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A comparison of methods to homogenise daily temperature data

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To be confident in the analyses of long-term changes in daily climate extremes, it is necessary for the data to be homogenized due to nonclimatic influences. In this study we intercompare two methods to homogenise daily temperature data applied to station series from Switzerland. The spline method interpolates daily adjustment values from monthly adjustment values calculated using mean differences between the candidate station series and multiple reference station series. The Higher Order Moments (HOM) method models the relationship between the candidate and reference stations on a daily basis. The non-linearity of the HOM model enables inhomogeneities in the variance and skewness of daily temperature series to be corrected. In this preliminary analysis, we show that for some stations the probability density function (PDF) of summer daily temperature records has inhomogeneities in the variance and skewness, in addition to inhomogeneities in the mean. The basis of these inhomogeneities is a non-climatic change in the short- and long-wave exposure of the thermometers, often associated with a change in instrumentation and/or site relocation. In these cases, time-series of the daily temperature adjustments indicate that they are not smooth functions of time (owing to the differential temperature adjustments as a function of the quantile), challenging the commonly held notion of continuous (time) functions between break-points in most inhomogeneity models. We advocate the use of the HOM method only if certain criteria regarding the model quality are met, since the non-linear model is susceptible to over-fitting when the number of reference stations available is low and/or the representativity of references stations is not high enough. The spline method is intuitively simple and should be used when it is clear that inhomogeneities in the HOMs do not exist. We demonstrate the utility of both methods on some example

daily temperature series and their effect on common extreme temperature indices.