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Which homogenisation method is appropriate for daily time series of relative humidity?

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Data homogenisation is an essential part of reliable climate data analyses. Different tools for detecting and adjusting breaks in daily extreme temperatures (Tmin, Tmax) and daily precipitation sums were developed in the last years.

Due to its influence on health, plants and construction relative humidity is another parameter of great importance. On the basis of 6 networks of measured (and homogenized with respect to the monthly means) relative humidity data, which cover different climatic areas in Austria, a synthetic data set for testing and validating homogenisation methods was built. Each network consists of 4 to 6 station time series with a minimum length of 5 years. The so-called surrogate networks resemble the statistical properties (e.g. distribution of parameter, auto- and cross correlation within the network) of the measured time series, but are extended to 100 year long time series, which are in a first step assumed to be homogeneous.

For creating the best possible surrogate dataset of relative humidity detailed statistical information on potential inhomogeneities is decisive. Information on the potential breaks was taken from parallel measurements available for some Austrian locations, mostly representing changes in instrumentation and/or station relocation. Beside changes in the distribution of the parameter the analyses includes an estimation of changes in the number of missing data, global and local biases, both on a seasonal and annual basis. An additional break is to be expected in the Austrian time series due to a change in observation time in 1970/1971. Since this change occurred simultaneously at all Austrian climate stations, standard homogenisation methods, which rely on a comparison with reference stations, are not able to detect or correct this shift. Therefore an independent correction method for this type of break, to be applied before homogenisation was developed. This type of change point was not included in the surrogate network.

Artificial inhomogenities were introduced to the dataset in three steps: (1) deterministic change points: within one homogeneous sub-period (HSP) a constant perturbation is added to each relative humidity values, (2) deterministic + random changes: random changes do not change the mean of the HSP but can affect the distribution of the parameter, (3) in addition realistic changes in break frequency and missing data.

In order to tests the efficiency of homogenisation methods, the procedure was separated in break detection and adjustment of inhomogenities. The methods MASH (Szentimrey, 1999), ACMANT (Domonkos, 2011), PRODIGE (Caussinus and Mestre, 2004), SNHT (Alexandersson, 1986), Vincent (Vincent, 1998), E-P method (Easterling and Peterson, 1995) and Bivariate test (Maronna and Yohai, 1978) were selected for break detection. Break detection is in all methods restricted to monthly, seasonal or annual data. Since we are dealing with daily data, the amount of methods for break correction is reduced and we concentrate on the following methods: MASH, Vincent, SPLIDHOM (Mestre et al., 2011) and the percentile method (Stepanek, 2009).

Information on the statistical characteristics of breaks in relative humidity series, the correction method concerning the changed observation times and first results concerning break detection will be presented.