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Trends in extreme temperature indices in Austria based on a new homogenized dataset of daily minimum and maximum temperature series

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Instrumental time series are often affected by inhomogeneities which can mask or amplify climate change signals. Various procedures for the detection and adjustment of breaks exist for monthly and annual time series. Homogenization methods on a daily basis are scarce and often disregard uncertainties accompanying the break adjustment. Here, we present a complete homogenization procedure for daily extreme temperature series based on the break detection method PRODIGE and SPLIDHOM for break correction. Both parts of the homogenization rely on the existence of highly correlated reference stations. After a statistical comparison with the neighboring stations, detected breaks are verified and further localized by an extensive collection of station metadata. The uncertainties of the break adjustments are estimated by altering reference stations and by applying a bootstrapping technique. The range of uncertainty gives an objective indication about the reliability of the homogenization.

The method was applied to 71 time series of minimum temperatures (TN) and maximum temperatures (TX) in Austria covering the period 1948 to 2009. Homogenization was not possible for 14 TN and 17 TX series due to missing highly correlated reference stations or large uncertainties in the adjustments. In the remaining 57 TN and 54 TX series a total number of 139 breaks were detected. 75% of those breaks are documented in the metadata archive, with most of them being caused by station relocations, followed by instrumentation changes. In general, the mean over the temperature dependent adjustments of all stations show a temperature reduction, which accordingly increases the warming trend. However, the majority of breaks have mean amplitudes of less than 0.5°C.

Finally, 16 “climate change detection indices” were evaluated for the newly homogenized dataset, showing a widespread warming trend in both TN and TX series. As mentioned above, the warming trend is generally amplified due to the homogenization. Contrary to other studies, we find a consistent warming trend in minimum and maximum temperatures. However, in autumn the trends in the number of cold day times (days with TX below the 10th percentile) are reversal and indicate a cooling trend especially in the eastern parts of Austria.