**RAINFALL AND RUNOFF ESTIMATION USING HYDROLOGICAL MODELS**

**ABSTRACT**

Water is one of the most important natural resources and a key element in the socio-economic development of a State and Country. Water resources of the world in general and in India are under heavy stress due to increased demand and limitation of available quantity. Proper water management is the only option that ensures a squeezed gap between the demand and supply. Rainfall is the major component of the hydrologic cycle and this is the primary source of runoff. Worldwide many attempts have been made to model and predict rainfall behaviour using various empirical, statistical, numerical and deterministic techniques. They are still in research stage and needs more focussed empirical approaches to estimate and predict rainfall accurately. Various spatial interpolation techniques to obtain representative rainfall over the entire basin or sub-basins have also been used in the past. In the present work, estimation of mean rainfall over the Mahanadi basin lying in Odisha and its sub-basins has been done using different deterministic and geo-statistical methods including nearest neighbourhood, Spline, Inverse-distance weighting, and Kriging techniques. Different thematic maps for the study area have been developed for water resources assessment, planning and development analysis.

Further, rainfall generated runoff is very important in various activities of water resources development and management. The method of transformation of rainfall to runoff is highly complex, dynamic, nonlinear, and exhibits temporal and spatial variability. It is further affected by many parameters and often inter-related physical factors. Determining a robust relationship between rainfall and runoff for a watershed has been one of the most important problems for hydrologists, engineers, and agriculturists. Many approaches are being used to estimate runoff, in which the soil conservation service curve number (SCS-CN) method (SCS 1956) converts rainfall to surface runoff (or rainfall-excess) using a CN derived from watershed characteristics and 5-days antecedent rainfall is one. In this study, simulation and critical evaluation of daily runoff has been done using various rainfall-runoff models based on (a) existing SCS-CN Model: NEH (1954) with remote sensing data as input, MS model (2002), Michel model (2005), and Sahu Model (2007), and (b) proposed FD-PE model (2014), MM-SCS model (2014), and ANN-MLP model (2014) techniques.

It is understood that, the CN value for estimating runoff potential for planning purposes at watershed, sub-basin and basin level is often a policy decision. The available approaches utilize either daily, weekly, half-monthly or monthly data or average physical characteristics of watersheds. Derivation of Curve Numbers for 1-day, 2-day, 3-day, 4-day, 5-day, 6-day, 7-day, 10-day, 15-day, 20-day, 25-day and 30-day runoff data has been done in the present work and equations are derived to obtain curve numbers and estimate runoff.

Monthly data are very useful for the planning, development and management of available water resources. Development of SARIMA and MLP-ANN models for monthly rainfall forecasting for Mahanadi basin lying in Odisha and its sub-basins has been done. Further, application of forecasted model to predict monthly runoff and their performance evaluation using different error statistics and correlation coefficient is done.