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Flow Structures and Effects of Spatial Resolution on Turbulence Statistics in Rough Wall Turbulent Channel Flow[1] JOSEPH KATZ, JIARONG HONG, Johns Hopkins University, MICHAEL SCHULTZ, US Naval Academy — PIV data obtained in the roughness sublayer of a turbulent channel flow is used for examining effects of spatial resolution on the magnitude, distribution, and trends of Reynolds stresses. Starting with a vector spacing of 63um (9-12 wall units), for roughness consisting of 0.45mm high pyramids at Re_τ=3400-5418, spatial filtering of data causes major reduction in the magnitude of Reynolds stresses in the roughness sublayer. Although these reductions extend to well above the log layer, they increase with decreasing distance from the wall, especially for terms involving the wall-normal velocity fluctuation component, but also for the streamwise component. As expected, these effects increase with filter size, and are much higher for 2D filters in comparison to 1D ones. Consequently, trends of Reynolds stresses, and even mean flow profile vary significantly with filter properties. Spatial energy spectra and distributions of 2D swirling strength show the increasing role of small scale eddies on 2^{nd} order statistics as the wall is approached, which is attenuated by filtering.

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