ASSESSMENT OF HYDROLOGICAL RESPONSE UNDER CLIMATE CHANGE SCENARIOS USING SWAT MODEL- A CASE STUDY OF SINA CATCHMENT, INDIA

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ABSTRACT

This study implicates Geographical Information System (GIS) and hydrological modelling tools, namely, Soil and Water Assessment Tool (SWAT), to various scenarios of climate change such as the change in temperature and precipitation, to estimate the potential impact of climate change on annual water balance components like precipitation, evapotranspiration and water yield, in a typical catchment in the Sina Catchment, Bhima Basin, India. Discharge was also analyzed at the outlet point for validation of the model output. Sequential Uncertainty Fitting Program (SUFI-2) in SWAT- Calibration and Uncertainty Programs (SWAT-CUP) was used for automatic calibration. Model performance was evaluated using several statistical parameters, such as the Nash–Sutcliffe coefficient and the normalized objective function. For calibration (1981-85), R2 was obtained as 0.92 and for validation (1986-1990) it was 0.76. Similarly, NSE during calibration was 0.88 and during validation was obtained as 0.76. Calibration and validation results showed good agreement between simulated and observed data.

Hydrological Simulations were conducted for Base Line, A2 and B2 scenarios using HadRM3 data. The overall investigation carried out during this study indicates that the simulated Sina catchment is very sensitive to climatic variations. Precipitation trend is decreasing in A2 as compared to Base Line with slight overall increase whereas in B2 precipitation is increasing significantly. While only little changes can be observed in the rate of evapotranspiration, water yield is increasing drastically. The study of the discharge for a thirty year period under climate change scenarios showed that there was an increase in river discharge in future scenarios. Compared to the Base Line scenario (1961-1990), A2 and B2 scenarios (2071-2100) have much higher minimum and maximum annual discharges.

KEYWORDS: Climate change, Water Balance Component, SWAT Model, SWAT CUP, PRECIS, Flow analysis