

Identification of the drivers controlling the seasonal hydrological forecasting skill in Europe

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Abstract:

Recent advances in understanding and forecasting of climate have led into skilful meteorological predictions, which can consequently increase the confidence of hydrological prognosis. There is currently a need to understand the large European river systems and make practical use of seasonal hydrological forecasts. In here, we analyse the seasonal predictive skill along Europe's hydro-climatic gradient using the pan-European E-HYPE v3.0 multi-basin hydrological model. Both model state initialisation (level in surface water, i.e. reservoirs, lakes and wetlands, soil moisture, snow depth) and provision of climatology are based on forcing input derived from the WFDEI product for the period 1979-2010. An ensemble of re-forecast forcing data (daily mean precipitation and temperature for the period 1981-2010) from ECMWF's System 4 (15 members initialised every month) are firstly bias corrected using a modified version of the Distribution Based Scaling (DBS) method to account for drifting conditioning the bias correction on the lead month, and further used to drive E-HYPE. The predictive skill of river runoff based on ECMWF and climatology for the European basins is assessed on monthly timescales. Seasonal re-forecasts are evaluated with respect to their accuracy against impact variables, i.e. streamflow, at different space and time-scales; the value of the predictions is assessed using various (deterministic and probabilistic) performance metrics. We analyse the skill across the about 35000 subbasins which represent various climatologies, soil-types, land uses, altitudes and basin scales within Europe. We finally use the Classification and Regression Trees (CART) analysis to link the gain in the seasonal skill to physiographic-climatic characteristics and meteorological skill, in order to suggest possible model improvements.

Keywords:

Seasonal hydrological forecasting; E-HYPE; ensemble seasonal forecasts; pan-European scale