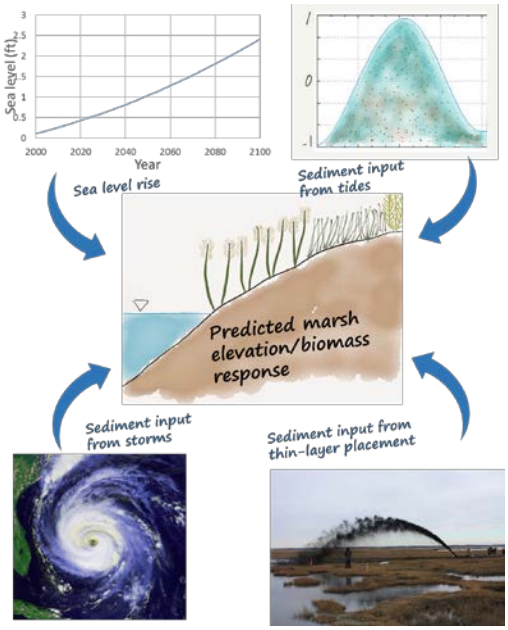
Predicting marsh response to dredged material placement

Problem

Rising sea levels and several high impact coastal storms have led to increasing interest in thin layer placement in marsh environments as a way to enhance coastal resiliency. Sediment transport and deposition in marsh systems are dynamic processes and can occur slowly over long time periods or rapidly through episodic inorganic sediment deposition from storm events. The processes controlling dynamics thin layer placement activities are poorly understood. While thin layer placement of dredged material in marsh environments mimics episodic sediment inputs from storms, there is currently no way to predict how marsh ecosystems will respond to thin layer placement projects in the long term under continued rising sea levels.

Study Description

The Marsh Equilibrium Model (MEM) was developed to simulate how salt marsh systems accumulate mineral sediment and respond to rising sea levels. The model is process-based and captures the ecomorphodynamic feedbacks between sediment accretion and consolidation, inundation, and biomass under astronomical tides. However, current versions of MEM cannot predict marsh response to larger episodic sediment deposition event such thin-layer placement. The objective of this effort is to add episodic sedimentation to the MEM structure, to determine how ecosystems will respond to thin layer placement efforts or natural episodic sedimentation events such as floods or storms. This capability will allow engineers and biologists to predict how marsh elevation will respond to proposed thin layer placement events both in the near-term (3-5 year) time but also on a decadal timescale (50-100 years). The new version of MEM can be used to design thin layer placement sediment thicknesses and elevations as well as plan for future placement actions that may be required. The unmodified version of MEM can also be used to better capture the effects of no action.



Products

This project will provide a tool that will equip USACE and other stakeholders with the ability to predict the short- and long-term responses of ecosystems to episodic sediment events such as thin layer placement in marsh environments. This tool will provide USACE the capability to more effectively engage resource agencies about the application of Engineering with Nature, better estimate out-year impacts of thin layer actions on marshes, identify and prioritize needed R&D, and, ultimately, improve the sustainability of the USACE Navigation Business Line.

Summary

Advancing the practice of thin layer placement activities in marshes requires a simple tool that can predict how marsh elevation will respond to the sediment placement so impacts can be better quantified and placement activities can be better designed. The planned updates to MEM will incorporate best current science to provide thin layer placement practitioners a tool to better plan and design marsh thin layer placement projects.

Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

POC: Candice Piercy
Environmental Laboratory • candice.d.piercy@usace.army.mil

December 2017