Recent advances in data assimilation and post-processing in operational ensemble flood forecasting

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This poster presents an overview of current research activities that have and will be carried out at WL|Delft Hydraulics in the context of operational flood forecasting.

A data assimilation (DATools) and an uncertainty analysis tool kit (UATools) have been developed. These instruments can be used either in stand-alone mode or can be embedded in the form of a specific module into the generic flood forecasting environment Delft-FEWS.

In Delft-FEWS observations are assimilated operationally into hydraulic and hydrological models via Ensemble Kalman Filtering (EnKF) or Particle Filtering techniques.

Figure 1 gives an overview of the application of these techniques in a typical model setting for operational forecasting. Research activities in post-processing of precipitation (HIRLAM weather model) and discharge forecast for the river Rhine using Bayesian revision of prior probability distributions on forecasted flow have been carried out. So far, these methods have been tested preliminarily using deterministic precipitation forecasts.

Figure 2 shows posterior probability density functions on water levels for the operational river Rhine flood forecasting system. The extension to a Bayesian ensemble forecasting system by including ensemble precipitation forecasts (ECMWF-EPS, COSMO-LEPS) is straight forward. However, issues such as scaling of precipitation need to be addressed explicitly and are subject of ongoing research.

Experience from recent Dutch research into Bayesian model averaging (BMA) for operational forecasting of storm surges in the North Sea using the North-West Shelf Operational Oceanic System (NOOS) will be extended to river flow forecasting.

Figure 3 shows an example of distributions of storm surge levels from different models and their respective combination into an average by weighting the models individually. The weights are determined over a typical model training period.

Figure 4 shows the application of an Ensemble Kalman Filter (EnKF) to the hydrodynamic Sobek model output (water levels) at the measurement point Andernach on the river Rhine.

