Deltares

FAQ

How does a forecasting system for high water work?

Update: 31-8-2021

How does a forecasting system for high water work?

What are water forecasting systems? Throughout the year, operational forecasting systems are used to determine the status and expected situation of water systems throughout the Netherlands and beyond. This information can be used for various purposes, such as day-to-day water management, shipping and water level management. The aim of a system of this kind is to collate all the relevant data and models in a coherent, integrated environment to make the best forecasts possible. In the Netherlands, many water authorities use a regional information and/or forecasting system for the water in the areas they manage. The Netherlands Water Management Centre (WMCN) uses the *RwsOS*[1] *Rivers* forecasting system for the Meuse. This system, which is based on the Deltares software Delft-FEWS[2], is developed and maintained in collaboration with Deltares.

In broad terms, a system for forecasting high water has the following functions:

- collecting all relevant data;
- controlling numerical models;
- processing data to produce forecasts;
- presenting the results for the user.

When high water is imminent, the information generated by a high-water forecasting system is vital in terms of providing timely warnings. In addition, steps can be taken in good time on the basis of this information to prevent flooding, and reports about high water can be[3] be drafted and passed on to all stakeholders. This warning system will often be set up at a specific location, sometimes with automatic input from the forecasting system.

Data

Data relating to both monitoring and forecasts are very important during periods of high water. An operational forecasting system will collect all kinds of data (automatically as much as possible). This will include current information (from monitoring) about the water system as well as forecasts. They can be weather forecasts, from the Dutch and German meteorological services for instance, but also data and forecasts from other parties such as water authorities, or from other countries. The system will often check the data to ensure it is correct.

1 https://www.helpdeskwater.nl/publish/pages/132725/broch_fews_web.pdf
2 https://www.deltares.nl/nl/software/hydrologic-forecasting-system-delft-fews/
3 https://waterberichtgeving.rws.nl/water-en-weer/verwachtingen-water/rivieren/maas/berichtgeving

FAQ

Update: 31-8-2021

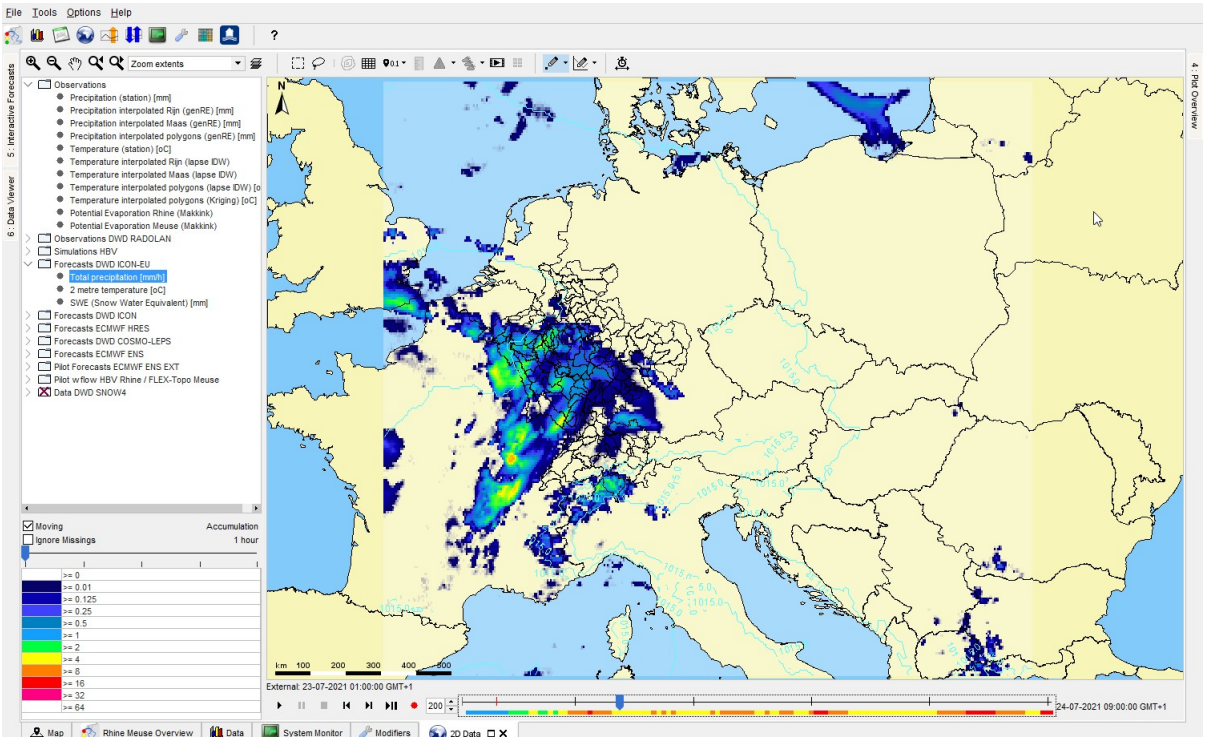

Figure 1 RWsOS Rivers - spatial precipitation forecasting product (DWD ICON-EU4) visualised in the forecasting system

Models

Forecasting systems work with computer models. The system often runs several models on the basis of a range of data. *Hydrological Precipitation-Runoff Models* calculate, for example, the rate at which measured or expected precipitation enters the river on the basis of, among other things, the weather forecast, the amount of precipitation that has fallen, the type of ground and the land use.

