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The Project of JRC Related to the Tisza River Basin

Europe faces public concern about complex issues such as food contamination, genetic modification, chemical and natural hazards, global change, environment and health, and nuclear safety. The Joint Research Centre (JRC) supports EU policy makers in the conception, development, implementation and monitoring of policies to tackle such trans-national and global problems. In effect, the JRC is a research-based policy support organization working for the EU policy-maker.

The JRC is a Directorate-General of the European Commission under the responsibility of Philippe Busquin, European Commissioner for Research. There are seven JRC institutes belong to the European Commission, they are located on five separate sites in Belgium, Germany, Italy, the Netherlands and Spain. The Institutes are:

The Institute for Reference Materials and Measurements (IRMM)
The Institute for Transuranium Elements (ITU)
The Institute for Energy (IE)
The Institute for Prospective Technological Studies (IPTS)
The Institute for the Protection and the Security of the Citizen (IPSC)
The Institute for Health and Consumer Protection (IHCP)
The Institute for Environment and Sustainability (IES)

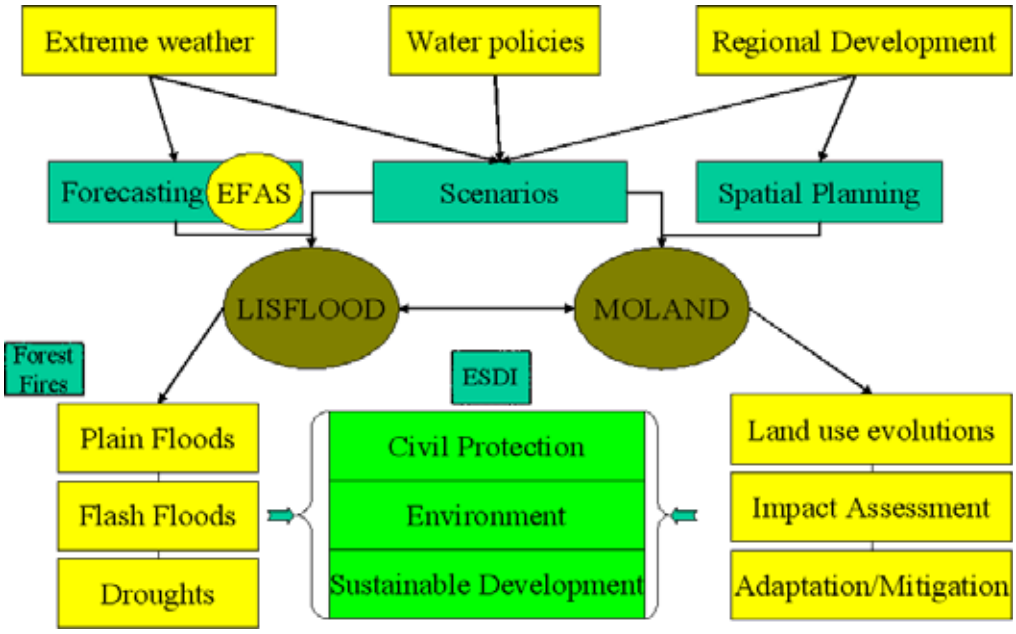
The Directorate-General is located in Brussels.

The mission of the *Institute for Environment and Sustainability* is to provide Scientific & Technical support to EU policies for the *Protection of the Environment*, and to contribute to the EU strategy on *Sustainable Development*.

Main activities:

- Investigate the level and fate of contaminants in the air, water and soil
- Assess the effects of these contaminants on individuals and the environment (from local to global scale)
- Promote a sustainable energy supply
- Development the European Forest Fire Information System (EFFIS), a coherent fire information system across Europe
- *Development the European flood modeling, forecasting, alert system*

