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Large-eddy simulation of the flow over two-dimensional dunes M. OMIDYEGANEH, U. PIOMELLI, A.M. DA SILVA, Queen's University, Kingston, Canada — When a fluid flows over a mobile sand bed the sediment transport generated by the interaction of the flow field with the bed often results in the periodic deformation of the bed in the form of dunes. Dunes generally reach an equilibrium shape, and slowly propagate in the direction of the flow, as sand is lifted in the high-shear regions, and redeposited in the separated-flow area. Our aim is to attempt to connect the flow-field characteristics with the bed deformation. As a first step, we perform large eddy simulation of the flow over a typical dune geometry at laboratory scale (the Reynolds number based on the average channel height and mean velocity is 18,900). We consider three dunes, with different heights (relative to the channel depth) but equal wavelengths, using approximately ten million grid points. The mean flow shows a recirculation region downstream of the dune crest, whose extent increases with dune height. After reattachment the shear stress becomes high, confirming that sediment is lifted up in this region. The Reynolds stresses are higher in the shear layer, where the high spanwise vorticity gives rise to coherent vortices. The budgets of turbulent kinetic energy show that, in addition to production and dissipation, the diffusion terms play an important role. In the reattachment region, diffusion and dissipation are more significant. The mean flow advection is important at the beginning of the shear layer.

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