Probabilistic regional envelope curves: Effect of intersite dependence of nested catchment structures on flood quantiles

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Using probabilistic regional envelope curves (PRECs) a recurrence interval is assigned to a regional envelope curve, which bounds all floods of record of a pooling group of sites. The intersite dependence of sites is explicitly considered in the PREC concept by determining the regional information content of the pooling group. To estimate the effective sample years of data, which are directly related to the recurrence interval of PREC, a correct estimation of the intersite correlation is required.

In this study, the PREC concept is refined by analysing intersite dependence of nested and unnested pairs of catchments separately. Different parameter sets for the cross-correlation function were applied for nested and unnested catchment relationships. This approach was compared with a traditional one in which one cross-correlation function for the whole study area was used. Several pooling groups of sites were constructed by the Region of Influence approach using different candidate sets of catchment descriptors for 89 catchments in Saxony/Germany.

The main outcomes of the study are: 1) The estimation of the effective sample years of data is improved by distinguishing between nested and unnested parameter sets for the cross-correlation function. 2) The effective sample years of data and the recurrence interval of PREC are reduced by a separation in nested and unnested pairs of catchments. The reduction effect increases for a larger number of observations and for a higher fraction of nested catchments. Because of a more realistic representation of the river network structure and a better estimation of the regional information content, it is recommended applying different cross-correlation functions for nested and unnested pairs of catchments.