Rijkswaterstaat
Ministerie van Verkeer en Waterstaat

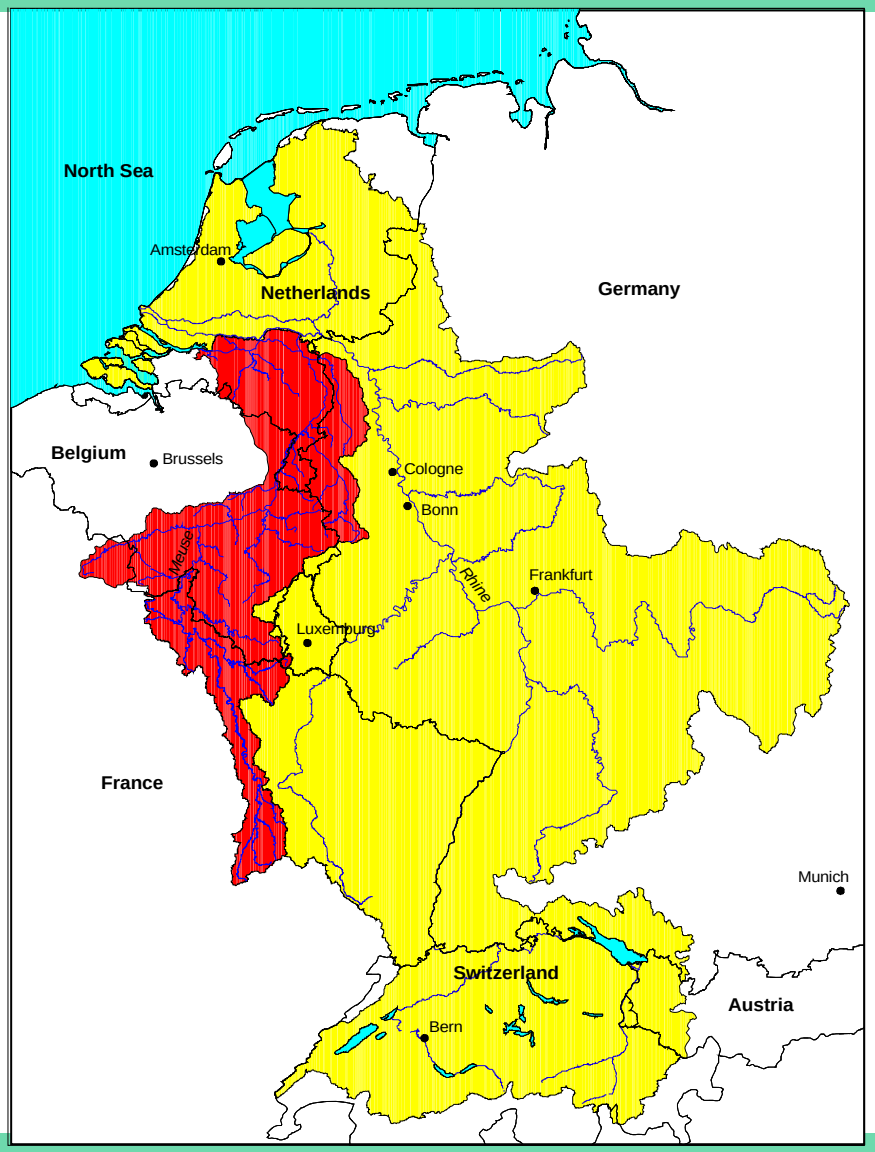
Visualising and communicating probabilistic flow forecasts in The Netherlands

Eric Sprokkereef
Rijkswaterstaat Centre for Water Management
Division Crisis Management & Information Supply

2-2-2009

Content

- The basins
- Forecasting in The Netherlands
  - Organisation
  - Tools
- FEWS NL for the rivers
- Visualisation of ensemble forecasts
- Implementation of ensemble forecasts in the operational process


North Sea
Amsterdam
Netherlands
Germany
Belgium
Brussels
Cologne
Bonn
Meuse
Rhine
Frankfurt
Luxemburg
France
Munich
Switzerland
Austria
Bern

Characteristics

	Rhine	Meuse
Basin surface	185.000 km^2	36.000 km^2
Length	1.320 km	935 km
Type	snowmelt + rain	rain
Q mean	2.300 m^3/s	230 m^3/s
Q peak	13.000 m^3/s	3.000 m^3/s

Forecasting organization

- Daily forecasts for the Rhine (365 d/y)
- No regular forecasts for the Meuse
- Flood forecasts when fixed levels are exceeded
- Centre for Water Management is responsible for forecasts on the national borders
- Regional services are responsible for forecasts on the inland branches and in the coastal area
- Centre for Water Management publishes flood reports for the entire river

What instruments did we use for river stage forecasting in 1995?

