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Seasonal hydrological forecasts for Australia – applications in agriculture and water management

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Hydrological extremes, including droughts or floods, can have devastating effects on many aspects of human societies and the natural environment (IPCC, 2012). Seasonal ensemble forecasts of hydrological indicators could help adapt to and increase the resilience towards hydroclimatic variability and extremes by providing the opportunity to optimise decisions in advance and prepare for potentially harmful events. The ability to forecast hydrological variables several months ahead would be beneficial for many sectors, including agriculture, water management, bushfire risk assessments, emergency services and infrastructure.

The Bureau of Meteorology has developed a high-resolution national seasonal ensemble forecasting system for soil moisture, evapotranspiration and runoff across Australia, using a gridded water balance model (AWRA-L) forced with downscaled and calibrated seasonal climate forecasts from the Bureau's ACCESS-S1 system.

In this presentation, we evaluate the hydrological forecasts relative to a historical reference simulation forced with observed climate inputs using hindcasts for the period 1990-2012. The forecasts were evaluated in terms of deterministic skill using the ensemble mean as well as probabilistically, assessing the accuracy and reliability of the forecast ensemble, with a specific focus on forecasts of hydrological extremes. Additionally, we assess the performance of the hindcast for selected use cases, particularly focusing on agriculture and water management, focusing on the Australian wheatbelt and major urban and rural water supply catchments.

Overall, we conclude that the forecasting system shows sufficient skill for a wide range of applications and regions. We outline limitations of the presented system and highlight potential future research directions.