Abstract Submitted
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Measurements of turbulent flow overlying impermeable and permeable walls[1] TAEHOON KIM, University of Illinois, Urbana Champaign, GIANLUCA BLOIS, University of Notre Dame, JAMES BEST, University of Illinois, Urbana Champaign, KENNETH CHRISTENSEN, University of Notre Dame — There exist an array of natural and industrial flow systems wherein the flow is bounded by a surface that is both permeable and rough (e.g. river beds, bed reactors). In such scenarios, the wall boundary condition is complex as it involves both slip and penetration which together significantly modify the statistical and structural modifications the overlying flow owing to momentum exchange across the wall. The current investigation explores the individual roles of topography and permeability in such flows by systematically decoupling one from the other with a number of wall models having the same porous structure (i.e. cubically arranged spheres; two and five layers, respectively, to highlight the effect of turbulence penetration depth) but with different surface topography (smooth versus cubically arranged hemispheres). High resolution particle-image velocimetry measurements were conducted in the streamwise-wall-normal $(x - y)$ plane and refractive-index matching was employed to optically access the flow within the permeable wall. First- and second-order velocity statistics are used to assess the flow modifications associated with the different wall models and thus ascertain the individual impacts of permeability and topography.

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