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Coherent Structures in a Convective Urban Boundary Layer: An Adjoint Lidar-Data Assimilation Study.[1] QUANXIN XIA, CHING-LONG LIN, Department of Mechanical and Industrial Engineering, IIHR-Hydroscience and Engineering, The University of Iowa, RONALD CALHOUN, Department of Mechanical and Aerospace Engineering, Arizona State University — The accuracy of the four-dimensional variational data assimilation (4DVAR) method is first evaluated using the dual lidar data measured during the Joint Urban 2003 atmospheric dispersion field experiment held in Oklahoma City. By comparing with the second lidar observational data, the single lidar 4DVAR is found to retrieval radial velocity fields with an accuracy of 80-90% in the cross-beam direction despite of the missing cross-beam information. This suggests that the current single lidar 4DVAR is able to retrieve reasonably accurate 3D wind fields. The retrieved complete wind and temperature fields are then used to identify coherent flow structures in a convective urban boundary layer, such as convective rolls. The correlation between the retrieved flow structures and the building data, such as the airpark, the central business district, and restaurants, is examined. The multi-scale nature of these structures is further analyzed by using the proper orthogonal decomposition (POD) technique. The interplay between different spatial and temporal POD eigenfunctions is discussed.

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