The Potential of the Delft-FEWS Flood Forecasting Platform for Application in the Mekong Basin

by

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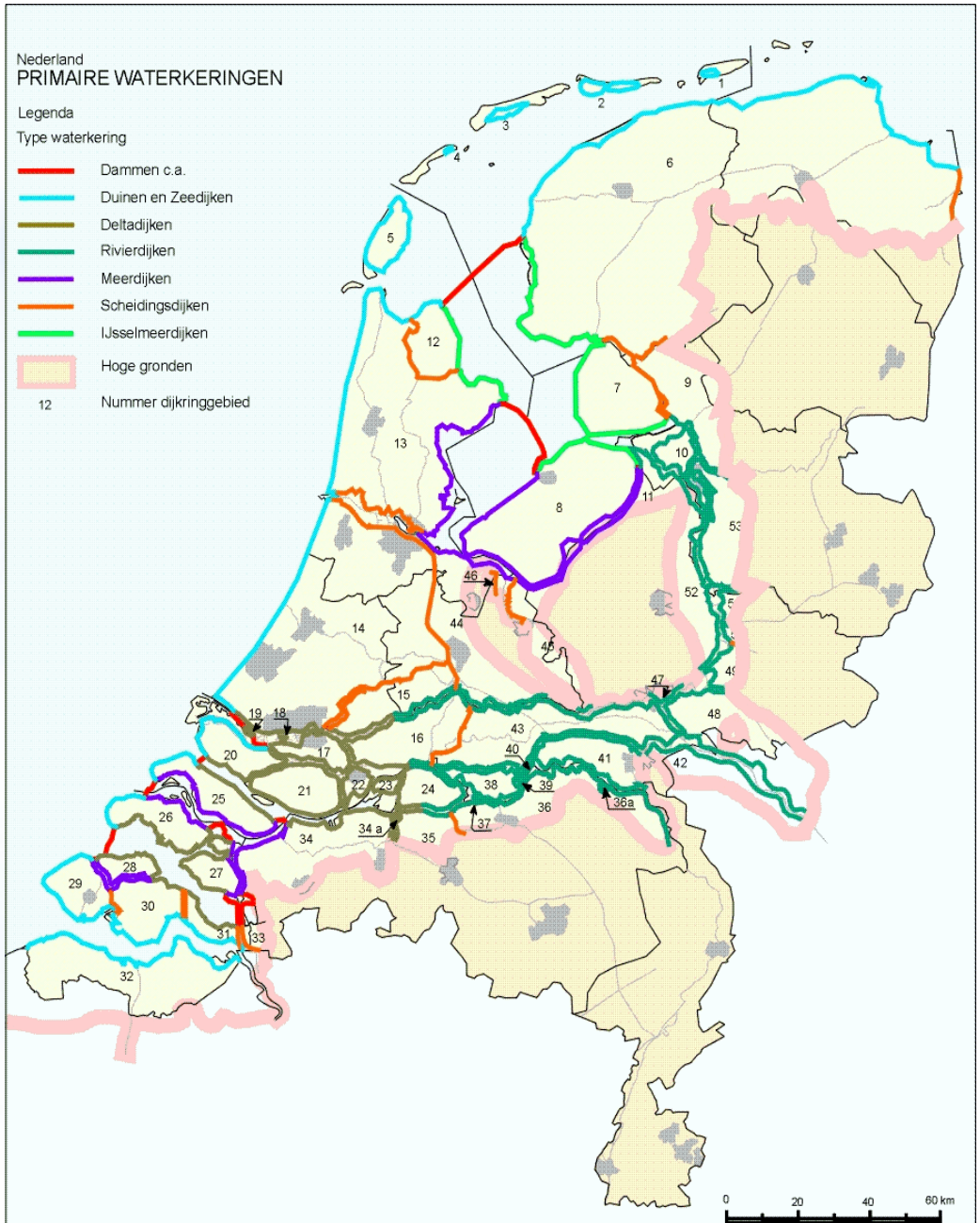
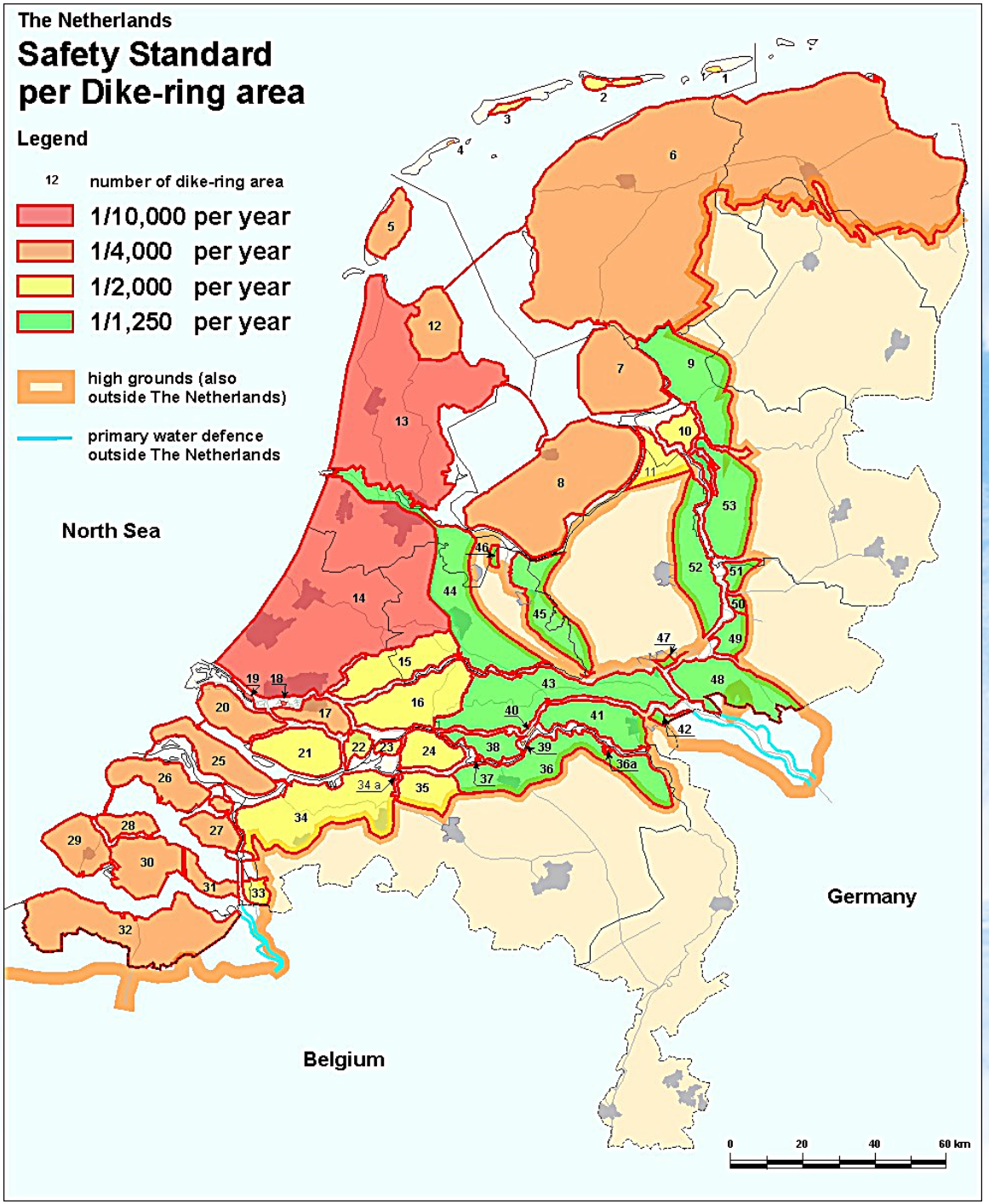
Need for flood protection