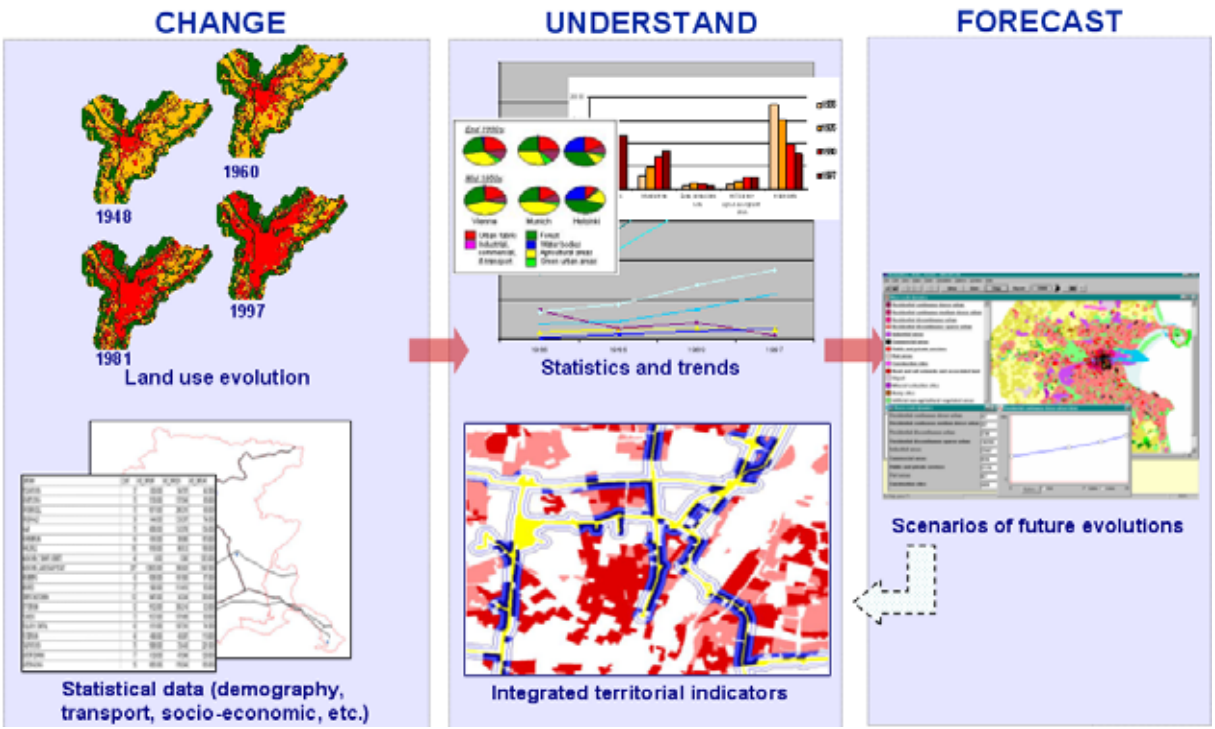
The Institute for Environment and Sustainability contains several units (Climate Changes, Global Vegetation Monitoring, Emission and Health, Inland and Marine Waters, Soil and Waste, Renewable Energies, Land Management).
The Weather Driven Natural Hazard (WDNH) action is working within the Land Management Unit and running two main projects: MOLAND and LISFLOOD.



Land Management Unit, Weather Driven Natural Hazard - The framework

MOLAND Monitoring Land Use/Cover Dynamics

The project MOLAND (Monitoring Land Use/Cover Dynamics) has been designed to provide a spatial planning tool that can be used for assessing, monitoring and modeling the development of urban and regional environments, in the perspective of environmental and human protection, and of sustainable development.

