Geophysical Research Abstracts
Vol. 20, EGU2018-3022-1, 2018
EGU General Assembly 2018

The pattern and control of erodibility of cohesive sediments in a Spartina alterniflora marsh on the coast of Jiangsu, China

Huaiyu Wei (1), Jin Guo (1), Yunzhen Chen (1,2), Jiahui Liu (1), Jiaying Lin (1), and Zixuan Liu (1)

(1) School of Marine Sciences, Sun Yat-sen University, Guangzhou, China (weihuaiyu97@qq.com), (2) Guangdong Provincial Key Laboratory of Marine Resources and Coastal Engineering, Guangzhou, China

Investigating the in situ erodibility of cohesive sediments and its control factors, is helpful for reducing uncertainties in predicting the evolution of salt marshes. In the summer of 2017, we collected 18 sediment cores from different geomorphic zones in a Spartina alterniflora marsh on the coast of Jiangsu, China. The UMCES-Gust Erosion Microcosm System was used to measure the erodibility of the samples over a range of shear stresses from 0.01-0.6 Pa, that is, the erodibility in various erosion depths. The properties of the samples, such as mean particle size, organic carbon content, chlorophyll a content, water content, were measured to explore the factors that affect the erodibility.

We recognized a general pattern of erodibility in the 18 samples. Sediments in the outermost surface layer are deposited in the last tidal cycle and have not yet been fully aggregated into large flocs, and thus have a critical shear stress for erosion of 0.01-0.05Pa. This layer is not detected in several samples, which is probably due to the erosion by the ebb current. Sediments in the second layer are deposited in earlier tidal cycles. In this layer particles are fully aggregated to form large flocs by cohesion and adhesion, causing a rapid decrease of erodibility. Hence the erosion threshold of the second layer increases to 0.1-0.15Pa. Sediments in the third layer are denser and the erosion threshold continues to increase with erosion depth but with a smaller gradient than that of the second layer.

For sediments with a median diameter <0.03 mm, organic carbon contents are larger than those of coarser sediments and fluctuate widely (0.32%-0.51%); thus erodibility tends to increase with increasing organic carbon content. Some moderate positive correlation is displayed between Chlorophyll a content (1-14μg/g) and erodibility. As elevation increases from the mudflat to the landward margin of the marsh, erodibility tends to first decrease (with a weak correlation) and then increases again, reaching its maximum over the mid-rear part of the marsh. The change of erodibility with elevation is mainly controlled by two factors, particle size and water content of sediments, because particle size first decreases and then increases with elevation, and the very reverse occurs to water content. Meanwhile, the changes of organic content and biomass of benthic microalgae with elevation play a role in weakening the correlation between erodibility and elevation.

Our findings suggests that the erodibility of salt marshes with finer sediments will be more affected by the global warming since the latter will influence the content of organic carbon which mostly adheres to finer sediments. Since the erodibility of cohesive sediments increases with decreasing particle size over a large distance landwards, salt marshes that suffer erosion will retreat with an increasing rate. In predicting the erosion rate of a salt marsh, a varying erosion threshold with depth should be taken into account.