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Regional Flood Frequency Analysis for Sub Himalayan Region

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ABSTRACT

In this report, flood frequency analysis has been carried out for Sub-Himalayan region using peak flood series data of ten small and medium size catchments varying in size from 6 sq. kms. to 2072 sq. kms. The study involves application of Extreme Value Type-I (EV1), General Extreme Value (GEV) and Wake by distributions using (i) at site data (ii) at site and regional data in combined form and (iii) regional data alone. Statistical tests based on U.S.G.S. method and coefficient of variation (CV) based method have been performed in order to test the homogeneity of the region.

Flood frequency analysis has been carried out for the two groups of the catchments. Annual maximum peak flood series data of 8 bridge sites passing the U.S.G.S. homogeneity test have been considered under Group-1; whereas the peak flood series of 5 bridge catchments, which passed the U.S.G.S. as well as 'CV based homogeneity tests have been considered under Group-2. The data of remaining two sites have been used for testing the methodology based on descriptive ability criteria for both the groups. Synthetic flood series have been generated using the regional EV1 (Case-1), GEV (Case-2) and Wake by (Case-3) parameters derived from the historical data of the two groups of the catchments. Generated data sets of specific record lengths (same as the record length of historical data for respective gauging sites) have been considered for both the groups of the catchments for developing the flood frequency relationships. For the two independent sites, variable record lengths viz. 1, 5, 10, 13, 20, 30 and 40 have been considered one at a time for computing the flood frequency estimates and the predictive ability criteria such as bias, root mean square error and coefficient of variation.

The above methodology has been applied to the generated data of different sample sizes for each population, considered as Case-1, Case-2, and Case-3 populations respectively for the two independent gauging sites of the two groups of the catchments. Performance of different methods has been evaluated based on predictive ability criteria viz. bias,

coefficient of variation and root mean square error. It is seen that the methods based on GEV(PWM) and Wake by (PWM) approaches using at site and regional data in combined form provide flood frequency estimates with computationally less bias, comparable root mean square error and coefficient of variation for the two test catchments. Further, the effect of regional homogeneity on flood estimates has also been examined using the Monte Carlo experiments. In general, it is observed that by using the SRGEV and SRWAKE methods for GEV and Wake by populations, relatively larger percentage differences between the respective flood estimates for different recurrence intervals are obtained based on the flood estimates of the two groups of the catchments as compared to the EV1 population.