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Temperature extremes in Western Europe and associated atmospheric anomalies

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This work´s focal point is the analysis of temperature extremes over Western Europe in the period 1957-2007 and their relationship to large-scale anomalies in the atmospheric circulation patterns. The study is based on temperature daily time series recorded at a set of meteorological stations covering the target area. The large-scale anomalies are analyzed using data from the National Centers for Environmental Prediction reanalysis project. Firstly, a preliminary statistical analysis was undertaken in order to identify data gaps and erroneous values and to check the homogeneity of the time series, using not only elementary statistical approaches (e.g., chronograms, box-plots, scatter-plots), but also a set of non-parametric statistical tests particularly suitable for the analysis of monthly and seasonal mean temperature time series (e.g., Wald-Wolfowitz serial correlation test, Spearman and Mann-Kendall trend tests). Secondly, based on previous results, a selection of the highest quality time series was carried out. Aiming at identifying temperature extremes, we then proceed to the isolation of months with temperature values above or below pre-selected thresholds based on the empirical distribution of each time series. In particular, thresholds are based on percentiles specifically computed for each individual temperature record (data adaptive) and not on fixed values. As a result, a calendar of extremely high and extremely low monthly mean temperatures is obtained and the large-scale atmospheric conditions during each extreme are analyzed. Several atmospheric fields are considered in this study (e.g., 2-m maximum and minimum air temperature, sea level pressure, geopotential height, zonal and meridional wind components, vorticity, relative humidity) at different isobaric levels. Results show remarkably different synoptic conditions for temperature extremes in different parts of Western Europe, highlighting the different dynamical mechanisms underlying their occurrence. Connections between the occurrence of these temperature extremes and the phase and strength of the most relevant teleconnection patterns (NAO, AO and PNA) are also analyzed.