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Rainfall Runoff Modelling of Morel Catchment for Design Flood Estimation

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ABSTRACT

The computations of flood hydrographs have always been one of the major concerns of the water resources engineers and scientists. Either the empirical, statistical or deterministic approaches have been quite often used for these purposes. Deterministic approach has the advantage over other two approaches as it provides complete shape of hydrograph.

For the purpose of rainfall-runoff process simulation, mathematical modelling is often resorted to. Continued research in this field has resulted in numerous types of rainfall-runoff models. For simulation and design flood evaluation, conceptual models and physically based models are widely used. The linearity principle of unit hydrograph theory has been widely applied for the simulation of rainfall-runoff process, particularly for small and medium sized catchments. For the gauged catchments the unit hydrographs can be derived by analysing the historical rainfall-runoff records. However, for ungauged catchments some indirect approaches have been used for the derivation of the unit hydrographs. Due to scarcity of data, particularly for small and medium sized catchments, physically based models are very difficult to be implemented. For these catchments, emphasis is either to use the regional information or to use the geomorphologic characteristics of the basin for estimation of floods. Geomorphological instantaneous unit hydrograph (GIUH) is one among the various approaches available for the simulation of flood events, especially for the ungauged catchments.

In the present study, design flood estimation of Morel catchment, of Rajasthan state is computed using the Snyder approach, regional relationships as proposed by Central Water Commission, using the Clark model, SCS method and using the GUIH based approach.

To estimate the parameters of Clark model, relationships between time of concentration and catchment area and time of concentration and ratio of length of stream channel to the equivalent slope have been developed for the region. Ratio of storage coefficient to the sum of time of concentration and storage coefficient is worked out for each catchment of the region and based on this a median value of this ratio is assigned to the region. Design flood for the basin is computed based on Clark model and GIUH approach being the more realistic and more appropriate for ungauged catchment.