- till January 1999: statistical model LOBITH (for daily forecasts as well as for flood forecasts)

Model LOBITH

- statistical model based on multiple linear regression
- input: water levels, discharges, observed and forecasted precipitation
- output: water level forecasts for the gauging station Lobith for the next 4 days

Development of FEWS NL

- Start of the project in 1996
- Financed by 2 EU frame work projects
- Cooperation with BfG (D) and FOEN (CH)
- Contracts to Deltares (formerly Delft Hydraulics) and SMHI

New aspects

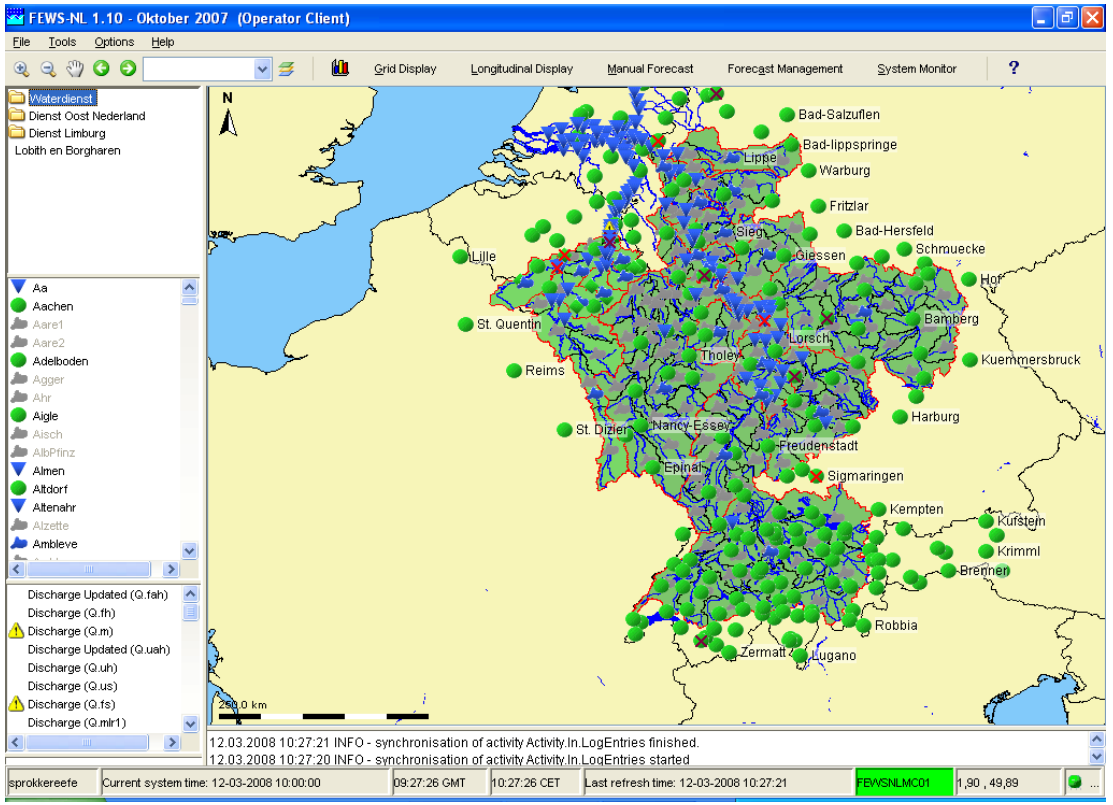
- Combination of hydrological and hydraulic models
- Medium range forecasts (4 – 10 days)
- Introduction of multiple weather forecasts
- Use of ensemble weather forecasts
- Client server / multi user
- Rhine and Meuse in one application
- Simulation for the entire basin
- Improvement through data assimilation techniques

Observations

- Water stages from appr. 60 gauges
- Precipitation and air temperature at appr. 700 stations

