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Spatio-temporal determination of the similarity of extreme floods in the Neckar catchment

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Investigation of extreme events and their spatial extent is one of the crucial tasks in the hydrology. Most hydrological models are not able to accurately simulate the upper quantile of the discharge time series. In this research, a new method for determining the spatiotemporal similarity of extreme floods was developed. The maximum absolute difference among CDFs was combined with an agglomerative hierarchical cluster, and a new tree based on clustering distribution properties was done. Initially, the continuous discharge time series of 46 gauges in the Neckar catchment were examined. Then, the two most prominent events of each year were selected. Subsequently, the empirical cumulative distribution functions of each point, based on selected peaks, were calculated; and the probability of occurrence of each event was determined. The pairwise similarity of CDFs, and consequently, the absolute deviation between them were computed. Thereupon, the hierarchical cluster tree based on the matrix of maximum differences was performed by employing a distinct distance method. At the final step, the cluster tree divided the basin into three major clusters, which contain some sub-catchments. The results illustrated a non-particular pattern for flood occurrences in the Ward linkage map. However, the Average linkage in the clustering showed that the catchment has a more or less homogeneous behavior with some small independent parts. Each separate category revealed a different response concerning the highest flooding mechanism, which the hydrological modeling has to take into account.