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Model Combination and Weighting Methods in Operational Flood Forecasting

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In order to get maximum benefits from operational forecast systems based on different model approaches, it is necessary to find an optimal way to combine the forecasts in real-time and to derive the predictive probability distribution by assigning different weights to the different actual forecasts according to the forecast performance of the previous days.
In the European Flood Alert System (EFAS) a Bayesian Forecast System has been implemented in order to derive the overall predictive probability distribution. The EFAS is driven by different numerical weather prediction systems like the deterministic forecasts from the German Weather Service and from the ECMWF, as well as Ensemble Prediction Systems from the ECMWS and COSMO-LEPS.
In this study the effect of combining these different forecast systems in respect of the total predictive uncertainty are investigated by applying different weighting methods like the Non-homogenous Gaussian Regression (NGR) model, the Bayesian Model Averaging (BMA) and an empirical method. Besides that different methods of bias removal are applied, namely additive and regression based ones, and the applicability in operational forecast is tested.
One of the problems identified is the difficulty in optimizing the weight parameters for each lead-time separately resulting in highly inconsistent forecasts, especially for regression based bias removal methods. Therefore in operational use methods with only sub-optimal skill score results, could be preferable showing more realistic shapes of uncertainty bands for the predicted future stream-flow values. Another possible approach could be the optimization of the weighting parameters not for each lead-time separately, but to look at different levels of aggregations over expanding windows of time ranges.
First results indicate the importance of the proper choice of the model combination method in view of reliability and sharpness of the forecast system.