Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Dynamic roughness model for LES of turbulent flow over multiscale urban-like topography[1] XIAOWEI ZHU, WILLIAM ANDERSON, UT Dallas — Urban-like topographies are composed of a wide spectrum of topographic elements, which results in multiscale, fractal-like distributions. This has important implications for microscale numerical weather prediction in urban environments, or urban meteorology: the range of scales inhibits the use of numerical schemes where the topography is fully resolved, but the self-similar nature of the topography inspires development of closures that leverage such self-similarity to parameterize unresolved information. That is, a natural urban landscape can be low-pass filtered at the large-eddy simulation grid scale, thereby removing details between the grid scale and the smallest scale of the landscape, but the effects of these truncated topographic modes can be modeled based on details of the large scale. LES has been used to investigate the effects of subgrid-scale (SGS) topography on the roughness length of multiscale urban-like topographies. First, high-resolution multiscale urban-like topographies were generated with random distribution function. Then, the high-resolution multiscale topography was filtered and separated into large- and small-scale topographies with the Reynolds decomposition. Thus, the topography was decomposed into resolved (scale larger than the grid scale) and SGS part (scale smaller than the filter scale). The resolved part was resolved in LES, while the SGS terrain must be parameterized. New models for urban roughness will be used to parameterize SGS topography.

[1]Army Research Office, Grant W911NF-15-1-0231

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Date submitted: 20 Jul 2016 Electronic form version 1.4