Abstract Submitted
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Direct numerical simulations of fluvial bedforms under turbulent flow.[1] NADIM ZGHEIB, University of Florida, J.J. FEDELE, D.C.J.D. HOYAL, M.M. PERILLO, ExxonMobil Upstream Research Company, S. BALACHANDAR, University of Florida — We examine fluvial bedforms using bed-flow coupled direct numerical simulations in a turbulent open channel at a shear Reynolds number of $\mathrm{Re}_\tau = 180$. The back coupling from the temporally and spatially evolving bed to the flow is enforced via the immersed boundary method. Using the near-bed flow field, we provide evidence on the role of locally intense near-bed vortical structures during the early stages of bed formation, from the emergence of quasi-streamwise streaks to the formation of incipient bedform crestlines. Additionally, we take a new look at a number of defect-related bedform interactions, including lateral linking, defect and bedform repulsion, merging, as well as defect creation and show that the underlying mechanisms, in these flow-aligned interactions, are very similar. Consequently, the interactions are labelled differently depending on the geometry of interacting structures and the outcome of the interaction. We compare our results to published experimental data and demonstrate the importance of neighbouring structures, especially upstream neighbours, on bedform dynamics and wave coarsening. We also show that not only do bedforms attain a self-similar shape, but that the bed shear stress becomes self-similar as well..

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