Effective measures of similarity for regional flood frequency analysis

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The study investigates the relative performance of several hydrological similarity measures that are used to form homogeneous pooling groups of catchments for regional (pooled) flood frequency analysis. We define several measures of hydrological similarity among catchments, assessing the capacity of each to summarise and describe the flood frequency regime of a particular catchment. These innovative measures are primarily based on mean annual precipitation (MAP) and, in particular, combine a catchment scale estimate of MAP with other relevant geomorphologic indexes (e.g., catchment area, low permeability area of the catchment, etc.) that can be computed without hydrometric information. The descriptive potential of these similarity measures is compared with the potential of a traditional seasonality measure that reflects the timing of extreme flood events, thereby requiring hydrometric information in the form of the date of occurrence of the flood events. The measures are applied to 32 unregulated catchments located in northern-central Italy, for which previous studies showed a high descriptive potential of traditional seasonality measures [e.g., Castellarin et al., J. Hydrol., 2001]. The different similarity measures are examined in the context of a pooling scheme that is designed to identify hierarchical, focussed pooling groups, (i.e., Region Of Influence approach) [Burn, WRR, 1990]. The homogeneity of the identified pooling groups is assessed using the Hosking and Wallis [WRR, 1993] heterogeneity measure. The reliability and uncertainty of the estimates of the T-year flood resulting from the pooling groups are quantified for gauged and ungauged catchments by jack-knife and bootstrap resampling procedures. The results of the study show that similarity measures based on MAP are as effective as seasonality measures for estimating extreme flow quantiles for the study area and have the noteworthy advantage of being suitable for ungauged catchments.