Evolution of the Yangtze Tidal Flats; A One-Dimensional Approach

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1. Introduction

The Yangtze river (China) is one of the biggest rivers in the world in terms of length, area, discharge and sediment load. The large sediment supply by the Yangtze river resulted in the development of large coastal wetlands in its estuary, which form rich and important ecosystems. Human activities are increasingly influencing the Yangtze estuary, for instance by the construction of plentiful dams in the river. The precise consequences of human interventions and the effects of climate change like global sea level rise, for the tidal flats are uncertain. In the last decades, the flats have been increasing in size, while measurements from recent years indicate a stop of this growth. Investigation of the development of the tidal flats is important for preserving nature, planning further land reclamation projects and coastal defence issues.

2. Description of the study

In this study, an one dimensional morphodynamic model is used to simulate the cross-sectional shape and size of tidal flats in the Yangtze estuary. The model simulates tidal and wave induced shear stresses, feeding a sediment transport and morphological module. Because of its simplicity, this model provides good insight in the first order processes which play a role in the evolution of the tidal flats. Since the Yangtze estuary is historically characterised by an abundant sediment supply, this study also seeks for a method to treat such unbalanced systems.

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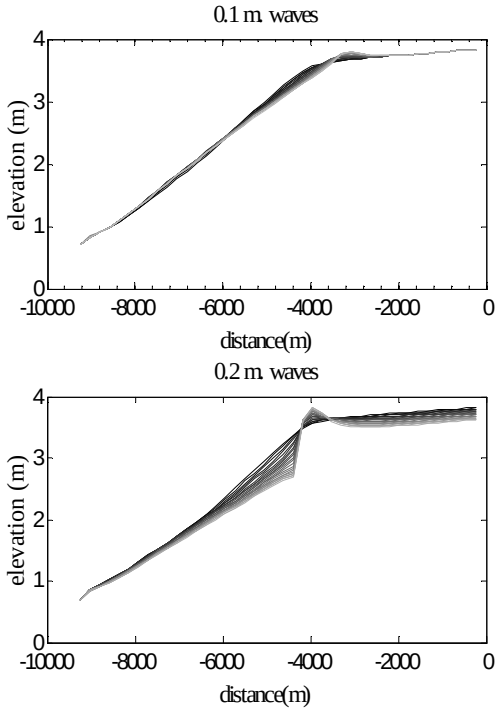

Simulations of the cross-shore profile of East-Chongming mudflat near mean sea level (2m) with mean wave heights 0.1 m (top) and 0.2 m (bottom) at the left boundary. The mudflat evolved from the East Chongming section as initial profile (dark) towards a stable equilibrium profile (light).

3. Conclusions

Comparison of the model results with the measured East-Chongming profile shows that the model is able to simulate the cross sectional shape of this tidal flat fairly well (see figure). The results are particularly sensitive to the presence of eroding wind-generated waves. Introducing wind waves on the tidal flats, results in lower and narrower flats and more concave cross sectional shapes (see figure). The concentration of suspended sediment is another parameter that influences the shape of the tidal flats. Sensitivity analyses on parameters as the settling velocity and critical shear stress will be performed. Final conclusions are to be drawn about the effects of a reduction in the suspended sediment concentration and a rise in sea level on the intertidal mudflats in the Yangtze Estuary.