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Numerical simulation of the flow over Barchan dunes MOHAMMAD OMIDYEGANEH, UGO PIOMELLI, Queen's University, Kingston (ON), Canada, KENNETH T. CHRISTENSEN, JIM BEST, University of Illinois at Urbana-Champaign — We performed large-eddy simulation of the turbulent flow over a typical barchan dune model. The configuration is similar to that of experiments carried out at the University of Illinois, but the Reynolds number based on the free-surface velocity and the dune height is one fifth of the experiment. The simulation adopts the volume-of-fluid technique to model the dune. The use of periodic boundary conditions in the streamwise and spanwise directions implies that we are considering a fully developed flow over one dune in an infinite array. The height of the domain is close to the thickness of the approaching boundary layer, upstream of the dunes in the experiment. The resolution used is close to a typical DNS; $\Delta x^+ < 20.7$, $\Delta y^+ < 0.8$, and $\Delta z^+ < 10.3$. The approaching flow to the dune accelerates over the stoss (upstream) side and rises up to the crest, while at the same time diverging slowly in the spanwise direction toward the closest horn. The separated flow either reattaches on the plane or moves helically inside the recirculation zone toward the closest horn. The separated shear-layer extends downstream and toward the free-surface and contribute to downstream dunes. The agreement of the turbulence statistics with the experiment is good.

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