



Effects of changes in observational sites position and surrounding urbanisation on the temperature time series of the city of Trento

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Results from field measurements and numerical simulations are analysed to evaluate the spatial variability of near-surface temperature in the urban area of Trento in the Alps. The analysis aims at gaining information supporting the reconstruction of the series of temperature observations in the city, the earliest dating back to 1816: a challenging task, due to various relocations of the observatories and the increasing effects of urbanisation.

The specifically designed field campaign was carried out from August 2009 to November 2010: five identical temperature sensors were placed at the sites of the historical observatories of Trento, to detect possible systematic differences between these places under various seasonal patterns and weather conditions. However, since differences measured nowadays may not be representative of those occurred in the past, numerical simulations were also run with the Weather Research and Forecasting (WRF) model, coupled with an advanced urban parameterization scheme, using a historical land use, reproducing early XX century urbanisation. Moreover, to test if the model is suitable to reproduce microclimatic differences in the urban area, simulations including the present land use, high-resolution urban morphology and anthropogenic heat sources were performed and compared against the observations carried out during the field campaign.

The validation highlights that the model captures well the thermal field inside the urban area, as well as the average temperature differences between the urban sites, with mean absolute errors of order 1°C and 0.5°C respectively. However it reproduces poorly the variability connected with seasonality and weather conditions. Furthermore it is found that the model simulates well the typical features of the urban heat island, even though urbanisation effects tend to be overestimated.

The analysis of the results of the “historical” simulations shows that temperature differences between the observatories more embedded in the urban area have not changed significantly from the past, probably due to similar changes in the surrounding urbanisation, whereas more relevant modifications have occurred at an observatory on the eastern sidewall of the valley, progressively incorporated in the urban area. Finally the comparison between “present” and “historical” simulations suggests that the progressive urbanisation has played a significant role on Trento temperature record in the last century, the effect being more significant under sunny conditions, when the urban heat island is stronger.