



## **Analysis of heavy rains with respect to precipitation intensity course**

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Design precipitation intensities are often determined not only for daily but also for sub-daily time windows because of their important role in flash flood formation. Nevertheless, the hydrological response to a given precipitation total can substantially vary due to differences in precipitation distribution during the event. To design the runoff from very small catchments correctly, mainly the temporal distribution of precipitation should be taken into account. In our study we utilized combined weather radar and rain gauge measurements to obtain rain rates in 1x1 km pixels covering the Czech Republic with the time resolution of 10 min. First, we selected independent maxima of 6-hour precipitation totals (R6) in warm half-years (May-September) since 2002 to 2011. Individual heavy rain events (defined by  $R6 > 10\text{mm}$ ) were further described by maximum totals within shorter (R3, R2, R1) and longer (R12, R24) time windows. The events were clustered with respect to ratios  $R12/R24$ ,  $R6/R12$ ,  $R3/R6$ , and  $R1/R2$ . The higher the ratios are, the more concentrated precipitation is. The proposed method enables to distinguish not only the main types of the events characterized by low (long lasting rains with small variations in precipitation intensity) or high (short torrential rains) values but also the events comprising two well-marked episodes separated by a short break. Surprisingly, both main types are represented in 6-hour precipitation extremes both in lowlands and in highlands; nevertheless, the percentage of short-term events generally decreases with altitude. Quantification of the proportion of individual types throughout the studied territory opens the door for the improvement of design runoffs at small streams.