Dike ring areas in The Netherlands



- 53 dike rings
- 3500 km primary dikes
- 25000 km secondary dikes

100 % safety
neither possible
nor desirable

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Closure dam Zuiderzee, 1932

Important sea floods

26 December 838

19 November 1404

18 November 1421

5 November 1530

1 November 1570

31 July, 4 August 1574

26 January 1682

15 January 1808

13-14 January 1916

1 February 1953

1953 flood Rhine Delta - Zeeland

1953 flooding disaster SW - Netherlands

Resulting in:

- the Delta-law

- the Delta-plan

Delta Plan, The Netherlands

Failure frequency of up to
1 in 10,000 years

Storm surge barrier Eastern Scheldt

Room for
the Rhine branches

Rhine flood threat 1995

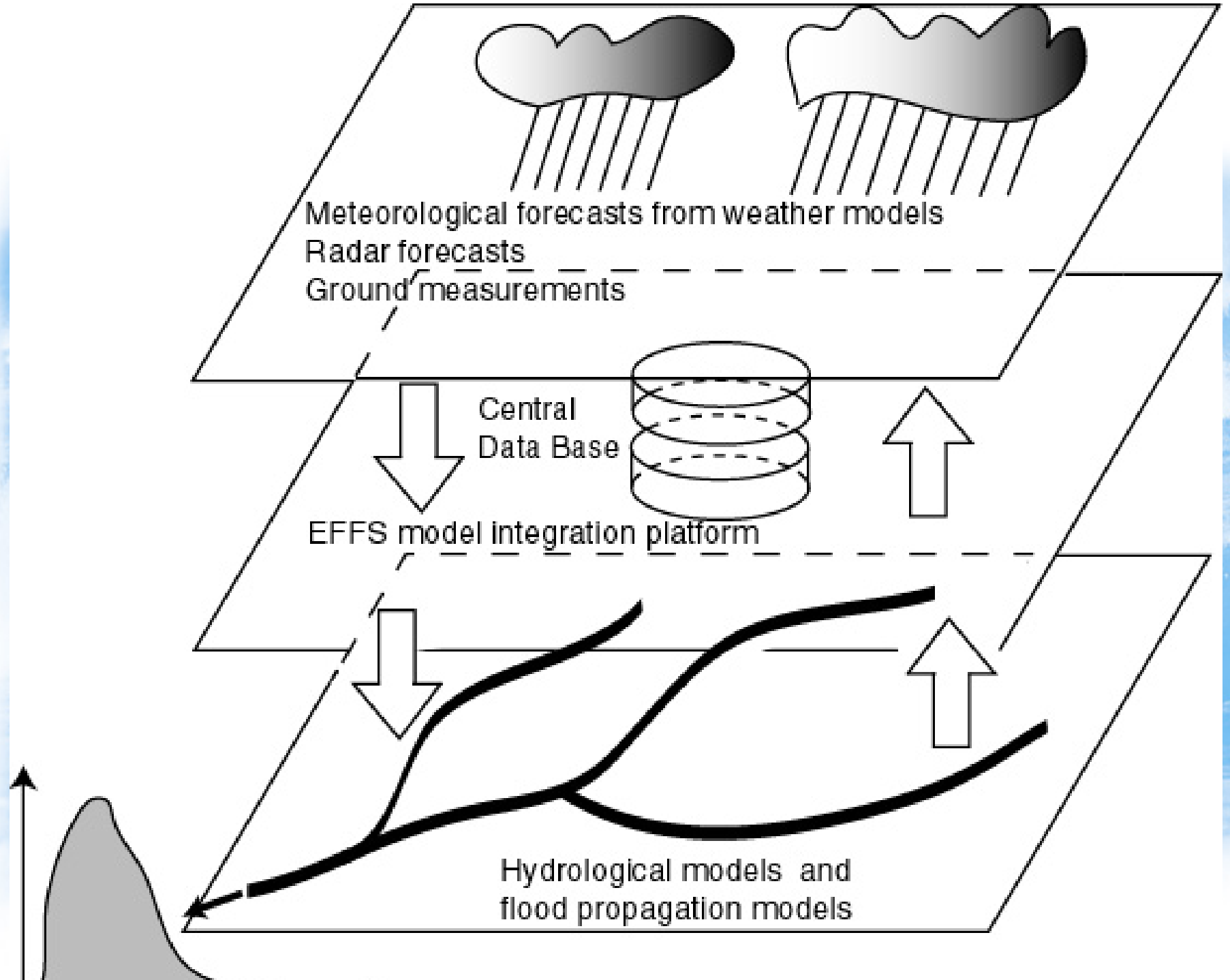
- 1993 & 1995 1/100 year Rhine floods
- Tieler Waard 250,000 persons evacuated
- Potential damage Euro 18 billion
- True safety < 1/100 year, instead of 1/1250

