Mediation of sediment dynamic processes by vegetation within a rapidly developing saltmarsh

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Nowadays, the rapid reduction of coastal saltmarshes has become a worldwide problem and the practical needs of restoration and creation require the understandings of the basic physical mechanisms controlling the development of saltmarshes. The pioneer zone has been widely recognized to be the key of saltmarsh development. Generally, the pioneer zone is occupied by pioneer species in the form of dynamic patches or tussocks. The positive and negative feedbacks among vegetation, sediment dynamics and morphology determine the pattern and the rate of saltmarsh development, as a representative case for biomorphodynamic study.

In order to examine the processes and relevant mechanisms affecting the development of saltmarsh pioneer zones, observations over a timescale from vegetation patches to fully developed saltmarsh are in need. The Andong Shoal, located at the turbidity maximum zone of Hangzhou Bay, is a typical area of high sediment supply in the world. The saltmarshes, mainly covered by *Scirpus mariqueter,* are developing at a high rate and thus, it is possible to observe the development of saltmarsh pioneer zone within a relatively short period. Our study attempts to understand the feedbacks between vegetation and morphodynamics from vegetation patches to a fully developed saltmarsh in the pioneer zone of the Andong Shoal saltmarsh. *In situ* observations of sediment dynamics were carried out in two seasons, comparing the bare mudflat, the vegetation patch and the gap between two patches. Meanwhile, *in situ* biological investigations and geomorphological surveys were undertaken.

The preliminary results revealed that: 1) the tidal flat of the Andong Shoal received a large amount of sediments, resulting in a vertical accretion rate up to 50 cm a^{-1}; 2) due to the high sedimentation rate, the patches could convert into a fully developed saltmarsh at a seasonal scale; 3) the geomorphological surveys indicated that both vegetation patches and the gaps between them were depositional; 4) in the pioneer zone, the vegetation patches with diameters of several meters were able to reduce 36% of the flow speed in comparison with the adjacent bare mudflat, whilst the gaps between patches accelerated the flow speed to 157%, as such, a positive feedback occurred within the patches but the negative feedback within the gaps was suppressed by a high sediment input; 5) when the vegetation patches merged together to form a fully developed saltmarsh, the vegetation reduced 65% of flow speed in comparison the previous bare mudflat; and 6) the mean suspended sediment concentration increased after the patches merged together, and this pattern implied that the presence of vegetation patches was likely to be a more efficient sediment trap than the fully developed saltmarsh, in order to accelerate the vertical accretion which was crucial for the saltmarsh establishment.

Keywords: Saltmarsh, Vegetation patch, Sediment dynamics, Geomorphology, high sediment supply

