Short term sedimentation rates in the North Inlet Estuary, South Carolina

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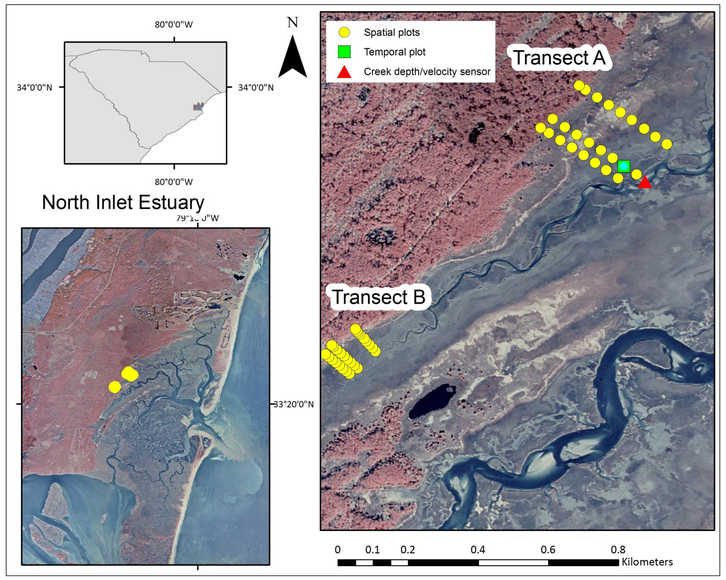
Introduction

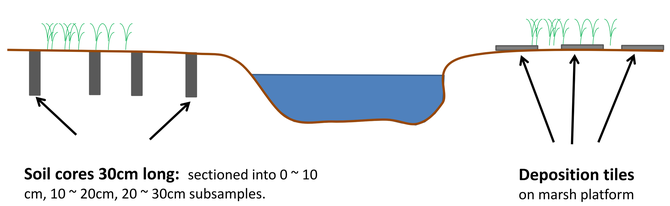
Work was carried out to determine short term spatiotemporal variations in sediment deposition on a marsh platform North Inlet Estuary, SC. The goal was to develop a better understanding of sediment contribution to marsh development and assess implications in the face of rising sea levels. Research objectives were: a) to characterize differences in grain size distribution of surface profiles between an older and younger section of marsh; b) to measure short term deposition rates and sediment quality with marsh age, distance from creek and elevation; c) to measure variation in deposition rates at one location on the platform; and d) to quantify suspended sediment concentration in the overlying water column during several tidal cycles. Analyses and results presented in this poster are however preliminary.



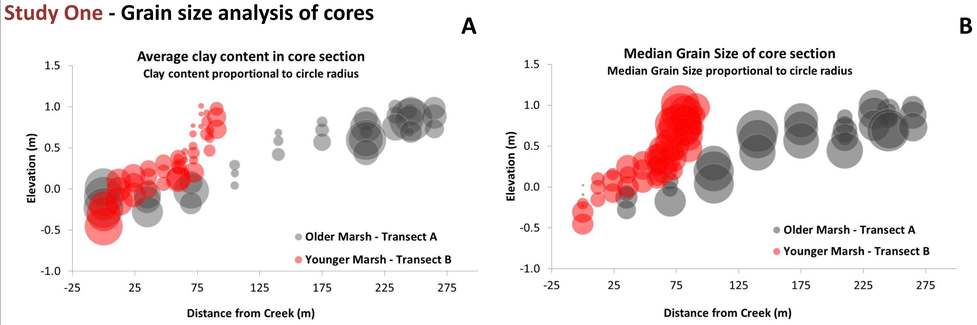
Methods

The work was divided into two sub-studies performed over the summers of 2010 and 2011 with the majority of data collection by two undergraduate students (authors[3,4]). **Study one** involved analyzing sediment cores and sediment deposited on tiles along two transects that traverse older (transect A) and younger (transect B) sections of marsh. Each core was 30cm in length sectioned into three 10cm subsamples. Each tile was 11X11cm deployed for approximately 24hrs. Sediment samples were measured for grain size distribution using a laser diffraction particle size analyzer. **Study two** involved measuring sediment deposition on tiles at one location on transect A. Additionally, suspended sediment concentration in the water column both at that sample plot and at the nearest tidal creek were collected over several tidal cycles. Depth of water over the marsh platform , depth of water in the creek, creek velocities and climatic measurements were also measured.

Study One – Spatial distribution of sediment deposition on marsh platform.

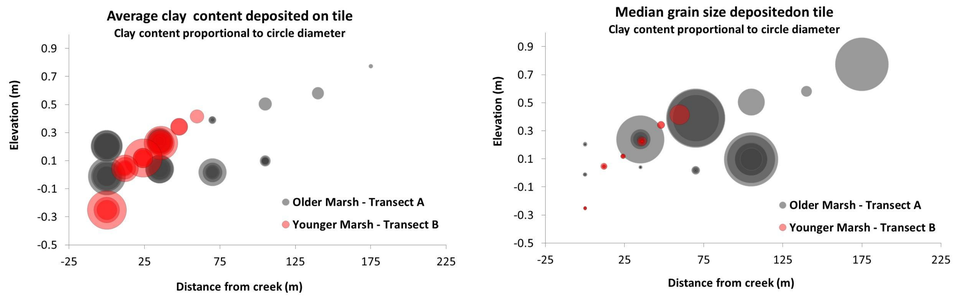


Study One - Grain size analysis of cores



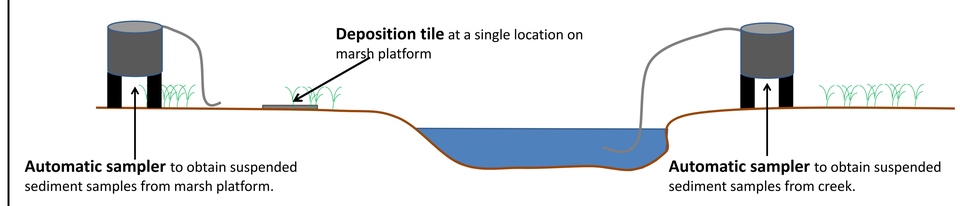
Distribution of average clay content and median grain size in soil cores with distance from creek and elevation. Vertical position of core samples represented by absolution elevation above MSL.

