Assessing Current and Future Water Resource Availability in the Sanaga Catchment: Insights from the Mbakaou and Bamendjing Sub-Basins

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ABSTRACT

Reliable assessment of water availability and its future evolution is essential for Sub-Saharan Africa, where climate-induced hazards such as droughts and floods pose significant threats to fragile economies. This study focuses on the Mbakaou and Bamendjing sub-basins of the Sanaga River to quantify current water resources and project changes under two future periods: near-term (2024–2035) and mid-term (2036–2050). The Soil and Water Assessment Tool (SWAT) was employed for hydrological modeling. Calibration and validation results indicate robust model performance, with R^2, NSE, and KGE values exceeding 0.68 and biases within ±10%. Spatial analysis revealed that infiltration (GW_RCH), streamflow (FLOWS), water yield (WYLD), and sediment load (SED) are highest in midstream areas of both sub-basins, whereas surface runoff is lowest in these regions. Evapotranspiration was generally higher in the eastern parts of the basins. Four global and regional climate models were used to project future water availability: CCCMA, REMO, HIRHAM5, and RCA4. Statistical evaluation of the historical period (2001–2005) identified REMO as the most reliable model. It projects reductions in precipitation and streamflow of up to 19% and 31%, respectively, under both RCP4.5 and RCP8.5 scenarios, regardless of the future period considered. Climate variability (CV) emerged as the primary driver of future flow dynamics, given that land-use and land-cover (LULC) changes are expected to be minimal. These findings indicate potential stress on water resources in the Sanaga catchment and underscore the need for proactive water management strategies. The results provide valuable guidance for regional planning and can inform policy measures aimed at mitigating the impacts of climate variability on hydrological systems in tropical river basins. Central Africa, Sanaga river basin, SWAT, regional climate models, climate variability, land use and land cover change

Keywords: Sanaga river basin, SWAT, regional climate models, climate variability, land use and land cover change.