Planned

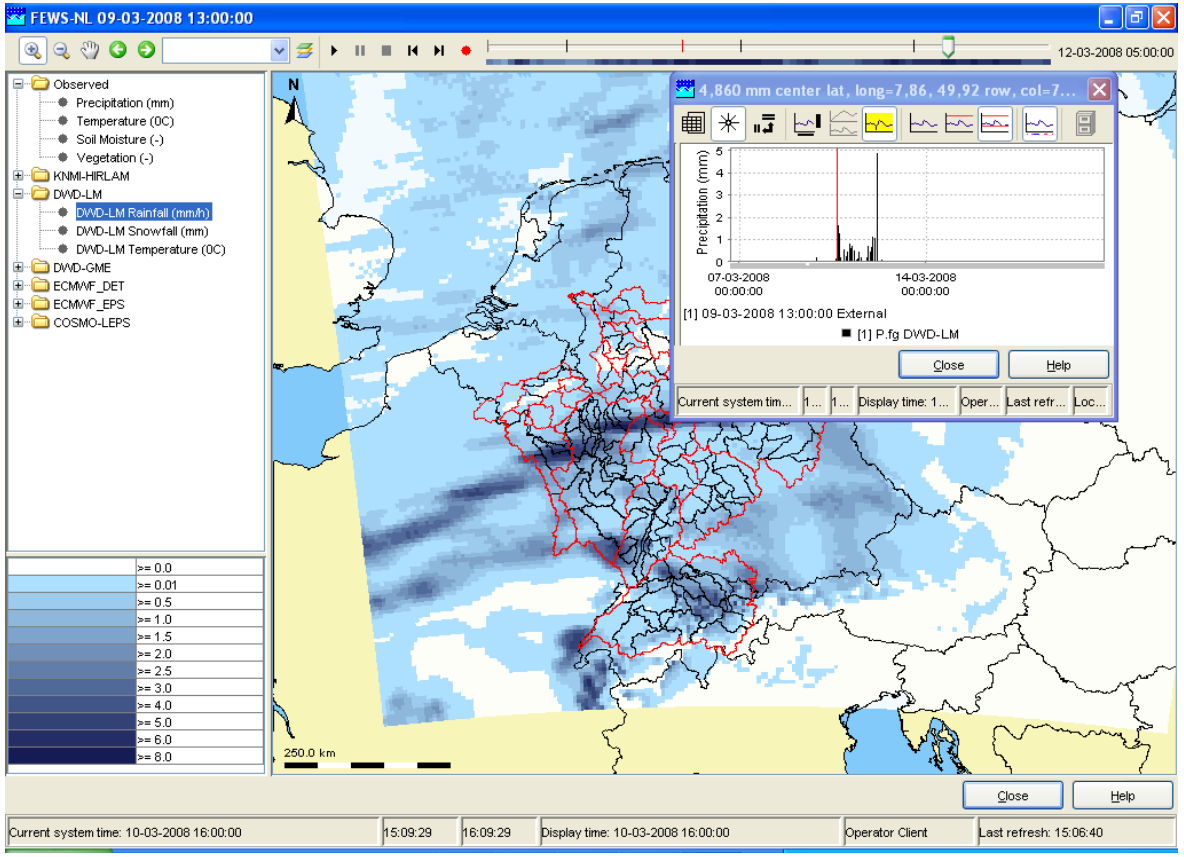
- Data from precipitation radar
- Observed soil moisture
- Potential evaporation



Weather forecast data

Numerical Weather Prediction grids

- KNMI-HIRLAM
  - 48 hrs lead time
- DWD-LM2
  - 78 hrs lead time
- DWD-GME
  - 174 hrs lead time
- ECMWF deterministic
  - 240 hrs lead time
- ECMWF ensemble
  - 240 hrs lead time
  - 51 ensemble members
- COSMO LEPS
  - 160 hrs lead time
  - 16 ensemble members



