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Observations of Large-Scale Meandering Motions in Rough-Wall Turbulence R. MEJIA-ALVAREZ, Y. WU, K.T. CHRISTENSEN, University of Illinois — Recent experimental evidence suggests the existence of meandering low-speed motions in the logarithmic region of smooth-wall turbulence with streamwise extents well exceeding the boundary- layer thickness. The present contribution explores the possible existence of these large-scale motions in turbulent flow over a rough surface. Time-resolved particle-image velocimetry experiments are performed in a streamwise–spanwise plane in the vicinity of a rough wall ($y \cong 0.065\delta$) replicated from a turbine blade damaged by deposition of foreign materials. This surface is highly irregular and contains a broad range of topographical scales. Taylor's hypothesis is utilized to reconstruct velocity fields over 8δ-long in the streamwise direction from the time- resolved PIV fields. Similar to previously-reported smooth-wall observations, these reconstructed velocity fields are marked by connected regions of low-speed fluid [$O(\delta)$ wide in the spanwise direction] that extend well beyond δ in the streamwise direction and meander significantly in the spanwise direction. In addition, wall- normal vortex cores of opposing rotation are found to populate the boundaries of these meandering, low-speed regions. The average characteristics of these motions in rough-wall turbulence are explored and compared to observations from smooth-wall flow.

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