Sedimentology of tidally-influenced fluvial deposits

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Sediments deposited within the Tidally-Influenced Fluvial Zone (TIFZ) possess a complex internal heterogeneity due to the fact that this region experiences a combination of fluvial and tidal flows, which may also be influenced by waves. As a result, sediment transport and depositional rates within the TIFZ vary considerably both spatially and temporally, being controlled principally by the magnitudes of these river and tidal currents. Although the typical facies of *either* fluvial *or* tidal deposits are now well documented, little is known about the facies *changes* that occur though the fluvial-tidal transition. Here in the TIFZ, the dominance of either river or tidal flow: (a) controls the morphology, geometry and migration direction of resulting bed and bar forms, and (b) determines the distribution of grain sizes, such as discontinuous mud-sand deposits.

This paper will report on an integrated field and modelling programme in a 40 km reach of the Columbia River Estuary, USA. The Columbia is the 2nd largest river in the USA with a drainage basin of 660 480 km^2 and mean discharge at the estuary mouth of 7 280 m^3 s^{-1}. Tides in the Columbia River Estuary are of mixed diurnal and semidiurnal type with the semidiurnal wave 1.5 to 2.1 times larger in amplitude than the diurnal wave. The semidiurnal predominance increases in the upriver direction and the spring tidal range is 3.6 m with a large freshwater discharge. Peak river discharge occurs through spring snowmelt and from major winter subtropical storms. Field data have been collected in year 1 of the project at both high (June) and low (September) river flow.

This paper will report on the first quantification of the sedimentary facies and heterogeneity of fluvial-tidal deposits both spatially (upstream to downstream) and temporally (from channel base to flow surface across the TIFZ). The TIFZ deposits are imaged, logged and quantified using Ground-Penetrating Radar (below exposed bar surfaces to depths of *c.* 10 m), Parametric Echo Sounding (penetration *c.* 6 m below the channel base) and vibracoring (depths to *c.* 4-5 m below the bar surface). Subsurface structure is related to channel morphodynamics through a time-series of historical aerial photographs. Results show eight key radar facies that typify the TIFZ and range in thickness from 1-4 m and length from 2-500+ m. Comparisons are made with ‘pure’ fluvial architecture from other large sandy anabranching rivers.