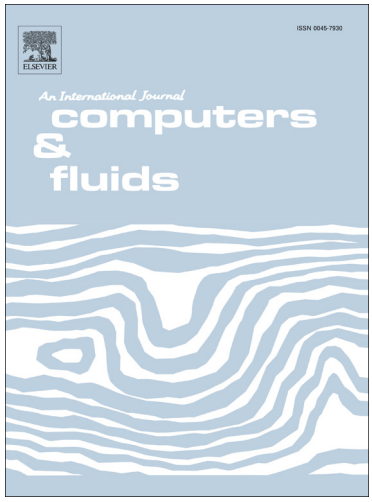

Near-field pollutant dispersion in an actual urban area: Analysis of the mass transport mechanism by high-resolution Large Eddy Simulations

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Near-field pollutant dispersion in an actual urban area: analysis of the mass transport mechanism by high-resolution Large Eddy Simulations

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Abstract

Large-Eddy Simulation of near-field pollutant dispersion from stacks on the roof of a low-rise building in downtown Montreal is performed. Two wind directions are considered, with different wind-flow patterns and plume behavior. The computed mean concentration field is analyzed by means of the convective and turbulent (including subgrid-scale) mass fluxes. This decomposition provides insight into the dispersion process and allows an evaluation of common turbulent transport models used with the Reynolds-Averaged Navier-Stokes approach, such as the standard gradient-diffusion hypothesis. Despite the specific character of the flow and dispersion patterns due to the complex geometry of the urban area under study, some similarities are found with the generic case of dispersion around an isolated simple building. Moreover, the analysis of dispersion in downtown Montreal is facilitated by the physical insight gained by the study of the generic case. In this sense, the present study supports the use of generic, simplified cases to investigate and understand environmental processes as they occur in real and more complex situations. Reciprocally, the results of this applied study show the influence on the dispersion process of the rooftop structures and of the orientation of the emitting building with respect to the incoming wind flow, providing directions for further research on generic cases.

Keywords

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