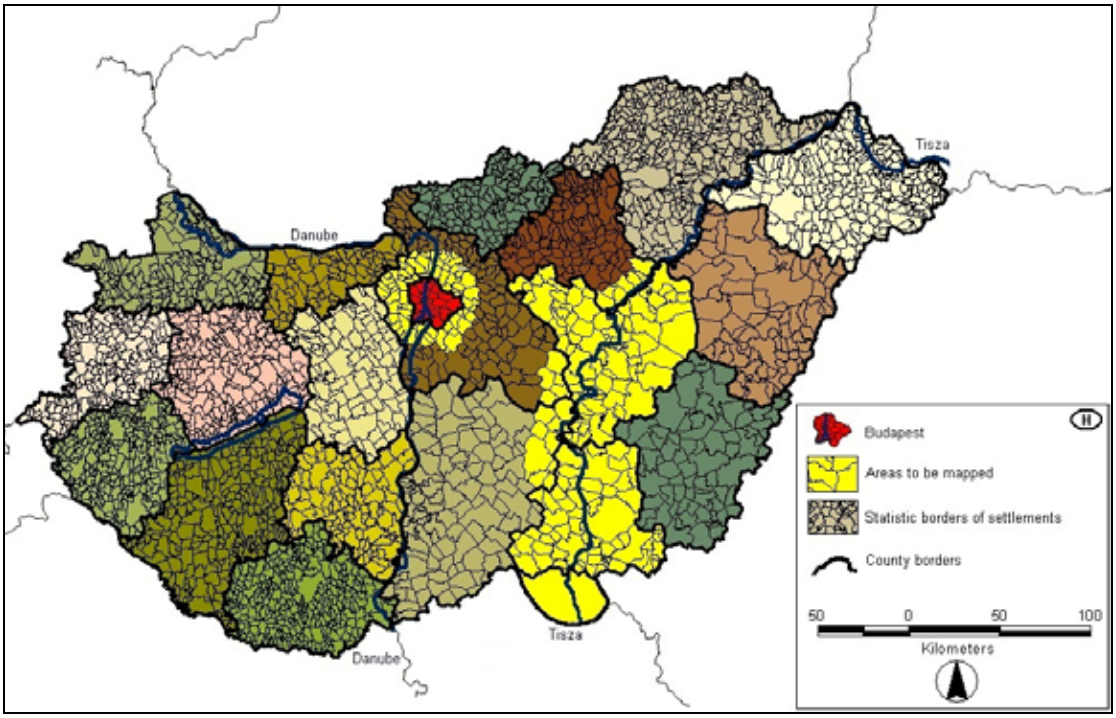


MOLAND: The methodology

The project comprises three interrelated packages:

Change detection (CHANGE). Measuring land use change in selected areas in Europe. A period of usually 50 years is considered. Land uses maps are merged with socio-economic data sets to measure changes over time.
Understanding (UNDERSTAND). Identifying a number of environmental indicators to be used to measure the "sustainability of areas". The indicators are used to compare "development potential" of the different studied cities and regions.
Development of scenarios (FORECAST). Development "urban and regional growth" scenarios using state of the art dynamics models.

MOLAND is developing his work around the definition of criteria for mitigating the risk of floods, applying its methodology to the area of the river Tisza. The first step is the creation of a Geographic Information System (GIS) format database made up of various data sets of land use types, transport networks, socio-economic and environmental conditions, which will provide a framework for developing scenarios of urban and regional development.



Mapping of Lower Tisza Catchment
Development of GIS database of land use types, transport networks, environmental, geo-physical and socio-economic conditions for environmental and human risk assessment

The database will be used for the ex-ante impact assessment of various types of regional development projects, and for the evaluation of risks and remedial actions following weather driven hazards. The database will also be used to develop alternative scenarios, that will serve to guide and assist in various tasks related to regional and spatial planning and monitoring (e.g. impact assessments, location of residential and industrial areas and services, transport planning, management of green areas and valuable natural areas, landscape management, etc.) at local and regional scales.

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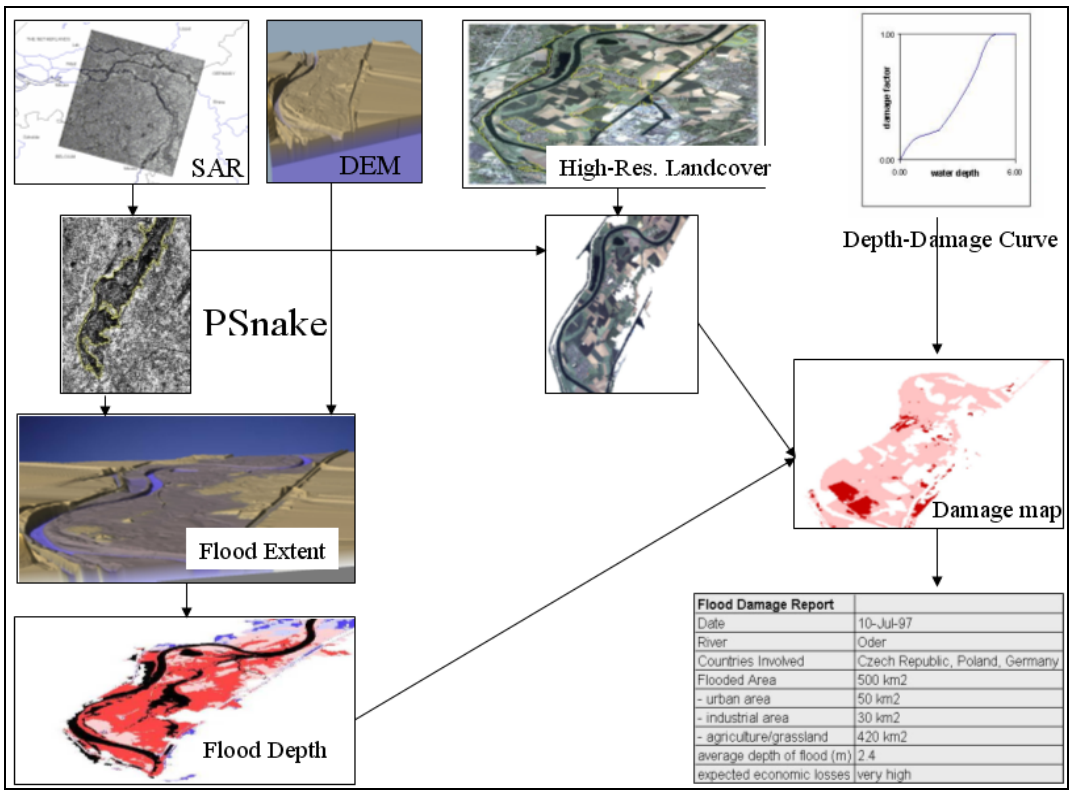
Weather Driven Natural Hazards Action
Institute of Environment and Sustainability

