



## **The spatial and seasonal variability of extreme precipitation events in Central Europe**

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Several extreme precipitation events occurred in Central Europe in the last years. One of the largest, the May/June 2013 event, affected mainly large parts of the Czech Republic, Austria and Germany. It resulted in extreme flooding, exceptional due to its spatial extent. In contrast to other Central-European events (e.g. in August 2002), heavy rains and high discharges were detected even at the Weser and in the middle and lower Rhine basins in 2013 due to unusual movement of cyclones from Mediterranean far to the north-west.

In this study, we present and analyze a set of major precipitation events which occurred in the Central Europe between 1961 and 2013. The study area covers the Rhine, Weser, Ems, Elbe, Oder river basins and Danube up to Bratislava. Daily precipitation amounts from rain gauge stations are the main employed data. Individual events are detected and evaluated by the weather extremity index, which reflects precipitation return periods at individual rain gauges, as well as the size of the affected area and the event duration. The return periods are estimated from series of 1-day to 10-days precipitation totals using the generalized extreme value distribution.

We evaluate the areal extremity of precipitation events on different spatial levels: the whole study area, five basic river basins, and individual sub-catchments. The spatial hierarchy reveals the internal variability of precipitation extremes. Events with extreme precipitation on local level contrast with cases where the precipitation extremeness is more equally distributed within the study area. This variability is related to the seasonality of events.

We employ the cluster analysis to distinguish several groups of precipitation extremes regarding the spatial distribution of precipitation. Within the resulting groups, the events are analogous not only in terms of precipitation, but also in the causal atmospheric circulation patterns. There might also be a similarity in the subsequent floods; the hydrological response however depends both on the event precipitation and on the antecedent saturation. Future work will seek to identify the relationship between extreme precipitation, flooding, antecedent saturation and mainly to find the equivalent circulation conditions leading to the emergence of hydrometeorological extremes.