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How to evaluate the extremeness of heavy precipitation events

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In general, climate change scenarios suggest an increasing extremity of precipitation at individual rain gauges. Nevertheless, heavy precipitation events should be considered not only from the viewpoint of the intensity at a site but also their extent and duration should be taken into account. We review methods which are frequently used for evaluation of precipitation extremity and present their pros and cons on selected heavy rains from the Czech Republic 1961–2010 including the very last event from 2013.

Probably the most popular approach is based on comparison precipitation totals at individual sites with a fixed threshold. Alternatively, thresholds are based on the empirical distribution of the variable at the given site (quantiles). More sophisticated methods standardize actual totals by return period estimates. Moreover, precipitation events always affect at least a small area and differ also in their duration. The spatial aspect of precipitation extremes can be considered using the areal average instead of individual point measurements. However, limits of both the affected area and the time period are “fuzzy” (not rigorous); therefore, the extremeness of an event depends on the extent of the considered region and the length of the time window. At this point, we suggest a method of “event-adjusted” evaluation which (i) normalizes regional differences in precipitation climatology by utilization of return period values instead of pure precipitation totals and (ii) optimizes both the considered area and duration for every precipitation event. The values of the resulting weather extremity index well correspond with the extremity of floods within the Czech Republic if considering also other factors which influence hydrological responses to precipitation events.