



Daily Weather Types Computed from Early Instrumental Data back to 1760

Mikhaël Schwander and Stefan Brönnimann

Institute of Geography, Oeschger Centre for Climate Change Research, University of Bern, Switzerland
(mikhael.schwander@giub.unibe.ch)

Weather types describe daily atmospheric circulation variability over a given region with a simple measure. Their use can be beneficial for historical climatology, which increasingly targets day-to-day variability but lacks comprehensive atmospheric circulation fields further back than 1871 (start of the Twentieth Century Reanalysis). A new statistical method is used to generate a daily weather type classifications (WTCs) covering the last 250 years. The method uses an existing classification (e.g. CAP, GWT) available for a reference period and extends it back to the end of the 18th century. The CAP and GWT classifications used in our study are available from 1957 onward. They have been computed by MeteoSwiss using ERA-40/ERA-Interim reanalyses. In order to produce a weather types time series which covers a longer time period than the available reanalyses, early instrumental data from weather stations are used. A classification (e.g. CAP) is taken as a reference for a determined period. Let x be a vector with information from stations $1..n$ for one day. x contains weather data from several stations. For example, t =temperature, p =pressure, Δp =pressure tendency.

$$x = \{t_1, p_1, \Delta p_1, t_2, p_2, \Delta p_2, \dots, t_n, p_n, \Delta p_n\}$$

Further, let i denote the weather type (e.g., types 1 to 9 for CAP9). Then, the weather type of day t is the type i that minimizes the following function (Mahalanobis distance):

$$D(i) = x_t^T \sum_i^{-1} x_t$$

\sum_i is the covariance matrix of x for all days in the reference period that pertain to the weather type i . Instrumental data from Western/Central Europe are used in order to cover the period ~ 1760 -2014. All the data need to be available for the reference period, so the whole time series is calibrated over the same period. The performance of the new classification method then needs to be analyzed. Such assessments can be for example done by comparing the new time series with the ones obtained from reanalyses (ERA-Interim, 20CR). These new WTCs offer the possibility to analyze weather conditions over Europe for more than two centuries with objective types.