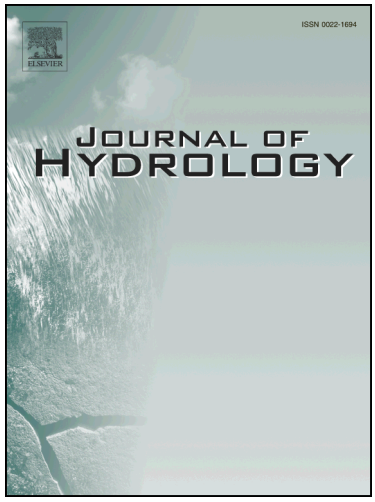

Research papers

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Entropy-based derivation of generalized distributions for hydrometeorological frequency analysis

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Abstract: Frequency analysis of hydrometeorological and hydrological extremes is needed for the design of hydraulic and civil infrastructure facilities as well as water resources management. A multitude of distributions have been employed for frequency analysis of these extremes. However, no single distribution has been accepted as a global standard. Employing the entropy theory, this study derived five generalized distributions for frequency analysis that used different kinds of information encoded as constraints. These distributions were the generalized gamma (GG), the generalized beta distribution of the second kind (GB2), and the Halphen type A distribution (Hal-A), Halphen type B distribution (Hal-B) and Halphen type inverse B distribution (Hal-IB), among which the GG and GB2 distribution were previously derived by Papalexiou and Koutsoyiannis (2012) and the Halphen family was first derived using entropy theory in this paper. The entropy theory allowed to estimate parameters of the distributions in terms of the constraints used for their derivation. The distributions were tested using extreme daily and hourly rainfall data. Results show that the root mean square error (RMSE) values were very small, which indicated that the five generalized distributions fitted the extreme rainfall data well. Among them, according to the Akaike information criterion (AIC) values, generally the GB2 and Halphen family gave a better fit. Therefore, those general distributions are one of the best choices for frequency analysis. The entropy-based derivation led to a new way for frequency analysis of hydrometeorological extremes.