LM2 Forecast: 09-03-2008 13:00 UTC

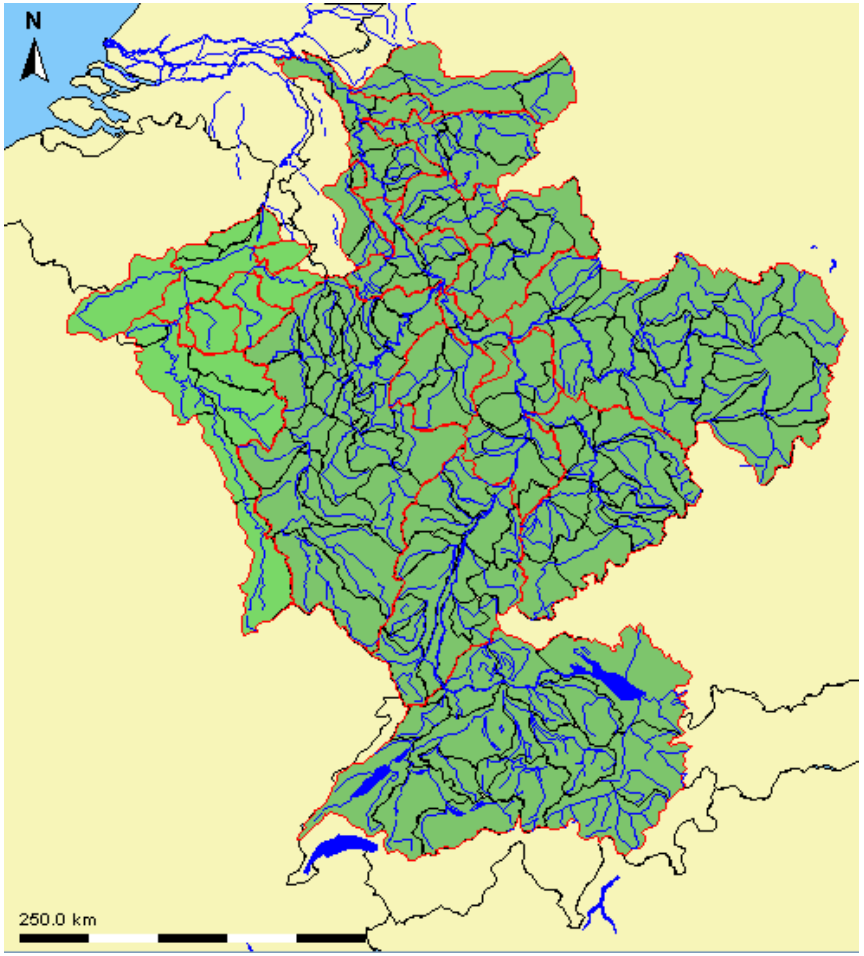
Forecasting Models

HBV Hydrological Model

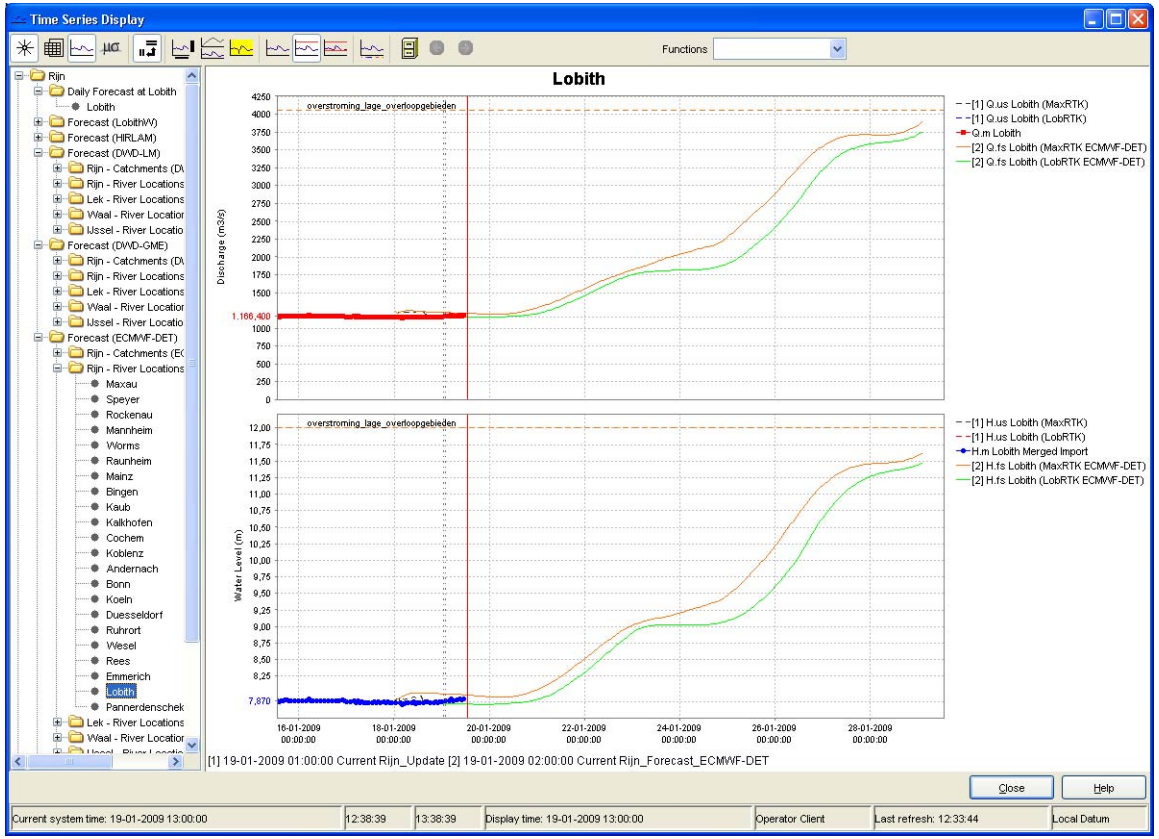
- Rhine 134 catchments
- Meuse 15 catchments

