Postprint: Mobile Downburst Wind Fields and Their Influence on Surface Wind Pressure of Multi-story Buildings

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Abstract

Downbursts often exhibit overall storm translation characteristics, with wind field features that differ significantly from stationary downbursts. By establishing a moving impinging jet numerical model with the horizontal translation speed of the downburst as the key variable, this study investigates the unsteady wind field characteristics of moving downbursts and the wind pressure characteristics on multi-story buildings under their action. The results demonstrate that: the movement of the jet center induces an offset between the storm center and the jet center, forming a bow-shaped extreme wind speed region at the storm's leading edge; moreover, as the translation speed increases, the offset distance increases while the radial width of the bow-shaped region decreases—when α=0.3, the offset distance reaches 0.7Djet and the radial width diminishes to 1.5Djet; as the downburst approaches, passes, and recedes from the building, the surface wind pressure exhibits pronounced temporal variation; different storm translation speeds cause significant differences in wind field structure, thereby influencing the distribution of wind pressure on multi-story building surfaces, with the maximum difference in wind pressure coefficients at identical building locations under downbursts of varying translation speeds reaching 1.304.

Full Text

Preamble

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Note: Figure translations are in progress. See original paper for figures.