Deltas: Landforms, Ecosystems and Human Activities
Proceedings of HP1, IAHS-IAPSO-IASPEI Assembly, Gothenburg, Sweden, July 2013 (IAHS Publ. 358, 2013)39-47.

The effect of river discharge on tidal dynamics in three alluvial estuaries: the Scheldt, Modaomen and Yangtze cases

HUAYANG CAI[1], HUBERT H. G. SAVENIJE[1] & MARCO TOFFOLON[2]

1 Department of Water Management, Delft University of Technology, Netherlands
h.cai@tudelft.nl

2 Department of Civil, Environmental and Mechanical Engineering, University of Trento, Italy

Abstract A new analytical model for tidal hydrodynamics has been developed, which takes into account the effect of river discharge. For a given topography, friction, tidal amplitude at the seaward boundary and river discharge at the landward boundary, we are able to reproduce the main tidal dynamics (e.g. velocity amplitude, wave celerity, tidal amplitude, and phase lag) along the estuary axis by solving a set of four implicit equations. Analytical solutions are compared with observations in three real estuaries (i.e. the Scheldt, the Modaomen and the Yangtze). In these estuaries, the agreement with measurements is good, which suggests that the proposed model is a useful tool to evaluate the influence of human interventions on tidal dynamics, such as flow reduction. We also show that a model that does not consider river discharge will lead to substantial overestimation of the roughness in the upstream part of the estuaries if one tries to fit analytical model to observations.

Key words tidal dynamics; river discharge; analytical solution