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Investigation of the pressure-strain-rate correlation using high-resolution LES of the atmospheric boundary layer[1] KHUONG NGUYEN, Clemson University, MARTIN OTTE, US Environmental Protection Agency, EDWARD PATTON, PETER SULLIVAN, National Center for Atmospheric Research, CHENNING TONG, Clemson University — We analyze the pressure-strain term in the Reynolds stress transport equation using large-eddy simulations of the atmospheric boundary layer (ABL). The simulations are implemented on computational meshes varying from 256^3 to 1024^3 grid points and employ several different SGS closures (Smagorinsky 1963; Sullivan et al. 1994; Kosovic 1997). The results highlight the influence of both shear and buoyancy on the pressure-strain-rate correlation. In the neutral (shear dominated) ABL, the behavior of the pressure-strain-rate correlation predicted by the Smagorinsky and Kosovic SGS models are consistent with the log-layer scaling and DNS results. In the strongly convective ABL, all three models predict behaviors for the pressure-strain-rate correlation that are consistent with the mixed- (outer-) layer scaling and field measurements. In cases where both shear and buoyancy are important, the highest-resolution runs are able to predict a combination of the log-layer scaling (near the wall) and the mixed-layer scaling (away from the wall), whereas the coarser-resolution runs are unable to capture this transition. The results are potentially useful for both Reynolds stress models and transport-equation-based SGS models for the convective atmospheric boundary layer.

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