Hydrodynamics of the tidally-influenced fluvial zone, Columbia River Estuary, USA

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In this paper we present results obtained from the application of DELFT3D to an 80 km-long and 3-5 km-wide region of the Columbia River Estuary, USA. Bed topography information was derived from a series of bathymetric (Multi- and Single-Beam Echo Soundings) and Lidar surveys conducted during 2009 and 2010 by NOAA, USACE and LCREP, and collated to generate a Digital Elevation Model (DEM). The modelled reach extends between an upriver boundary at the Beaver Army Terminal (BAT) and the Hammond Tide Gauge (HTG) in the lower part of the estuary. This reach is represented in DELFT3D as three sub-domains (computed using domain-decomposition). At these boundary locations, total discharge (BAT) and water surface elevation (HTG) are monitored continuously and provide the model with inlet and outlet boundary conditions. Bed shear stress was estimated using a variety of roughness parameterisation methods including Chezy, Colebrook-White and Manning and turbulence was closed assuming a uniform eddy-viscosity. We present velocity data collected at multiple locations within the study reach obtained using an acoustic Doppler current profiler (aDcp). This data was collected during high ~14 000 m^3s^{-1} (June 20011) and low ~4 000 m^3s^{-1} (October 2011) river discharges as measured at BAT. These results are compared with the DELFT3D model output and these inter-comparisons show that the model reproduces well the spatial distribution of velocity. We are currently running simulations with other roughness parameterisations including van Rijn's (2007) roughness-length predictor and evaluating the influence of model mesh resolution on simulated hydrodynamics.

van Rijn, L.C. (2007) Unified view of sediment transport by currents and waves. I: Initiation of motion, bed roughness, and bed-load transport. *Journal of Hydraulic Engineering-ASCE*, **133**, 649-667.