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Particle Dispersion in the Urban Boundary Layer by Complete and Reduced-Order Flow Fields Retrieved from Lidar Data[1] QUANXIN XIA, CHING-LONG LIN, Department of Mechanical and Industrial Engineering, IIHR-Hydroscience and Engineering, The University of Iowa — The four-dimensional variational data assimilation (4DVAR) method is used to retrieve complete 3D wind fields in the urban boundary layer from the Doppler lidar data measured during the Joint Urban 2003 atmospheric dispersion field experiment. The proper orthogonal decomposition technique is then applied to the retrieved wind fields to extract turbulent coherent structures (eigenmodes). It is found that the overall flow features, such as roll vortices, are captured by the first several low-order eigenmodes. These low-order eigenmodes are used to reconstruct the transient 3D reduced-order flow fields. We then study turbulent particle dispersion in the urban setting by those complete and reduced-order velocity fields. The Lagrangian particle dispersion model is first validated by using the large-eddy simulation (LES) data of an idealized convective boundary layer flow. The results show that the reduced-order flow fields could yield similar particle dispersion patterns as the complete flow fields.

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