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Multivariate postprocessing techniques for probabilistic hydrological forecasting

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

(1) Heidelberg Institute of Theoretical Studies, Heidelberg, Germany (stephan.hemri@h-its.org), (2) German Federal Institute of Hydrology, Koblenz, Germany

Hydrologic ensemble forecasts driven by atmospheric ensemble prediction systems need statistical postprocessing in order to account for systematic errors in terms of both mean and spread. Runoff is an inherently multivariate process with typical events lasting from hours in case of floods to weeks or even months in case of droughts. This calls for multivariate postprocessing techniques that yield well calibrated forecasts in univariate terms and ensure a realistic temporal dependence structure at the same time. To this end, the univariate ensemble model output statistics (EMOS; Gneiting et al., 2005) postprocessing method is combined with two different copula approaches that ensure multivariate calibration throughout the entire forecast horizon. These approaches comprise ensemble copula coupling (ECC; Schefzik et al., 2013), which preserves the dependence structure of the raw ensemble, and a Gaussian copula approach (GCA; Pinson and Girard, 2012), which estimates the temporal correlations from training observations. Both methods are tested in a case study covering three subcatchments of the river Rhine that represent different sizes and hydrological regimes: the Upper Rhine up to the gauge Maxau, the river Moselle up to the gauge Trier, and the river Lahn up to the gauge Kalkofen. The results indicate that both ECC and GCA are suitable for modelling the temporal dependences of probabilistic hydrologic forecasts (Hemri et al., 2015).

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