Flood & Drought Research

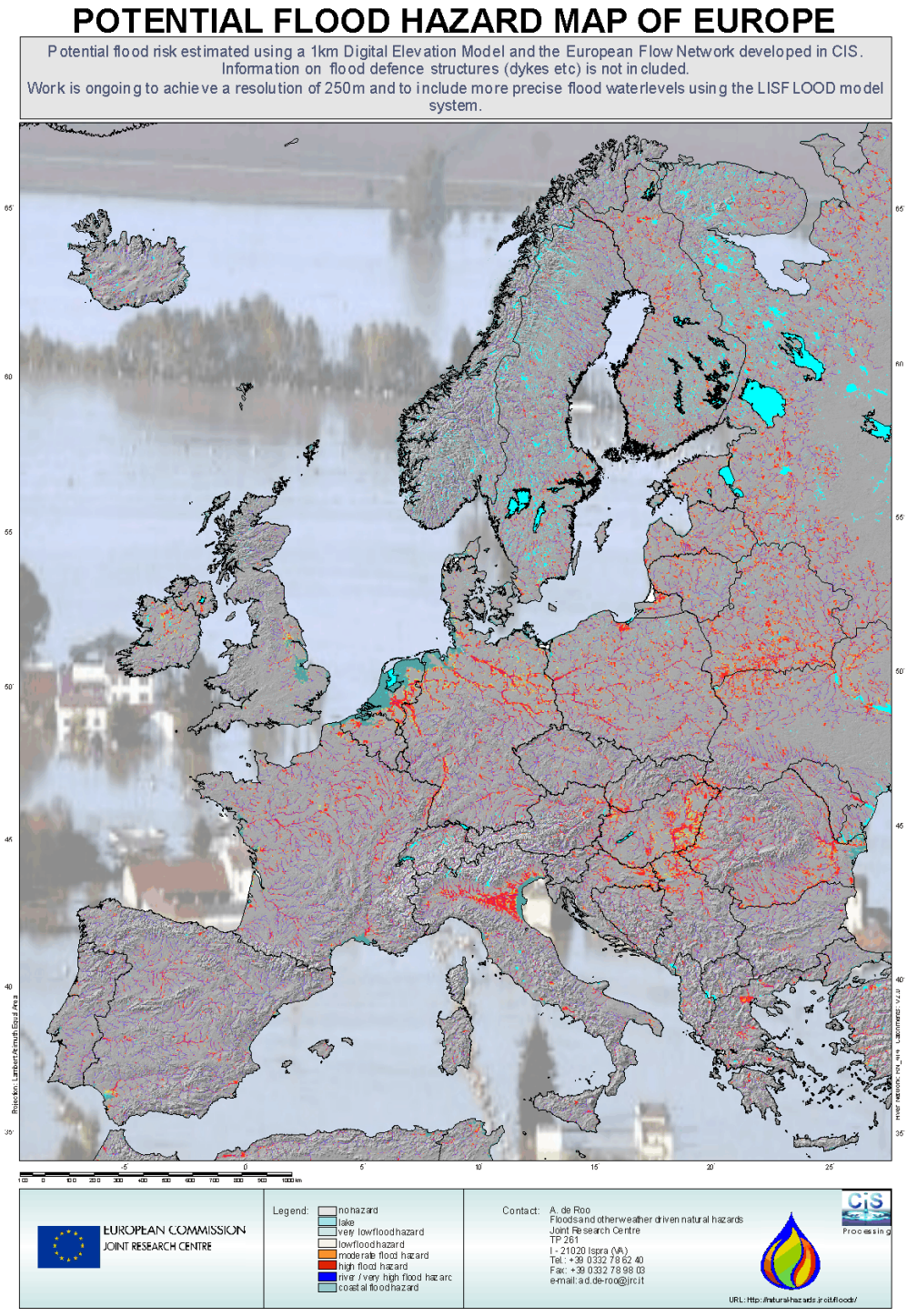
The collected data will be useful for the flood and drought research too and makes the recent model more accurate and reliable.

