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A complex network approach for catchment classification based on co-occurrence of extreme floods

Wencong Yang (1,2) and Hanbo Yang (1,2)

(1) Department of Hydraulic Engineering, Tsinghua University, Beijing, China (ywc17@mails.tsinghua.edu.cn), (2) State Key Laboratory of Hydro-Science and Engineering, Tsinghua University, Beijing, China (ywc17@mails.tsinghua.edu.cn)

Catchment classification is crucial for determining the dominant flood generating mechanisms and regional flood frequency analysis. The occurrences of extreme floods have similarities between different catchments. This study aims to divide catchments into groups within which the catchments have high possibility to generate extreme floods synchronously. We apply the concept of community structure in the complex network theory to classify catchments. We use 319 US catchments with daily streamflow data of 40 years. If the occurrence time of 7-day floods with return periods exceeding 2 years in two catchments overlaps then we define it as co-occurrence. The edges of the network are added according to some co-occurrence criteria. Five community detection algorithms are used to test the consistency of the classification results. The results show that 11 large communities are detected. The catchments in the same community have similar meteorologic characteristics (annual mean of temperature and precipitation) and hydrologic characteristics (annual mean of runoff and potential evaporation). Different communities have distinct differences of temperature and flood seasons. The results reveal the potential drivers of the floods regionally and provide the new prospect to explore hydrologic similarity.