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The London Heat Island—Surface and Air Temperature Measurements in a Park and Street Gorges

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ABSTRACT

This paper reports results from short-term tests carried out as part of a project to characterize the urban heat island in London. The investigations looked at air temperatures upstream and downstream of a park and the surface and air temperatures within street gorges. It was found that the air in the park was associated with lower mean (0.6°C [1.1°F] less) and peak temperatures (1.1°C [2.0°F] less) compared to residential or shopping streets on either side. The apparent cooling influence of the park extended downstream between 200 and 400 meters (200 to 400 yards). Measurements in four street gorges showed a wide variation in surface temperatures—up to 22°C (40°F)—although 5ºC to 10°C (9ºF to 18°F) was more typical. For a given facade, lighter surfaces were associated with lower temperatures, between 6ºC and 10°C (11ºF and 18°F) cooler. A strong relationship was found between mean gorge surface temperature and the gorge air temperature measured at 6 m (20 ft) (half-gorge height). This was true for both a sunny day and a cloudy day. The results suggest that significant reductions in air temperature may be possible by adjusting the albedo of urban surfaces.

INTRODUCTION

The heat island effect leads to urban air temperatures being, in general, warmer than those found in rural areas. The form and fabric of an urban area differ substantially from rural zones, and this alters the way in which heat flows into and out of the area. Solar gain is more efficiently captured in a city and, together with heat from anthropogenic sources, is better stored. Likewise, the way in which heat may be dispersed through re-radiation and air cooling is less effective than in the countryside. The effect of these urban/rural differences can be seen if temperature is measured along a transect from the countryside into a city. However, a city is a complex of microclimates with local variation dependent on form, surface characteristics, and anthropogenic fluxes. This variation can act as a guide to developing ways of modifying urban temperatures and mitigating the heat island effect.

The heat island in London is being monitored each hour at 80 measurement stations located on a uniform radial grid of approximate diameter 50 km (30 miles) and some of the results have been reported by the authors elsewhere (Palmer et al. 2000; Watkins et al. 2001). To supplement the long-term air temperature data, short-term tests were carried out in the summer of 2000, aimed at identifying the effect of a park on air temperature and the relationship between air and surface temperature within street gorges on sunny and cloudy days. These measurements are reported in this paper.

Parks

Parks usually contain vegetation through which evapotranspiration converts incoming solar radiation into latent rather than sensible heat, thereby reducing the surface temperature and, in turn, the air temperature. Elevated vegetation, such as tree canopies, intercepts solar energy before it reaches the ground, both providing shading and a better opportunity for the heat to be dispersed. Many observations have confirmed the cooling effect of parks, although their influence beyond their boundaries is uncertain.

Landsberg (1981) reported that large parks situated in urban areas are cooler on warm summer nights. Saito has investigated air and surface temperatures in Kumamoto City in Japan and found that the urban air temperature distribution is related to the distribution of green covering (Saito et al.

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