

Modifications of the urban heat island characteristics under exceptionally hot weather - A case study

Dimitra Founda (1), Fragiskos Pierros (1), and Mathew Santamouris (2)

(1) National Observatory of Athens, Institute for Environmental Research and Sustainable Development, Athens, Greece (founda@meteo.noa.gr), (2) Physics Department Section of Applied Physics, Physics Department, National & Kapodistrian University of Athens, Greece

Considerable recent research suggests that heat waves are becoming more frequent, more intense and longer in the future. Heat waves are characterised by the dominance of prolonged abnormally hot conditions related to synoptic scale anomalies, thus they affect extensive geographical areas. Heat waves (HW) have a profound impact on humans and they have been proven to increase mortality.

Urban areas are known to be hotter than the surrounding rural areas due to the well documented urban heat island (UHI) phenomenon. Urban areas face increased risk under heat waves, due to the added heat from the urban heat island and increased population density. Given that urban populations keep increasing, citizens are exposed to significant heat related risk. Mitigation and adaptation strategies require a deep understanding of the response of the urban heat islands under extremely hot conditions.

The response of the urban heat island under selected episodes of heat waves is examined in the city of Athens, from the comparison between stations of different characteristics (urban, suburban, coastal and rural). Two distinct episodes of heat waves occurring during summer 2000 were selected. Daily maximum air temperature at the urban station of the National Observatory of Athens (NOA) exceeded 40 °C for at least three consecutive days for both episodes. The intensity of UHI during heat waves was compared to the intensity under 'normal' conditions, represented from a period 'before' and 'after' the heat wave. Striking differences of UHI features between HW and no HW cases were observed, depending on the time of the day and the type of station. The comparison between the urban and the coastal station showed an increase of the order of 3 °C in the intensity of UHI during the HW days, as regards both daytime and nighttime conditions. The comparison between urban and a suburban (inland) station, revealed some different behaviour during HWs, with increases of the order of 3 °C in the nocturnal UHI intensity under HW, but decrease in the daily UHI.

The findings were confirmed qualitatively and quantitatively from other two severe episodes of heat waves, occurring during summer 2007.