Dissection of Platform Marshes by Ecophysical Processes in Response to Sea-Level Rise

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Objectives

In some estuarine and coastal environments, salt marshes are being incised by the development of channels, some of which are headward eroding at the rate of 2 to 3 meters per year. Our objective is to understand the functioning and development of creeks on a platform marsh that is tidally forced. We will relate creek development, spacing, network characteristics, and growth rate to environmental parameters, to be able to predict the fate of these invaluable ecosystems in a regime of rapid climate change.

Hypotheses and questions

We hypothesize that the rapid progression of tidal creeks into the marsh platforms that they are draining, is due to an increase in the tidal prism, as well as the period and frequency of inundation of the marsh platform. Erosion due to these factors is modulated by faunal activity and plant structure on the marsh. Thus, the accelerated rate of relative sea-level rise, acts as the triggering mechanism in the incision of marsh platforms.

Study site

Our study focuses on a marsh platform along a former distributary of the Santee River (dammed in the early 1940's), which exhibits a unique assemblage of periodically spaced, pinnate shaped channel formations ending in headwalls, along one of its edges. This site is unique because it is highly active and the channels are only 10-40 years old. The developing channels incise into the marsh platform, spreading headward by a few meters each year. The mean tidal range in the study area is 1.25 m increasing to 1.45 m during spring tides.

Approach

Field and modeling investigations will act symbiotically to enhance our understanding of the processes. Observations will be used to drive and test models, and guide our process understanding. Models will be used to test hypotheses, guide the field campaign, and develop functional relationships. Linkages between the ecology and physics will be examined through observations that will be parameterized in our models.

Expected Significance

The study will result in understanding the working of a tidally forced marsh, its drainage, and the processes that control the development of channels. The models will help to quantify relationships between the various environmental parameters and the processes, and help to predict the effects of accelerated sea-level rise on coastal wetlands.