



## Homogenization, trends and urban effects on the Spanish temperature series

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The detection of climate change through observational series implies the study of several variables, but focus is placed mainly on temperature, since it is the primary climatic element to be affected by the enhancement of the greenhouse effect.

However, some criticism has been shed on computed temperature trends, since its series are often perturbed by inhomogeneities in form of sudden changes or artificial trends, as is the case with increasing urbanization in the surroundings of many observatories.

The study of temperature trends is generally made on the longest series, leaving aside a good amount of thermometric information just because their series are not very long. In this work, homogenization is applied to all Spanish series of monthly average maximum and minimum temperature with at least 10 years of observations in the period 1951-2012 (2880 series in total). This process resulted in the correction of 2585 outliers and 8330 shifts in the monthly maximum temperatures, with corresponding figures of 2453 outliers and 8536 shifts for minimum temperatures.

The 'Climatol' R package was used to process such amount of data in a rather straightforward way, applied to rectangular overlapping areas to avoid a longer processing time if all 2880 series were treated together.

Trends were computed from the homogenized series, and their spatial distribution shown in maps. The higher positive values were obtained in summer and spring. To study the possible influence of urbanization on these trends, a heuristic approach was undertaken, based on the expected differential seasonal response of maximum and minimum temperatures to this perturbing factor, and using population variations as a proxy for urbanization. This methodology and the results obtained are discussed, opening prospects for further investigations.