Sobek hydraulic model

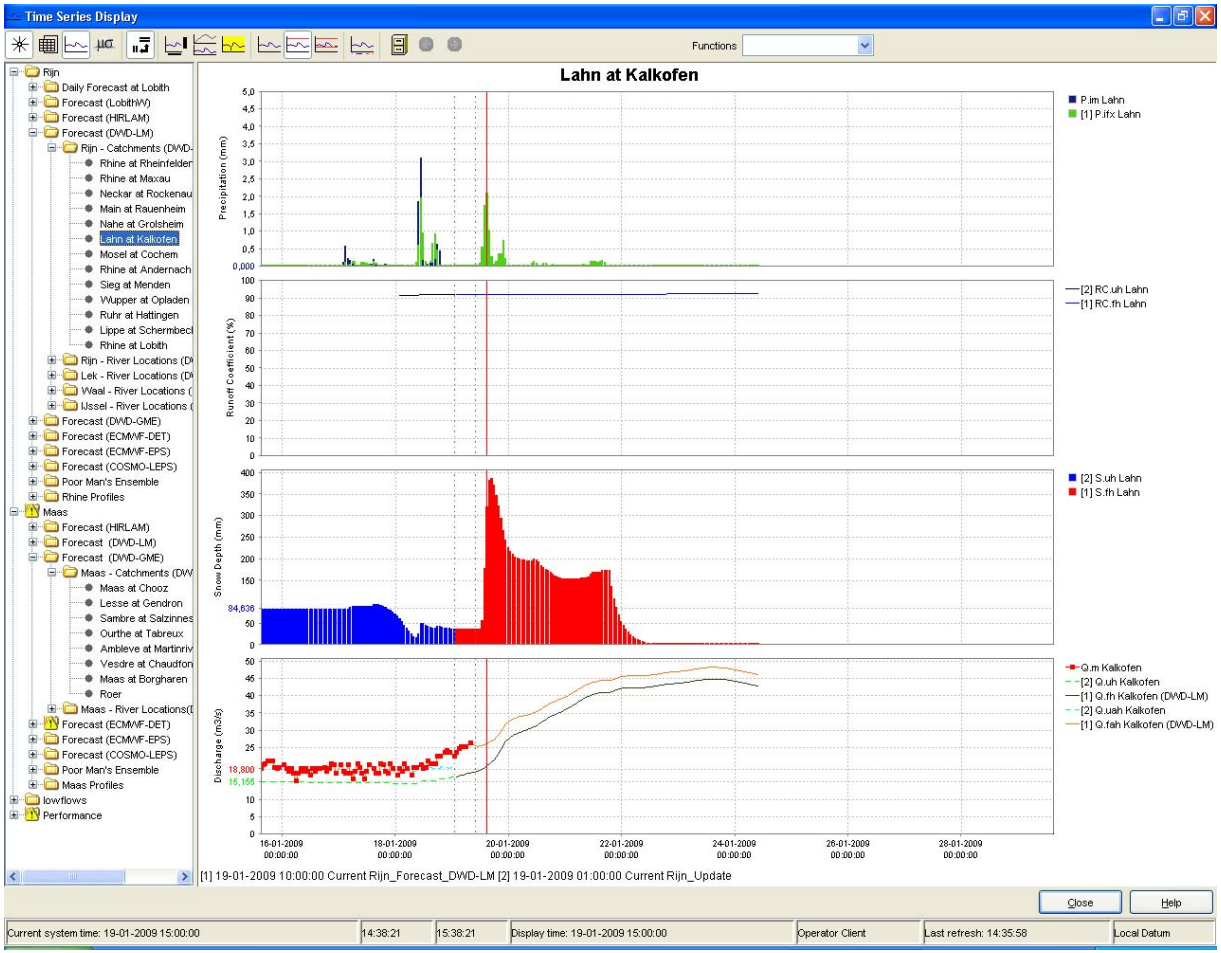
- Rhine Maxau-Lobith
- Meuse Chooz-Borgharen



