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Building a multi-model flood prediction system with the TIGGE archive

Ervin Zsoter (1), Florian Pappenberger (1), Paul Smith (1), Rebecca E. Emerton (1,2)
(1) ECMWF, Reading, UK, (2) Department of Geography and Environmental Science, University of Reading, UK

Operational probabilistic flood forecasts have become common in supporting decision-making processes and providing a platform to risk reduction. Ensemble forecasts can assess uncertainty, but they are limited to the uncertainty in a specific modelling system. The multi-model approach provides a platform for more complete representation of the uncertainty and also potential reduction of the predictive error.
In this study we present aspects of building a multi-model hydro-meteorological forecasting system using multiple atmospheric reanalysis datasets for river initial conditions and multiple TIGGE ensemble forcing inputs to the ECMWF land-surface model. We also analyse the impact of the post-processing required to run a multi-model system on the forecasts. The findings can be summarised in three groups highlighting the value of the TIGGE archive for river discharge forecasting:
(i) The impact of replacing or altering the input variables to fit the system requirements is small and as such, allows the use of variables from the TIGGE archive for this hydrological study.
(ii) The multi-model average historical discharge provides a very valuable source of uncertainty and a general gain in skill.
(iii) The quality of the raw TIGGE discharge forecasts has been shown to be low, which is mainly determined by the limited performance of the reanalysis-driven historical river conditions. Significant improvements in the forecast distribution can be produced through the use of different bias corrections on the TIGGE model discharge, or on the combination of the forecast models. However, the combination of techniques used has a big impact on the improvement observed, with the Bayesian Model Averaging providing the highest skill.