The hydraulic models, which contain the relevant river characteristics, then use this data to calculate and predict water levels and the discharge of river water, as in the Meuse. In this way, *RWsOS Rivers* calculates the discharges at relevant locations in all upstream tributaries of the Meuse, resulting in a forecast for the coming days at St. Pieter, where the Meuse enters the Netherlands. In the case of the Meuse, there are also more detailed hydraulic models that calculate the discharges and water levels in the lower reaches of the Meuse in greater detail and with more options for interaction.

In addition, the models are often run with multiple sets of weather forecasts (which are also known as *ensembles*). That provides the user with an impression of the uncertainty in the forecasts. There are also options for calculating scenarios and including local measures in the model calculations. If there are specific questions relating to the water system from, for example, a crisis organisation, the system can be used to find the best possible answers.

FAQ

Update: 31-8-2021

The high-water forecasting system plays an important role in terms of allowing this process of modelling and the interpretation of the results to take place as *efficiently and accurately* as possible.

4 https://www.dwd.de/EN/ourservices/nwp_forecast_data/nwp_forecast_data.html

That is very important during a period of high water: the earlier and more accurate the forecast, the more proactive the response can be.

Results and products

The model results can be presented in several ways in the system, for example as a graph, table or map. The aim is to identify the most important parameters quickly in order to arrive at the best forecast. In addition to the source data and model results, additional information from other sources is also taken into consideration. Validation based on empirical rules and expert judgment is also used to produce the most realistic forecast given the information available at that time. Ultimately, the hydrologist on duty has the last word about the forecasts.

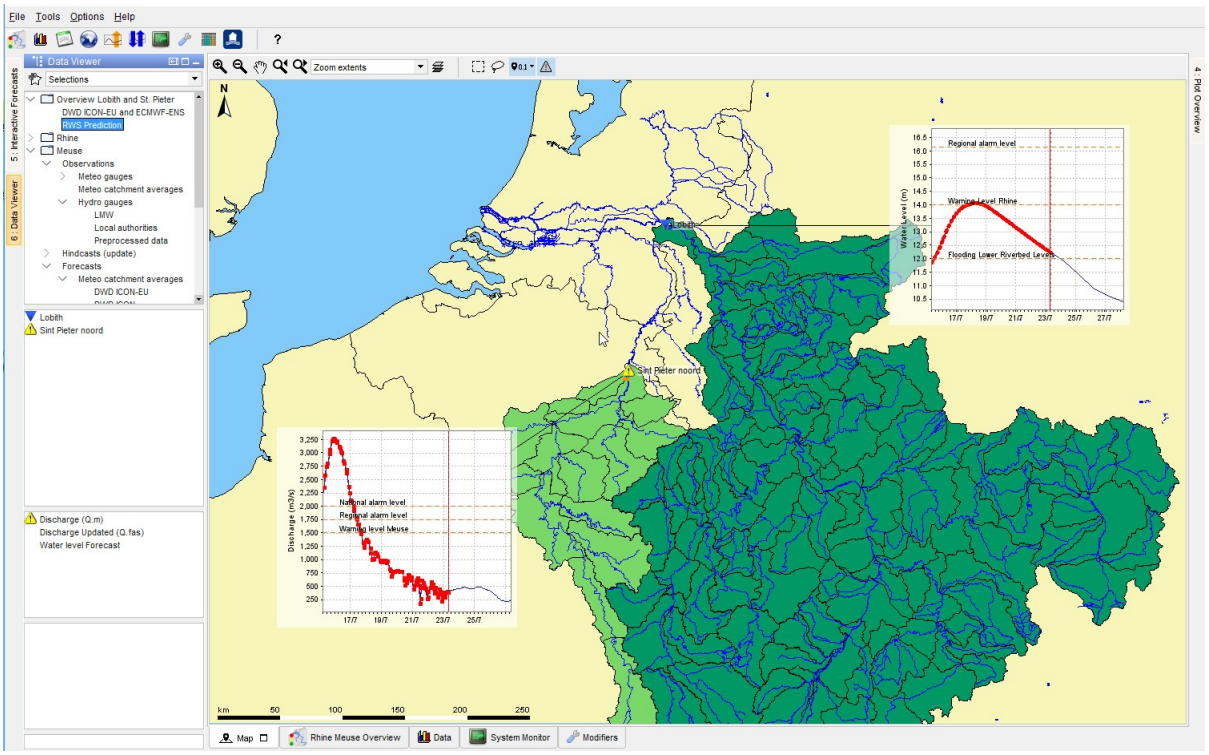

Figure 2 RWsOS Rivers - monitored discharge in previous days (red) and forecast discharges (blue) for Lobith and St. Pieter

FAQ

Update: 31-8-2021

Communications and/or warnings can then be organised on the basis of this calculated forecast. The system generates a lot of relevant information products that can be used in a clear presentation, such as reports about high water[5]. In this way, the system therefore transforms data into relevant information.

