Abiola Adebiyi[1] and Eric Prokocki[1]

[1]Affiliation not available

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Abstract

The deposits of subaqueous dunes are a fundamental building block of verticallystacked alluvium in river to tidal settings and are responsible for producing the largest component of frictional resistance to flow via form roughness. Thus, dunes have attracted considerable attention amongst researchers for decades since they are found in virtually all environments (headland rivers to abyssal plains) and grain sizes (coarse silts to gravels) along the source-to-sink sediment transport pathway. Of these environments, dunes produced by rivers (unidirectional flows) are the most widely studied with respect to their morphologic dynamics and their scaling of height and wavelength to flow depth, whilst our understanding of these same characteristics within bidirectional (tidal) and combined-flow (currents with a unidirectional and oscillatory component) is quite limited. This knowledge gap is addressed herein by evaluating a set of multibeam echo sounding (MBES) surveys of the main channel of the Lower Columbia River (LCR), WA/OR, USA, within its downstream most hydraulic regime, which is dominated by bidirectional tidal-flows and/or combined-flows consisting of a tidal component and a shorter period (oceanic to intrabasinally derived) wind-wave component. Specifically, variations in dune geometric parameters (e.g., height, wavelength, roundness, symmetry, dimensionality, stoss- and lee- angle, and ratio of stoss- to lee- angles) and scaling of height and wavelength to flow depth are systematically quantified within the main channel (0- 32m depth) and are linked to depth transitions in formative current styles. These findings provide insight into the morphologic differences (i.e., form roughness) between dunes generated within non-uniform and unsteady flow conditions and those from more uniform and steady flows, whilst further adding to our understanding of the scaling of height and wavelength to depth within such dynamic flows. Preliminary results show that dunes remain asymmetric at all depths and possess lee-angles [?] 15°, their roundness is maximized at both the shallowest and deepest depths, and present river-tidal scaling relations overpredict their heights and wavelengths, which suggests that new relations are needed to better understand the dunes of tidal and combined-flow settings.