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Turbulent flow structure associated with interacting 3D bedforms
NATHANIEL BRISTOW, GIANLUCA BLOIS, University of Notre Dame, JAMES BEST, University of Illinois at Urbana-Champaign, KENNETH CHRISTENSEN, University of Notre Dame — Barchan dunes are three-dimensional, crescent-shaped bedforms, and while most commonly associated with aeolian environments, recent observations have shown them to form in subaqueous and extraterrestrial environments as well. As barchans migrate in the direction of the flow, they interact with their neighbors, typically by way of a collision. The morphodynamics of such collision processes are complex, where the role of the turbulent flow structure is strongly coupled to that of the sediment transport and morphological change. Here we study the flow structure in a decoupled manner through measurements of the turbulent flow over fixed-bed models of barchan dunes in various configurations involved in a barchan collision process. Particle image velocimetry is used to measure the flow in a refractive-index matched flume environment that enables access to the whole flow field around these geometrically complex bedforms. Presented herein are results from planar PIV measurements in several measurement planes, including the cross-plane, showing the dynamics of turbulent flow structures associated with barchan dunes which are hypothesized to drive the morphodynamics of the dune interaction.

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