

Investigation of Urban Heat Island Intensity in Istanbul

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Urban heat island (UHI) is defined as the temperature difference between the urbanized areas and their surroundings due to local surface energy balance since urban materials and build up structures modify the heating and cooling rates of the ambient air. Istanbul is the largest city of Turkey with the population over 14 million inhabitants and the urbanization is drastically expanded since 1965 due to the population increase from 2 million to 14 million. In this study we investigate impacts of urban expansion on meteorological variables in relation to the UHI effect in Istanbul. To estimate the strength of UHI, temperature differences between urban and suburban stations are calculated by using temperature observations from 6 stations for 1960-2013 years, and 34 stations for 2007–2012. The results show that, the UHI intensity is stronger during summer season and Kartal experiences intensified UHI effect more than the others. The daytime(nighttime) UHI intensity defined with respect to Şile (suburban) varies between 0.41°C and 3.0°C (1.02°C and 2.18°C).

The atmospheric UHI usually reaches its highest intensity on summer nights, and under calm air and a cloudless sky. Therefore, the total of 127 dry days, which have cloudiness less than 2/8 and wind speed less than 2 m/s are selected to estimate the strength of UHI in Istanbul. The hourly temperature differences between a selected urban station (Pendik) and a rural station (Terkos), are calculated as 5°C for daytime and 8°C for the nighttime.

The urbanization negatively impacts the heat stress of urban areas. So that it is important to investigate what type of changes in the urban landscape affect the near-surface climate and elevate the intensity of UHI in the city. The relationship between urbanization and long-term modification of the urban climate of Istanbul is investigated by modeling the present-day spatial distribution of the urban heat load. Geographical data of the Istanbul Metropolitan Municipality and CORINE Land Cover Raster Data are used to generate the land use distribution. Furthermore, the new urban land use types are defined by considering the spatial coverage and the average height of the buildings. Effects of change in land use on daytime and nighttime urban heat island (UHI) of Istanbul is examined using the local-scale atmospheric model MUKLIMO 3. The hot spots of the Istanbul have been identified as central area especially through the southern part of Bosphorus and the historical peninsula. This work is supported by TUBITAK Project, number 114Y047.

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