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Generating coherent ensemble forecasts after hydrological postprocessing: Adaptations of ECC-based methods

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Hydrological ensemble forecasts are frequently biased and need to be statistically postprocessed in order to account for the total predictive uncertainty. Very often, this step relies on parametric, univariate techniques such as EMOS or BMA that ignore the between-basins and between-lead times dependencies. However, end-users may need to derive from these marginal distributions an ensemble of multivariate trajectories that is coherent, for instance to drive hydrodynamic models, or to estimate accumulated volumes across several lead times. Hence, this contribution does not focus on hydrological postprocessing itself, but rather on the step that necessarily follows, which generates the multivariate streamflow ensemble.

The ensemble copula coupling (ECC) approach, which is already popular in the field of meteorological post-processing, is attractive for hydrological forecasts as it preserves the dependence structure of the unprocessed ensemble, assumed as spatially and temporally coherent. However, the existing implementations of ECC have strong limitations when applied to hourly streamflow. They produce forecasts that are neither realistic with respect to the strong autocorrelation, nor calibrated in terms of multivariate aspects. Based on the causes of these limitations, this contribution investigates several variants of ECC, in particular the addition of a perturbation to the unprocessed ensemble to handle the non-dispersive cases, and the smoothing of the temporal trajectories in order to make them more realistic. The evaluation is conducted on a case study of hydrological forecasting over a set of French basins. Results show that the new variants improve upon the existing ECC implementations, while they remain simple and computationally inexpensive.