STATISTICAL DOWNSCALING METHODS FOR ASSESSING FUTURE RAINFALL USING GCM OUTPUT

Sudhir Katkar
Graduate Student,
Department of Civil Engineering,
Indian Institute of Technology Bombay,
Powai, Mumbai - 400 076

Amandeep Gupta
Undergraduate Student, Department of Civil Engineering,
National Institute of Technology
Kurukshetra, Haryana.

Subimal Ghosh
Assistant Professor,
Department of Civil Engineering,
Indian Institute of Technology Bombay, Powai,
Mumbai - 400 076,

e-mail: subimal@civil.iitb.ac.in,

ABSTRACT

General Circulation Models(GCMS) are tools designed to simulate time series of climate variables globally, accounting for effects of greenhouse gases in the atmosphere. They attempt to represent the physical processes in the atmosphere, ocean etc. They are currently the most credible tools available for simulating the response of the global climate system to increasing greenhouse gas concentrations, and to provide estimates of climate variables(e.g. Mean sea level pressure, air temperature, geopotential height etc.) on a global scale. GCMs demonstrate a significant skill at continental and hemispherical spatial scales and incorporate a large proportion of the complexity of the global systems. They are however unable to represent local subgrid scale features and dynamics. Moreover, accuracy of GCMs, in general, decreases from climate related variables, such as wind, temperature, humidity and air pressure to hydrologic variables such as precipitation, evapotranspiration, runoff and soil

moisture, which are also simulated by GCMs. These limitations of the GCMs restrict the direct use of their output in hydrology. Downscaling, in the context of hydrology, is a method to project the hydrologic variables (e.g., rainfall and streamflow) at a smaller scale based on large scale climatological variables (e.g., mean sea level pressure) simulated by a GCM. Transfer function based statistical downscaling methods gain popularity among researchers because of their simplicity. In the present study linear regression, Artificial Neural Network and Support Vector Machine are used as transfer functions in downscaling. The results obtained from all these three methods are compared. Uncertainty resulting from the use of multiple downscaling methods is assessed. The proposed methodology is demonstrated with the prediction of monsoon rainfall in meteorological subdivision of North-East India.