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Multiscale water accounting under climate change in a transboundary West African basin

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Water accounting frameworks assess water availability and consumption of various users and are key tools to inform decision and policy making for integrated water resources management. This study presents a modelling framework that integrates a spatially explicit hydrological model and climate change scenarios with the Water Accounting Plus (WA+) tool to anticipate future water resource challenges and provide mitigation measures. The fully distributed mesoscale Hydrologic Model (mHM), spatially calibrated with multiple satellite remote sensing products, is used to predict water fluxes, stocks and flows in the transboundary Volta River basin (VRB) in West Africa. The mHM model is forced with a large ensemble of climate change projection data from eleven general circulation models (GCMs) downscaled by four regional climate models (RCMs) under the representative concentration pathway RCP8.5, obtained from CORDEX-Africa. Outputs from mHM are used as inputs to the WA+ framework to report on the state and trends of water resources over the historical baseline period 1991-2020 and the near-term future 2021-2050. The basin-scale WA+ reporting is reinforced with a multi-scale summary of water accounts across spatial domains including four climatic zones, four sub-basins and the six riparian countries.

The long-term multi-model ensemble mean of the net inflow to the basin is found to be 419 km^3/year with an inter-annual variability of 11%, and is projected to slightly increase in the near-term future (2021-2050), due to the increase in rainfall, thereby highlighting the need for adaptation strategies to optimize the water-energy-food-ecosystem nexus in the VRB.