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Combined impacts of climate and land-use change on future water resources in Africa

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Africa depends on its water resources for hydroelectricity, inland fisheries, and water supply for domestic, industrial, and agricultural operations. Anthropogenic climate change (CC) has changed the state of these water resources. Land use and land cover has also undergone significant changes due to the need to provide resources to a growing population. Yet, the impact of the Land Use and Land Cover Change (LULCC) in addition to CC on the water resources of Africa is underexplored. Here we investigate how precipitation, evapotranspiration (ET), and river-flow respond to both CC and LULCC scenarios across the entire African continent. We set up a SWAT+ model for Africa and calibrated it using the Hydrological Mass Balance calibration (HMBC) methodology detailed in Chawanda et. al., (2020). The model was subsequently driven by an ensemble of bias-adjusted global climate models to simulate the hydrological cycle under a range of CC and LULCC scenarios. The results indicate that the Zambezi and the Congo River basins are likely to experience reduced river flows under CC by up to 7% decrease, while the Limpopo will likely have higher river flows. The Niger River basin is likely to experience the largest decrease in river flows in all of Africa due to CC. The Congo River basin has the largest difference in river flows between scenarios with (over 18%% increase) and without LULCC (over 20% decrease). The projected changes have implications on agriculture and energy sectors and hence the livelihood of people on the continent. Our results highlight the need to adopt policies to halt global greenhouse gas emissions and to combat the current trend of deforestation to avoid the high combined impact of CC and LULCC on water resources in Africa.