Frequency Analysis of Minimum Ecological Flow and Gage Height in Indus River Using Maximum Likelihood Estimation

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Abstract : Hydrological frequency analysis has been conducted to estimate the minimum flow elevation of the Indus River in Pakistan to protect the ecosystem. The Maximum likelihood estimation (MLE) technique is used to estimate the best-fitted distribution for Minimum Ecological Flows at nine stations of the Indus River in Pakistan. The four selected distributions, Generalized Extreme Value (GEV) distribution, Generalized Logistics (GLO) distribution, Generalized Pareto (GPA) distribution, and Pearson type 3 (PE3) are fitted in all sites, usually used in hydro frequency analysis. Compare the performance of these distributions by using the goodness of fit tests, such as the Kolmogorov Smirnov test, Anderson darling test, and chi-square test. The study concludes that the Maximum Likelihood Estimation (MLE) method recommended that GEV and GPA are the most suitable distributions which can be effectively applied to all the proposed sites. The quantiles are estimated for the return periods from 5 to 1000 years by using MLE, estimations methods. The MLE is the robust method for larger sample sizes. The results of these analyses can be used for water resources research, including water quality management, designing irrigation systems, determining downstream flow requirements for hydropower, and the impact of long-term drought on the country's aquatic system.

Keywords : minimum ecological flow, frequency distribution, indus river, maximum likelihood estimation

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