



## **Evolving deltas: Conceptualising coevolution with engineered interventions**

Amy Welch, Robert Nicholls, and Attila Lazar

Faculty of Engineering and the Environment, University of Southampton, Southampton SO17 1BJ, UK  
(acw1e15@soton.ac.uk)

Mid to low latitude deltas have been populated for thousands of years due to their fertile soil and coastal location. This has led to an alteration in the land cover of deltas to primary agriculture and dense rural settlements and more recently, major cities and megacities have developed on or adjacent to many deltas. Deltas may be prosperous in terms of their outputs and services; however, they are also susceptible to many hazards due to their location and low-lying nature. Hazards include storm surges, fluvial flooding and erosion of both coastal and riverine areas, as well as subsidence, relative sea-level rise and pollution. This can have severe impacts on the delta, its population and its services. Therefore engineered interventions have been used for some time to protect the population and the valuable land from the consequences of hazards.

Coevolution can be described as a feedback loop between nature and humans: each has an effect on how the other behaves and hence this inter-dependence interaction continues. Therefore the natural evolution of the delta interacts with engineered interventions, such as promoting accelerated subsidence over time, necessitating further adaptation. The deltaic landscape and associated livelihoods are thus the result of this co-evolution process between natural delta processes and engineered interventions.

This presentation will identify and discuss various drivers and consequences of large scale engineered interventions, comparing and contrasting the management approaches taken in five populated deltas (Ganges-Brahmaputra-Meghna, Yangtze, Rhine-Meuse-Scheldt, Mekong and Nile). The type of engineered intervention and management approaches had a direct effect on the coevolution of deltas, with each of the deltas being at different stages in terms of extent of coevolution.

A qualitative timeline of the typical steps of coevolution between the human system and the delta system of the studied deltas was produced. The major constraint of development of the human system is the ability to invest in engineered adaptations and research; therefore the deltas that were located in the Lower Middle Income bracket are at a much earlier stage of development than those in the Higher Income bracket. This timeline can inform delta planners, particularly in the less developed deltas, to forecast future problems that may be experienced if they continue pursuing the same development trajectory as the more developed deltas.

This investigation gives a systematic understanding of delta development in order to avoid unintended consequences and lock-in trajectories when implementing engineered interventions.