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Climate Change Impact Assessment on Soil Water Availability and Crop Yield in Blue Nile Basin: Case Study Anjeni Watershed, Ethiopia

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Abstract

General Circulation Models (GCMs), currently the most advanced tools for estimating future climate change scenarios, operate at coarse (typically 0.5o) resolutions. Downscaling of GCM output is necessary to assess the impact of climate change on local water management activities. This study was conducted to quantitatively assess variations of water availability and crop production under different climate change scenarios in the Anjeni watershed. This watershed (113.4 ha) is located in Northern Ethiopia at 37°31'E / 10°40'N. Within the watershed terracing is a common soil and water conservation practice.

In order to estimate possible climate change impacts on water availability and crop production within the watershed, climate change scenarios of precipitation and temperature were developed for the South Gojam sub basin, an area of 16,762km^2, in which the watershed is located. The outputs of HadCM3 coupled atmosphere-ocean GCM model for the SRES A2 and SRES B2 emission scenarios were used to produce scenarios for the period 2011 to 2070. These outputs were downscaled to the watershed scale through the application of the Statistical Downscaling Model (SDSM). Results indicated that for both scenarios there is an overall increasing trend in annual temperature, the A2 scenario showing high increment relative to B2 scenario and significant variation of monthly and seasonal precipitation (*i.e.* decrease in average Kiremt precipitation by about 9 and 7 % in 2020 and 6 and 5 % in 2050 for both A2 and B2 scenarios) from the base period (1984–2001). These changes in rainfall and temperature were used with the Soil Water Assessment Tool (SWAT) hydrological model to simulate future water availability and crop production. SWAT was calibrated with five years of monthly flow data (1986–1990) and then the model was rerun using the scenario data as input. The results indicate that for both scenarios there is an increasing trend in potential evapotranspiration as well as a reduction in the soil water content in the watershed.

The study investigate that due to combined effect of projected variation in seasonal rainfall and increase in temperature and then reduction in soil water content there will be overall variation in crop production in the watershed.

Keywords: Climate change, crop yield, SDSM, SWAT, water availability

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