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Using seasonal forecasts in a drought forecasting system for water management: case-study of the Arzal dam in Brittany

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The Arzal dam is located at the outlet of the Vilaine River basin (10,000 km2) in Brittany, France. It controls a reservoir (50 hm3) managed for multiple water uses: drinking water, flood control, irrigation, sailing and fish by-passing. Its location in the estuary creates a physical divide between upstream freshwater and downstream saline water. The reservoir thus plays an essential role in the regional water management system. Its operational management during the summer season poses several challenges, mainly related to the quantification of future water inflows and the risks of having restricted water availability for its different uses. Indeed, the occurrence of severe drought periods between May and October may increase the risk of salt intrusion and drinking water contamination due to lock operations. Therefore it is important to provide decision-makers with reliable low-flow forecasts and risk-based visualization tools, which will support their choice of the best strategy for allocation of water among different users and stakeholders.

This study focuses on an integrated hydro-meteorological forecasting system developed to forecast low flows upstream the Arzal dam and based on a lumped hydrological model. Medium-range meteorological forecasts from the ECMWF ensemble prediction system (51 scenarios up to 9 days ahead) are combined with seasonal meteorological forecasts also from ECMWF to provide extended streamflow forecasts for the summer period. The performance of the forecasts obtained by this method is compared with the performance of two benchmarks: (i) flow forecasts obtained using an ensemble of past observed precipitation series as precipitation scenarios, i.e. without any use of forecasts from meteorological models and (ii) flow forecasts obtained using the seasonal forecasts only, i.e. without medium-term information. First, the performance of ensemble forecasts is evaluated and compared by means of probabilistic scores. Then, a risk-based visualisation tool was set up to assess whether the different ensembles can forecast past drought risks. The tool is designed to support decision-making in situations that may potentially be a source of conflict between stakeholders and users by characterising future events in relation to past observed extremes. Results are presented and the capacity of the system to provide useful information in an operational context is discussed.

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