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Evaluating the Technical Performance of the Koga and Gomit Reservoirs in the Blue Nile under Existing Conditions and Possible Climate Change

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Abstract

The aim of this study was to evaluate the possible impacts of climate change on surface water storage (*i.e.* the Koga (83.1 Mm^3) and Gomit (0.74 Mm^3) reservoirs) in the Blue Nile basin. Daily rainfall runoff modelling and reservoir simulation was conducted using HEC-HMS. The performance of the reservoirs was evaluated in terms of reliability, resilience and vulnerability (RRV) criteria under both existing and hypothetical future climate conditions. A digital elevation model of the study area was used to extract the physical characteristics of watersheds using Arc-GIS, Arc-Hydro and HEC-GeoHMS. Simulation of inflow to each reservoir was conducted using input data of rainfall, evaporation, watershed characteristics and reservoir water releases. After calibrating the model, the Koga and Gomit reservoirs were simulated on a daily time-step for 20 and 10 years of historical data respectively. This was done, to determine the availability of water to meet irrigation, hydropower (only Koga) and environmental flow requirements. Under historic conditions RRV values for Koga were 0.992, 0.037 and 37 respectively and for Gomit 0.95, 0.0324, and 71 respectively. Differences between the two reservoirs reflect differences in the ratio of storage to mean annual inflow. Previous studies indicate that future rainfall changes in the area are likely to lie within range of -20 % to +20 %. Hence, the effect of hypothetical rainfall changes within this range, were determined. Simulation results indicate that the RRV values at Koga varied from 0.968, 0.02, and 64 to 1, 1 and 0. Similarly at Gomit they varied from 0.874, 0.0164, and 88 to 0.979, 0.055, and 44. The RRV criteria provide an indication of how the technical performance of reservoirs maybe affected by climate change and so provide a starting point for building climate change into dam planning and management.

Keywords: Blue Nile, climate change, HEC-HMS, model performance, reservoir RRV

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