



## **Seasonal runoff forecasts for Europe: verification and sources of skill**

Wouter Greuell, Wietse Franssen, and Ronald Hutjes

Water Systems and Global change group, Wageningen University and Research, Wageningen, Netherlands  
(wouter.greuell@wur.nl)

This contribution deals with the skill of a physical model-based system built to produce probabilistic seasonal hydrological forecasts, applied here to Europe. The system basically consists of the Variable Infiltration Capacity (VIC) hydrological model forced with bias-corrected output of ECMWF's Seasonal Forecasting System 4. Our analyses focus on skill in runoff hindcasts determined with so-called pseudo-observations, i.e. with runoff data generated with VIC forced with historical meteorological observations (1981-2010; skill in discharge against true observations are available but beyond the scope of the present analyses). For specific parts of the year, hot spots of significant discrimination skill were identified in Fennoscandia, the southern part of the Mediterranean, Poland and northern Germany, Romania and Bulgaria, western France and the eastern side of Great Britain. Generally, the skill decreases with increasing lead time, except in spring in regions with snow-rich winters.

To explain the skill in runoff, we first analysed the meteorological forcing. Most importantly for runoff, the precipitation forecasts contain hardly any significant skill beyond the first lead month. Seasonal forecasts of temperature have more skill, which is partly related to climate warming. To explain the skill in runoff, we also performed a suite of specific hydrological hindcasts akin to Ensemble Streamflow Predictions (ESP), which each isolate a different source of skill. These hindcasts show that in Europe initial conditions of soil moisture form the dominant source of skill in runoff. From April to July, initial conditions of snow contribute significantly to the skill. The combination of specific hindcasts and pseudo-observations revealed several interesting features. The most noteworthy is that beyond the second lead month, full hindcasts with S4-forcing are less skilful than hindcasts with forcing without interannual variation (like ESPs) because the S4-forcing consists mainly of noise which enhances degradation of the skill.