Geophysical Research Abstracts
Vol. 13, EGU2011-7495, 2011
EGU General Assembly 2011

Application of a physics based correction method on inhomogeneities in the subdaily temperature series of Basel, Switzerland

Renate Kocen and Stefan Brönnimann

Oeschger Centre for Climate Change Research, Graduate School of Climate Sciences, University of Bern, Switzerland (renate.kocen@giub.unibe.ch)

Long-term climate records are often affected by inhomogeneities due to non-climatic changes. Such artificial shifts or trends are caused by station relocations, changes in instrumentation and instrument exposure, changes in observing schedules/practices or environmental changes in the proximity of the observation site. Those disturbances can distort or even hide the true climatic signal, and could seriously affect the correct assessment and analysis of climate trends, variability, and climatic extremes. It is therefore crucial to detect and eliminate artificial shifts and trends, to the extent possible, in the climate data prior to its application. In the process of homogenization, detailed information of the station history and instruments (metadata) can be of fundamental importance in order to support the determination of the exact time of inhomogeneities and the interpretation of statistical test results.

While similar methods can be used for the detection of inhomogeneities in subdaily or monthly mean data, quite different methods for their correction can be chosen. The wealth of information in a high temporal resolution, in combination with multivariate data series, allows more physics-based correction methods.
Whatever the reason for a non-climatic break, it is always linked to a change in the physical environment, exposure or equipment of the observational system. The different conditions, or responses of the system, respectively, before and after a break, can be modeled for every single measurement. The response or outcome of the observational system appears to be the single measured e.g. temperature value. Usually not all measurements show the same size of errors, except there is an offset of the instrument. This means that e.g. a radiation error depends on time of day, season, cloud cover, and environmental conditions, such as the existence of a snow cover. Being aware of this, a physics-based correction model is in fact a more straigthforward way to correct inhomogeneities. Usually pure statistical correction methods are used for performing corrections of the mean or higher order moments. Additionally accounting for physical processes, hiding behind every measurement system, can make it possible to correct subdaily data for all types of inhomogeneities, without using reference series in the correction procedure. The method implies subdaily measurements of temperature, wind speed, cloud cover, and knowledge on the geometry of an observation site. By modeling radiation at the observation site, before and after a break, physical parameters of the observational system can be estimated, resulting in correction amounts for single temperature values.

The application of such a physics based correction model will be shown on the example of the subdaily temperature series of Basel, Switzerland. This longest record of Switzerland shows several alterations that are not only due to variations of climate or weather. During the observation period of approximately 250 years, several station relocations, instrument changes and changes in the observation schedule, have been undertaken. By means of a detailed station history and study of metadata, exact times as well as possible causes for inhomogeneities, are being identified. The correction of one break, based on our physics-based error model will be demonstrated.