Bedform morphology across the fluvio-tidal transition, Columbia River, USA.

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ABSTRACT

Bedload transport within the fluvio-tidal zone is governed by the interaction between unidirectional currents with tidal flows of varying magnitude, with the additional superimposition of waves, and which all display an appreciable spatio-temporal variation across a range of scales. These changes in the hydrodynamics should control the differing characteristics of bedforms within this region, and thus ultimately determine the subsurface preserved sedimentary facies. This paper will detail the morphology of bedforms in the fluvio-tidal transition in the Columbia River, USA, through analysis of high-resolution multibeam echo sounder data collected in 2009 by NOAA (US National Oceanic and Atmospheric Administration) and extending from near the mouth of the river to *c.* 82 km upstream. These data have been used to quantify the different types of bedforms in the main channels (c. 500-1000m wide and 10-20m deep) and on barforms in the Columbia River and their geometric characteristics, including planform geometry, dune orientation, bedform asymmetry index and leeside angle. The data show a marked increase in the planform two-dimensionality of bedforms near the river mouth, where the dunes are also both more symmetric and smaller in amplitude than those further upstream, likely reflecting the modulation of bedforms by waves and tidal flows in this region. The data also shows dune orientation to depend on both the distance from the river mouth and lateral position in the channel and superimposed on the larger (c. 500-1500 long and 200-500 m wide) sand bars. Dunes within the fluvially-dominated reach are typically asymmetric in profile and displayed less superimposition of smaller forms than in the fluvio-tidal transition zone at the time of these surveys. Additionally, there are regions of channel bed in the fluvially-dominated reach where the mobile sand appears to be moving over a more resistant substrate that influences the geometry of the bedforms, with smaller barchanoid dunes being present. This paper will illustrate the nature of bedforms across this transition, examine their scaling with mean flow depth, and discuss the implications of these results for sedimentary facies in the tidally-influenced fluvial zone.