



Seasonal hydrological ensemble forecasts over Europe

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Seasonal forecasts have an important socio-economic value in hydro-meteorological forecasting. The applications are for example hydropower management, spring flood prediction and water resources management. The latter includes prediction of low flows, primordial for navigation, water quality assessment, droughts and agricultural water needs. Traditionally, seasonal hydrological forecasts are done using the observed discharge from previous years, so called Ensemble Streamflow Prediction (ESP). With the recent increasing development of seasonal meteorological forecasts, the incentive for developing and improving seasonal hydrological forecasts is great.

In this study, a seasonal hydrological forecast, driven by the ECMWF's System 4 (SEA), was compared with an ESP of modelled discharge using observations. The hydrological model used for both forecasts was the LISFLOOD model, run over a European domain with a spatial resolution of 5 km. The forecasts were produced from 1990 until the present time, with a daily time step. They were issued once a month with a lead time of seven months. The SEA forecasts are constituted of 15 ensemble members, extended to 51 members every three months. The ESP forecasts comprise 20 ensembles and served as a benchmark for this comparative study.

The forecast systems were compared using a diverse set of verification metrics, such as continuous ranked probability scores, ROC curves, anomaly correlation coefficients and Nash-Sutcliffe efficiency coefficients. These metrics were computed over several time-scales, ranging from a weekly to a six-months basis, for each season. The evaluation enabled the investigation of several aspects of seasonal forecasting, such as limits of predictability, timing of high and low flows, as well as exceedance of percentiles. The analysis aimed at exploring the spatial distribution and timely evolution of the limits of predictability.