Study One – Tile deposition

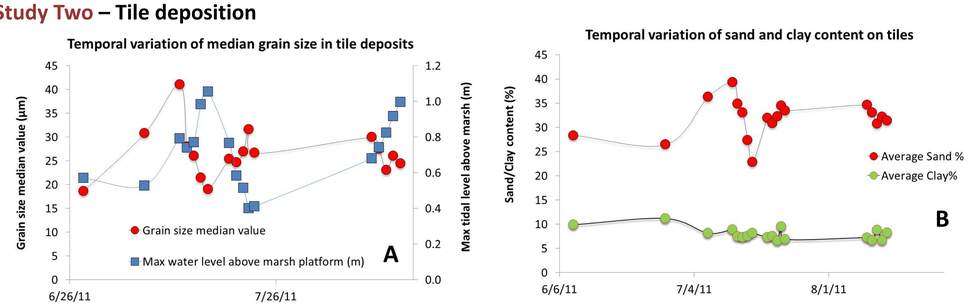


Distribution of average clay content and median grain size on deposition tiles with distance from creek and elevation. Vertical position of core samples represented by absolution elevation above MSL.

Study Two – Temporal distribution of sediment deposition on the marsh platform.

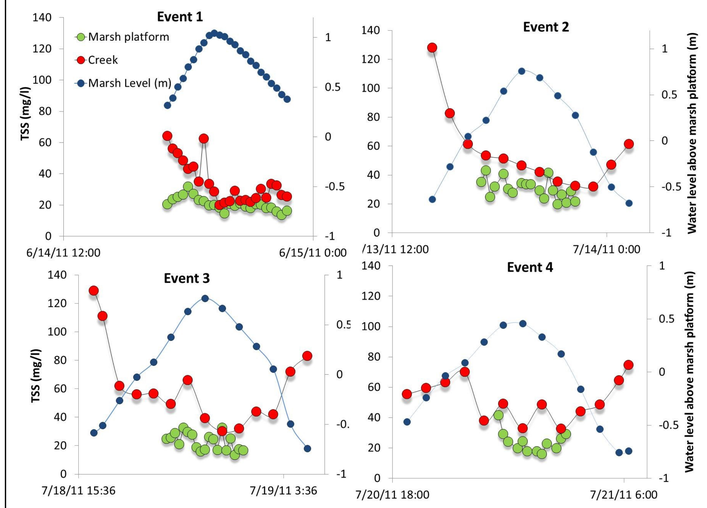


Study Two – Tile deposition

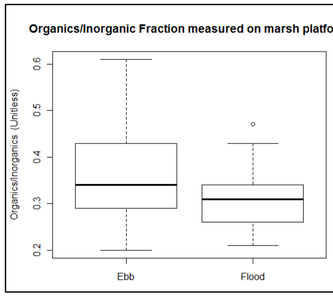


Temporal distribution of average median grain size, sand and clay content on deposition tiles. Maximum tide level above marsh platform is also shown in Figure B.

Study Two – Suspended sediment samples



Temporal distribution of sediment concentration (TSS) over four measured events. Maximum tide level above marsh platform is also shown.



Box plot of organic/inorganic fraction in suspended sediment samples measured on the marsh platform via automatic sampler classed by flood and ebb tides. One way ANOVA showed that flood and ebb tides had a significant effect on the organic/inorganic ratio at α=0.05 [$F(1,72)$= 8.66, p=0.004]. Flood and ebb tides did not appear to affect organic/inorganic fraction of samples measured in the creek.

Results

Study one showed that clay dominated sediment and core samples close to the creek. Median grain size increased with distance from the creek and with elevation. Median grain size of particles deposited on tiles placed on the older marsh where considerably larger. Temporal variation of median grain size deposited on the tiles varied with maximum water level above the marsh platform. Tile deposits showed the sand fraction was more variable than the clay fraction. Suspended sediment concentrations were highest and most variable in the creek compared to suspended sediment over the marsh. However, creek and marsh samples were similar during slack tide. Most transport occurred midway during flood and ebb tides. Lastly, the ratio of organic to inorganic fraction in suspended sediment samples measured on the marsh were significantly greater during the ebb tide than during the flood tide.

Discussion

The study shows that the marsh platform comprised primarily of fine particles close to the tidal creek with coarse fractions increasing with distance and elevation. This trend was most apparent in the young marsh. Differences in sediment sizes deposited in the younger and older marsh was not resolved and an area for future work. The ebb tide organic fraction appears to be larger suggesting a net export of organic material however this is based only on concentration data. These results are preliminary and further analyses of data is requited to assess implications to marsh development in the face of rising sea level. We hope to add statistical power by expanding the study over longer time periods and to more sites on the marsh.

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