Abstract Submitted
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A dynamic surface rougness model for large-eddy simulation of atmospheric boundary layer flow over fractal-like evolved fluvial landscapes[1] WILLIAM ANDERSON, Johns Hopkins University, PAOLA PASSALACQUA, FERNANDO PORTÉ-AGEL, University of Minnesota, CHARLES MENEVEAU, Johns Hopkins University — Evolved fluvial landscapes are characterized by a multi-scale composition of channels which display scale-invariance properties. A high-resolution evolved landscape is obtained through solution of a modified version of the Kardar-Parisi-Zhang equation. This landscape is spatially filtered to various resolutions for large-eddy simulations (LES) of the atmospheric boundary layer flowing over such surfaces. In the LES the subgrid-scale motions are parameterized using the Lagrangian scale-dependent dynamic model (Bou-Zeid et al. 2005). The boundary condition at the lower boundary is prescribed using a roughness length that is modeled as the product of local standard deviation of the unresolved height field and an unknown dimensionless coefficient. This coefficient is evaluated dynamically by comparing the plane-average force due to wall-stress at two resolutions. The results illustrate that the challenges posed by the multi-scale interactions of fluvial fractal-like lower surface boundary condition with the atmospheric turbulence may be addressed using a dynamic model for unresolved surface roughness.

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