



Overview of the RHtests_dlyPrcp software package for homogenization of daily precipitation

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The RHtests_dlyPrcp software package is specifically designed for and is the only software that is suitable for homogenization of daily precipitation data, which are non-continuous (it does not occur every day), non-negative, and non-normally distributed. It is based on the transPMFred algorithm (Wang et al. 2010), which integrates a data adaptive Box-Cox transformation procedure into the PMFred algorithm (Wang 2008a) to make the data approximate to a normal distribution. The PMFred algorithm is based on the penalized maximal F (PMF) test (Wang 2008b) that is embedded in a recursive testing algorithm (Wang 2008a), and is used in the case “without a reference series” in the RHtestsV3, RHtestsV4, and RHtestsV4 packages. It accounts for lag-1 autocorrelation in the series, modelling the lag-1 autocorrelation and linear trend in tandem while accounting for all identified shifts (Wang 2008a). It also allows users to test both known and unknown changepoints.

The Box-Cox transformation is necessary, because daily precipitation amounts are non-negative and not normally distributed. Since daily precipitation is highly variable both spatially and temporally (it could be raining in this side of the street, but not the other side), it is hardly possible to find a suitable reference series (except in the case of parallel measurements). Thus, this software does not use any reference series. It has three functions, all of which can be run in the convenient Graphic User Interface (GUI) mode.

Note that it is wrong to adjust the 0 values in a daily precipitation data time series for days of no precipitation occurrence! Thus, the conventional methods are not applicable to daily precipitation data series, although they can be applied to annual or monthly total precipitation data series, especially after they are log-transformed (i.e. applied to test the log(P) time series instead of the P time series).

This package provides/outputs both the mean-adjusted (i.e. IBC-adjusted; IBC stands for Inverse-Box-Cox transformation) and QM-adjusted data series, along with plots of the series and the resulting regression fit. In addition, its users have (i) choices of testing daily precipitation amounts that are greater than 0 or a given small non-zero amount (e.g., 0.3 mm), (ii) choice of the segment to which the base series is to be adjusted, (iii) choices of using the whole or part of the segments before and after a shift to estimate the QM-adjustments, (iv) choices of the nominal level of significance at which to conduct the tests. This package is available free of charge at <http://etccdi.pacificclimate.org/software.shtml>. So far, the RHtests_dlyPrcp and the different versions of the RHtests packages have over 3000 users worldwide.

Since daily precipitation is not a continuous process, discontinuities in the occurrence frequency of precipitation might exist and should be dealt with first to avoid complicating the homogenization of daily precipitation data time series. Please refer to Section 6 of Wang et al. (2010) for more details on how to deal with frequency discontinuities.

References

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