Flood Classification Based on Hydrograph Characteristics

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Abstract

Several flood-generating mechanisms could produce high flows in catchments however, AMS/POT sampling is not considering these hydrological processes. Grouping the floods into homogenous samples (in terms of process) has many potential advantages, such as better estimation of return level. This study aims to develop methods to classify and group floods, based on the simple flood hydrograph characteristics, from the daily discharge data. This approach is based on the underlying hypothesis that similar hydrological and catchment conditions lead to similar hydrological responses. We used the Dresden gauge station on the Elbe river, Germany (1950-2019). Flood separation follows four steps: 1. Identification of peaks, i.e., points with a higher streamflow value than its prior and next values, 2. Pruning based on 90^{th} percentile threshold value, 3. Application of independence criterion, 4. Identification of flood starting and ending position. From the separated flood events, six features are extracted for clustering, i.e., peak, volume, timescale, rise to duration ratio, occurrence season and the existence of multi peaks. Extracted flood features include both numerical and categorical variables thus, to deal with these mixed feature datasets, we employed the K-medoids technique for clustering. Further, various cluster validation indices robustly help to identify the optimal number of clusters. We also performed the feature relevancy analysis to understand the hydrograph features' relative importance. Since hydrometeorological variables are not used for classification, we used the magnitude of the precipitation and snowmelt during the flood duration to characterize the various clusters. Clustering results show that the employed methods are effective in classifying the flood events driven by different flood drivers.

Keywords: Flood classification, Flood separation, Flood frequency analysis