EGU22-3406, updated on 16 Aug 2022
https://doi.org/10.5194/egusphere-egu22-3406
EGU General Assembly 2022

The evolution of tidal hydrodynamics and its underlying mechanism in "Bay-Outlet-Tidal Channel" system of the Pearl River Delta, China

Ping Zhang, Qingshu Yang, and Huayang Cai

Due to the intensive human activities, the tidal hydrodynamics of "Bay-Outlet-Tidal Channel" system experienced considerable spatiotemporal change owing to the morphological alterations. The outlets in the Pearl River delta (PRD), especially the connecting outlet between Lingdingyang Bay and Shiziyang Channel, are small-scale dynamic structures that have a special morphodynamic feature, playing an essential role in energy transport and transformation. In this study, bathymetric maps of the "Bay-Outlet-Tidal Channel" system in 1965, 1974, 1989, 2009, and 2015 were collected to investigate the geomorphologic structure by means of a digital elevation model (DEM). It was shown that the water depth increased with the decreasing convergence width, indicating the channel deepening and narrowing. The tidal hydrodynamics, especially focusing on the tidal amplitude and velocity amplitude, were explored using a 2D numerical model in the system of "Lingdingyang Bay-Humen outlet-Tidal Channel" considering dramatic anthropogenic effects. In addition, the 1D analytical model was used to reproduce the historical development of tidal hydrodynamics and its underlying mechanism. The results show that the relationship of tidal amplitude and velocity amplitude was dramatically affected by the morphological alterations, with the deepening playing a much more important role. It was shown that the tidal amplitude was increased by 0.0393 m, while a decrease by 0.0432 m/s for the velocity amplitude. Owing to the Outlet in the "Bay-Outlet-Tidal Channel" system, the channel networks and outer bay in the PRD were kept relatively stable, with the tidal energy decay rate of tidal channel remaining approximately constant (70%). These results quantifying the impacts of estuarine morphology on tidal hydrodynamics can provide scientific guidelines for sustainable water resources management in the PRD and other estuaries that are subject to intensive human interventions, especially regarding morphological alterations.