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An automatic method to homogenize trends in long-term monthly precipitation series

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Lack of homogeneity of long-term series of in-situ precipitation observations is a known problem and requires time consuming manual data correction in order to allow for a robust trend analysis. This work is focused on the development of an algorithm for automatic data correction of multiple stations.

The algorithm relies on the similarity of climate signals between close stations. It consists of three steps: 1) Construction of networks of comparable precipitation behaviour; 2) Detection of breakpoints; 3) Trend correction. Detection and correction are based on the homogenization software (Prodige) adopted from Météo France (Caussinus and Mestre 2004).

The networks are constructed based on monthly accumulated precipitation and several indices. For the classification, principal component analysis in S-mode is applied followed by a VARIMAX rotation. Within each network, a segmentation method is used to detect the breaks. In order to develop a fully automatic method, scaled time series are combined to create the reference series. The monthly correction applied is a multiple linear regression as described in Mestre, 2004 which also conserves the annual cycle.

At present, the algorithm has been used to homogenize 100 years of precipitation records from stations in Germany, without any missing values. The data has been digitized recently by the Meteorological Institute of the University of Bonn and the Deutscher Wetterdienst. The resulting networks correspond well to the German geographical regions. The number of detected breaks varies between 0 $\sim$7 breaks per station. The majority of breaks is very small (below $\pm$10 mm per year) despite a few high (up to $\pm$200 mm) ones.

In future, the algorithm will be used to generate a homogenous global precipitation data set HOMPRA for the period 1951-2005 using more than 16000 stations in collaboration with the Global Precipitation Climatology Centre (GPCC, Becker et al., 2012).

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