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Parameters estimation for heterogeneous distribution based on cross entropy method

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Abstract: Traditionally, hydrological frequency analysis involves the important restriction of statistically independent and identical distribution (iid) that all hydrological observations are from the same population. However, the process of hydrologic cycle has been changed to varying degrees with the phenomena of global climate change such as Pacific decadal variability, El Nino/La Nina Oscillations or changing in weather patterns resulting from low-frequency climate shifts. Extreme precipitation events are from different populations, which challenges the iid assumption. Traditional probability distributions fail to fit these heterogeneous hydrological samples. Given this, the paper employs the widely used heterogeneous distribution (HTM) to quantify the probability of extreme precipitation events. Here, the generalized extreme value and Pearson type III distributions are combined to form one 7-parameter HTM. Parameters estimation for HTM is extremely crucial for hydrological frequency analysis. Hence, this paper suggests one cross entropy-based method to determine the parameters of HTM. Moreover, the performance of this method is compared with the that of the generally used maximum likelihood method and expectation maximization algorithm. Results indicate that the cross entropy-based method outperforms the other two methods in parameters estimation.