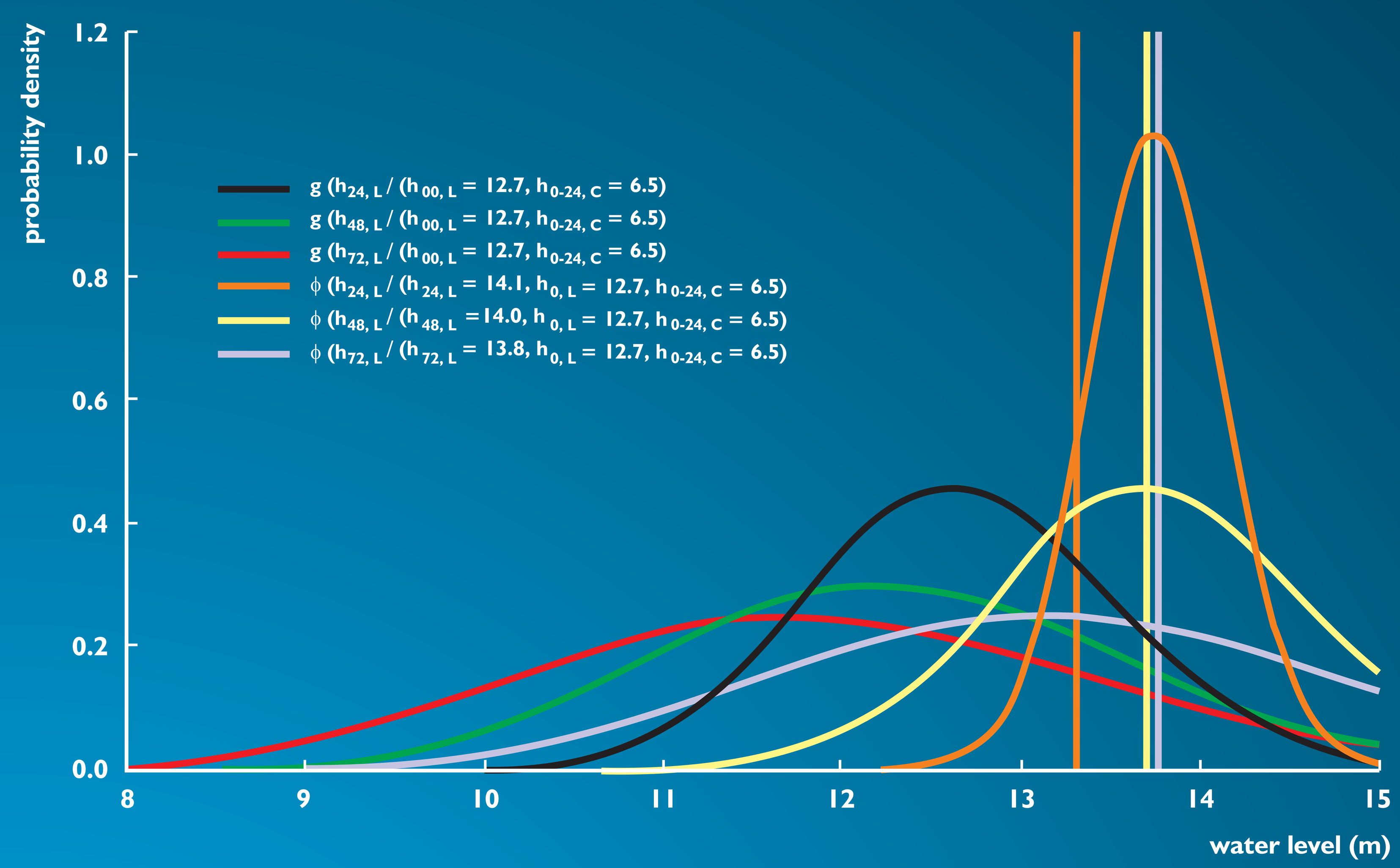

figure 2 - prior and posterior probability densities of water levels, lead time 24, 48 and 72 hours, Lobith, 04/03/07