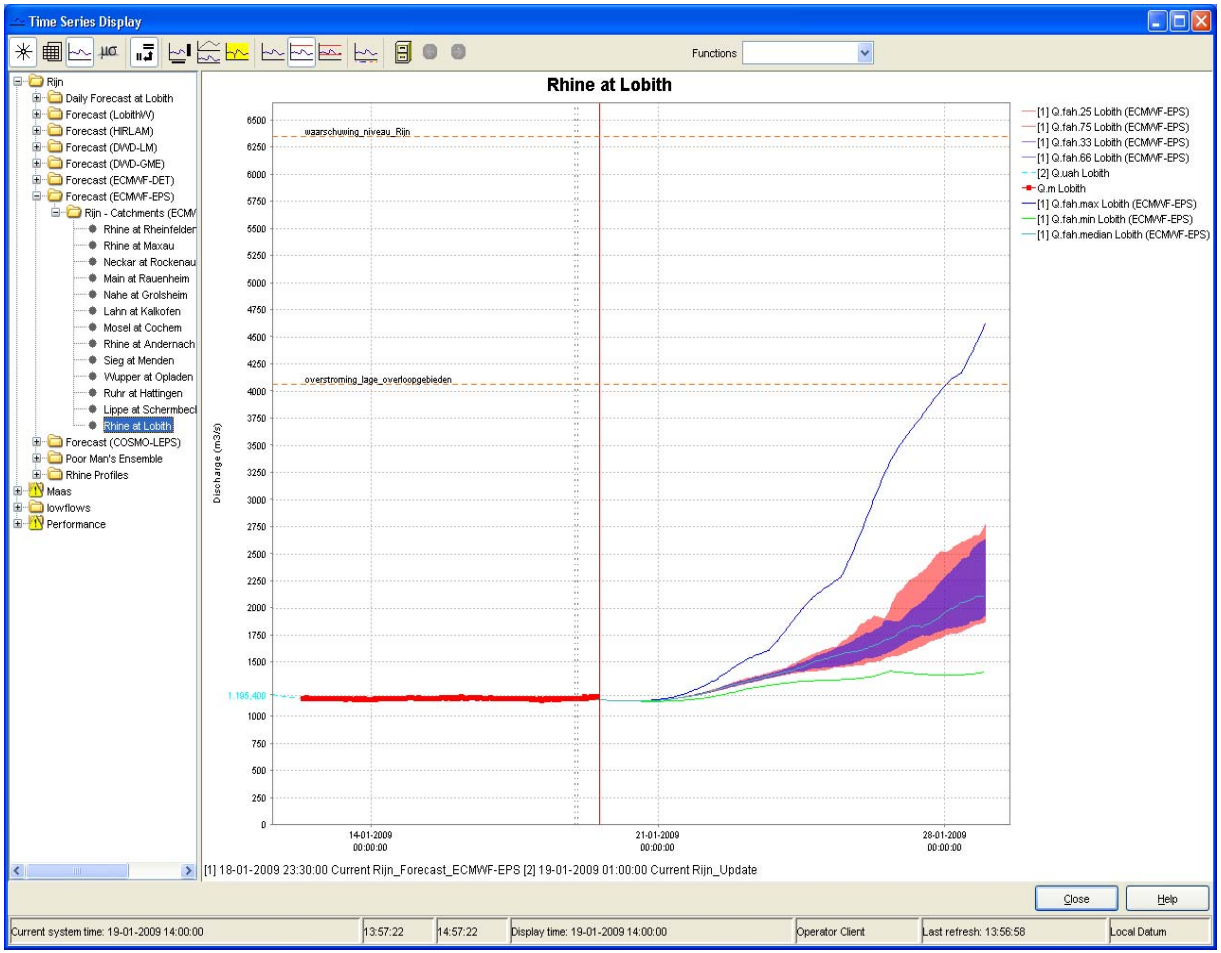
Forecasting results deterministic



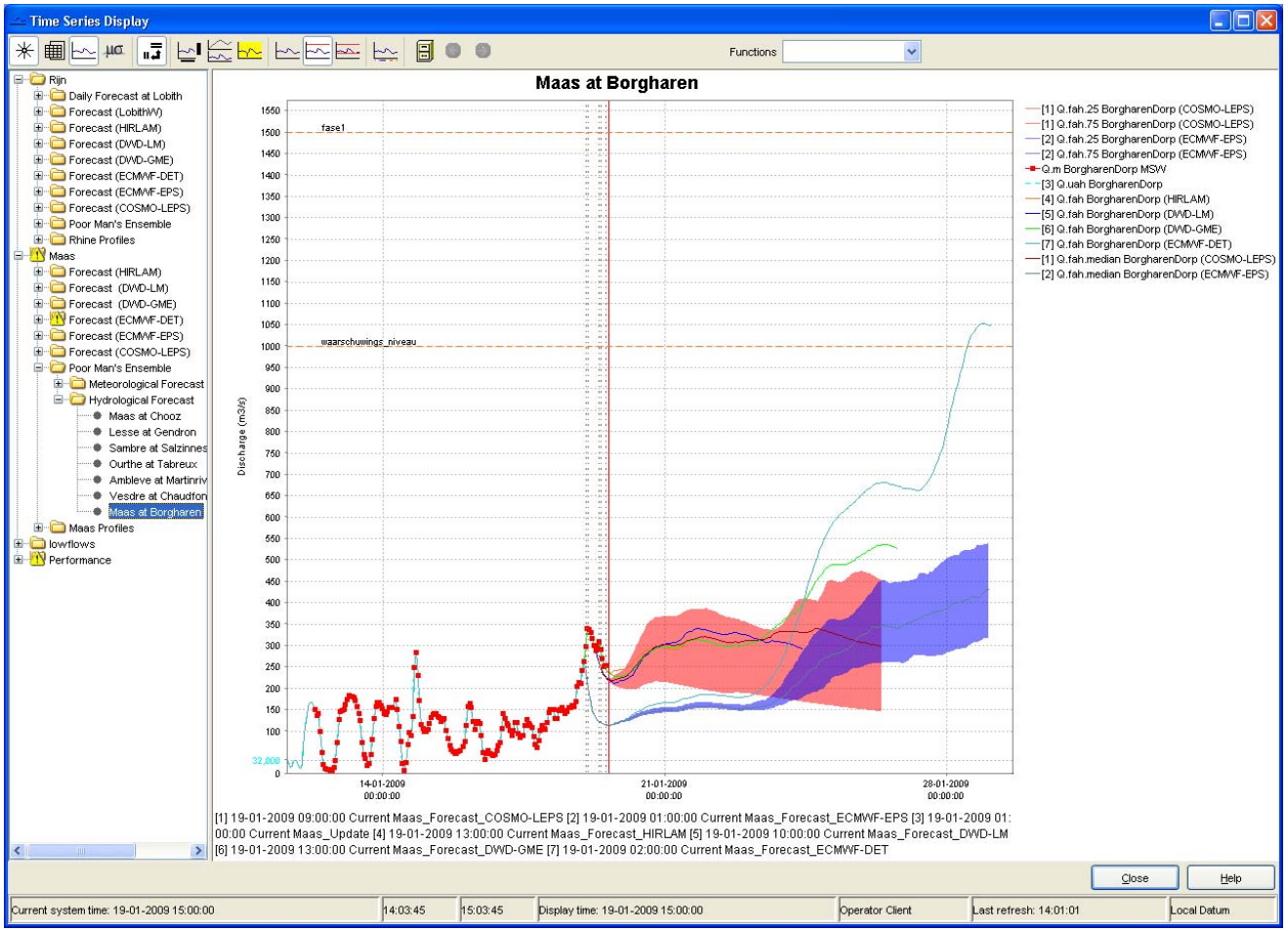
Deterministic with additional information



