EMS Annual Meeting Abstracts
Vol. 16, EMS2019-737, 2019

DWD climate reference measurements: error correction and uncertainty estimation for measurements with the LTS-2000 temperature sensor

Sven Brinckmann (1), Lisa Hannak (2), and Ruud Dirksen (1)

(1) German Weather Service (DWD), Research and Development, Tauche (OT Lindenberg), Germany (sven.brinckmann@dwd.de), (2) German Weather Service (DWD), Climate Monitoring, Offenbach, Germany (lisa.hannak@dwd.de)

The German Weather Service (DWD) operates 10 climate reference stations for surface observations of meteorological parameters. Since 2008, parallel measurements of traditional (manual) and automatic instruments are performed at these stations. Two kinds of housing are employed to shield the temperature and relative humidity sensors: manual instruments are mounted inside a Stevenson screen and automated instruments are placed inside a ventilated LAM-630 screen. Parallel observations of temperature and humidity are performed both with identical and different sensor types to investigate biases and measurement uncertainties.

These comparative measurements are used to identify and correct for inhomogeneities resulting from changes in the measurement systems. Furthermore, measurement uncertainties are estimated using the combination of climate reference data, laboratory analyses and other field experiments involving instrument inter-comparisons.

Here we show a method for processing temperature data measured with the Pt100 resistance thermometer LTS-2000. First, corrections for known systematic errors due to radiation, nonlinearity and response time are applied. In the second step of the data processing the uncertainty for each data point is estimated by evaluating five main uncertainty components:

(1) calibration/nonlinearity
(2) radiation
(3) response time
(4) data logger and rounding
(5) statistic effects (position and electronics)

The potentially largest source of uncertainty is radiation, causing deviations of up to 1 K under unfavourable conditions (with low sun elevation angle and low wind speed). For the other components standard uncertainties are usually below 0.1 K. Overall uncertainties are calculated by addition of the individual contributions according to error propagation. Overall standard uncertainties after correction are typically between 0.1 and 0.2 K and reach peak values of approx. 0.6 K.