Developments in The Netherlands

Floods and flood threats in The Netherlands have led to the following important developments:

- **Delft flood forecasting platform – Delft-FEWS**
- **Delft 2D/3D generic modeling system – Delft-3D**
- **Delft 0D/1D/2D generic modeling system – SOBEK**
- **integrated approach to modeling**

Delft-FEWS platform



Experience record for Delft-FEWS

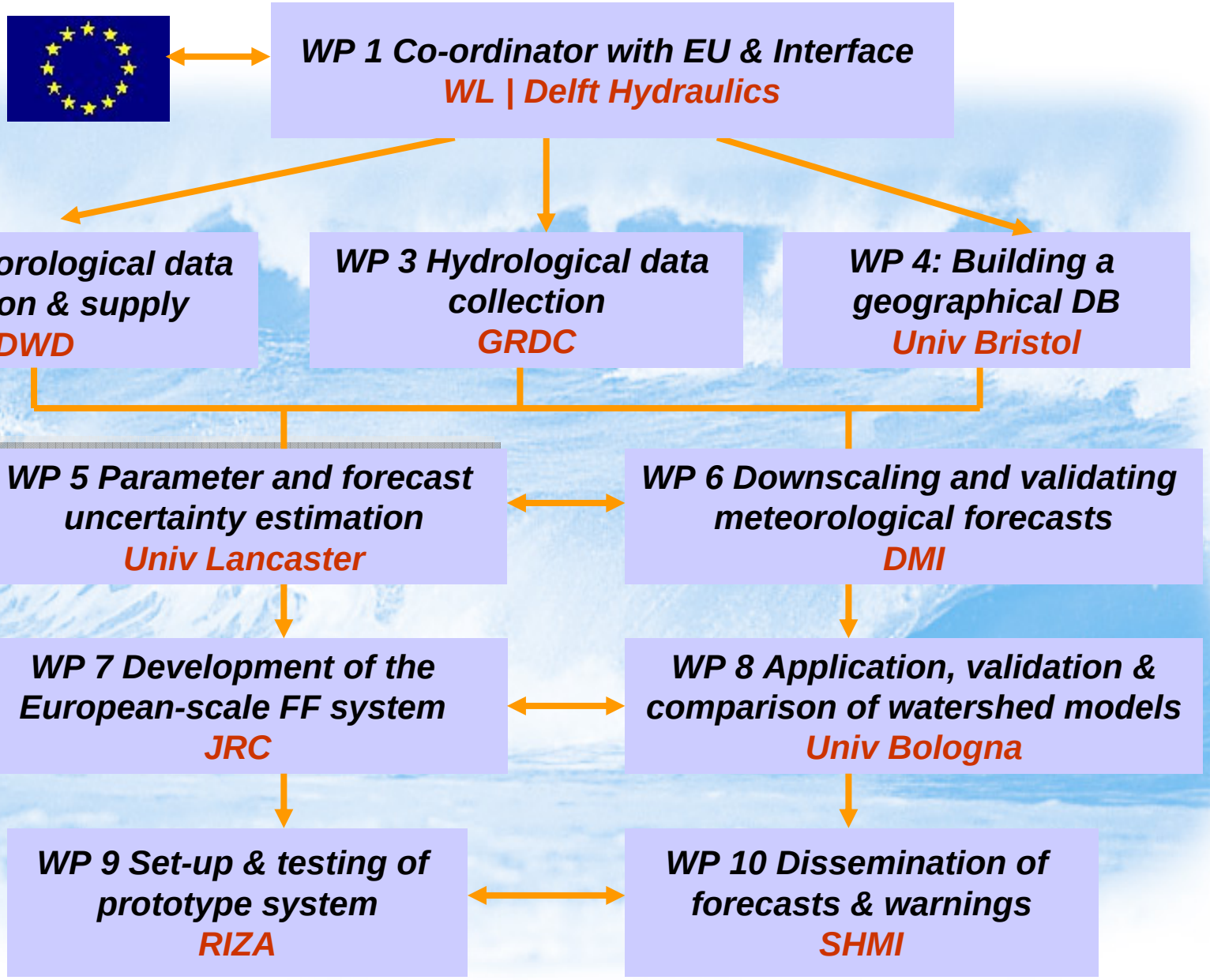
- Various flood forecasting projects in the past, such as Pakistan, Sudan
- Platform developer for the EU co-funded EFFS project
- Developer of the NFFS: generic flood forecasting platform for England and Wales (jointly with Tessella, UK). Client: Environment Agency UK
- Various subsequent flood forecasting system developments (on the basis of NFFS tool):

