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Inhomogeneities in daily data and their removal

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Daily datasets have become a focus of climate research because they are essential for studying the variability and extremes in weather and climate. However, long observational climate records are usually affected by changes for non-climatic reasons. Looking at the known physical causes of these inhomogeneities, one may expect that the tails of the distribution are especially affected.

In this review we investigate the (physical) causes of inhomogeneities and how they affect the distribution with respect to its mean and its tails. We review what is known about historical changes in the distribution from existing parallel measurements. We discuss effects of the state-of-the-art homogenization methods on the temperature distribution.

As expected, this review provides evidence that the tails of the distribution are generally more affected by non-climatic changes than the means. This is a problem because the question to which extent daily homogenization methods can reduce those effects is insufficiently studied. Most available methods are focused on temperature only. Concerning the large daily collections, many of them are not homogenized (with respect to the distribution), whereas the number of national and regional homogenized datasets is strongly growing.

Given the strong interest in studying changes in weather variability and extremes and the existence of often large inhomogeneities in the raw data, the homogenization of daily data and the development of better methods should have a high research priority.

This research would be much facilitated by a comprehensive database with parallel measurements. We have started a Parallel Observations Science Team (POST) in the International Surface Temperature Initiative (ISTI). Its aims will be explained and its progress will be presented. The climate community, and especially those involved in homogenization, bias correction and the evaluation of uncertainties, will hopefully take an active role to foster the compilation of such a comprehensive database.