Geophysical Research Abstracts
Vol. 13, EGU2011-12398, 2011
EGU General Assembly 2011

Is statistical downscaling able to detect inhomogeneities in a time series?

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The reanalysis data can be considered as an independent estimate of the surface temperature (Kalnay et al. 2006). However two limitations could affect the direct use of the reanalysis as a tool to detect non-natural inhomogeneities in a local temperature time series: the scale difference and the greater error of the reanalysis diagnostic fields like the surface temperature. For these reasons we applied a statistical downscaling to bridge the gap between the scale of some prognostic fields of the ERA40 (geopotential at 500 hPa; temperature at 850 hPa and 1000 hPa) and the local temperature time series.

Two examples of application are given, considering two high-quality stations in the North-East of Spain: Ebro(Tortosa) and Fabra (Barcelona), for the period in common with ERA40, 1958-2001. In order to test the homogeneity of the series, a standard statistical test was performed for the two stations, confirming the results of Wijngaard et al. (2003): both the series are "suspect". While for the Tortosa station there are no documented substantial variations of the station environment, for the Fabra station, in the period 1978-1983 the thermometer was in a non-homologated tower (Prohom, personal communication).

For both stations, the statistical downscaling model is calibrated and independently tested in the period without doubtful discontinuities with good results. Then the model is applied to reproduce the doubtful periods resulting in a different behaviour only for the anomalous period of the Fabra series . Whereas for the Fabra station this can corroborate that an artificial discontinuity affects the time series, for Tortosa this result is not conclusive.

Finally we discuss the limitations and the applicability of this approach to detect inhomogeneities in a local temperature time series, highlighting the importance of sharing the climate data and metadata.