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A large-eddy simulation study on statistical attributes of urban-like geometries relevant to parameterizing bulk aerodynamic characteristics[1] XIAOWEI ZHU, WILLIAM ANDERSON, UT Dallas — The inherent spatial heterogeneity exhibited by real urban environments complicates a priori estimation of the roughness height needed to parameterize the inertial layer mean streamwise velocity. A large-eddy simulation study of turbulent flow over 3-D random urban-like topographies is conducted to explore the effects of surface geometry on bulk aerodynamic characterization. In a mean sense, we find that statistical attributes including surface height root mean square and skewness can adequately capture the spatial heterogeneities and randomness of real urban geometries. We find, however, that higher-order statistical moments have a negligible affect on aerodynamic drag (i.e. kurtosis may be omitted). The results enable exploration of applicability of some recently-proposed roughness parameterizations that are relevant to complex, urban-like roughness (including the model proposed by Flack and Schultz, 2010: J. Fluids Eng. 132, 041203-1). We evaluate empirical parameters needed in these models for the present urban-like cases. We find that two empirical parameters (relevant to height rms and skewness) can characterize the bulk aerodynamic roughness of topographies with statistical attributes comparable to dense urban environments.

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