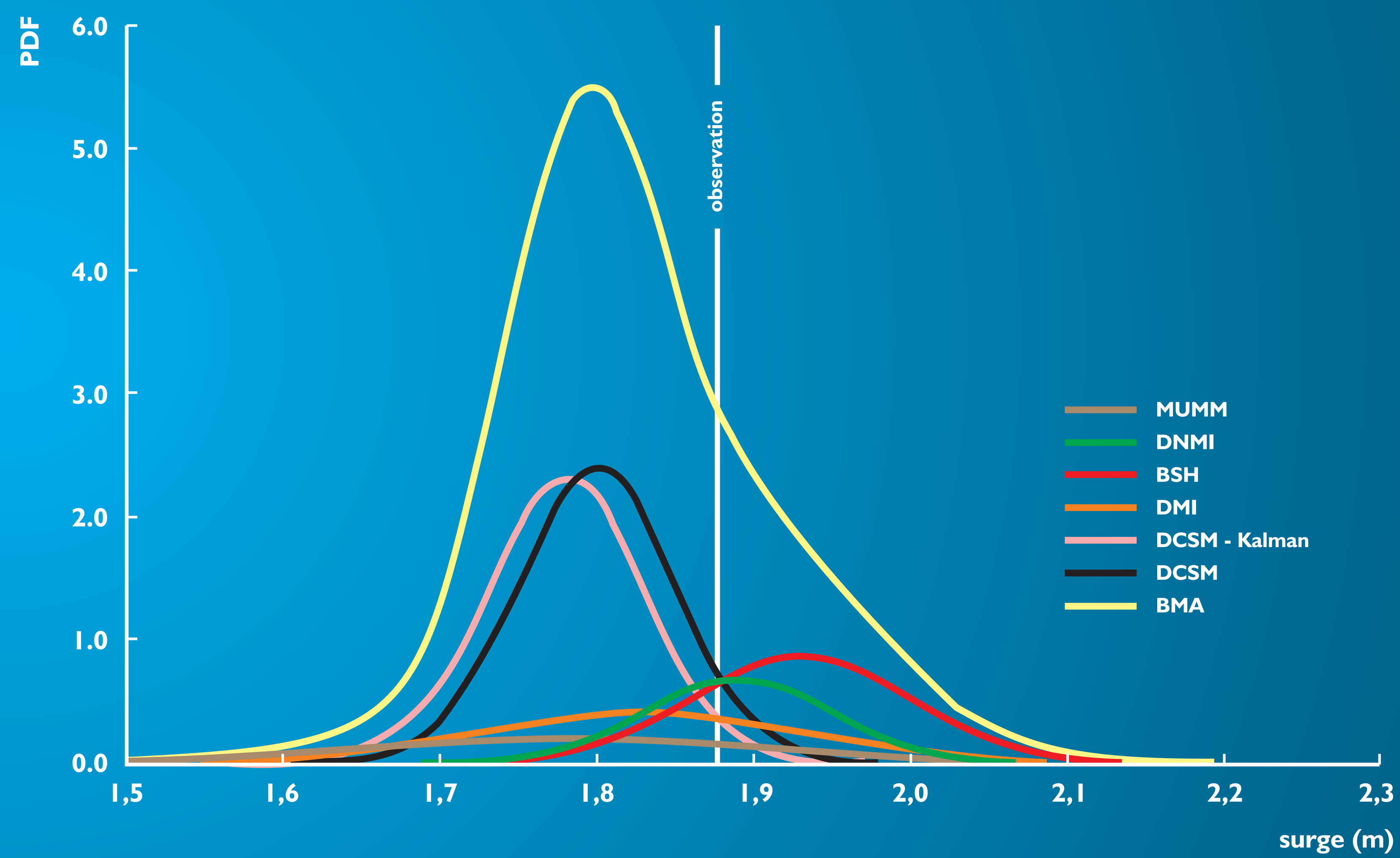

figure 3 - example of Bayesian Model Averaging (BMA) of six different storm surge forecast models

