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Can Continental Models Convey Useful Seasonal Hydrologic Information at the Catchment Scale?

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Climatic variations can have a significant impact on a number of water-related sectors. Managing such variations through accurate predictions is thus crucial. Continental hydro-climate services have recently received attention to address various user needs. However, predictions for months ahead can be limited at catchment scale, highlighting the need for data tailoring. Here, we address how seasonal forecasts from continental services can be used to address user needs at the catchment scale. We compare a continentally-calibrated process-based model (E-HYPE) and a catchment-specific parsimonious model (GR6J) to forecast streamflow in a set of French catchments.

This work provides insights into UPH 20 (How can we disentangle and reduce model structural/parameter/input uncertainty in hydrological prediction?) by proposing a skill assessment framework that isolates gains from hydrological model forcings and forecast initialisation. Our results show that a good estimation of the hydrologic states, such as soil moisture or lake levels, prior to the prediction is the most important factor in obtaining accurate streamflow predictions in both setups. We also show that the spread in internal model states varies largely between the two systems, reflecting the differences in their setups and calibration strategies, and highlighting that caution is needed before extracting hydrologic variables other than streamflow.

This work also provides insights into UPH 21 (How can the (un)certainty in hydrological predictions be communicated to decision makers and the general public?). Despite the expected high performance from the catchment setup against observed streamflow, the continental setup can, in some catchments, match the catchment-specific setup for 3-month aggregations and when looking at statistics relative to model climatology, such as anomalies. Nevertheless, differences in the setups can result in different uncertainties for variables such as soil water content.