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Paradigm Shift in distribution preferences for Flood Frequency Analysis and the 'LMoFit' R-Package

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Safe and economical design of dams, highways, bridges, and other infrastructures require accurate estimates of the magnitude and frequency of peak floods obtained by flood frequency analysis (FFA). The Generalized Extreme Value (GEV) distribution is the traditional preference for FFA along with other distributions having location, scale, and shape parameters. In this poster, two alternative power-type distributions comprising one location and two shape parameters are explored, these are Burr type III (BrIII) and Burr type XII (BrXII) distributions. The performances of BrIII and BrXII are compared against that of GEV in describing annual maximum streamflow records at 1088 sites across Canada. A generic L-moment algorithm is developed to fit these distributions regardless of the unavailability of some of their analytical L-moment expressions. This algorithm is devised in the R package "LMoFit" on CRAN. The latter comparison shows that: (1) the three distributions perform equally-well in describing the observed peaks; (2) the BrIII and the BrXII distributions predict larger streamflow peaks increasing the heaviness of their right tails compared to that of the GEV distribution; (3) the predictions of the GEV distribution reach the upper limits of the distribution in 39% of the sites, while the corresponding predictions of BrIII and BrXII are not limited and exceed the reached limits of GEV; (4) the GEV distribution might be underestimating the risk of extreme events, especially for large return periods. Accordingly, there are potential limitations in using the GEV distribution for FFA and the findings suggest BrIII and BrXII distributions as consistent alternatives for future FFA practices. The "LMoFit" R package is devised to facilitate the future application of the suggested distributions.