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How good are hydrologic uncertainty processors when forecasting high flows in an extrapolation context ?

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An increasing number of operational flood forecasting services assess and communicate the uncertainty associated with their forecasts. While getting reliable forecasts is key, it is a challenging task, especially when forecasting high flows in an extrapolation context, i.e. when the event magnitude is larger than what was met before. In this study, we present a “crash-testing” framework that aims at evaluating the operational quality of hydrological forecasts in an extrapolation context. This framework is used to evaluate the uncertainty bounds provided by hydrologic uncertainty processors. The experiment setup is based on i) a large set of 202 catchments in France, ii) the GRP rainfall-runoff model designed for flood forecasting and used by the French operational services and iii) an empirical hydrologic uncertainty processor designed to estimate conditional predictive uncertainty from the hydrological model residuals. The uncertainty processors used in this study differ in the data transformation they used (log, Box-Cox and log-sinh) to ensure heteroscedasticity. Different data subsets are selected based on a preliminary event selection. The probabilistic performance - reliability, sharpness and overall quality - of the hydrologic uncertainty processors is compared. Results show that the increase in statistical treatment complexity does not result in significant improvement in performance in extrapolation.