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Automatic bias correction of long term monthly precipitation series

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For accurate climate studies a reliable data base is essential. Due to changes in measuring practice, alteration of instruments and relocation of measuring sites, the continuity in the raw data can not be expected.

In this study an automatic algorithm is presented to correct the bias in the time series and to estimate the remaining uncertainty. The objective is to receive obtain more homogeneous data with reliable monthly trends, which allow further investigation.

The data base, provided by the German Weather Service (DWD), consists of monthly precipitation time series in Germany including meta data. But especially at the beginning of the 20th century few meta data are available. The examined data set consists of 394 stations covering 75 years of data with only 2.0 % of missing values along with 118 stations covering 100 years with 1.1 % missing data.

The automatic algorithm is relative to time series of surrounding stations and consists of three steps. 1) Construction of a reference series by using neighbouring stations to distinguish between natural and artificial changes. Since the neighbourhood stations are assumed to be inhomogeneous, they are iteratively homogenized together with the target stations. 2) For the actual detection of inhomogeneities a maximum likelihood approach with the Causinus-Mestre criterion (Caussinus and Mestre, 2004) was applied on relative annual time series. 3) The correction is carried out monthly by means of a multiple linear regression. As additional parameter the annual cycle is added.
The error of the corrected series is estimated by varying neighbour station with at least 0.8 correlation randomly.

The software was successfully tested on artificial time series, developed during the COST ACTION HOME. Additionally the application to real data allows the comparison to breakpoint positions indicated in the meta data. Variation of the neighbour station show the dependences of correlation and number of station.

The automation allows an objective correction of large data sets with manageable machine time and the estimation of uncertainties in the results.