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Measurements of turbulent boundary layer flow and surface fluxes over roughness and temperature transitions COREY MARKFORT, IIHR-Hydroscience and Engineering, University of Iowa, WEI ZHANG, Mechanical Engineering Department, Cleveland State University, FERNANDO PORTE-AGEL, WIRE Laboratory, EPFL — Often natural and engineered surfaces have spatially heterogeneous properties at a variety of scales that affect the structure of the turbulent boundary layer, which is no longer in equilibrium with the local surface. Predicting the spatial distributions of surface momentum and scalar fluxes over heterogeneous surfaces remains a challenge. We present measurements made in a thermally stratified boundary layer wind tunnel to characterize the turbulent flow and surface fluxes for abrupt transitions in surface temperature and roughness. We compare the development of internal boundary layers for momentum and heat, and associated mean surface flux for two cases. The first is a smooth boundary layer with an abrupt change in surface temperature and the second also involves a change from a fully rough to a smooth wall. The effects of roughness change on surface heat flux and implications for prediction are examined. The data will be compared to typical models that utilize Monin-Obukhov similarity theory.

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