5 https://waterberichtgeving.rws.nl/water-en-weer/verwachtingen-water/rivieren/maas/berichtgeving

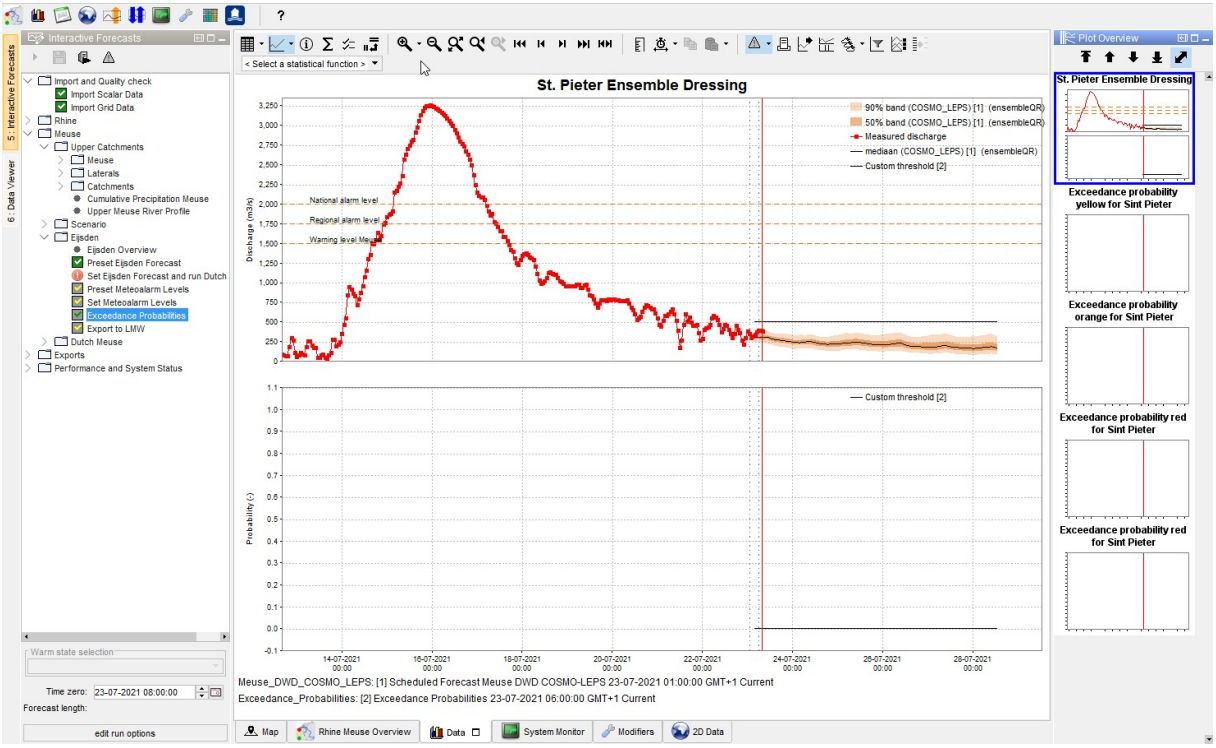

Figure 3 RWsOS Rivers - Ensemble Dressing Product at St. Pieter for high-water reports

FAQ

Update: 31-8-2021

Hoogwaterbericht H20, woensdag 21 juli 2021, 10uur

BIJLAGE D: Regionale-waterstandrapportages

VERWACHTE WATERSTANDEN aan de peilmeetstations Nederlandse Maas
voor voorspeltijd T+12 uur (**21-07-2021 19:00 uur**)
behorende bij Hoogwaterbericht Maas: **nr.H20 21-07-2021 07:46,** dd. 21-07-2021 07:46 uur
Pagina 1 van 2

peilschaal	(m+NAP)	km-raai
St. Pieter	44.29	10.800
Borgharen_dorp	40.13	16.000
Elsloo	36.10	29.325
Rotem	27.28	44.945
Maaseik	24.02	52.720
Stevensweert	21.63	61.570
Heel_boven	20.94	67.340
Linne_beneden	17.92	70.400
Roermond_boven	16.82	79.750
Heel_beneden	14.81	85.075
Neer	14.49	90.112
Belfeld_beneden	13.03	102.697
Venlo	12.84	107.470
Well	11.92	132.100
Sambeek_beneden	9.24	147.700
Gennep	8.44	155.100
Mook	7.71	165.800
Grave_beneden	6.29	177.000
Megen	5.33	190.750

Figure 4 Example of a product (regional water-level report) in high-water reporting for the Meuse, as issued by the WMCN

Warnings

Partly on the basis of this information about the current and predicted situation in the water system, the authorities can take timely action, for example to evacuate an area. For the purposes of decisions about action of this kind, information from other sources will often also be used in order to establish the broadest possible picture.

The cycle of collecting and validating data, running the model and producing new forecasts will be completed regularly and often several times a day. With the passage of time, more measurements, new meteorological forecasts and so on become available that can be used to modify the water-level and discharge forecasts.