  - replacement Rhine forecasting system
  - replacement Meuse forecasting system
  - development of Danube forecasting system for Austria
  - update EFFS at JRC, based upon 50 EPS forecasts of ECMWF serving as input to LISFLOOD
  - flood forecasting systems in Switzerland and Taiwan

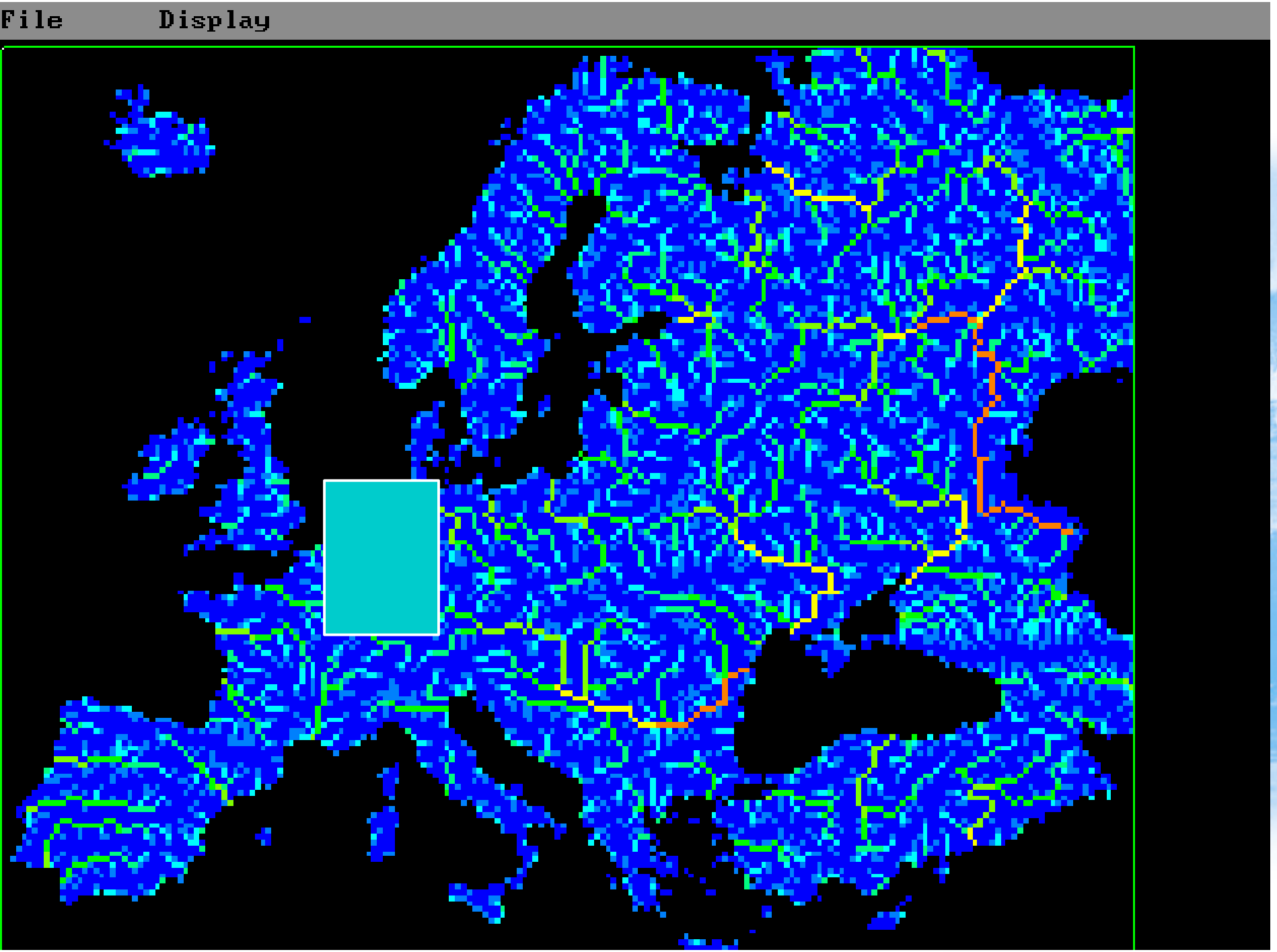
EFFS

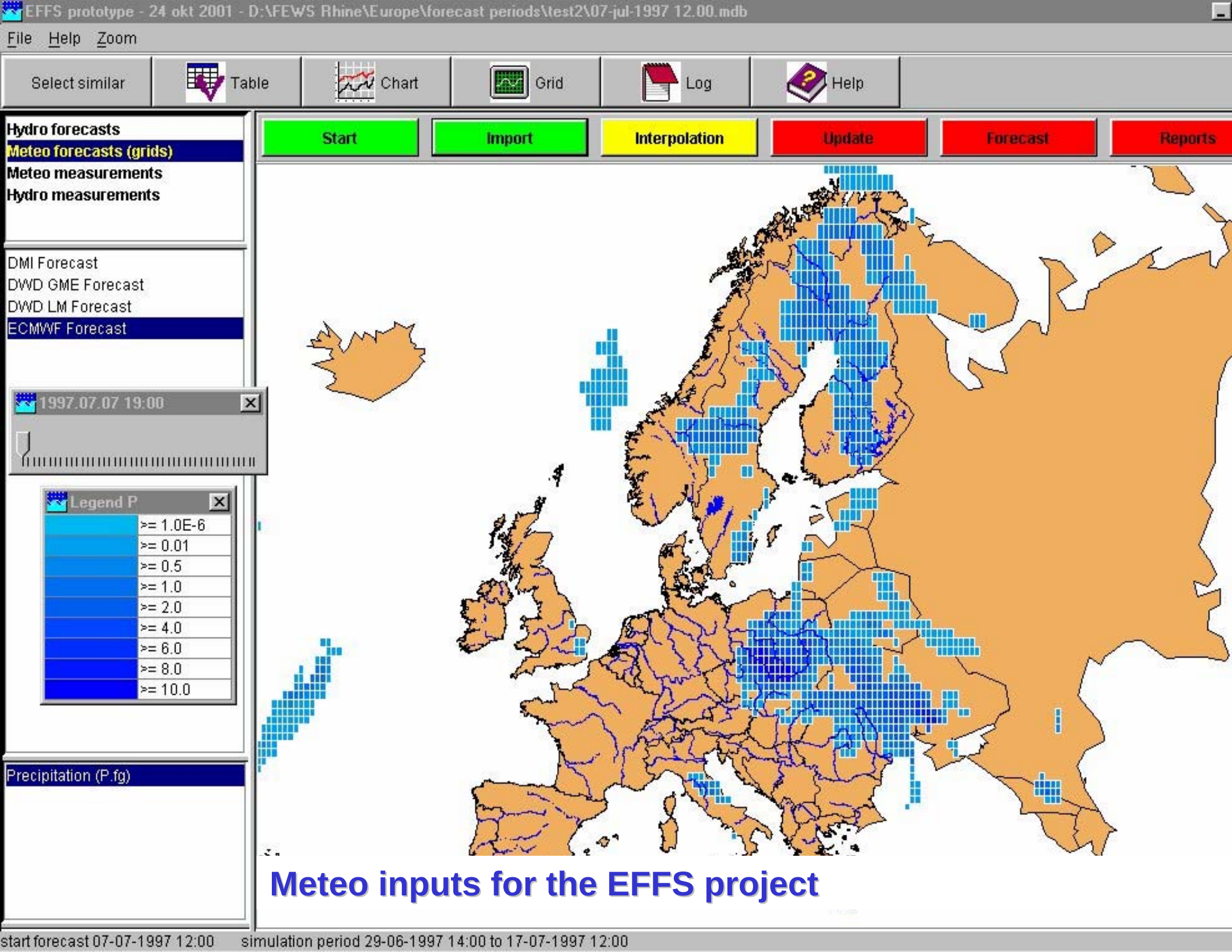
- pilot development of a European Flood Forecasting System (2000 – 2003)
- 19 European partners
- emphasis on medium range: 4 - 10 day forecasts
- acting as a pre-warning system
- use of meteorological inputs generated by ECMWF
- encapsulation of pre-existing hydrological and river routing models already calibrated, tested and used by local authorities
- allowing the gradual replacement of existing models by new models

