Geophysical Research Abstracts,
Vol. 11, EGU2009-5747-3, 2009
EGU General Assembly 2009

Screen bias detection and statistical minimisation from Western Mediterranean long temperature records

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The substitution of ancient shelters by modern Stevenson screens is thought to be the main cause of breaking homogeneity of long temperature records. It is also known that the so-called screen bias has induced a warm (cold) bias in long maximum (minimum) temperature records, whose magnitude is dependent on the latitude, on the moment of the year / day or on the meteorological conditions of the measurement (Parker, 1994). In the Mediterranean region, screen change is responsible for a strong positive bias in daily maximum temperature records (of about 1 ºC at the annual scale, which shows a clear annual cycle with higher values in summer and lower in winter), meanwhile daily minimum temperatures show a small cold bias (about 0.2 ºC, without seasonal differential behaviour) compared to the modern observations (e. g. Nichols et al., 1996; Brunet et al., 2008). Therefore, the use of the uncorrected data in assessments of long-term temperature variability and change will give negatively-biased results in term of trends, largely underestimating (slightly overestimating) maximum (minimum) long-term rate of temperature change, respectively; this bias would affect so to trend's estimation of the derived daily mean and diurnal temperature range series.
Here we present an exploratory statistical analysis aimed at the minimisation of the "screen bias" from the affected Western Mediterranean air temperature time series. Our approach lies in the statistical analysis of about 6 years (5 years as calibration and 1 year as validation periods) of daily paired maximum and minimum temperature observations taken under a replicated ancient MONTSOURI shelter (one of the open stands used in the past to protect thermometers from direct or indirect radiation and wetting) and the modern STEVENSON screen installed in two experimental sites, the meteorological gardens of La Coruña and Murcia, Spain. These sites are representing the 2 most contrasted Mediterranean climate types: Oceanic/Atlantic and Mediterranean Arid and Semi-Arid, respectively. Descriptive statistical analysis of the paired series from both locations, the general regression model generated for minimising the screen bias and their results for both extreme daily temperatures will be presented and discussed.

References:

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