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Results from the Phoenix Urban Heat Island (UHI) experiment: effects at the local, neighbourhood and urban scales

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This paper reports on the analysis of results from a large urban heat island experiment (UHI) performed in Phoenix (AZ) in April 2008. From 1960 to 2000, the city of Phoenix experienced a minimum temperature rise of 0.47 °C per decade, which is one of the highest rates in the world for a city of this size (Golden, 2004). Contemporaneously, the city has recorded a rapid enlargement and large portion of the land and desert vegetation have been replaced by buildings, asphalt and concrete (Brazel et al., 2007, Emmanuel and Fernando, 2007). Besides, model predictions show that minimum air temperatures for Phoenix metropolitan area in future years might be even higher than 38 °C. In order to make general statements and mitigation strategies of the UHI phenomenon in Phoenix and other cities in hot arid climates, a one-day intensive experiment was conducted on the 4th-5th April 2008 to collect surface and ambient temperatures within various landscapes in Central Phoenix. Inter alia, infrared thermography (IRT) was used for UHI mapping. The aim was to investigate UHI modifications within the city of Phoenix at three spatial scales i.e. the local (Central Business District, CBD), the neighborhood and the city scales. This was achieved by combining IRT measurements taken at ground level by mobile equipment (automobile-mounted and pedicab) and at high elevation by a helicopter. At local scale detailed thermographic images of about twenty building façades and several street canyons were collected. In total, about two thousand images were taken during the 24-hour campaign. Image analysis provides detailed information on building surface and pavement temperatures at fine resolution (Hedquist et al. 2009, Di Sabatino et al. 2009). This unique dataset allows us several investigations on local air temperature dependence on albedo, building thermal inertia, building shape and orientation and sky view factors. Besides, the mosaic of building façade temperatures are being analyzed in terms of local buoyancy fluxes and possible wind flow modifications by such thermally driven flows will be elucidated. The results are of consequence for understanding microclimate of large cities in order to derive urbanizations schemes for numerical models and to set-up suitable heat mitigation strategies.

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