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# Clustering the extreme flood magnitude based on dependency structure in upper Neckar catchment

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Modelling of the extreme flood events is a significant challenge for hydrologists. Also, dealing with this matter becomes necessary considering the fact that most of the hydrological models have already some underestimating errors and they are not able to accurately estimate the peak values of discharges. In this study, we analyzed the discharge data of 21 stations in upper Neckar catchment. Each position has a continues daily discharge time series for 25 years. First, peak values of each year are selected. Then, the correlation coefficient between the peaks within the stations is determined to investigate the dependency and relation between the flow connected stations and independent sub-catchments. Also, the rank correlation coefficient is determined to understand nonlinear dependency. It shows a link between different stations and their corresponding peak discharge magnitudes as well as the size of the sub-catchments. Furthermore, clustering is done through Euclidean distance function which is calculated the distance between Kendall Tau's correlations within the stations. Subsequently, a hierarchical classification tree is defined using the Pairwise distance between pairs of observations linkage method. As a result, the region has been divided into the three main clusters, which already contain some sub-clusters. The results illustrate a particular pattern for flood occurrence magnitude corresponding to each class. Therefore, upper Neckar catchment is divided into the northeast sub-catchments, small independent catchments in the south and the rest of the basin. Each separate category shows different behavior in order to represent a flooding mechanism. Moreover, it would be a base for modification of the hydrological models to decrease the potential errors.