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LES of atmospheric boundary layer flow over fluvial-like anisotropic topography with a dynamic surface drag model[1] WILLIAM ANDERSON, Mechanical Eng, Baylor University, CHARLES MENEVEAU, Mechanical Eng. & CEAFM, Johns Hopkins University — A dynamic surface drag model (A. & M. 2011, JFM 679, 288 - 314) is applied in LES of atmospheric boundary layer (ABL) flow over fractal-like topography where the height field exhibits power-law energy spectrum. Initially, the dynamic drag model was applied in LES of ABL flow over isotropic synthetic fractal-like roughness. Here we consider fluvial-like anisotropic landscapes. Two main cases are considered. The first is a fluvial-like topography built through numerical solution of the Kardar-Parisi-Zhang equation.[2] The second is a rescaled topography (Texas) map from the U.S. National Elevation Dataset. These landscapes are dominated by anisotropic modes that have emerged through geomorphological erosion processes. The dynamic model yields stable solutions even in these highly anisotropic cases: performance is strongest for cases where the LES grid- and test-filter width are within the landscape "self-similar" range. Weaknesses are reported for cases where spectral exponent changes with wavenumber, motivating the development of a scale-dependent version of the dynamic approach using two test-filters.

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