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Evolution of the Urban Heat Island of the city of Bologna (Italy) in the last 30 years

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The Urban Heat Island (UHI) phenomenon is the air temperature difference between the urban area and the surrounding agricultural area of a city, due to the anthropic activities and different surfaces typical of the town. This phenomenon has been documented for many cities with different population, topography and climate (Chandler, 1962 and Oke, 1982 among the first), and has been quantified in many areas (see as an example for Italy Agnese et al, 2008). Many causes contribute to the UHI, such as different heat capacities of vegetated surfaces as compared to buildings and paving materials; different absorption due to canopy geometry; anthropogenic heat sources and so on. (for example see Camilloni and Barros, 1997) What is not so easy to find in literature is the study of the evolution of this phenomenon with time. UHI could be improved by changes in the town behaviour (increase in car traffic or winter-heating/summer-cooling), reduced by the enlargement of the suburb area, arriving to include the rural meteorological stations, or mitigated by the general growth of air temperature due to global warming.

In this work, results from the analysis of two 30 years time series air temperature data are presented. The first data set comes from an agrometeorological station sited in the Botanical garden of the University of Bologna, in the centre of the town (44° 30' 05"N, 11° 21' 18" E). The second agrometeorological station is sited in the experimental farm of the University of Bologna in Cadriano (44° 33' 03" N, 11° 24' 36" E), 9 km from the first and outside of the town boundaries. Both data series range from 1978 to 2007 and are measured by mechanical thermoigrometers. Detailed information about instruments and data treatment are available in Matzneller et al. (2009).

Results show an increasing trend in both stations for air maximum (Tmax) and minimum (Tmin) temperatures, more evident in the rural data.

The mean UHI is of about 1.3 $\pm$ 0.7 °C as an average on the 30 years, and shows no significant trend during this period. This means that the difference in temperature between the city and the countryside remains quite constant in time.

On a seasonal base, data show a significant decrease of differences of Tmax in summer, due to a greater increase of air temperature in Cadriano than in Bologna. Moreover, summer data show a significant increase of differences of Tmin, due to higher night temperatures in town in recent years.