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A-priori Wind Tunnel Study of Subgrid-scale Models for LES of a Boundary Layer Over a Rough-to-Smooth Transistion MATT CARPER, FERNANDO PORTÉ-AGEL, St. Anthony Falls Lab, University of Minnesota, Minneapolis, MN — Improving our understanding of subgrid-scale (SGS) physics is of key importance to large-eddy simulation (LES) becoming a reliable tool to study atmospheric boundary layer fluxes over heterogeneous land surfaces. The largest errors in LES of the atmospheric boundary layer are associated with parameterization of the subgrid-scale fluxes required to account for the effect of the unresolved (subgrid) scales on the resolved scales. In particular, the SGS stresses need to be specified through the entire boundary layer, using a SGS model, and at the surface, as a boundary condition (or wall model). Many of these SGS models have limited accuracy due to their assumptions of horizontal spatial homogeneity. In this wind tunnel experiment we evaluate, *a priori*, the SGS stresses and energy transfers from measurements using stereoscopic particle image velocimetry (PIV) in a boundary layer ($Re_\theta = 10,000$) over a rough- to-smooth transition. The high-resolution, planar 3-D velocity fields, obtained at various positions downstream of the roughness transition, are spatially filtered in 2-D and used to calculate SGS stresses and filtered strain rates. These in turn are used to compute local SGS transfers of resolved energy. The results of this analysis are used to characterize the SGS stresses and energy transfers as a function of position in the flow, and to evaluate (*a priori*) several SGS models.

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