Title

WATER4CAST- integrated Forecasting System for Water and the Environment

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Abstract

Forecast-informed decision-making has been proven to improve water management. However, the practical implementation of such systems need to account for a wide range of processes and variables with the proper spatiotemporal resolution at the regional and local levels (meteorological, hydrological, agronomic, reservoir management and ecosystems). Furthermore, forecasts need to cover all the relevant temporal scales, from short-term to subseasonal to seasonal, to ensure an integrated approach including from quick emergency responses to strategic operational decisions.

In this regard, the project "Integrated Water and Environmental Forecasting System (WATER4CAST)" develops an innovative visual decision support system (VDSS) to enable forecast-informed decision-making in the Jucar River Basin (Spain) covering the above processes (https://water4cast-app.upv.es/). The VDSS offers short-term (15 days), subseasonal (8 weeks) and seasonal (6-7 months) forecasts. It includes meteorological (temperature, precipitation, solar radiation, wind), hydrological (streamflow, soil moisture, reservoir inflows), agronomic (potential evapotranspiration, irrigation needs), environmental (habitat for native fish species) and water resource management variables (stored volumes, reservoir releases) and indicators (drought and fire risk). Short-term meteorological forecasts come from the NOAA GFS, while subseasonal predictions are obtained from the NOAA CFS. On the contrary, a multi-model approach is adopted to acknowledge uncertainty in seasonal forecasts, employing predictions from the Copernicus Climate Change Service (C3S). All raw forecasts are post-processed to correct biases, ensuring their fit to the local climatic patterns of the Jucar River Basin using artificial intelligence (fuzzy logic). Hydrological forecasts are provided by the fully-distributed eco-hydrological model TETIS, properly calibrated and validated for the Jucar. Agronomic forecasts rely on FAO56 agronomic models are tailored to the irrigated areas of the Jucar with the support of remote sensing. Ecosystem forecasts employ fish habitat models that relate streamflows to suitable habitat of native species. Finally, reservoir operation forecasts are provided by a water resource management model whose operating rules are defined using fuzzy rule-based systems.

The VDSS consists of two parts: a public part and a private part available to specific users on request for selected variables considered sensible. The VDSS was co-developed with the users of stakeholders of the Jucar River Basin to ensure they account for their needs.

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