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Extreme rainfall analysis and estimation of Probable Maximum Precipitation (PMP) by statistical methods over the Indus river basin in India

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Abstract

Annual extreme rainfall series of 1-3 day durations at stations located inside the Indus basin in India were subjected to statistical analysis in order to estimate point Probable Maximum Precipitation (PMP) and maximum rainfall of different return periods for the durations of 1-3 days. Daily rainfall data of 210 stations ranging from 1901-2000 (with varying data length) has been considered for the present study. Rainfall distribution of the basin on seasonal and annual scale has been examined. Spatial patterns of 1-3 day extreme rainfall over the basin have been presented which showed that low values of extreme rainfall are located in the Ladakh region located in the northern parts of the basin, while region lying in the Himachal Pradesh (Sutlej river basin) experienced heavy rainfall. Over the entire basin, point PMP estimates were found to range from about 5 to 98 cm for 1-day, 7 to 137 cm for 2-day and 8 cm to 163 cm in 3-day durations. Highest values of point PMP for 1-3 day durations were found to correspond to Kilba station in the Sutlej basin. Extreme Value Type-I (EV1) distribution has been fitted to 1-3 day extreme rainfall series and various return period values were estimated. Using the same fit it was found that, PMP estimates for 1-3 day durations, have return period of the order of 1000-year. Extreme rainfall features and estimates of point PMP and maximum rainfall for different return periods documented in this study will be useful for designing and planning the water resources projects in the basin.

Keywords

rainfall; Probable Maximum Precipitation; PMP; Indus; river basin; India

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