Forecasting results probabilistic



Poor Man's Ensemble



Exceedance of thresholds

Rhine

Meuse

Use of ensemble forecasts in the operational process

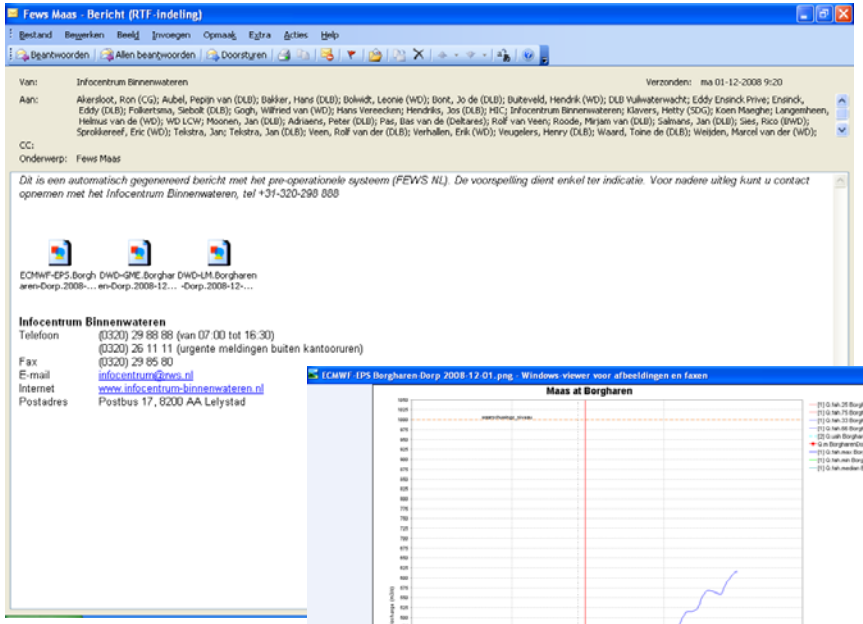
- Visual interpretation of the poor men's ensemble (uncertainty)
- Early Warning
  Pre-alert when within the next 10 days at least one of the four deterministic models and/or at least 50% of the ensembles predict water levels above the pre-warning level (for the Rhine 1 meter below the actual warning level)

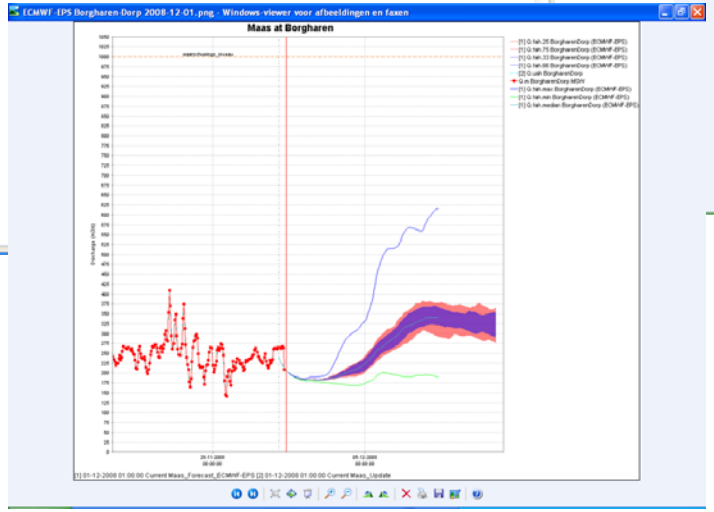
  For the Meuse the considered forecasting period is 4 days.