EFFS Project Organigram



EFFS - Lisflood

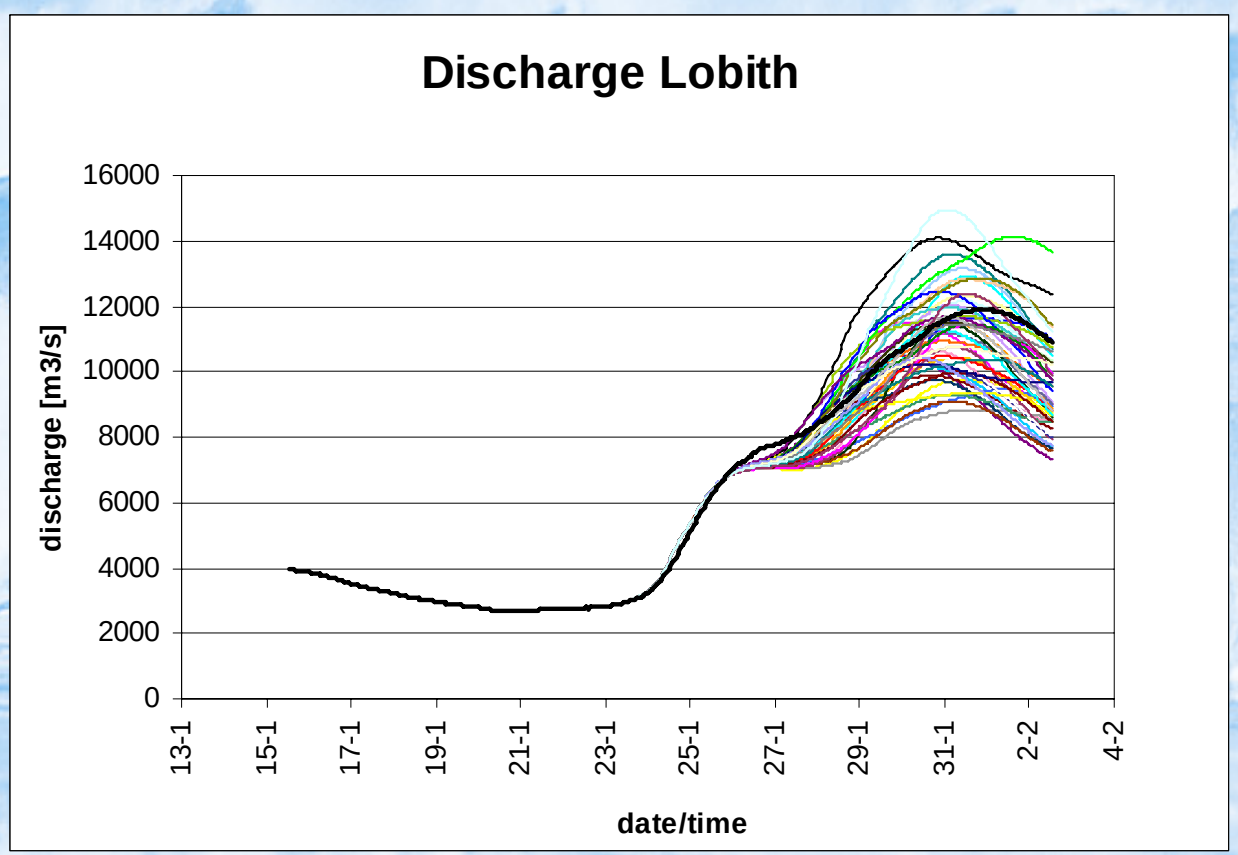




Meteo inputs for the EFFS project

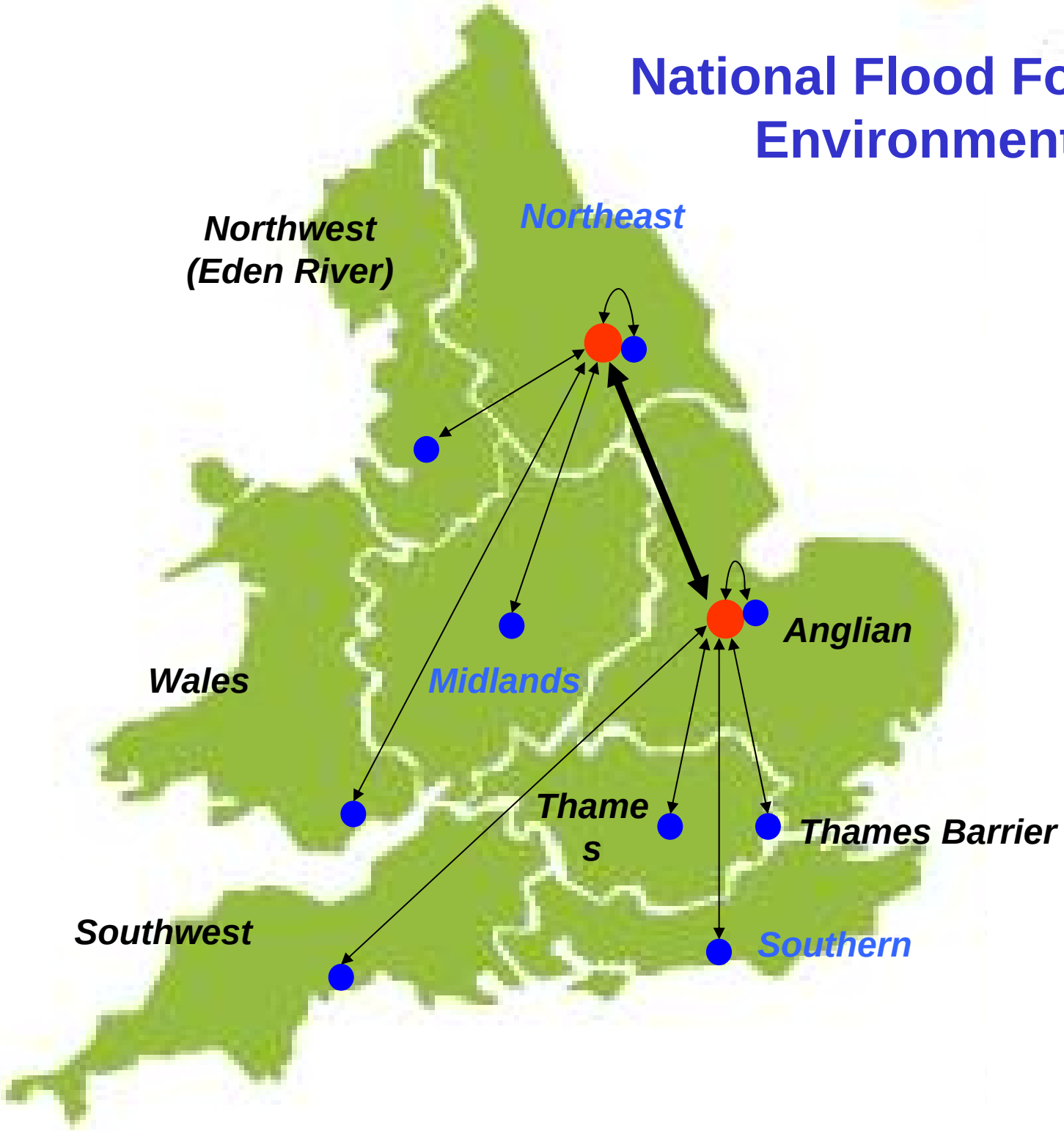
Example of output EFFS

Rhine basin flood forecast at Lobith, inflow point of the Rhine into The Netherlands



