Assessing the skill of seasonal meteorological forecast products for predicting droughts and water scarcity in highly regulated basins

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Drought and water scarcity are important issues in Southern Europe and many predictions suggest that their frequency and severity will increase over the next years, potentially leading to negative environmental and socio-economic impacts. This work focuses on the Jucar river basin, located in the hinterland of Valencia (Eastern Spain), which is historically affected by long and severe dry periods that negatively impact several economic sectors, with irrigated agriculture representing the main consumptive demand in the basin (79%).

Monitoring drought and water scarcity is crucial to activate timely drought management strategies in the basin. However, most traditional drought indexes fail in detecting critical events due to the large presence of human regulation supporting the irrigated agriculture. Over the last 20 years, a sophisticated drought monitoring system has been set up to properly capture the status of the catchment by means of the state index, a weighted linear combination of twelve indicators that depends on observations of precipitation, streamflow, reservoirs' storages and groundwater levels in representative locations at the basin.

In this work, we explore the possibility of predicting the state index, which is currently used only as a monitoring tool, in order to prompt anticipatory actions before the drought/water scarcity event starts. In particular, we test the forecasting skill of retrospective seasonal meteorological predictions from the European Centre for Medium-range Weather Forecasts (ECMWF) System 4. The 7-months lead time of these products allows predicting in February the values of the state index until September, thus covering the entire agricultural season. Preliminary results suggest that the Sys4-ECMWF products are skillful in predicting the state index, potentially supporting the design of anticipatory drought management actions.