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Evaluation of ensemble streamflow predictions of the European Flood Awareness System (EFAS)

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In operational hydrological forecasting systems, improvements are directly related to the continuous monitoring of the forecast performance. An efficient evaluation framework must be able to spot issues and limitations and provide feedback to the system developers. In regional systems, the expertise of analysts on duty is a major component of the daily evaluation. On the other hand, large scale systems need to be complemented with semi-automated tools to evaluate the quality of forecasts equitably in every part of their domain.
This work presents the current status of the monitoring and evaluation framework of the European Flood Awareness System (EFAS). Twice per day, EFAS performs hydrological simulation of ensemble weather predictions over Europe and detects river sections where forecast streamflow is likely to exceed flood warning thresholds in the coming days. In each 5x5 km2 grid point of the European river network, 10-day ensemble streamflow predictions driven by ECMWF weather forecasts are evaluated against a reference simulation which uses observed meteorological fields as input to a calibrated hydrological model. Performance scores are displayed spatially on maps and plotted against their forecast lead time, basin size, as well as in time, considering average scores for 12-month moving windows of forecasts. Results indicate skillful predictions in medium to large river basins over the 10-day range. An evaluation of 12-month average scores over the past 5 years suggests a moderate improvement for all 12-month forecasts ending from the beginning of 2013 onwards. Such improvement occurred notwithstanding an increasing negative forecast bias in mountain regions. On average, performance drops significantly in river basins with upstream area smaller than 300 km2, due to resolution issues and to the underestimation of the runoff in mountain areas. On the other hand, performance in rivers with large upstream area (i.e. 10,000 km2 and above) shows highly positive skill and little bias for the entire forecast range, thanks to a combination of skillful input weather predictions and to the delay between precipitation and runoff, which is in the order of few days in large European river basins. Model limitations and recommendations to improve the evaluation framework are also discussed.