INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: **CLTMATE CHANGE IMPACTS on HYDROLOGICAL PROCESSES and WATER DEMAND SCENARIO in the WEYIB RTVER BASIN, SOUTHEASTERN ETHIOPIA**

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SHORT ABSTRACT

The main objective of this study was to investigate the spatiotemporal variation of current and projected hydrological processes, water demand and water availability under changing climate and increasing population in the Weyib River basin in Ethiopia. The impact of climate change on the temperatures and rainfall characteristics of the basin has been investigated using GFDL-ESM2M, CanESM2, and GFDL-ESM2G models output for the RCP2.6, RCP4.5, and RCP8.5 scenarios from coupled model inter-comparison project 5 (CMIP5). The SDSM calibrated and validated using the observed daily data of twelve meteorological stations was used to generate the future scenarios. The ArcSWAT hydrologic model calibrated and validated using the observed daily streamflow data for historical time period was employed to projected future hydrological processes and hence to evaluate water availability. Current and projected population of the basin is considered to estimate the annual water demand thereby status of water resources need of the basin was estimated based on water stress index analysis.

Results revealed that the mean annual maximum and minimum temperature, and rainfall have shown statistically significant (at 5% significant level) increasing trend in all the nine ESM-RCP scenarios in the 2020s 2050s and 2080s time slices. The variability of both temperatures and rainfall is higher in all ESMs of RCP8.5 than RCP4.5 and RCP2.6. The mean annual actual evapotranspiration, ground water contribution to the streamflow (baseflow), percolation, soil water content and water availability in the stream have been found to increase for all the nine ESMs-RCP scenarios in the entire basin and in all the sub-basins. However, surface runoff and potential evapotranspiration have shown a decreasing trend. The future (mean of 3 ESMs) total annual water availability in the basin is observed to increase ranging from 15.04 to 21.61%, 20.08 to 23.34% and 16.21 to 39.53% by the 2020s, 2050s and 2080s time slice respectively from the available water resources (2333.39 Mm^3) of the base period. Sub-basin level analysis has shown that the annual, seasonal and monthly variations of hydrological processes in all the six sub-basins are similar in terms of direction but different in magnitude as compared to that of the entire basin analysis. Analysis has also revealed that the future total annual water demand of the basin will increase by 83.47% after 15 years, 200.67% after 45 years and 328.78% after 75 years, i.e., by the 2020, 2050 and 2080 respectively from the base period water demand of 289 Mm^3. The current water availability per capita per year of the basin is about 3112.23 m^3 and tends to decline ranging from 11.78 to 17.49%, 46.02 to 47.45% and 57.18 to 64.34% by the 2020s, 2050s and 2080s respectively from base period per capita per year water availability. This indicated that there is a possibility that the basin may face water stress condition in the long term. Net water availability tends to decrease in all months on the dry season this might cause water scarcity in the lowland region, and greater increase of water availability in intermediate and rainy seasons this might cause flooding to some flood prone region of the basin. Since the variation of net water availability among the six sub-basins in upcoming period is high, there is a scope of meeting agriculture water demand through water transfer from sub-basin having more available water in small area to the sub-basin having less available water in a larger agricultural area.