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Turbulent flow over different groups of cubical obstacles¹ STE-FANO LEONARDI, Dep. Mech. Eng., University of Puerto Rico at Mayaguez, Puerto Rico, IAN CASTRO, School of Engineering Sciences, University of Southampton, Southampton, UK, PAOLO ORLANDI, Dip. Meccanica ed Aeronautica, University of Rome, "La Sapienza", Rome, Italy — Atmospheric boundary layers flow over a rough surface, composed of buildings, hills, valleys, vegetation. The present investigation extends previous studies by carrying out a set of DNSs of flow over arrays of cubical obstacles with varying the plan densities (1:4, 16:81, 4:25, 16:121, 1:9, 1:25). The Reynolds number based on the bulk velocity and the obstacle height is Re = 7000. Boundary conditions are periodic in the streamwise and spanwise directions, and free slip is applied on the upper boundary. The passive scalar diffusion equation is solved with Pr=1 and concentration c=1 at the bottom wall and c=0 at the upper boundary. The effect of the cubes is to increase the wall normal velocity fluctuations therefore the scalar is transported away from the wall most effectively. The drag is almost entirely due to the form drag, the frictional contribution being small. The roughness function and the roughness length scale well with the wall normal velocity rms at the crests plane. This confirms that the effect of roughness on the overlying flow is via the wall normal velocity fluctuations.

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