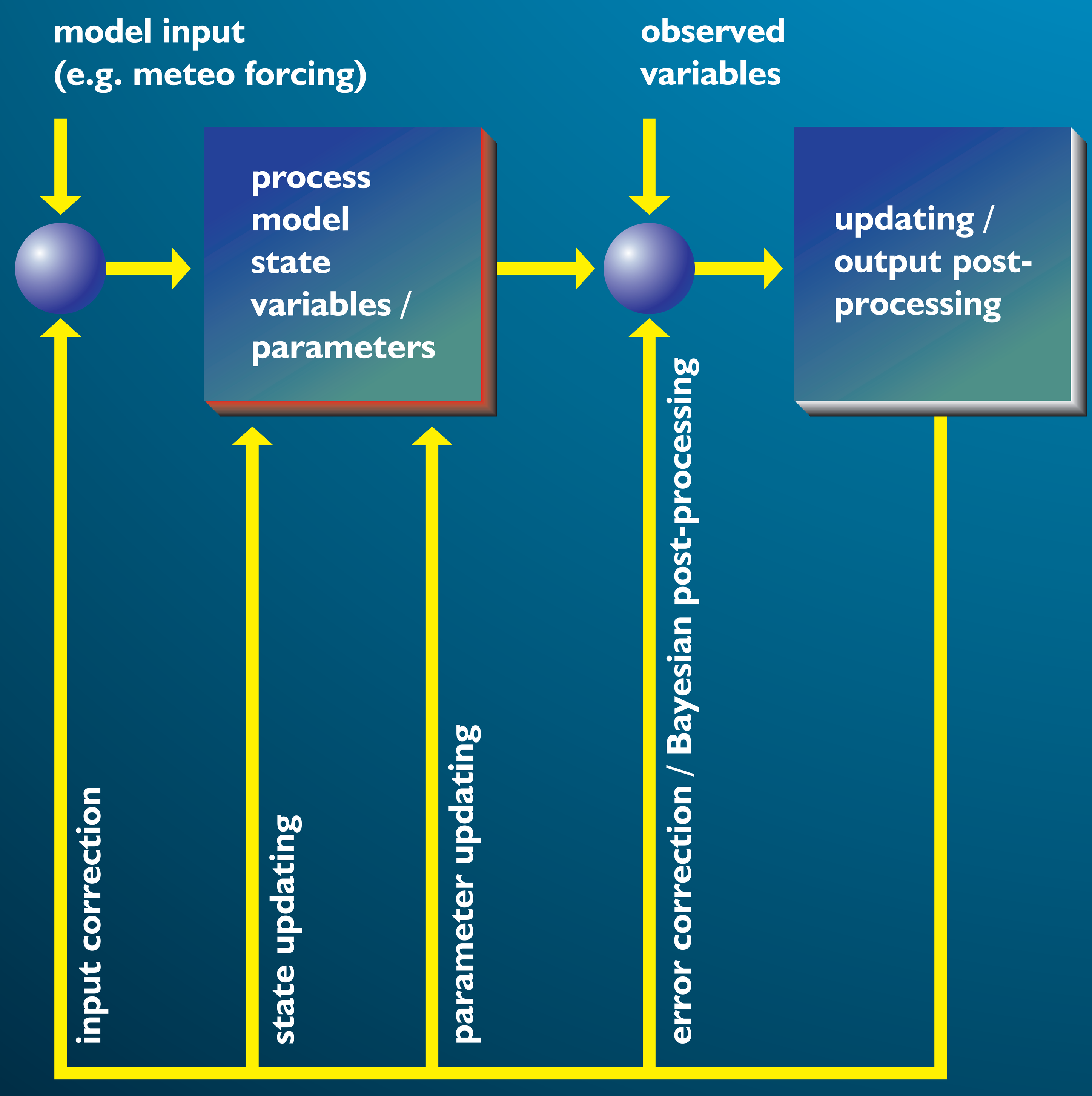

figure 1 - uncertainty analysis model state updating and output post-processing

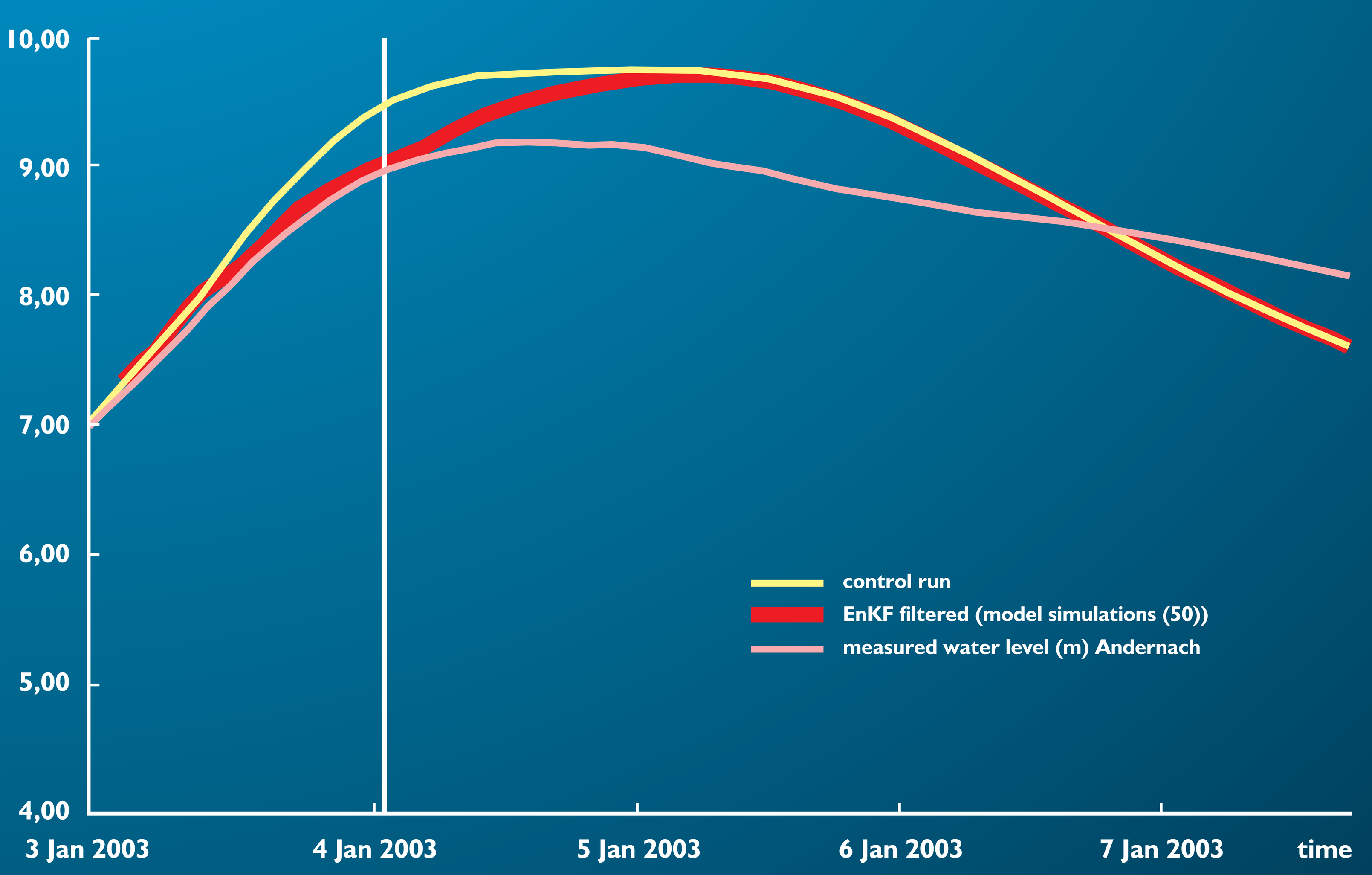

figure 4 - ensemble Kalman filtering of water level predictions at Andernach, river Rhine

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