Flood damage assessment
Based on satellite images we can separate the flooded areas and estimate the flood damage according to land use maps. This operation can be automated.



Schematic flowchart of flood damage assessment

Flood risk mapping
The first step is the European Potential Flood Hazard Map that is based on surface characteristics (DEM), the river networks and discharge data using additional information (dikes, reservoirs, soil, vegetation) that makes the model more realistic.



Potential Flood Hazard Map of Europe (Ad de Roo)

The LISFLOOD model provides the basic feature for the next three functions:

Flood scenario analysis

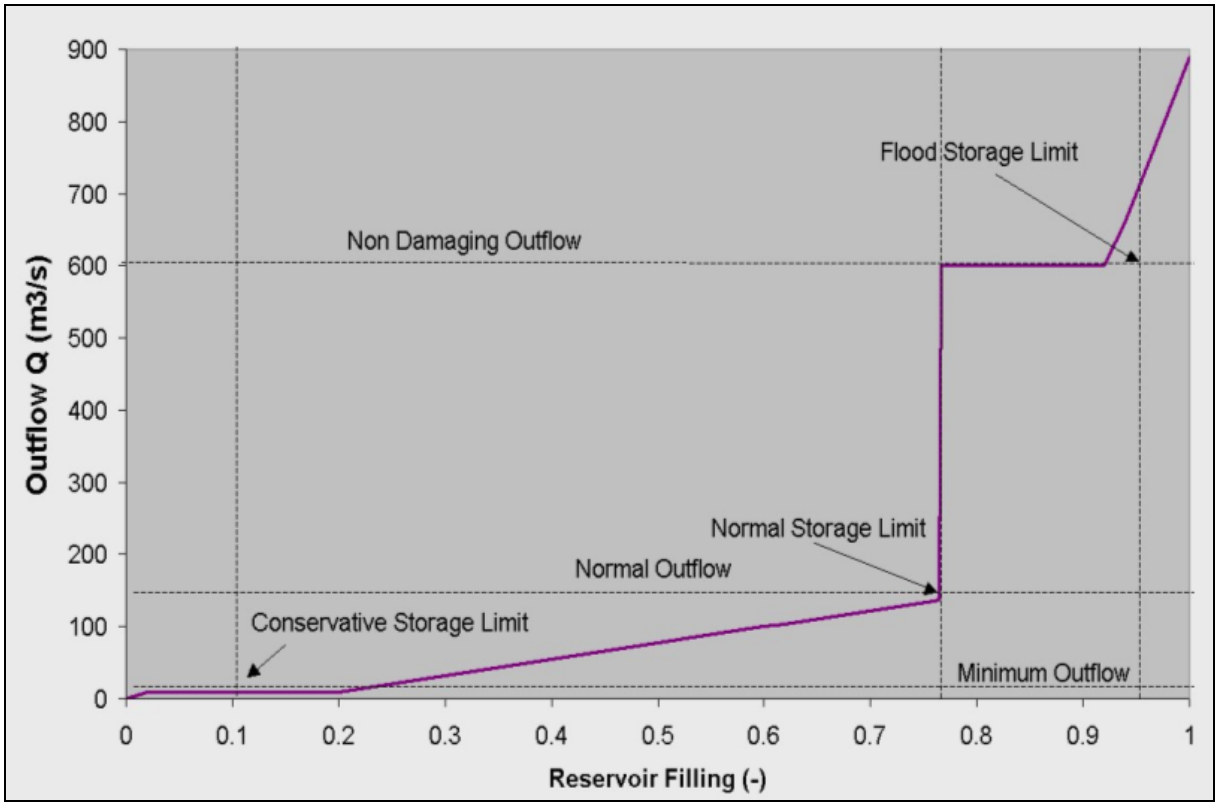
The LISFLOOD is a physically based distributed rainfall-runoff model programmed in a dynamic GIS-language. The LISFLOOD has several modules:

