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Impacts of uncertainties in weather and streamflow observations in calibration and evaluation of an elevation distributed HBV-model

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The aim of this study is to assess the uncertainties in streamflow simulations when uncertainties in both observed inputs (precipitation and temperature) and streamflow observations used in the calibration of the hydrological model are explicitly accounted for. To achieve this goal we applied the elevation distributed HBV model operating on daily time steps to a small catchment in high elevation in Southern Norway where the seasonal snow cover is important. The uncertainties in precipitation inputs were quantified using conditional simulation. This procedure accounts for the uncertainty related to the density of the precipitation network, but neglects uncertainties related to measurement bias/errors and eventual elevation gradients in precipitation. The uncertainties in temperature inputs were quantified using a Bayesian temperature interpolation procedure where the temperature lapse rate is re-estimated every day. The uncertainty in the lapse rate was accounted for whereas the sampling uncertainty related to network density was neglected. For every day a random sample of precipitation and temperature inputs were drawn to be applied as inputs to the hydrologic model. The uncertainties in observed streamflow were assessed based on the uncertainties in the rating curve model. A Bayesian procedure was applied to estimate the probability for rating curve models with 1 to 3 segments and the uncertainties in their parameters. This method neglects uncertainties related to errors in observed water levels. Note that one rating curve was drawn to make one realisation of a whole time series of streamflow, thus the rating curve errors lead to a systematic bias in the streamflow observations. All these uncertainty sources were linked together in both calibration and evaluation of the hydrologic model using a DREAM based MCMC routine. Effects of having less information (e.g. missing one streamflow measurement for defining the rating curve or missing one precipitation station) was also investigated.