# INTERTIDAL COHESIVE SEDIMENT TRANSPORT AND ASSOCIATED TOPOGRAPHY CHANGE IN SAN FRANCISCO BAY

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A numerical model has recently been developed with incorporating a wetting and drying scheme into the Princeton Ocean Model (POM; Blumberg and Mellor, 1983) to simulate tidal currents in San Francisco Bay, CA, USA (WD-POM; Uchiyama, 2004). An extended logarithmic law was newly introduced into the model so as to accurately estimate bed shear stresses and resultant sediment resuspension and deposition in extremely shallow basins. San Francisco Bay is encompassed by huge intertidal area including mudflats and salt marshes where flooding and draining are predominant for hydrodynamics. Intertidal sediment transport and associated topography changes are of interest for coastal engineers (e.g., Dyer, 1986) as well as marine biologists (e.g., Kuwae *et al*., 2003), whereas no three-dimensional numerical models have been developed thus far to calculate the intertidal sediment transport. In the present study, cohesive sediment transport and bed elevation changes are modeled and adapted to WD-POM to assess intertidal morphodynamics in San Francisco Bay.

The cohesive sediment transport model includes settling speeds of cohesive flocs (Burban *et al*., 1990) and the sink/source terms due to deposition (Partheniades, 1992) and resuspension (Krone, 1962) at the seabed, and is transformed into the horizontal orthogonal curvilinear coordinate and the vertical sigma coordinate as used in POM. The bed elevation model is based upon the volume conservation of the deposited/suspended sediments and is capable of considering consolidation through sediment density and porosity.

Astronomical tidal oscillations are imposed onto the open boundary condition off Golden Gate (the bay mouth). Neither fluvial sediments nor surface wind stresses are assumed in the computation for the simplicity. The model outputs exhibit that cohesive sediments are suspended dominantly in the deeper channels while being transported and deposited on intertidal areas fringing the bay (Figure 1). The morphological change due to tidal currents during a spring-neap cycle shows that intertidal mudflats tend to slightly be accreted whereas channels seem rather eroded (Figure 2). These results demonstrate that the intertidal areas play an important role in the sediment budgets in the estuary, acting as ‘sink’ of the suspended cohesive sediments under action of the tidal currents.

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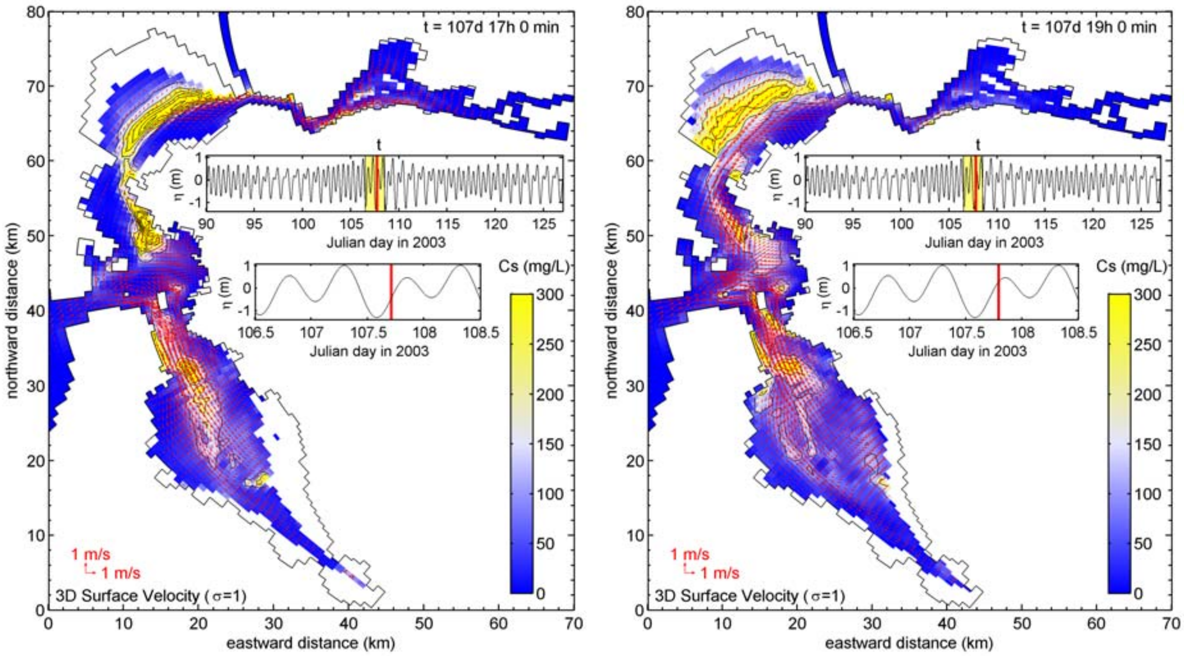


