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Links between high-impact winter weather and large-scale atmospheric circulation

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Extreme weather considerably affects various sectors of human society and natural environment. While effects of high-impact summer weather have been widely studied in the context of rising global temperature, winter extremes have so far received far less attention. We aim to expand the understanding of extreme winter weather with respect to their driving mechanisms.

In this study, we analyze links between large-scale atmospheric circulation and winter events of anomalous temperature and rain/snow characteristics. We aim to find useful methods to detect significant synoptic links in observed climate, which could be subsequently used as reference for an evaluation of high-impact winter weather and its driving mechanisms in historical runs and projections of climate models. The study is performed over Central Europe, defined roughly between 48–52°N and 10–20°E. This domain excludes high-altitude mountain ranges (Alps and Carpathians) and therefore has a relatively homogenous climate. We focus on events of extremely high and low temperatures, sudden temperature changes, occurrence of frost/arctic days, heavy snowfalls or rains in extended winter over recent decades. Large-scale atmospheric circulation is represented by indices (flow direction, strength and vorticity) and classifications derived from circulation patterns produced by reanalyses.