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# EVALUATION OF CLIMATE CHANGE IMPACT ON BLUE NILE BASIN CASCADE RESERVOIR OPERATION

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## ABSTRACT

This study mainly deals with evaluation of climate change impact on Blue Nile basin cascade reservoir operation in particular to Beko-Abo, Mandaya and Border reservoirs, which are proposed cascade hydropower development on main stream of Abbay river basin. To evaluate the impact of climate change, climate change scenario of evapotranspiration & precipitation were developed for three period using output of ECHAM5 with RCM for A1B emission scenario was used to develop the future climate change scenario. A hydrological model,HEC HMS,was used in order to simulate the current and future inflow volume to the reservoirs.The performances of the model was assessed through calibration and validation process and resulted NSE from 0.74 to 0.88 during calibration and from 0.71 to 0.84 during validation at the four gauge stations. The projected future climate variable shows an increasing trend for both maximum and minimum temperature and evapotranspiration but precipitation shows fluctuating trend in the next century. Relative to the current condition, the average annual open water evaporation for Beko-Abo reservoir might increase by 4.02% and 5.934%, for Mandaya reservoir it might also increase by 8.11% and 10.23% and for Border reservoir also shows an increase of 8.68% and 17.05% in 2011-2026 and 2026-2041 scenarios respectively. Comparison to the base period and the future period average annual inflow volume shows an increase of 9.05% and 6.04% at Beko-Abo and an increase of 7.17% and 4.39% at Mandaya during 2011 2026 and 2026 2041 periods respectively and at Border reservoir a decrease of 12.29% during 2011 2026 and 14.55% during 2026 2041 periods. .The averageannual power generation using HEC ReSim might increase by 1.53% and 1.11% at Beko Abo and might alsoincrease by 2.56% and 1.47% at Mandaya hydropower station during 2011 2026 and 2026-2041 periods respectively. For Border hydropower station, the average annual power generation might decrease by 0.95% and 2.91% for both periods in comparison to the base period.

On average the time based and volumetric reliability of the reservoirs estimated to be more than 90% .The resilience of the reservoirs is below 50% and their vulnerability is less than 50%. Therefore, these performance indices reveals good performance of the reservoirs except the speed of recovery of the reservoir from failure because the reservoir will not able to recover rapidly from failure to safe state.

**KEYWORDS:** Climate Change, RCM, CLM, Reliability, Resilience, Vulnerability, Blue Nile, Beko-Abo, Mandaya, Border, HEC-HMS, HEC-Ressim, Reservoir Operation