State updating of a distributed hydrological model with Ensemble Kalman filtering: effects of updating frequency and observation network density on forecast accuracy

O. Rakovec (1), A. H. Weerts (2), P. Hazenberg (1), P. J. J. F. Torfs (1), and R. Uijlenhoet (1)

(1) Wageningen University, Hydrology and Quantitative Water Management, Wageningen, The Netherlands
(olda.rakovec@wur.nl), (2) Deltares, P.O. Box 177, 2600MH Delft, The Netherlands

This paper presents a study on optimal setup for discharge assimilation within a spatially distributed hydrological model. The well-known ensemble Kalman filter (EnKF) is employed to update the grid-based distributed states of the hourly HBV-96 model. Synthetic and real world experiments are carried out for the Upper Ourthe ($1\,600\ \mathrm{km}^2$), a quickly responding catchment in the Belgian Ardennes. We assess the impact on the forecasted discharge of (1) various sets of the spatially distributed discharge gauges and (2) the filtering frequency. The results show that the hydrological forecast at the catchment outlet is improved by assimilating interior gauges. This augmentation of the observation vector improves the forecast more than increasing the updating frequency. In terms of the model states, the EnKF scheme is mainly changing the pdf's of the two routing model storages during situations when the uncertainty in the discharge simulation is larger than the defined observation uncertainty.