

Modeling of seasonal variations of fine-grained suspended sediment dynamics in the Yangtze Estuary

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When the median grain size (D50) of natural sediment is finer than 62µm (Mehta and McAnally, 2008), the sediment composition and cohesive content of fine-grained sediment changes the degree of cohesion, introducing significant flow-sediment interaction and furthering impact macro-scale behaviour of sediment transport and hydrodynamics. Firstly, spatial and temporal measurement data characterizing dry-wet seasonal variations of velocity, salinity and suspended sediment concentration (SSC) in the North Passage Deepwater Navigational Channel (DNC) of the Yangtze Estuary, China are presented. Subsequently, using a Delft3D-based 3D model, the seasonal variations of fine-grained suspended sediment dynamics in the Yangtze Estuary are simulated. A series of numerical experiments as related to various effects from riverine inflow, seasonal wind and sediment-current interactions are carried out to identify the primary mechanism describing the complexity of water circulation and sediment dynamics in the complex estuarine system. The modelling results highlight: (1) Saltwater intrusion controls vertical structure of currents near the estuarine turbidity maximum (ETM) area, especially during lower current speed time, when baroclinic pressure gradient forcing could significantly reshape local vertical velocity profile; (2) the transport of residuals generated by internal tidal asymmetry plays a dominant role in sediment trapping and maintaining ETM dynamics; (3) SSC-varied settling velocity and turbulence damping effects are of critical importance to reproduce the density stratification.