Development of large scale fluvio-deltaic morphology: a long-term modeling study

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To investigate initial delta development and forcing controls, this study uses a process-based morphodynamic model (Delft3D) to simulate long-term (millennial time scale) morphodynamic development of a schematized large-scale fluvio-deltaic system (700 km long and 100 km wide) forced by high river discharge and strong tides. The model couples water motion, sediment movement, and bathymetric updating enhanced by a morphological acceleration technique which bridges the time scale gap between hydrodynamics and morphology (Roelvink, 2006). Model results (Figure 1) suggests that (1) river flow magnitude and sediment supply exerts strong controls on deltaic morphodynamic development and associated channel pattern; (2) estuarine bank erodibility plays a role by supplying sediment and providing space for channel migration and sand bar formation; and (3) initial basin geometry and shelf slope also have impacts on the deltaic morphodynamic development. The sensitivity simulations to varying governing factors thus help to unveil the basic controls on deltaic morphodynamics and provide guidelines to understand delta in nature.

Keywords: Estuary, Delta, Morphodynamic