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Multi-model assessment of hydrologic impacts of climate change in a small Mediterranean basin

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Assessing the hydrologic impacts of climate change is of great importance in the Mediterranean region, which is characterized by high precipitation variablitity and complex interactions within the water cycle. In this work we focus on the hydrological response of the Rio Mannu catchment, a small basin located in southern Sardinia (Italy) and characterized by a semi-arid climate. Specifically, we investigate inter-model variability and uncertainty by comparing the results of five distributed hydrologic models, namely CATchment HYdrology (CATHY), Soil and Water Assessment Tool (SWAT), TOPographic Kinematic APproximation and Integration eXtended (TOPKAPI-X), TIN-based Real time Integrated Basin Simulator (tRIBS), and WAter flow and balance SIMulation (WASIM), that differ greatly in their representation of terrain features, physical processes, and numerical complexity. The hydrological models were independently calibrated and validated on observed meteorological and hydrological time series, and then forced by the output of four combinations of global and regional climate models (properly bias-corrected and downscaled) in order to evaluate the effects of climate change for a reference (1971-2000) and a future (2041-2070) period. Notwithstanding their differences, the five hydrologic models responded similarly to the reduced precipitation and increased temperatures predicted by the climate models, and lend strong support to a future scenario of increased water shortages. The multi-model framework allows estimation of the uncertainty associated with these hydrologic simulations and this aspect will also be discussed.