

Assessment of Climate Change Impacts on the Hydrology of Upper Guder Catchment, Upper Blue Nile

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Abstract : Climate changes alter regional hydrologic conditions and results in a variety of impacts on water resource systems. Such hydrologic changes will affect almost every aspect of human well-being. The goal of this paper is to assess the impact of climate change on the hydrology of Upper Guder catchment located in northwest of Ethiopia. The GCM derived scenarios (HadCM3 A2a & B2a SRES emission scenarios) experiments were used for the climate projection. The statistical downscaling model (SDSM) was used to generate future possible local meteorological variables in the study area. The down-scaled data were then used as input to the soil and water assessment tool (SWAT) model to simulate the corresponding future stream flow regime in Upper Guder catchment of the Abay River Basin. A semi distributed hydrological model, SWAT was developed and Generalized Likelihood Uncertainty Estimation (GLUE) was utilized for uncertainty analysis. GLUE is linked with SWAT in the Calibration and Uncertainty Program known as SWAT-CUP. Three benchmark periods simulated for this study were 2020s, 2050s and 2080s. The time series generated by GCM of HadCM3 A2a and B2a and Statistical Downscaling Model (SDSM) indicate a significant increasing trend in maximum and minimum temperature values and a slight increasing trend in precipitation for both A2a and B2a emission scenarios in both Gedo and Tikur Inch stations for all three bench mark periods. The hydrologic impact analysis made with the downscaled temperature and precipitation time series as input to the hydrological model SWAT suggested for both A2a and B2a emission scenarios. The model output shows that there may be an annual increase in flow volume up to 35% for both emission scenarios in three benchmark periods in the future. All seasons show an increase in flow volume for both A2a and B2a emission scenarios for all time horizons. Potential evapotranspiration in the catchment also will increase annually on average 3-15% for the 2020s and 7-25% for the 2050s and 2080s for both A2a and B2a emissions scenarios.

Keywords : climate change, Guder sub-basin, GCM, SDSM, SWAT, SWAT-CUP, GLUE

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