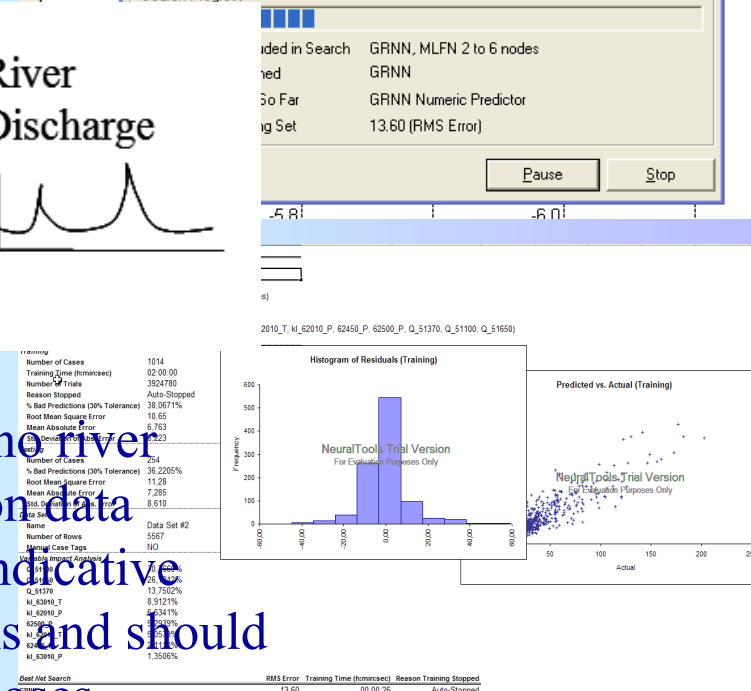
# Some examples!

## Neuron networks applications in flood forecasting

- Training the network
- Testing the network
- Forecasting



The method is suitable for locations where no river basin dedicated hydrometric and precipitation data collection system exists. The system gives indicative forecasts valid for the river gauging locations and should further be interpreted for flood warning purposes.



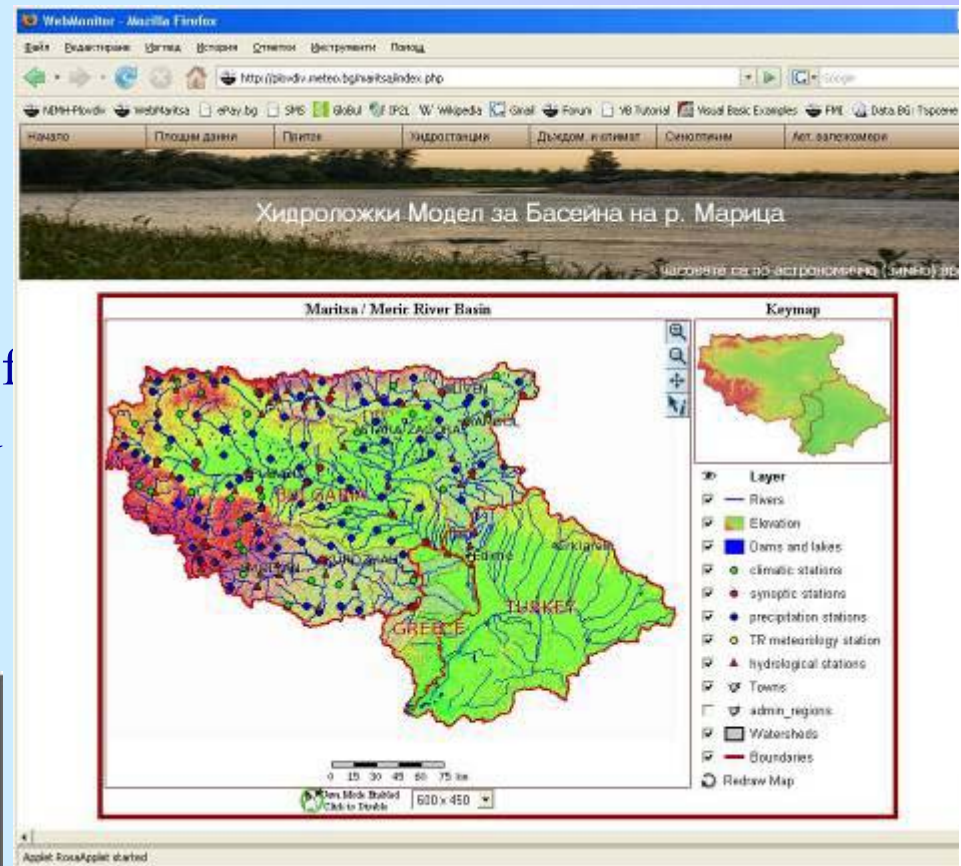
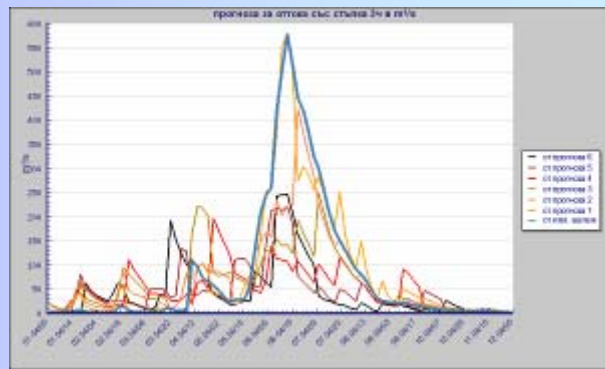
## Some examples!

### MODCOU – ISBA balanced type models applications for Maritza basin, NIMH Plovdiv, fully developed model

Provides 3 days ahead forecasts for river discharge at different points of Maritza, Tundja and Arda basins:

- Works operationally for the prediction of inflows to Arda cascade, will be extended soon for Maritza and Tundja basins lowland.

Example of Arda river forecasts



*NIMH deliver products and data for crisis management*

**Crisis Management  
Centre (CMC)**

NIMH Expert:  
temporarily assigned to CMC

*Accidents and Disasters: prevention, operational management*

**Accidents:**

- Chemical;
- Nuclear;
- Dam breaks;
- .....

**Natural Disasters:**

- Earthquakes;
- Floods;
- Forest fire;
- .....

**NIMH Functions:**

- Hydro-meteorological observation, diagnosis;
- Forecasts, spatial – temporal distribution of air T, rainfall
- Expertises, bulletines
- Research and development

**Thank you!**

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