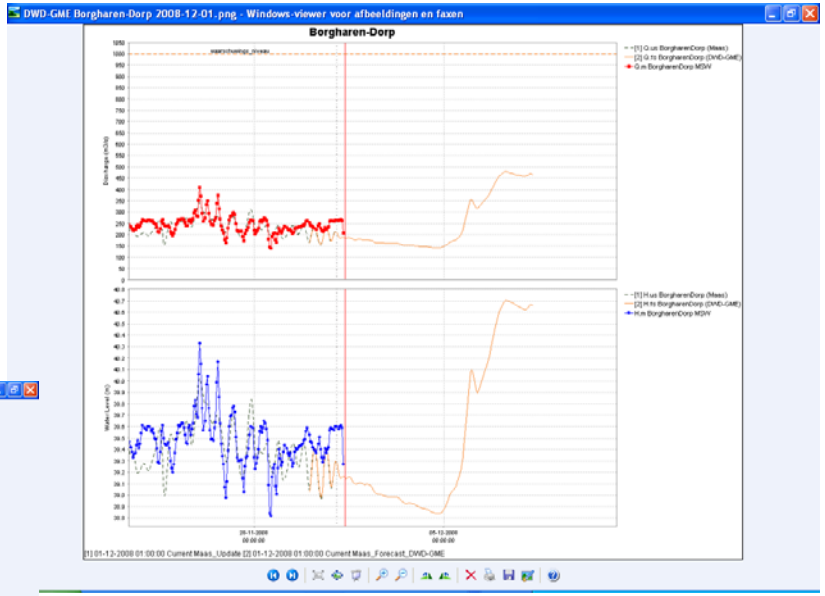
Communication of the results

- Daily reports to clients
- Website for designated users

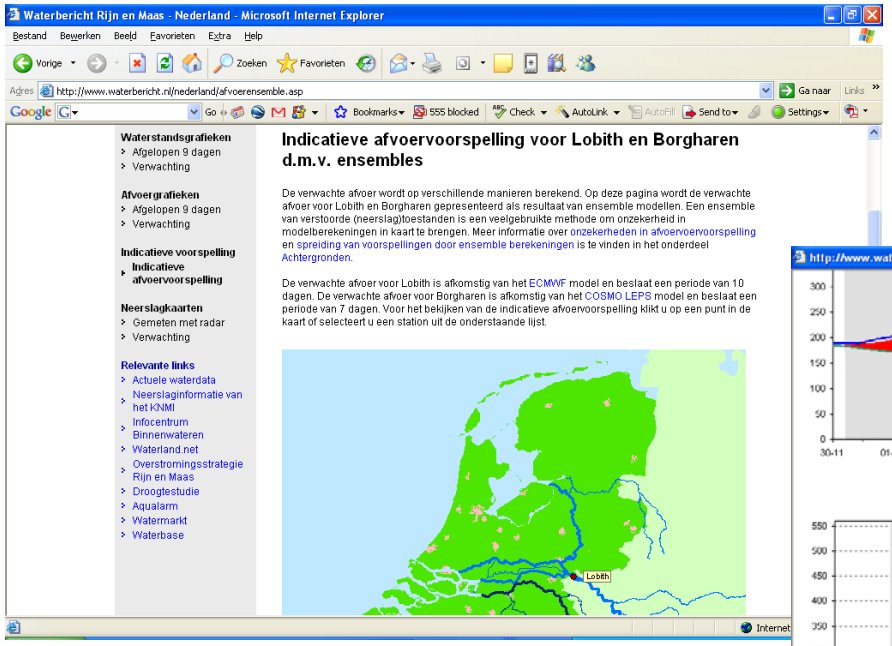
Daily reports to clients by e-mail

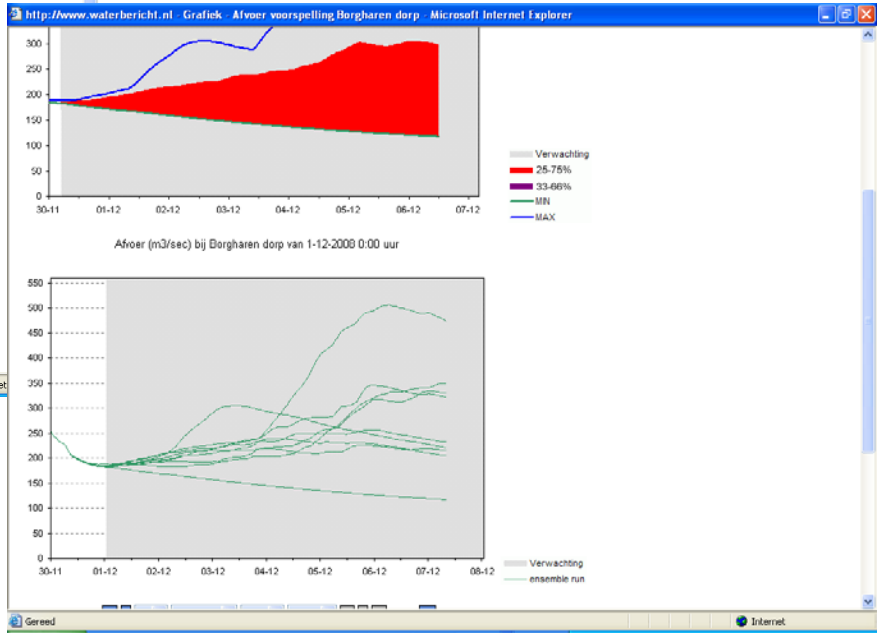






Website www.waterbericht.nl





The Questions

- When did our institute start thinking about exploring EPS for forecasting purposes? – During the EFFS project (1998)
- What triggered us to start exploring EPS? Results of the cases in EFFS.
- What strategy was used for this? Joint research with Delft Hydraulics, BfG, FOEN
- What was needed to implement EPS? Development of a new forecasting system. New hardware. Training of staff.
- How long was the testing phase? We are still testing.
- How was the transfer from the testing to the operational phase? The transfer is not yet completed. Just a small group of staff works with the ensembles.
- When did we start the operational production of EPS based forecasts? We did not.
- How did we prepare our staff for the EPS based forecasts? Training given by the MET office.
- To what extend does our staff use the EPS based forecasts? For visual interpretation of the uncertainty and for pre warning (level over thresholds)