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Hydrological skill of different sources of PQPF: a case study on the French upper Rhone

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The most common way to produce probabilistic hydrological forecasts is to feed rainfall-runoff models with Probabilistic Quantitative Precipitation Forecast (PQPF). Yet, the specificities of the PQPF used as input are likely to impact the forecasting capacities of the issued probabilistic hydrological forecast. In order to highlight this effect, the performance of different PQPF for forecasting high flow events with lumped hourly ARX rainfall-runoff models is evaluated over 5 catchments (from 300 to 2000 km^2) of the French upper Rhone River. Both PQPF from the Ensemble Prediction System of ECMWF and NCEP (namely, ECMWF-EPS and GEFS) and PQPF from an analogy-based post-processing of the deterministic run of the ECMWF and the NCEP Numerical Weather Prediction models are considered. Verification is made over a large number of high flow events within the 2007-2014 period, with a focus on flow peaks, by separating forecasting performances on peak amplitude and peak timing and using CRPS and rank histograms. Verification is conducted against both simulated and observed streamflow, in order to separate the relative meteorological and hydrological uncertainty. Results obtained with different PQPF as input show very similar hydrological forecasting performances when averaged over the 5 basins. However, ensemble-based and analogue-based streamflow forecasts produce different signatures on peak events in terms of bias, spread and reliability. Their skill for generating reliable extreme events forecasts, as well as potential improvements that can be achieved by capitalizing on their complementarity are discussed.