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Variants of synoptic-scale weather patterns inducing heavy steady rains

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Previous studies confirmed the close relationship between synoptic-scale meteorological conditions and the occurrence of heavy widespread and steady rains in the Czech Republic. We showed that some dynamic and thermodynamic variables had regularly reached abnormal values in specific regions before and during extreme precipitation events. On the other hand, these anomalies partly varied among individual events. The presented study utilizes the results and is aimed at the objective classification of causal synoptic-scale weather patterns.

We compiled the set of extreme precipitation events that had affected the Czech Republic during warm half-years from 1958 to 2002. In order to classify the events, we employed re-analyses ERA-40. We focused on the horizontal components of moisture flux, anomalies of which are the typical features of the most significant events and are responsible for an increased water vapour supply into the rainfall area. For compiled events, we quantified the extremeness of the anomalies by distribution function in individual grid points. We applied a divisive and fuzzy clustering method in order to cluster the events in terms of the extremeness of the horizontal components of moisture flux within the rainfall area from a day before to two days after the precipitation onset. We identified and defined four variants of causal synoptic-scale weather patterns. The first two variants are associated with the passage of an extra-tropical cyclone across Central Europe. The differences between the variants consist in the cyclone track. The third variant is characterised by cold frontal waves repeatedly affecting heavy rain sites. The forth variant is similar to the third variant but is rounded off by the passage of a frontal wave cyclone. The classification method will be briefly presented and all four variants will be described using average thermo-baric fields. Further applications of the classification method will be also mentioned.