

# Analysis on variations of water/sediment and morphodynamics response in Hangzhou Bay in recent 50 years

Lu Hai-yan<sup>1,2</sup>, He Qing<sup>1</sup>, Pan Cun-hong<sup>2</sup> and Cao Ying<sup>2</sup>

<sup>1</sup> State Key of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, P.R. China  
E-mail: [luhy@zjwater.gov.cn](mailto:luhy@zjwater.gov.cn)

<sup>2</sup> Zhejiang Institute of Hydraulics and Estuary, Hangzhou 310020, P.R. China

Hangzhou Bay is located on the eastern coast of China, the south of the Yangtze River Delta. The total length of the bay from the head named Ganpu to the mouth named Luchaogang is about 85km. Hangzhou Bay with the strong tide and the swift current, is the waterfront section of the Qiantang River Estuary, abuts on the estuarine section of the Qiantang River and the Yangtze River, where water and sediment exchange closely. Under such complex dynamic conditions and high intensity development activities by human impacts, the bathymetry, the hydrograph and sediment field in Hangzhou Bay have been changed significantly in the past 50 years. In order to further understand the dynamic mechanism of the erosion/deposition pattern and the sediment transport in the Hangzhou Bay, the measured bathymetry data combined with DEM (digital elevation model) is used to analyse the changes of the major geomorphic units in Hangzhou Bay. Based on the calibration and verification of the model parameters of the hydrology and sediment, a two-dimensional numerical model is employed to reproduce the current and suspended sediment field before and after the large-scale reclamation project in the adjacent waters.

The results show that the tidal influx volume and the sediment load from JinShan to Ganpu area in the Hangzhou Bay reduced by 10% to 40%, 17% to 28% respectively. It is mainly owing to the large-scale reclamation of tidal flat in Qiantang River Estuary since 1960s, which reduce the storage capacity for tidal water. The net accretion in the Hangzhou Bay is up to 4 billion m<sup>3</sup> in recent 50 years, though the sediment discharge from the Yangtze River is decreasing. The transport rate of suspended sediment is asymmetric with the suspended sediment concentration of flood tide higher than that of ebb tide, which results in a net onshore transport during the tidal cycle.

However, the spatial distribution of erosion/deposition are different between the north channel, the middle channel and the south channel in Hangzhou Bay. The sea bed near the north channel is eroded, with the sediment scour amount of 340 million m<sup>3</sup>, and the average scour depth amount of 0.21m. The bed of the middle channel is relatively stable, with the average accretion depth about 0.06cm, and the sediment siltation amount of 80 million m<sup>3</sup>. Substantial siltation occurs in the south channel, the total sediment storage amounts to 4.2 billion m<sup>3</sup>, even more than the total net sediment storage in the Hangzhou Bay. The sharp decline of sediment discharge from the Yangtze River Basin, the large-scale reclamation of the Nanhui tidal flat, and the north extension of the Andong tidal flat, is the main cause of the scour in the north shore of Hangzhou Bay (zhapu ~ Luchaogang coast).

## Keywords

Hangzhou Bay; Sediment transport; Human reclamation; Morphodynamics changes.



Fig. 1. Location of Hangzhou Bay.

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