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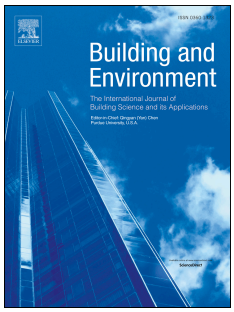

CFD investigation on the effects of wind and thermal wall-flow on pollutant transmission in a high-rise building

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CFD Investigation on the Effects of Wind and Thermal Wall-Flow on Pollutant Transmission in a High-rise Building

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Abstract

The solar radiation can heat the building outer surface, and then cause the upward natural convection flows adjacent to the wall. This phenomenon is especially obvious on a windless sunny day. The near wall thermal plume can drive gaseous pollutants released from lower floors to upper floors. Combined with the effect of ambient approaching wind, the transmission routes will be very complicated. The paper aims to investigate the airflow patterns and pollutant transmission within a building under the effects of wind and thermal forces. A hypothetical twenty-storey slab-shape high-rise building in Shanghai with single-sided natural ventilation is set as the research object in the present study. The intensity of solar radiation on a typical day during transition season is theoretically analysed. The temperature difference between the heated building envelope and the ambient air is calculated by a simplified heat balance model. Finally, the tracer gas method is employed in the numerical simulation to analyse the influence of the wind and wall thermal plume flow on the inter-flat pollutant transmission characteristics. The results show that, the temperature difference between sunward and shady side wall is about 10K at noon on the designate day. When the source is set as a point with steady intensity and the buoyancy is stronger than or approximately equivalent to the wind, the reentry ratio of the flat immediately above the