

IMPACT OF CLIMATE CHANGE ON HYDROLOGICAL REGIME: A CASE STUDY OF MAHANADI BASIN

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ABSTRACT

Hydrological modeling is one of the important method to understand, simulate and monitor the hydrological processes and their space-time variability within the river basin. In future the biggest threat is climate change. Climate change will directly affect the entire hydrological regime. There is a possibility of increase in atmospheric water vapour, increase/decrease in precipitation amount, increase in precipitation intensity, increase in extreme events, reduction in snow/glacial cover area, which will ultimately lead to change in soil moisture, runoff, evapotranspiration and ground water recharge and increased risks of flooding and drought. There will be a significant reduction in snowmelt runoff and seasonal shift in streamflow due to decrease in snow/glacial cover because of increase in temperature (IPCC, 2008). Variable Infiltration Capacity (VIC) model is a macro scale hydrological model that is designed to represent surface energy and hydrological fluxes and regime at macro scale from large river basin to the entire globe over a grid mesh. It is grid based semi distributed hydrological model which quantifies the dominant hydrometeorological process taking place at land surface atmospheric interface. Typically grid resolution in VIC model is ranged from 1/8 to 2 degree. VIC computes the vertical energy and moisture flux in grid cell based on specification at each grid cell considering soil properties and vegetation coverage. Also it includes the representation of sub grid variability in soil infiltration capacity as well as in land cover. Runoff and base flow routed via a separate channel routing module to produce stream flow at a given point within the domain. The study area is the Mahanadi river basin covering 141,500 km² of area which is located in the state of Chattisgarh and

Orissa. The geographical location is within latitude and longitude of $19^{\circ}20'N \sim 23^{\circ}35'N$ and $83^{\circ}0'E \sim 86^{\circ}50'E$ respectively. VIC model was used to simulate the hydrological process in Mahanadi river basin and analysis were carried out of impact of climate change on stream flow pattern. The meteorological forcing, vegetation parameters and soil parameters were derived using remote sensing based product and other ancillary information. The projected climate change parameters were taken from NATCON, UNFCC. Main data used in the study are IRS-P6 AWiFs (Advanced Wide Field Sensor) for 2008, MODIS Leaf Area Index (MOD15A2.5), MODIS Albedo Product (MOD43B3.5), GTOPO 30 Digital Elevation Model, Soil map at scale 1:50,000, and hydro-meteorological data etc. The obtained results indicate that there is a increase in runoff by 13% and ET 6% approximately. This is attributed to increase in projected rainfall and temperature. However, it was found that base flow decreases which indicates a lesser ground water recharge. In other hand, VIC model input data were prepared based on the climate change scenarios for 2050 and response of hydrological processes to the climate change has been analyzed compared with the result of simulation for 2008.