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Contribution of potential evaporation forecasts to 10-day hydrological streamflow forecast skill

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It is generally agreed that precipitation and temperature forecast skill are dominant factors affecting streamflow forecast skill. Less attention is given to downward shortwave radiation that affects the evaporative flux in the hydrological models through the concept of potential evaporation. Many operational hydrological models use very simple approaches, such as monthly mean potential evaporation climatology, to deal with potential evaporation. However, current day satellite products make it possible to derive hourly and daily potential evaporation estimates on an operational basis. Here, we investigate the impact of potential evaporation forecasts on 10-day streamflow forecast skill for the Rhine Basin using a 20 year ECMWF reforecast from model Cycle 43r1 (Buizza et al. 2017).

We first present the forecast skill of the meteorological forcing precipitation, temperature, downward shortwave radiation and its derivative Makkink potential evaporation (de Bruin et al. 2016) across the Rhine basin by comparing them against gridded meteorological observations. Hourly gridded temperature and shortwave radiation estimates for the Rhine basin have been derived by van Osnabrugge et al. (2018) as part of this research.

Secondly, we show to what extend skill in potential evaporation forecasts translates into streamflow forecast skill by comparing simulations and forecasts made with both daily varying potential evaporation and with fixed monthly mean evaporation. To assess streamflow forecast skill, 10-day ahead forecasts are made with the wflow_hbv Rhine model. Skill metrics of both forcing and streamflow are calculated with the Ensemble Verification System (EVS) (Brown et al. 2010).

Last, we reflect how the findings on the above influence our perception of potential evaporation as hydrometeorological variable in operational medium-range streamflow forecasting.

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