**Tidal-fluvial interaction in a delta exposed to high seasonal river runoff**

M. W. E. Elahi1,2, I. Jalón-Rojas3,2, X. H. Wang1,2 and E. A. Ritchie2

1The Sino-Australian Research Consortium for Coastal Management, UNSW Canberra, Canberra, ACT, Australia.

2School of Science, UNSW Canberra, Canberra, ACT, Australia

3 UMR5805 EPOC, CNRS, OASU, University of Bordeaux, Pessac, France

**Abstract**

Understanding the interaction between river discharge and tidal waves in deltas and estuaries subject to varying river runoff is essential to unravel complex transport patterns and the evolution of the system. This study focuses on the nonlinear tidal-fluvial interaction along the Ganges-Brahmaputra-Meghna delta, a macro tidal estuary exposed to monsoon. The Delft3D hydrodynamic model was validated and applied to an averaged flood year condition and nine idealized scenarios covering the typical seasonal and annual variations of river runoff.

Results show that the residual water level slope and tidal damping rate increase with river discharge beyond 100 km of the estuary mouth. The balance between the generation and dissipation of quarterdiurnal tides shifts spatially as a result of changes in channel convergence and friction, and temporally as a function of river discharge, which controls the total friction in the upper tidal river. The residual velocity generated by river discharge and the velocity of principal tides determine the balance between tidal dissipation and generation. An optimal condition of dissipation of semidiurnal tides and generation of quarterdiurnal tides is observed at critical river discharge thresholds that modulate through friction at the upper and middle estuary. River discharge above the critical river discharge amount more rapidly dissipates both semidiurnal and quarterdiurnal tides than generates quarterdiurnal tides from nonlinear interactions. Tidal component with longer period like MSF tide can propagate beyond 200 km from the mouth where other tides are completely dissipated.

Reference:

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