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Skill of a global seasonal ensemble streamflow forecasting system

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Forecasting of water availability and scarcity is a prerequisite for managing the risks and opportunities caused by the inter-annual variability of streamflow. Reliable seasonal streamflow forecasts are necessary to prepare for an appropriate response in disaster relief, management of hydropower reservoirs, water supply, agriculture and navigation. Seasonal hydrological forecasting on a global scale could be valuable especially for developing regions of the world, where effective hydrological forecasting systems are scarce.

In this study, we investigate the forecasting skill of the global seasonal streamflow forecasting system FEWS-World, using the global hydrological model PCR-GLOBWB. FEWS-World has been setup within the European Commission 7th Framework Programme project Global Water Scarcity Information Service (GLOWASIS). Skill is assessed in historical simulation mode as well as retroactive forecasting mode.

The assessment in historical simulation mode used a meteorological forcing based on observations from the Climate Research Unit of the University of East Anglia and the ERA-40 reanalysis of the European Center for Medium-Range Weather Forecasts (ECMWF). We assessed the skill of the global hydrological model PCR-GLOBWB in reproducing past discharge extremes in 20 large rivers of the world. This preliminary assessment concluded that the prospects for seasonal forecasting with PCR-GLOBWB or comparable models are positive. However this assessment did not include actual meteorological forecasts. Thus the meteorological forcing errors were not assessed. Yet, in a forecasting setup, the predictive skill of a hydrological forecasting system is affected by errors due to uncertainty from numerical weather prediction models. For the assessment in retroactive forecasting mode, the model is forced with actual ensemble forecasts from the seasonal forecast archives of ECMWF. Skill is assessed at 78 stations on large river basins across the globe, for all the months of the year and for lead times up to 6 months. The forecasted discharges are compared with observed monthly streamflow records using the ensemble verification measures Brier Skill Score (BSS) and Continuous Ranked Probability Score (CRPS).

The eventual goal is to transfer FEWS-World to operational forecasting mode, where the system will use operational seasonal forecasts from ECMWF. The results will be disseminated on the internet, and hopefully provide information that is valuable for users in data and model-poor regions of the world.