Modeling extreme floods emerging from heterogeneous processes by using the simplified Metastatistical Extreme Value Distribution

Sumra Mushtaq[1], Arianna Miniussi[1], Ralf Merz[1], Larisa Tarasova[1], Francesco Marra[2] and Stefano Basso[1]

(1) *Department of Catchment Hydrology, Helmholtz Centre for Environmental Research - UFZ, Halle (Saale), Germany*
(2) *Germany Institute of Atmospheric Sciences and Climate, National Research Council of Italy (CNR-ISAC), Bologna, Italy*

Traditional flood frequency analysis relies on the assumption of homogeneity of the analyzed events. However, floods are often generated by different physical mechanisms. Accounting for the diversity of flood generation processes may thus improve estimates of flood frequency and magnitude. In this study we used the Simplified Metastatistical Extreme Value (SMEV) distribution to infer frequency and magnitude of floods emerging from multiple underlying processes. We separately consider the intensity and occurrence frequency of different event types, defined according to the key processes which caused each runoff event. The study considers a large number of peak flows observed and labeled in a set of river basins in Germany, which are described through SMEV and used to estimate extremes from the properties of ordinary events. Results show that this approach improves the estimation of the largest flood quantiles and allows us to improve the estimation of flood magnitude with high return periods. Moreover, the proposed method shows reduced estimation uncertainty thanks to consideration of the bulk of ordinary events versus only a few flood maxima, as done in the classical extreme value approach.