



How does the definition of a temperature extreme affect the results? (the example for Europe)

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Extremely high or low air temperatures can have disastrous impacts on human, natural and industrial systems all over the globe. These systems are sensitive to the frequency and severity of temperature extremes whose influence increases with a size of the affected area.

There is no universal definition of a temperature extreme; the literature offers a vast number of metrics based on different criteria and reference periods. It is therefore of utmost importance to quantify the results obtained using different definitions, and thus determine whether they are comparable.

The aim of this study is to estimate the role of a definition adopted to distinguish a temperature extreme in heat and cold extremes analysis for Europe. The study is based on daily maximum (TX) and minimum (TN) temperatures for summer (JJA) and winter (DJF) seasons obtained from the E-OBS dataset with a spatial resolution of 0.5°. Patterns and trends of frequency, severity and spatial extent of summer heat and winter cold extremes are investigated. The period of 1961–2017 is considered with a closer look at the most recent events.

Days with extremely high/low temperature are determined using several previously published metrics. They are delimited at each grid point using TX and TN separately as well as their intersection, for both heat and cold events. Extremes are identified using percentile and standard deviation based thresholds of varying severity (e.g. 90th, 95th and 99th percentiles) which are computed using different approaches, i.e. seasonal and monthly values and values calculated for each calendar day using moving window with several window size. The thresholds are computed for two commonly used periods, 1961–1990 and 1981–2010. Severity of a temperature extreme is characterized by the cumulative temperature excess above/below the corresponding heat/cold threshold for the total area affected.

The study demonstrates that the choice of a temperature extreme definition and reference period is critically important to the resulting analysis of patterns and trends. The obtained results enable to indicate methods characterized by high/low degree of comparability as well as to show weaknesses and strengths of different approaches.