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Investigation of turbulence structure over impermeable and permeable rough walls with identical topography TAEHOON KIM, University of Illinois at Urbana Champaign, GIANLUCA BLOIS, University of Notre Dame, JIM BEST, University of Illinois at Urbana Champaign, KENNETH CHRISTENSEN, University of Notre Dame — Turbulent flow over complex topographies, both impermeable and permeable, is encountered in a broad range of natural and engineering systems. Wall permeability gives rise to significant modifications of the underlying flow structure owing to modified wall boundary conditions: slip and penetration. Across this interface, remarkable flow interactions occur and govern significant mass and momentum exchange resulting in apparent modification of the turbulence. In addition, the topography (roughness) of the surface modifies the near-wall flow. The current investigation explores the role of permeability and topography in turbulent flow through the use of sphere-based impermeable (single layer of hemispheres) and permeable (two layers of spheres) walls. Flow across the permeable interface was accessed using a refractive-index matching technique, that permitted high resolution particle-image velocimetry (PIV) measurements to be made in the streamwise-wall-normal (x x y) plane. This paper will detail analysis of the first and second order velocity statistics associated with these two different cases.

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