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Simulations of turbulence and dispersion in idealized urban canopies using a new kinetic scheme LIAN-PING WANG, PABLO HUQ, University of Delaware, USA, ZHAOLI GUO, Huazhong University of Science and Technology, China — In this talk, we will demonstrate the capabilities of a new kinetic scheme, known as the Discrete Unified Gas Kinetic Scheme (DUGKS), by simulating turbulent flow and scalar dispersion in an idealized urban canopy. DUGKS is a finite-volume formulation of the Boltzmann equation which can incorporate a non-uniform grid. It could be used as an direct numerical simulation tool or as a large-eddy simulation tool for turbulent flow in a complex geometry. We will describe this mesoscopic CFD method, and details in setting up a non-uniform grid, no-slip boundary condition on solid surfaces, and far-field boundary conditions. The model urban canopy contains an array of buildings with a prescribed building-height-to-width aspect ratio. Several aspect ratios will be considered in the simulations. A passive scalar is continuously released from a near-ground point source. Profiles of mean velocity, turbulence statistics, and scalar concentration obtained from the simulations will be compared to data from water-tunnel measurements. Grid refinement will be performed to study the convergence of the simulated results on the grid resolution.

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