Abstract Submitted
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Scale-separation phenomena in rough-wall turbulent boundary layers[1] RACHEL EBNER, CALEB MORRILL-WINTER, University of New Hampshire, JOSEPH KLEWICKI, University of New Hampshire, University of Melbourne — Analysis of data from smooth-wall flows indicates that scale- separation and scale-selection phenomena occur between the velocity and vorticity fields as a function of distance from the wall and Reynolds number. These phenomena are significant since correlations between specific velocity and vorticity components underlie the momentum and energy transport mechanisms operative in boundary layer turbulence. The current effort explores these phenomena in rough-wall flows by examining the behaviors of velocity and vorticity component spectra and co-spectra as derived from multi-sensor hot-wire measurements. The data were acquired at multiple Reynolds numbers and for two different sizes of homogeneously distributed roughness. A four-wire probe configuration allowed for well-resolved measurements of the streamwise and wall-normal velocity components, as well as the spanwise component of vorticity. Pre-multiplied power spectra and the associated co-spectra are interpreted relative to the wall- normal variations of the Reynolds stress and kinetic energy gradient. These results are compared to the smooth-wall analysis, and the recent rough-wall findings of Hong et al. (*J. Fluid Mech.* **667**, 2011) indicating that roughness effectively sets the scale of the vortical motions throughout the boundary layer.

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