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Two-way coupled direct numerical simulations of sinuous-crested bedforms.[1] NADIM ZGHEIB, School of Engineering - Lebanese American University, S BALACHANDAR, Dept. of Mechanical and Aerospace Eng. - University of Florida — We present results from direct numerical simulations on the transition from straight-crested to sinuous-crested bedforms. The numerical setup is representative of turbulent open channel flow over an erodible sediment bed at a shear Reynolds number of $Re_\tau = 180$. The immersed boundary method accounts for the presence of the sediment bed. The simulations are two-way coupled in the sense that the turbulent flow can erode and modify the sediment bed, and in turn, the sediment bed modifies the overlying flow. The coupling from the flow to the sediment bed occurs through the Exner equation, while the back coupling from the bed to the flow is achieved by imposing the no-slip and no-penetration condition at the immersed boundary. The simulation setup is similar to that by Zgheib et al. (https://doi.org/10.1002/2017JF004398) except for the presence of sidewalls to better mimic laboratory flume conditions. Sidewalls are observed to significantly increase bedform sinuosity. We also investigate the effect of domain size and a zero sediment flux boundary condition on crestline sinuosity.

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