LISFLOOD-WB	Water balance model	-> initial conditions
LISFLOOD-FS	Flood simulation model	-> validation & scenarios
LISFLOOD-FF	Flood forecasting model	-> forecasting
LISFLOOD-FP	Flood Inundation model	-> flood extent

Aims of flood modeling:

- Increase flood warning time
  - European Flood Forecasting System
    - 0-10 day leadtime; pre-warning to MS authorities
- Decrease flood risk
  - Technical measures
    - reservoirs
    - polders / retention areas
    - increase floodplain storage
    - increase dyke heights
  - Environmental measures
    - land use planning
      - catchment: (reforestation / afforestation, set aside etc)
      - floodplain: re-allocation of flood prone settlements
    - combat climate change

The LISFLOOD model is prepared for the reservoirs modeling and modeling of the effects of new scheme of reservoirs planned by the Vásárhelyi-plan and the catchment-wall modeling according to the recent plans of the Ukrainian authorities on the Upper-Tisza.



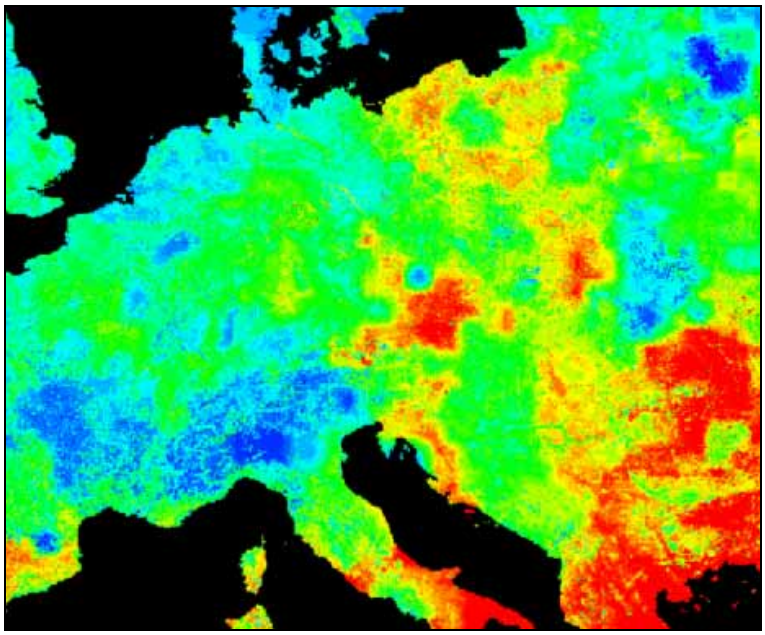
Reservoirs (!) in LISFLOOD

Flood forecasting

Based on the daily precipitation and discharge information from the majority of the European countries the WDNH action runs an interpolation model to estimate the probable discharge and predict the flood events within 10 days. The name of this service is European Flood Alert System (EFAS).

Drought forecasting

The LISFLOOD is also suitable for modeling the changes of the soil moisture in the top- and the subsoil. The major part of Hungary and the Lower-Tisza region is under the effect of drought according to the model, but the upper part of the Tisza catchment has overflow.



A snapshot of the dynamic model of drought in the top soil
(the red colors mean 3.5 and higher pF value)

Summary

The Tisza is an interesting and important river system for environmental and hydrological research since considerable part of its catchment is under the influence of floods and draughts as well. The politically distributed catchment area, the river regularization and modification the natural and urban surroundings since the middle of the 19th century, the continuous flood hazard and the actual landscape plans keep the region in the focus of research of the Weather Driven Natural Hazard action of the Institute for Environment and Sustainable, Joint Research Centre.

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