Deltas: Landforms, Ecosystems and Human Activities
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Salinity and tides in deltas. Can we predict tidal processes and salinity intrusion in poorly gauged deltas?

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Abstract Deltas are a special type of alluvial estuaries, which are complex systems. They form the interface between the terrestrial drainage system and the sea. Deltas have multiple functions: morphologic, hydraulic, hydrologic, ecologic and socio-economic. They are also the areas where different sources of energy converge: tidal energy, wind energy, potential energy from freshwater and sediments, and solar energy to feed the biotic system. The dissipation of all this energy has created a unique environment, with very special tidal and morphologic characteristics. One would expect that such a complex system is difficult to describe in simple mathematical terms, but the opposite is true. If considered at the right scale, deltas and estuaries appear to obey surprisingly simple "laws". For instance: the shape of an alluvial estuary obeys a simple exponential law; the amplitude of the tidal velocity is 1 m/s at spring tide throughout the tidal region; and more surprisingly, this amplitude is the same throughout the world. If left undisturbed, estuaries tend to become "ideal" estuaries, where the tidal wave is undamped, propagating as a simple shallow water wave. As a result, there is also simplicity in the process of salt intrusion and the mixing of substances in estuaries. There are two important research questions related to this surprising simplicity. The first is of course the understanding of the more fundamental physical laws behind this surprising simplicity and uniformity; the second is how to predict the behaviour of estuaries in poorly-gauged regions, because this simplicity may help us to predict how estuaries behave when we have very limited knowledge on the ground. In this presentation, examples are given of two major deltas where predictive equations appear to work remarkably well.

Key words ungauged deltas; estuaries; salt intrusion; geometry; prediction