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Investigation of Reynolds stresses in a 3D idealized urban area using large eddy simulation AKSHAY GOWARDHAN, Los Alamos National laboratory, ERIC PARDYJAK, University of Utah, INANC SENOCAK, Boise State University, MICHAEL BROWN, Los Alamos National laboratory — Large eddy simulation (LES) of neutral flow through an array of cubes has been conducted with periodic boundary conditions in horizontal directions. In this paper, we first describe the model formulation and validate the simulation by comparing the mean flow and turbulence statistics with wind-tunnel experimental data from a cube array of buildings. The LES model is then used to investigate the physical mechanisms that lead to the low turbulent stresses that have been reported in the lower half of the urban canopy layer. To do this, the urban boundary layer is conceptually broken down into three distinct regions: (a) the urban roughness sub-layer, (b) street channels (roads with axis aligned with mean wind direction aloft) and (c) street canyons (roads with axis normal to the mean wind direction aloft). The distribution of the Reynolds stresses differs significantly amongst these regions. In a complex urban area, these regions can be observed intermittently at the same physical location, thus, stresses with opposite signs have the potential to cancel each other and on average yield a low magnitude. In this paper, mean turbulence statistics and spectra from high resolution LES have been analyzed for these scenarios and the results have been interpreted.

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