Forecast start: 23-Jan

National Flood Forecasting System
Environment Agency, UK

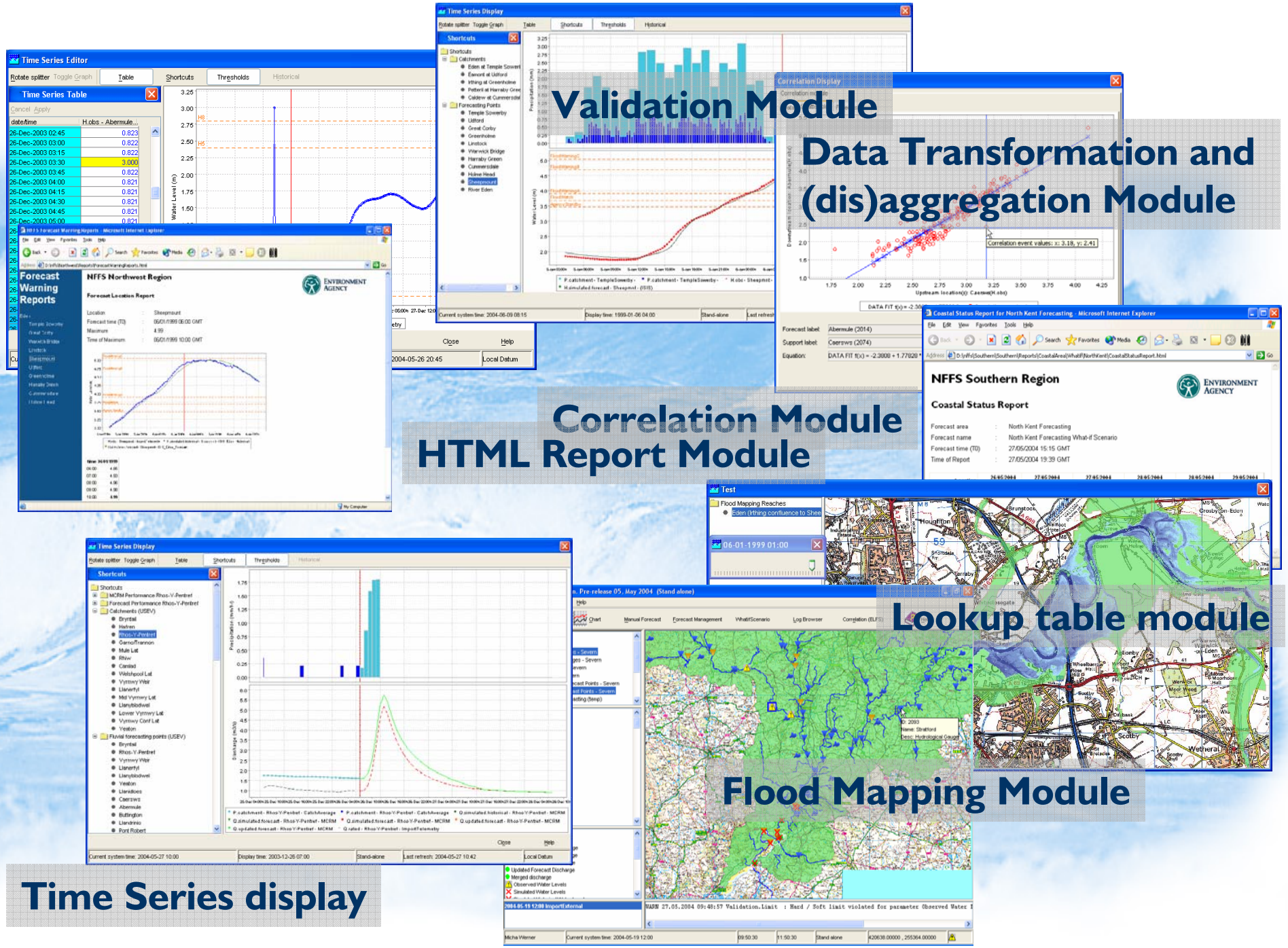


UK Environment Agency NFFS Project

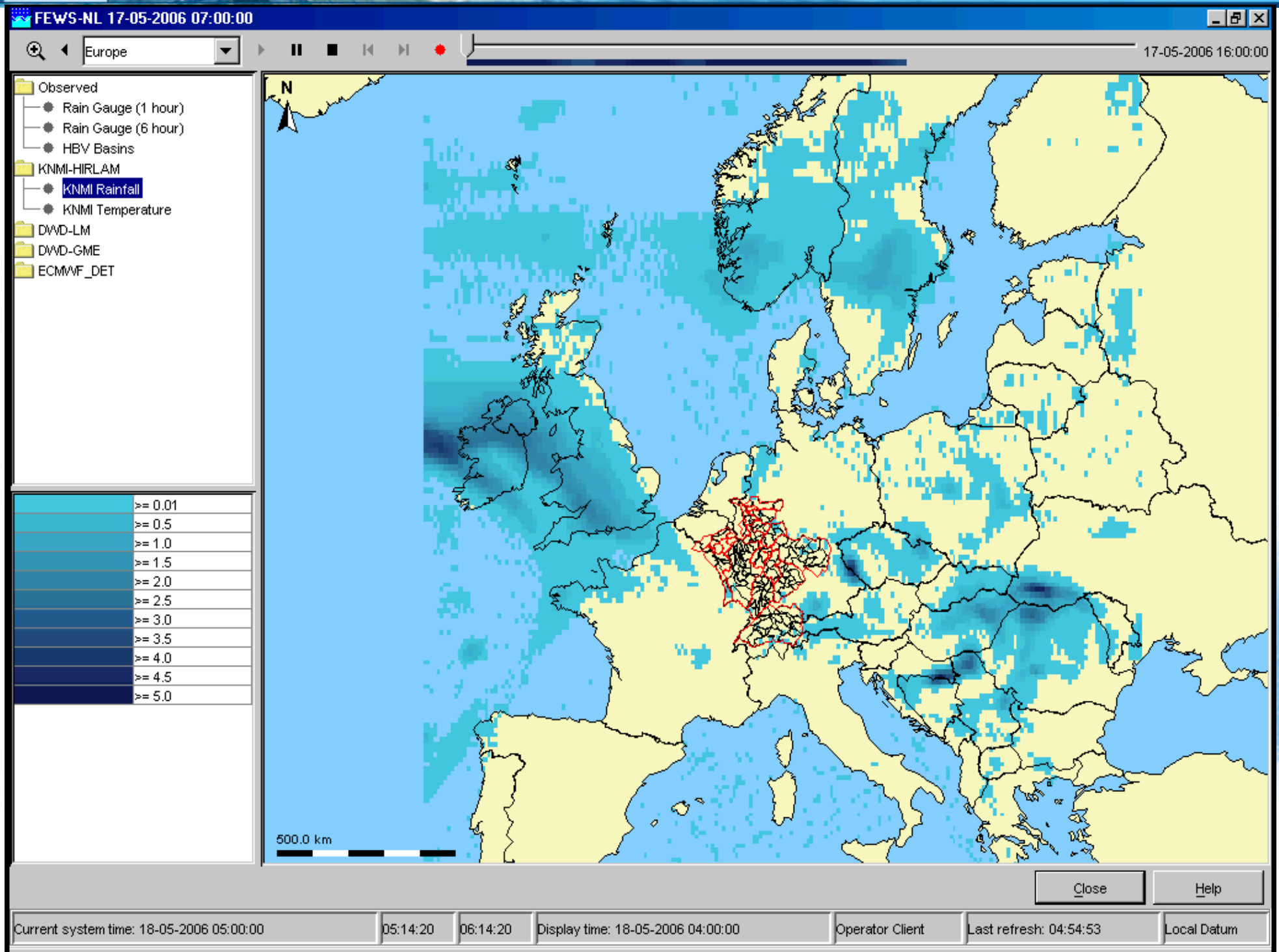
- creation of a generic system for England + Wales
- replaces e.g. existing FFS2 system for the Midlands based upon the MCRM and DODO models, which will be retained as part of the new system
- commisioned to WL | Delft Hydraulics (Delft-FEWS) and Tessella Scientific
- best placed to deliver: open system, where existing components could be incorporated to achieve:
  - access to new sources of input data
  - improved dissemination of results, e.g. intra- and internet
  - continued use of existing assets
  - possibility to gradually improve the system

Flood Forecasting Tasks handled by Delft-FEWS

- Import of external sources of data (output of various meteorological models, satellite data, radar data, gauges, retrieval from data bases)
- Validation and interpolation of incoming data
- Data transformation
- Execution of the hydrologic and hydraulic forecasting models (connected via Published Interface: HEC-RAS, Sacramento, SOBEK, Mike11, Mike NAM, ISIS, HBV, LISFLOOD etc.)
- Updating the state of the models (e.g. ensemble Kalman filtering)
- Visualisation of results on maps
- Dissemination of forecasts (e.g. intranet and internet)


Validation Module
Data Transformation and (dis)aggregation Module
Correlation Module
HTML Report Module
Lookup table module
Flood Mapping Module
Time Series display

Rainfall Forecast Europe May 19, 2006



New applications Delft-FEWS

- drought forecasting Taiwan and Vietnam (Red River basin)
- temperature forecasting River Rhine
- salt intrusion forecasting Songkhla Lagoon, Thailand
- water quality forecasting Singapore Marina Reservoir

Road Map for the Mekong Basin ? (I)

Objective: increase the lead time and quality of flood forecasts

