Rainfall-runoff modelling for water availability study in Ken river basin using SCS-CN model and remote sensing approach

T. Thomas and R. K. Jaiswal

ABSTRACT

Estimation of runoff from a natural catchment is essentially required for the planning, management and evaluation of the available water resources. Much hydrologic research has been directed at understanding the hydrologic processes involved with the gauged watershed and applying this knowledge to predict the runoff values needed for the efficient water resources development and management.

Simulation of rainfall-runoff process for ungauged catchments is one of the important areas of modern research. All well established techniques like unit hydrograph technique, conceptual models and physically based modelling requires a certain amount of historical data for establishing various parameters. However, due to sparse gauging network available in most of the Indian catchments, particularly for small catchments, it becomes very difficult for such techniques to be directly applicable.

The water availability study for the Ken river system is proposed to be carried out in two parts. In this report an attempt has been made to evaluate the direct surface runoff in the smaller basins, where gauging sites are not available. In continuation of this work, the base flow components will be worked out using suitable models and flow duration curve techniques will be employed for assessing the dependable flows in these ungauged sub-basins.

In the present study as Part - I of the water availability study in Ken river basin, Rainfall - Runoff Modelling in the Sonar, Bearma and Bebas river basins which are the sub-basins of the Ken River system have been carried out using the SCS Curve Number model. This is a widely used hydrological model for calculating direct runoff from ungauged catchments, has been applied for calculating the runoff using rainfall and curve number (CN). The SCS curve number is a quantitative descriptor of the land use/land cover/soil complex characteristics of a watershed. The CN is an index that watershed runoff potential.

The latest technique of satellite remote sensing provides a real time and a reasonably accurate information of the prevailing land use patterns at a faster rate and less tedious way as compared to the conventional methods. In this study various land use classes have been interpreted using the IRS 1A, LISS-II satellite imageries. The large sub-basins of river Ken namely, Sonar and Bearma, has been further sub-divided into smaller basins and the runoff for each of these sub-basins have been computed, after establishing their respective SCS curve numbers. The runoff from these smaller sub-basins were summed up, taking the effect of the time lag , if any, and the discharges were predicted at the Garhakota G/D site on R. Sonar at the Gaisabad G/D site on river Bearma. These predicted runoff values at these gauging stations are quite in agreement with the available observed surface runoff, which implies that the sub-basin wise runoff estimation is satisfactory.