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Effects of biofilm on flow over and through a permeable bed FARZAN KAZEMIFAR, GIANLUCA BLOIS, MARCELO AYBAR, PATRICIA PEREZ-CALLEJA, ROBERT NERENBERG, Univ of Notre Dame, SUMIT SINHA, RICHARD HARDY, Durham Univ, JAMES BEST, Univ of Illinois, GREGORY SAMBROOK-SMITH, Univ of Birmingam, KENNETH CHRISTENSEN, Univ of Notre Dame — Biofilms constitute an important form of bacterial life in aquatic environments and are present at the interface of fluids and solids, such as riverbeds. Biofilms are permeable, heterogeneous, and deformable structures that can influence the flow and mass/momentum transport, yet their interaction with flow is not fully understood in part due to technical obstacles impeding quantitative experimental investigations. The porosity of river beds results in the generation of a diverse mosaic of 'suction' and 'ejection' events that are far removed from typical assumptions of turbulent flow structure over an impermeable bed. In this work, the effect of biofilm on bed permeability is studied. Experiments are conducted in a closed water channel equipped with 4-cm-deep permeable bed models consisting of horizontal cylinders normal to the bulk flow direction, forming an idealized two-dimensional permeable bed. Prior to conducting flow experiments, the models are placed within an independent biofilm reactor to initiate and control the biofilm growth. Once a targeted biofilm growth stage is achieved, the models are transferred to the water channel and subjected to transitional and turbulent flows. Long-distance microscopic particle image velocimetry measurements are performed to quantify the effect of biofilm on the turbulence structure of the free flow as well as the freestream-subsurface flow interaction.

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