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The Role of Law-of-the-Wall and Roughness Scale in the Surface Stress Model for LES of the Rough-wall Boundary Layer. JAMES BRASSEUR, U Colorado Boulder, PAULO PAES, Penn State, MARCELO CHAMECKI, UCLA — Large-eddy simulation (LES) of the high Reynolds number rough-wall boundary layer requires both a subfilter-scale model for the unresolved inertial term and a "surface stress model" (SSM) for space-time local surface momentum flux. Standard SSMs assume proportionality between the local surface shear stress vector and the local resolved-scale velocity vector at the first grid level. Because the proportionality coefficient incorporates a surface roughness scale z_0 within a functional form taken from law-of-the-wall (LOTW), it is commonly stated that LOTW is "assumed," and therefore "forced" on the LES. We show that this is not the case; the LOTW form is the "drag law" used to relate friction velocity to mean resolved velocity at the first grid level consistent with z_0 as the height where mean velocity vanishes. Whereas standard SSMs do not force LOTW on the prediction, we show that parameterized roughness does not match "true" z_0 when LOTW is not predicted, or does not exist. By extrapolating mean velocity, we show a serious mismatch between true z_0 and parameterized z_0 in the presence of a spurious "overshoot" in normalized mean velocity gradient. We shall discuss the source of the problem and its potential resolution.

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