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Inner and Outer Flow Interactions on Rough, Turbulent Boundary Layers[1] SHEILLA TORRES-NIEVES, Rensselaer Polytechnic Institute, HYUNG-SUK KANG, CHARLES MENEVEAU, The Johns Hopkins University, LUCIANO CASTILLO, Rensselaer Polytechnic Institute — Laser Doppler and hotwire anemometry measurements are performed to study the effects of surface roughness on the different length scales of the turbulent boundary layer. Measurements are carried out downstream of an active grid, with free-stream turbulence and Reynolds number, based on momentum thickness, of up to 6% and 4,300, respectively. Second-order structure functions and energy spectra distributions are used to identify and examine how surface roughness affects the inner and outer regions of the boundary layer. Second order structure function analysis suggests that, for favorable pressure gradient flows, surface roughness directly interacts with, not only the small length scales of the flow, but also with intermediate and even large scales. These observations are even more evident when additional levels of turbulence are present in the free-stream. Power spectral density plots are analyzed in order to understand the mechanism by which larger length scales interact with the surface roughness at the wall.

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