Consideration of flood geneses in flood statistics by a mixture POT-model

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Flood events can be caused by several different meteorological circumstances. For example, heavy rain events often lead to short flood events with high peaks, whereas the snowmelt normally results in very long events with a high volume. Both event types have to be considered in the design of flood protection systems. Moreover, all these different event types are often included in annual maximum series. Unfortunately, certain event types are underrepresented in the annual maximum series. This is especially unsatisfactory if the most extreme events result from such an event type. Therefore, we want to use monthly maximum data to enlarge the information spectrum on the different event types. Of course, not all events can be included in the flood statistics because not every monthly maximum can be declared as a flood. It is also essential to estimate the flood peaks and not the monthly maximum at the beginning or end of a month which belong to the falling or rising limb of a flood in the previous or following month. To take this into account, a mixture Peak-over-threshold (POT) model is applied, with thresholds specifying flood events of several types that occur in a season of the year. For this a combination of the classical POT-distributions, the Generalized Pareto Distribution, and the marginal distributions of the maxima is used. The applicability of this model is shown in a German case study, where the impact of the single event types in different parts of a year is evaluated. Moreover, the benefits of such a distinction for regionalisation are shown, where the elevation as well as the catchment size have influence on the homogeneity of different event types.