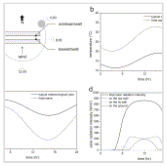
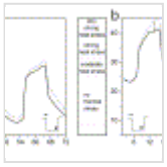
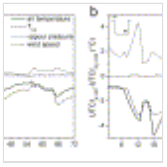
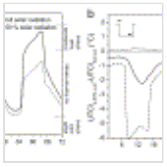
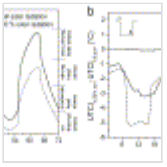
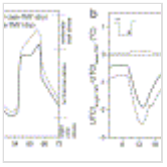
Outline

Figures (9)

Tables (4)

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Comparative assessment of various heat island mitigation measures

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Highlights

- Model is used to assess effectiveness of 3 common heat island mitigation measures.
- Increase in humidity is found to restrict beneficial effect of evaporative cooling.
- Using a higher surface albedo yields lower surface temperatures and increased comfort.
- Shading additionally reduces direct solar irradiation and yields highest comfort gain.
- Performance of measures is found to greatly depend on given context and climate.

Abstract

With the rapid intensification of urban heat islands worldwide, measures for its mitigation are gaining attention. Some of the most popular measures are based on employing evaporative cooling, altering the surfaces' albedo or making use of shading. In this paper, we numerically investigate the influence of each of these three methods on the comfort of a pedestrian in a typical urban street canyon. The environmental conditions in the urban street canyon are obtained from a detailed microclimatic model, and serve as input for a comfort model based on the Universal Thermal Climate Index (UTCI). Simulations are conducted for average summer conditions, taken from a typical meteorological year (TMY), and for heat wave (HW) conditions. The results show that evaporative cooling can considerably reduce the air temperature and the mean radiant temperature, but that the corresponding increase in vapor pressure limits the net gain in comfort. Shading results in significantly reduced surface temperatures, in addition to decreasing the intensity of direct solar irradiation, both leading to an increased comfort sensation. Increasing the local albedo of urban surfaces also leads to lower surface temperatures, but does not affect the amount of direct solar irradiation, explaining the lower

comfort gain compared to shading. The cooling effect of all methods proved to increase during a HW in comparison to a TMY. These observations show that the effectiveness of mitigation measures highly depends on the climatic conditions and demonstrate the potential of microclimatic models to determine the optimal combination of measures for a given context.

Keywords

Heat island; Evaporative cooling; Albedo; Shading; Street canyon; Thermal comfort