

Abstract

City Ventilation by Thermal Buoyancy for Better Urban Environment

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With the rapid development of urbanization in many countries of the world, the man-made climatic alteration in cities becomes significant. How to effectively remove the heat and pollutants in the urban city is one of the major challenging scientific problems in mega-city air environment and energy in future.

Hong Kong is one of the most energy-efficient cities in the world, which is often partly attributed to its high-rise compact city design. Can Hong Kong become a model for large cities in other developing countries? A high population density also, however, means concentrated human activities, and urban heat and pollutant generation, which requires good ventilation in the urban cities. There is a need to establish the ventilation standards and assess the ventilation efficiency for urban cities.

The buoyancy flows can be induced for ventilation of an urban environment due to a large mass of anthropogenic heat and stored solar radiation heat by urban objects. The thermally induced convection airflows such as wall flows over the vertical buildings and slope flows along the mountain surfaces can play an important role on the local air movement in the city when there is no or weak background wind.

Hence, through field measurement and numerical simulation, we carried out this study of the city ventilation of Hong Kong by thermal buoyancy, attempting to improve our understanding of how the thermally-induced air flows are induced in the urban city and how to model the urban thermal environment as well as assess the ventilation effect. The concept of building ventilation by thermal buoyancy has been introduced for the ventilation of a city. The results may be useful to establish an optimum ventilation strategy, and thus helpful for developing effective design tools for healthy environment in the urban areas.

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