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A new Goodness-of-fit test for Frequency Analysis of Peak Flows in L-moment Framework

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Over the past two decades, L-moment based flood frequency analysis (FFA) procedure is being extensively used in hydrology for estimation of flood quantiles at target locations in river basins. The procedure is based on the assumption that (i) peak flows at a location constitute a sample drawn from one of the known frequency distributions such as Generalized extreme value (GEV), Generalized Pareto (GPA), and Pearson Type III (PE3), and (ii) the distribution can be identified using L-moment ratio diagram. Through Monte-Carlo simulation experiments it would be demonstrated that conventional L-moment goodness-of-fit (GOF) test, which is widely used for identifying the best-fit frequency distribution, may not be effective in identifying true distribution (population) corresponding to samples, when L-moments specified for sample generation belong to certain ranges. The ranges identified corresponding to various forms of frequency distributions would be presented and discussed. To overcome the limitation of L-moment GOF test, an alternate test would be presented, which examines the hypothesis that peak flow data follows GEV, GPA, PE3, Generalized Logistic or Generalized Normal distributions. The proposed test involves: (i) use of a transformation mechanism to map peak flows from the original space to a dimensionless space where the form of their frequency distribution does not change, (ii) estimation of location, scale and shape parameters of the hypothesized distribution using the transformed data, (iii) computation of deviation of the estimated parameters with respect to their population values that are determined based on analytic formulations proposed by the authors in a previous work, and (iv) considering the deviation as the basis to accept/reject the hypothesis that the chosen distribution is appropriate to fit the peak flow data. The proposed GOF test would be demonstrated to be effective compared to conventional L-moment GOF test through Monte-Carlo simulation experiments.