ABSTRACT

The eastern red soil region is one of the ten soil conservation regions of India selected for the present study. Fifty watersheds, five from Machkund, eight from Hirakud, twelve from Mayurakshi and twenty five from Damodar valley catchments of this region, are chosen for the present analyses. The time series data on annual runoff, sediment production rate and rainfall are collected and several geomorphic parameters are evaluated. Multicollinearity usually exists between these geomorphic parameters. Thus, principal component analysis and analytical rotations are applied to screen out the less significant parameters and regroup the remaining into physically significant components.

In order to develop deterministic hydrologic response models for prediction of mean annual runoff and SPR from small ungauged watersheds, multiple regression techniques are applied to regress these dependent non-dimensionalized parameters on the independent dimensionless parameters - annual rainfall and geomorphic parameters (one each from significant components at a time). In all, twenty four such combinations of data sets are used for this purpose. Same combinations are also tried using logarithmically transformed data sets and the best fit is selected on the basis of higher multiple correlation coefficient and greater F-test value.

Stochastic models to predict annual runoff at selected recurrence intervals or return periods are also developed in

the same way. Before taking up this analysis, the best fit probability distribution function of the region as two-parameter lognormal (LN2) distribution, is chosen on the basis of goodness of fit tests. The 95% upper and lower confidence limits are also calculated and modelled with respect to the same independent parameters in order to account for the uncertainties involved. It is concluded from the analyses that the dimensionally homogeneous and statistically optimal models developed under this study can conveniently be used to predict the said hydrologic responses from small ungauged watersheds knowing the average rainfall and evaluating the required geomorphic parameters.

KEY WORDS

Watershed
Drainage Basin
Catchment
Hydrologic Response
Mean Annual Runoff
Sediment Production Rate
Mean Annual Rainfall
Geomorphic Parameters
Principal Component Analysis
Analytical Rotations
Components
Factors
Parameters
Ungauged
Prediction
Multiple Regression
Deterministic Models
Priority Watershed
Relative Deviations
Homogeneity
Randomness
Probability Distribution Function
Stochastic Models
Uncertainties
Risk of Failure