EMS Annual Meeting Abstracts
Vol. 16, EMS2019-326, 2019

Towards more accurate homogenization of climatic time series

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Some 10 years ago European project COST ES0601 ("HOME", 2007-2011) opened a new era in the development of time series homogenization. One of the most important conclusions of HOME was that when complete homogenization methods including time series comparisons, break detection and adjustments for inhomogeneities are tested, the diversity of method efficiency is generally much higher than when only break detection methods are tested. However, the HOME benchmark dataset was relatively small, hence it could represent a limited variety of homogenization problems.

Since HOME, we have newly developed homogenization methods and also new efficiency tests. Such tests serve best the improvement of effective homogenization when A) Test datasets simulate well real climate series and their homogenization problems; B) Homogenization methods used in practice are subjected to the tests; C) Transparent evaluation of efficiency is provided; D) Tests and the measured method efficiencies are published; E) Test datasets remain easily accessible for the homogenization community.

We have many still unpublished results of Spanish MULTITEST project (2015-2017). We will present a part of the MULTITEST results from12 test datasets, all for monthly temperature series, but otherwise for widely varied statistical properties. These datasets together include 1900 networks and 24,500 time series. ACMANT, Climatol, MASH, PHA (USHCN) and the Penalised t-test of RHTests were tested. The efficiency was evaluated with various kinds of residual errors after homogenization: a) monthly centred root mean squared error (CRMSE), b) annual CRMSE, c) bias of the mean linear trend, d) network-mean annual CRMSE, e) network-mean trend bias. For each of these efficiency measures, for each of the 12 test datasets and for each homogenization method, the mean residual error and the 95 percentile of this error (altogether 120 metrics for each homogenization method) were calculated.

In 85% of the examined cases ACMANTv4 gave the best results. Climatol often gave comparably good results as ACMANT, but its network-mean errors tend to be larger than those of ACMANT and PHA. PHA has much better results for network-mean characteristics than for the accuracy of individual time series. In case of concerted breaks, which mimics a network-wide technical change within a few years or one-two decades, PHA or ACMANT gave the best results depending on the length of the period of the concerted breaks. Note that ACMANT gave the best results also in HOME tests and in the daily temperature homogenization tests with the dataset of Willet et al. (2014), although in the latter case Climatol was tied with ACMANT.