- **There is a recognized need for an impovement of the real-time data transfer. In general, we see a shift from the use of point data to spatial data. So ….. mobilize the potential of spatial real-time data sources, such as meteorological models, radar. At the same time, mobilize the assets of people and mobile phones to transfer more real-time point data;**
- **For improvement of the flood forecasting system, there is no immediate need to develop new hydrological, hydraulic and hydrodynamic models. MRCS has heavily invested in the development of its Decision Support Framework (DSF), so ……. for flood forecasting make use of the existing models: rainfall-runoff (SWAT, or even SSARR), channel routing (IQQM) and hydrodynamic models already available (ISIS, VRSAP, Mike11 etc.);**

Road Map for the Mekong Basin ? (2)

- For the Mekong Basin, there is primarily a need for a better data management platform (shift from a model centred approach to an information centred approach);
- Introduce gradual elimination of uncertainties by state of the art data assimilaton techniques, e.g. Kalman filtering. This allows for using the benefits of spatial data while reducing the effects of their errors;
- Always allow for adequate transitions: run in parallel existing systems and improved systems, possibly on the same platform;
- As the need arises, models connected can gradually be improved or replaced by learning from the behaviour of the forecasting system;

Road Map for the Mekong Basin ? (3)

- Delft-FEWS provides such a platform and has proven its quality on a wide range of very small and very large applications;
- The system can be extended to applications in environmental forecasting (droughts, salt intrusion, etc.);
- Give space to the demands of each country: arrange a form of installation that provides independent use of the system by the various member countries. Each country should be able to run their own scenario's, models etc. within a common environment.