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Adaptation to sea level rise from Shanghai city, China

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Sea level rise (SLR) is a major of climate change. Changing coastal cities are situated in the delta regions expected to be threatened by SLR to various degrees. Shanghai is one of those cities. In recent years, intensifying waterlogging, salt intrusion, wetland loss, and ecosystem degradation in the city have generated the pressing need to create an urban form that is suited to both current and future climates incorporating SLR. However, adaptation planning uptake is slow. This is particularly unfortunate because patterns of urban form interact with mean sea level rise (MSLR) in ways that reduce or intensify its impact. There are currently two main barriers that are significant in arresting the implementation of adaptation planning with reference to the MSLR projections composed of geomorphologic MSLR projections and eustatic MSLR projections from global climate warming, and making a comprehensive risk assessment of MSLR projections. The purpose of this study is to map MSLR projections and their risk assessment approaches, and then the adaptation actions in the city. Grey model approaches with linear fitting and the least squares measured tidal levels during1921-2000 in Wusong Vertical Elevation Datum at 5 tidal gauge stations were utilized to estimate the eustatic MSLR (ESLR) projection from climate warming in the area. Hierarchical partitioning analysis of variability in 2000-2009 is used to analyze urban land subsidence (ULS) projection. Digitized historical nautical charts during 1997-2013 were utilized to map the magnitude of bed erosion, e.g. regional sea level fall (RSLF) projection by anthropogenic geomorphologic changes. MIKE 21 was used to simulate the regional SLR (RSLR) caused by the land reclamation. The total decadal SLR (DSLR) is supposed to consist of ESLR, ULS, RSLF, RSLR and tectonic subsidence. Vladimir algorithm was used to calculate the variation in the tidal datum. ATP was used to make the risk assessment involved in the timing and magnitude of MSLR projections on a shortage of fresh water supply in Shanghai city. Four design frequencies of highest tidal level were assessed. The DSLR is 10-16 cm during 2011-2030. The standard of existing seawall needs to be raised. New fresh water resource needs to be sought. Four adaptation strategies for responding to the total DSLR are proposed. They are control of land subsidence, raising most of the seawall standard from one-in-100-year flood height to one-in-200-year flood height, construction of a Huangpu River tidal barrier, and an integrated ecological engineering projection to cover the salt marsh with artificial oyster reefs from the intertidal flats to the sub-tidal zone.

Biography

Cheng Heqin has her expertise in estuarine and coastal sediment dynamics and morphodynamics, integrated coastal zone management. Her long time measurement data sets of the estuarine tidal level, current velocity, bathymetry, bedforms, channel morphology and transition regime of ripple-dune, response of sediment dynamics to the human interventions in the watershed, fishery model in the East China Sea, semi-analytical model of sediment entrapment in estuaries, impact of sea level rise in the Changjiang (Yangtze) river estuary create new pathways for improving sustainable management strategy of coastal system and adaptation estuarine and coastal cities to sea level rise. She has built this challenging strategy after years of experience in research, evaluation, teaching and administration in institutions. The foundation is based on most of historical data sets and methodology of field measurements, numerical simulation, huge experiences and data analysis results from her colleagues in her institute, Shanghai Water Authority and many other institutes, which referred to be stakeholders of sea level rise.

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