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Scale interactions in a turbulent boundary layer overlying roughness with spanwise heterogeneity using high speed PIV. RONGNAN YAO, University of Notre Dame, GOKUL PATHIKONDA, Georgia Institute of Technology, KENNETH T. CHRISTENSEN, University of Notre Dame — Recent studies have shown that, similar to smooth-wall turbulence, boundary layers overlying roughness embody strong inner–outer interactions even though the near-wall region is significantly perturbed by the roughness. The intensity of these interactions can be even stronger in rough wall flow as reflected in amplitude and frequency modulation correlations. In this study, we investigate these scale interactions for the case of flow overlying roughness with spanwise heterogeneity using high-speed particle image velocimetry. Spanwise-heterogeneous surfaces are common in both nature and engineering applications, and these topographies give rise to unique flow physics that requires further study for a more comprehensive understanding. Here, two spanwise heterogeneous surfaces are used: a complex heterogeneous roughness and an idealized ridge-type roughness. The PIV measurements are performed in a refractive-index matched flow facility to enable high quality data yield in the near-wall region. For both topographies, streamwise–wall-normal flow fields are measured at high-momentum and low-momentum pathways associated with roughness-induced secondary flows owing to topographical spanwise heterogeneity. These data provide a basis for exploring the spatio-temporal nature of inner–outer interactions.

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