Controls on mud distribution and architecture along the fluvial-to-marine transition

Daniel Parsons¹, Wietse Van de Lageweg², Lisanne Braat³, and Maarten Kleinhans³

¹Energy and Environment Institute, University of Hull, Hull, UK
²HZ University of Applied Sciences, Netherlands
³Universiteit Utrecht, Netherlands

The interaction of marine (tides and waves) and fluvial processes determines the sedimentary fill of coastal systems in the fluvial-to-marine (FTM) transition zone. Despite frequent recognition of tidal and wave influence in modern and ancient systems, our understanding of the relative importance of marine processes and their impact on mud deposition, coastal system stability and sedimentary architecture is limited. This study combined subsurface field observations and numerical simulations to investigate the relative importance of river flow, tides, waves, and mud input in governing the sedimentary fill in funnel-shaped basins along the FTM transition. Model simulations show a self-forming bar-built estuary with dynamic channels and sandy bars flanked by mud flats, which is in agreement with trends observed in nature. From three-dimensional virtual sedimentary successions, statistical tendencies for mud distribution and thickness were derived for the spectrum of marine and fluvial processes, and these values provide quantitative information on the net-to-gross ratio and mud architecture. The relative influence of marine and fluvial processes leads to a predictable facies organization and architecture, with muddier and more heterogeneous sediments toward the flanks. For the first time, our simulations allow the sedimentary fill in basins along the FTM transition to be related explicitly to hydrodynamic conditions, providing new insights into the morphosedimentary evolution of coastal systems, with implications for system stability in the modern and sequence stratigraphy preserved in the ancient.