Geophysical Research Abstracts
Vol. 18, EGU2016-9726, 2016
EGU General Assembly 2016

Effects of Uncertainties in Hydrological Modelling. A Case Study of a Mountainous Catchment in Southern Norway

Kolbjorn Engeland (1) and Ingelin Steinsland (2)

(1) NVE, Oslo, Norway (koe@nve.no), (2) Department of Mathematical Sciences, Norwegian University of Science and Technology, Trondheim, Norway

The aim of this study is to investigate how the inclusion of uncertainties in inputs and observed streamflow influence the parameter estimation, streamflow predictions and model evaluation. In particular we wanted to answer the following research questions:
• What is the effect of including a random error in the precipitation and temperature inputs?
• What is the effect of decreased information about precipitation by excluding the nearest precipitation station?
• What is the effect of the uncertainty in streamflow observations?
• What is the effect of reduced information about the true streamflow by using a rating curve where the measurement of the highest and lowest streamflow is excluded when estimating the rating curve?
To answer these questions, we designed a set of calibration experiments and evaluation strategies. We used the elevation distributed HBV model operating on daily time steps combined with a Bayesian formulation and the MCMC routine Dream for parameter inference. The uncertainties in inputs was represented by creating ensembles of precipitation and temperature. The precipitation ensemble were created using a meta-gaussian random field approach. The temperature ensembles were created using a 3D Bayesian kriging with random sampling of the temperature laps rate. The streamflow ensembles were generated by a Bayesian multi-segment rating curve model. Precipitation and temperatures were randomly sampled for every day, whereas the streamflow ensembles were generated from rating curve ensembles, and the same rating curve was always used for the whole time series in a calibration or evaluation run. We chose a catchment with a meteorological station measuring precipitation and temperature, and a rating curve of relatively high quality. This allowed us to investigate and further test the effect of having less information on precipitation and streamflow during model calibration, predictions and evaluation. The results showed that including uncertainty in the precipitation and temperature input has a negligible effect on the posterior distribution of parameters and for the Nash-Sutcliffe (NS) efficiency for the predicted flows, while the reliability and the continuous rank probability score (CRPS) improves. Reduced information in precipitation input resulted in a and a shift in the water balance parameter Pcorr, a model producing smoother streamflow predictions giving poorer NS and CRPS, but higher reliability. The effect of calibrating the hydrological model using wrong rating curves is mainly seen as variability in the water balance parameter Pcorr. When evaluating predictions obtained using a wrong rating curve, the evaluation scores varies depending on the true rating curve. Generally, the best evaluation scores were not achieved for the rating curve used for calibration, but for a rating curves giving low variance in streamflow observations. Reduced information in streamflow influenced the water balance parameter Pcorr, and increased the spread in evaluation scores giving both better and worse scores. This case study shows that estimating the water balance is challenging since both precipitation inputs and streamflow observations have pronounced systematic component in their uncertainties.