(a) Flooding phase (b) high slack phase

**Figure 1:** Spatial distributions of cohesive sediment concentration and horizontal current velocity (red arrows) at the surface ($\sigma = 1$) at (a) a flooding phase and (b) high slack phase.

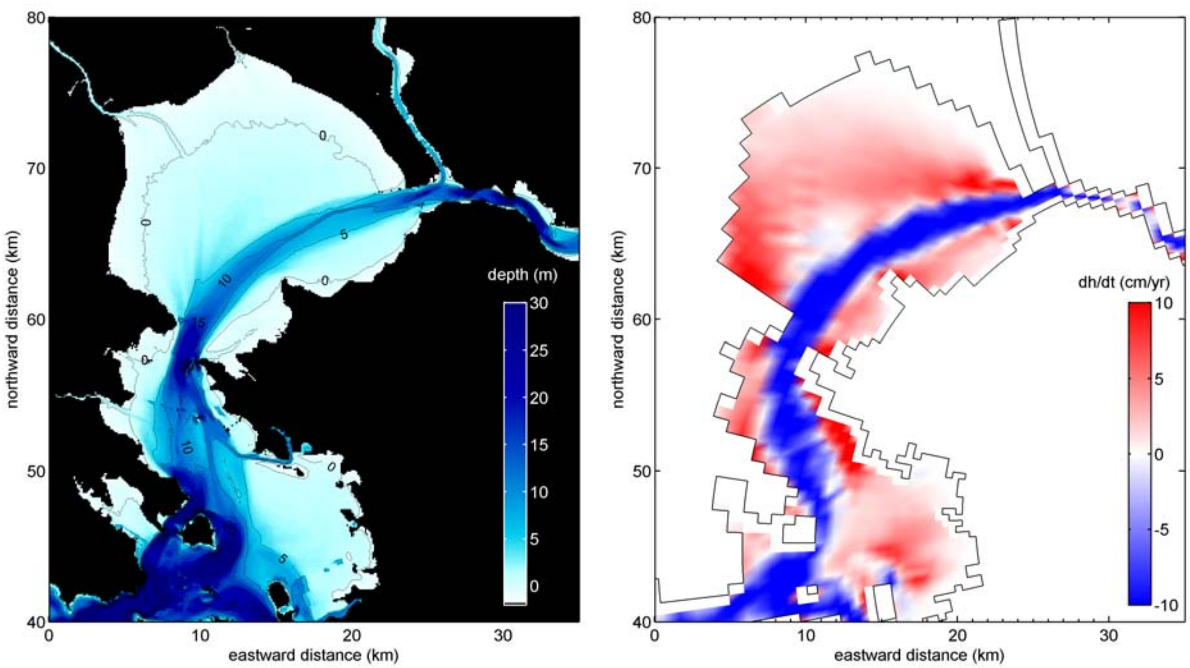


**Figure 2:** (left) bathymetry and (right) model-generated bathymetry change in San Pablo Bay