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Impact of different sources of uncertainty on the quality of ensemble streamflow forecasts

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Studying the uncertainties in flood forecasting, quantifying and propagating them through the forecasting system can help to gain more information about the different sources of uncertainty that may affect the quality of the forecasts. Several questions can be investigated: what is the impact of different sources of uncertainty on the quality of the forecasts? Among all sources of uncertainty that stem from different components of the system, which sources significantly affect the forecasts? What methods can be used to efficiently quantify and propagate those uncertainties through a forecasting model? The aim of this research is to quantify and propagate different kinds of uncertainty sources that are expected to play a role in a flood forecasting system. In this research, an ensemble prediction system, based on a lumped hydrologic model, is applied at the daily time step to three catchments in France and for a period of about 4 years. We investigate the propagation of uncertainties from observed precipitation, forecast precipitation, observed discharge (used to update the hydrological model at the beginning of a forecast) and model parameters, which are acknowledged as important sources of uncertainty in hydrological modelling and forecasting. Uncertainties are individually quantified and then propagated through the forecasting system by multiplying the simulations. Results are assessed for lead times from 1 to 9 days through typical probabilistic scores. They highlight the importance of forecast precipitation uncertainty comparatively to the other sources of uncertainty investigated. Moreover, they also show the important contribution of discharge data uncertainty to improve forecast reliability of flow predictions, especially at shorter lead times when the influence of forecast updating is greater.