Geophysical Research Abstracts
Vol. 16, EGU2014-3310, 2014
EGU General Assembly 2014

Post-processing of multi-model ensemble river discharge forecasts using censored EMOS

Stephan Hemri (1), Dmytro Lisniak (2), and Bastian Klein (2)

(1) Computational Statistics group, Heidelberg Institute for Theoretical Studies, Heidelberg, Germany, (2) German Federal Institute of Hydrology (BfG), Koblenz, Germany

When forecasting water levels and river discharge, ensemble weather forecasts are used as meteorological input to hydrologic process models. As hydrologic models are imperfect and the input ensembles tend to be biased and underdispersed, the output ensemble forecasts for river runoff typically are biased and underdispersed, too. Thus, statistical post-processing is required in order to achieve calibrated and sharp predictions. Standard post-processing methods such as Ensemble Model Output Statistics (EMOS) that have their origins in meteorological forecasting are now increasingly being used in hydrologic applications. Here we consider two sub-catchments of River Rhine, for which the forecasting system of the Federal Institute of Hydrology (BfG) uses runoff data that are censored below predefined thresholds.

To address this methodological challenge, we develop a censored EMOS method that is tailored to such data. The censored EMOS forecast distribution can be understood as a mixture of a point mass at the censoring threshold and a continuous part based on a truncated normal distribution. Parameter estimates of the censored EMOS model are obtained by minimizing the Continuous Ranked Probability Score (CRPS) over the training dataset. Model fitting on Box-Cox transformed data allows us to take account of the positive skewness of river discharge distributions. In order to achieve realistic forecast scenarios over an entire range of lead-times, there is a need for multivariate extensions. To this end, we smooth the marginal parameter estimates over lead-times. In order to obtain realistic scenarios of discharge evolution over time, the marginal distributions have to be linked with each other. To this end, the multivariate dependence structure can either be adopted from the raw ensemble like in Ensemble Copula Coupling (ECC), or be estimated from observations in a training period.

The censored EMOS model has been applied to multi-model ensemble forecasts issued on a daily basis over a period of three years. For the two catchments considered, this resulted in well calibrated and sharp forecast distributions over all lead-times from 1 to 114 h. Training observations tended to be better indicators for the dependence structure than the raw ensemble.