Visualising and communicating probabilistic flow forecasts in The Netherlands

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- 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
## Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Rhine</th>
<th>Meuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin surface</td>
<td>185,000 km²</td>
<td>36,000 km²</td>
</tr>
<tr>
<td>Length</td>
<td>1,320 km</td>
<td>935 km</td>
</tr>
<tr>
<td>Type</td>
<td>snowmelt + rain</td>
<td>rain</td>
</tr>
<tr>
<td>Q mean</td>
<td>2,300 m³/s</td>
<td>230 m³/s</td>
</tr>
<tr>
<td>Q peak</td>
<td>13,000 m³/s</td>
<td>3,000 m³/s</td>
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</table>
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
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)