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Post-processing of a low-flow forecasting system in the Thur basin (Switzerland)

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Low-flows and droughts are natural hazards with potentially severe impacts and economic loss or damage in a number of environmental and socio-economic sectors. As droughts develop slowly there is time to prepare and pre-empt some of these impacts. Real-time information and forecasting of a drought situation can therefore be an effective component of drought management.

Although Switzerland has traditionally been more concerned with problems related to floods, in recent years some unprecedented low-flow situations have been experienced. Driven by the climate change debate a drought information platform has been developed to guide water resources management during situations where water resources drop below critical low-flow levels characterised by the indices duration (time between onset and offset), severity (cumulative water deficit) and magnitude (severity/duration).

However to gain maximum benefit from such an information system it is essential to remove the bias from the meteorological forecast, to derive optimal estimates of the initial conditions, and to post-process the stream-flow forecasts. Quantile mapping methods for pre-processing the meteorological forecasts and improved data assimilation methods of snow measurements, which accounts for much of the seasonal stream-flow predictability for the majority of the basins in Switzerland, have been tested previously.

The objective of this study is the testing of post-processing methods in order to remove bias and dispersion errors and to derive the predictive uncertainty of a calibrated low-flow forecast system. Therefore various stream-flow error correction methods with different degrees of complexity have been applied and combined with the Hydrological Uncertainty Processor (HUP) in order to minimise the differences between the observations and model predictions and to derive posterior probabilities. The complexity of the analysed error correction methods ranges from simple AR(1) models to methods including wavelet transformations and support vector machines. These methods have been combined with forecasts driven by Numerical Weather Prediction (NWP) systems with different temporal and spatial resolutions, lead-times and different numbers of ensembles covering short to medium to extended range forecasts (COSMO-LEPS, 10-15 days, monthly and seasonal ENS) as well as climatological forecasts.

Additionally the suitability of various skill scores and efficiency measures regarding low-flow predictions will be tested. Amongst others the novel 2afc (2 alternatives forced choices) score and the quantile skill score and its decompositions will be applied to evaluate the probabilistic forecasts and the effects of post-processing.

First results of the performance of the low-flow predictions of the hydrological model PREVAH initialised with different NWP's will be shown.