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Large Eddy Simulation of a boundary layer flow over urban-like roughness KOJIRO NOZAWA, Shimizu Corporation, TETSURO TAMURA, Tokyo Institute of Technology — In this study, Large Eddy Simulation (LES) of a boundary layer flow over large-scale roughness was performed targeting the experiments conducted by Cheng and Castro [Boundary-Layer Meteorology 104, 229-259 (2002)]. In order to duplicate the experimental conditions, the pseudo periodic boundary method for rough-wall boundary flows [Nozawa and Tamura (2000)] was applied to the inlet boundary conditions and the computational area was reduced to less than 50% in the streamwise direction. The roughness blocks were modeled using immersed boundary approach which would reduce the grid points around the roughness blocks. The characteristics of the turbulent flow over large-scale roughness, whose roughness area density was 25% and the ratio δ/h (δ : boundary layer thickness, h roughness height) was almost $7 \sim 10$, were different from those whose ratio δ/h is more than 40 [Jimenez, Annu. Rev. Fluid Mech., 36, 173-196 (2003)]. The spatial variation of vertical profiles of mean and fluctuation velocities are studied in detail and compared to the experimental data. We focus on the influence to the spatial variations of turbulence structure deduced by large-scale roughness. This study was conducted using the Earth Simulator in Yokohama, Japan.

Tetsuro Tamura
Tokyo Institute of Technology

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