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Decadal trends of high-intensity precipitation events and relation to atmospheric circulation in central Germany

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This contribution analyses long-term trends of high-intensity precipitation events in a region covering the central-western parts of Germany. A large number of previous studies looks at strong precipitation events on a daily, and occasionally also on an hourly scale. However, only few studies cover shorter time-scales like 5 or 10 minutes. Such time-scales, nevertheless, need to be investigated to understand characteristics and spatiotemporal evolution of heavy precipitation events. This knowledge lays the foundation for further investigations, e.g., of erosivity largely caused by short-term convective precipitation events mainly occurring during the summer season. We use digitalised precipitation data based on recordings of 21 stations starting since the 1950s or 1960s with as little as possible data gaps, taken every 5 minutes. Such data were obtained by graphical recorders until the 1990s, and replaced by more sophisticated methods afterwards. To judge data plausibility, accumulated 5 minutes data are compared with daily precipitation sums derived from classical Hellmann precipitation gauges. All precipitation data originate from the German Weather Service (DWD).
We focus on the extended summer season (May until September) due to limitations in data availability and because those months are mostly relevant for high-intensity precipitation. Trends in precipitation intensity are studied by employing a) daily precipitation maxima and b) excess frequencies of various threshold values for different time steps (5 minutes, 1 hour, 6 hours, 1 day), comparing the period 1961–1990 with a recent years (1991–2015). The Grosswetterlagen classification (their manual original and an automated version) is used to reveal relations of high-intensity precipitation events and weather patterns.