



## **Central European temperature and precipitation extremes in relation to large-scale atmospheric circulation types**

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Analyses are based on daily temperature and precipitation time series compiled during the EU project EMULATE (European and North Atlantic daily to multidecadal climate variability) back to 1850. Extremes in temperature and precipitation are defined on a seasonal basis in terms of particular percentiles (the 2<sup>nd</sup>, 5<sup>th</sup>, 95<sup>th</sup> and 98<sup>th</sup> for temperature, the upper ones for precipitation). Extreme precipitation has increased in Central Europe during the last decades except for the summer season with the earliest date of an upward trend during winter.

Relationships to the large-scale atmospheric circulation have been investigated based on daily mean SLP reconstructions from EMULATE back to 1850 classified by an advanced simulated annealing clustering technique. Comparing for each of these circulation types their percentages among extreme days and among non-extreme days (with respect to temperature or precipitation) clearly reveals that in most cases only a few of the seasonal circulation types are important for the occurrence of daily extremes. For example during winter, these types include an eastward or southward shifting of the subpolar centre of low pressure compared to normal conditions. Furthermore, in contrast to positive temperature extremes during winter being linked preferably to zonal patterns within the positive mode of the NAO, strong winter precipitation in Central Europe is distinctly associated with less zonal patterns implying only weak correlations with the NAO. Particular indices reveal additionally that changing frequencies of extremes are not only due to corresponding frequency changes of these impor-

tant circulation types, but also to changes in percentages of extremes with respect to the overall occurrences of these circulation types. This means that their association to temperature or precipitation extremes is also changing with time (some kind of within-type changes) thus strongly influencing the general dynamics of extremes. Examples from Central Europe for different seasons will be discussed, especially including strong winter precipitation and hot summer extremes.