

Observed and simulated impacts of anthropogenic heat on air temperatures in downtown Tokyo and Osaka

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Abstract

In this study, surface meteorological observations using the multi-site installed instruments were carried out in two couples of contrastive urban areas in Tokyo and Osaka during August 2007. Each couple consists of an uptown low-rise residential area and a downtown high-rise business area within the same city. The amounts of anthropogenic heat were estimated based on actual energy consumptions to be greater value up to 200W/m² in business areas and less value around 20W/m² in residential areas. Anthropogenic heat in business areas also indicated remarkable decreases by around 50% at weekends compared to those on weekdays. Then, differences in areal mean surface air temperatures between business area and residential area were analyzed for weekdays and weekends separately. As a result, greater differences up to 1 °C were found on weekdays compared to those on weekends both in Tokyo and Osaka suggesting actual impacts of anthropogenic heat on air temperatures in downtown business areas. To verify this point, a meso-scale model WRF was used. Our original urban Canopy and Building energy Model (AIST-CBM) was newly incorporated into WRF for this calculation. Finally, the observed impacts of anthropogenic heat on air temperatures in downtown Tokyo and Osaka were reasonably reproduced by WRF/AIST-CBM.