Verification of seasonal hydrological forecasts for Europe with real and pseudo observations

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Within the framework of the EU-project EUPORIAS, seasonal forecasts of hydrological variables are produced for Europe with three hydrological models. We evaluated the skill of the forecasts made by two of the models, VIC and LPJmL, by analysing the model output from hindcasts (1981-2010), which were forced with ECMWF's System4 seasonal 15 output. The forcing was bias-corrected with a quantile-quantile method using the WFDEI data as reference. The latter data set was also employed as forcing for a so-called baseline simulation, which generated the initial conditions for the hindcast runs. Also, all output fields from the baseline run (e.g. runoff, discharge, evapotranspiration and soil moisture) served as so-called pseudo-observations for verification of the hindcasts. An asset of these pseudo-observations is the completeness of its spatial coverage. Probabilistic skill was determined with several metrics (correlation coefficient, ROC area and RPSS). For a lead time of two months we found several regions with significant skill that persisted during at least three target months, e.g. the southern part of the Mediterranean regions from June to August and southern Fennoscandia from April to June. These findings are hardly sensitive to the type of verification metric. We also found that for lead times beyond the first month, significant skill is mostly due to the initial conditions. Tailored experiments demonstrate the relative importance of snow and soil moisture. The hindcasts were also evaluated with real discharge observations (GRDC and EWA). Significant skill remains in specific regions and seasons but the skill found when using the pseudo-observations also diminishes in a number of cases. We analyse the differences between using pseudo and real observations and we discuss the advantages and limitations of both types of observations.