

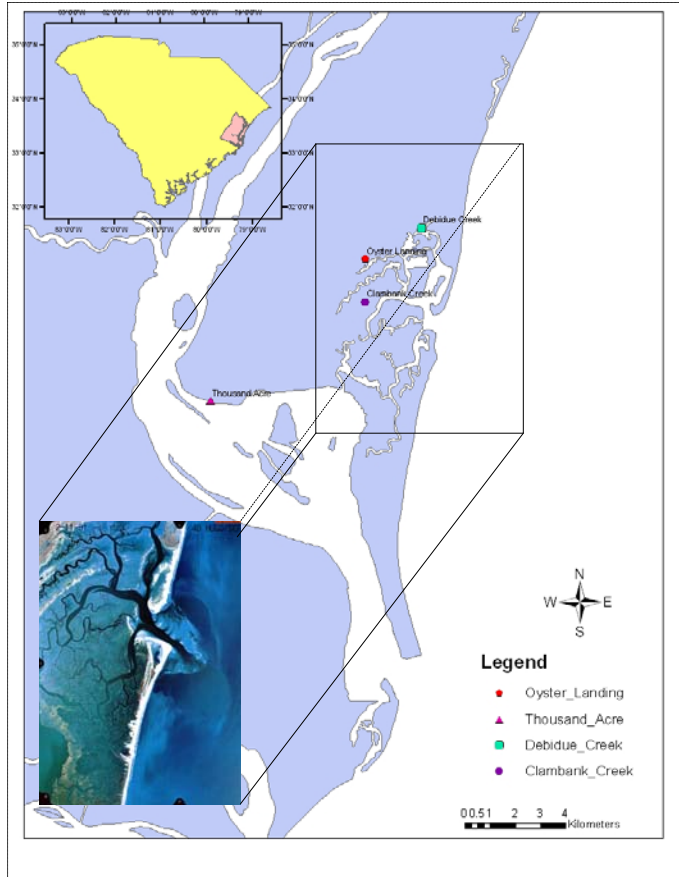
Spatial Variations in Sediment Flux in North Inlet-Winyah Bay:

Sediment Load Variations of Four Monitoring Sites in Winyah Bay, Georgetown, SC

Amy Williams, EES 24, Furman University, Greenville, SC, November 2005

Abstract

The North Inlet-Winyah Bay tidal estuary has been a highly researched area in South Carolina for sedimentation and chemical flow. The presence of a steel plant, paper mill, chemical plant, public sewage treatment plant, and coal fired plant within 5km+ of the monitoring stations make this area ideal for chemical and sediment monitoring. A current hypothesis in the area is whether the three stations in the tidally controlled marsh are affected by the sediment fluxes in estuary (Thousand Acre station). In conjunction with the Research Initiative there, I have mapped the spatial and temporal fluxes of total, organic, and inorganic suspended sediment in four monitoring sites within the Bay. The GIS data analysis presented here can be used for Dr. Steppen Murphy's continuing research, integrating a new medium into the understanding and presentation of the sediment fluxes of the North Inlet-Winyah Bay estuary.



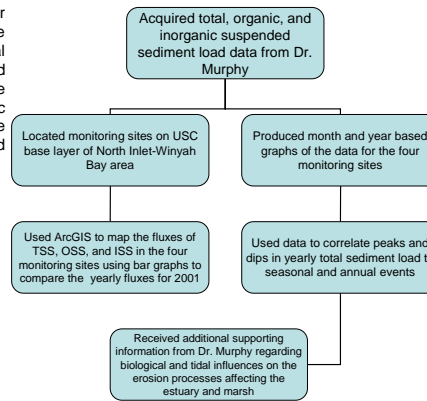
Background Research

For many years, Dr. Murphy has been conducting research on sediment and chemical flows in the Winyah Bay-North Inlet area. His data reaches back over twenty years, but this analysis is based on the total, organic, and inorganic suspended sediment fluxes which have occurred at four monitoring sites from 1993 to 2004. The North Inlet-Winyah Bay National Estuarine Research Reserve is one of the largest river-estuary ecosystems on the East Coast. The North Inlet is a bar-built Class C estuary located 10km east of Georgetown, SC. Winyah Bay is a Class B estuary located 14.4 km south of the North Inlet Estuary mouth.

Acknowledgements

I would like to thank Dr. Suresh Muthukrishnan and Dr. Steppen Murphy, Earth and Environmental Sciences, Furman University, for their contributions of data, support, and time. I would also like to thank the North Inlet-Winyah Bay National Estuarine Research Reserve for their online web-based support. Finally, I would like to thank Lynn Shirley, Webmaster, Center for GIS & Remote Sensing, Department of Geography, University of South Carolina, for personally providing the Winyah Bay base layer and Clemson for the bay jpeg. The projection meta data are as follows: Winyah Bay, Clarke_1866, SC boundaries, OL, CB, DC, and TA, NAD_1927.

Methodology

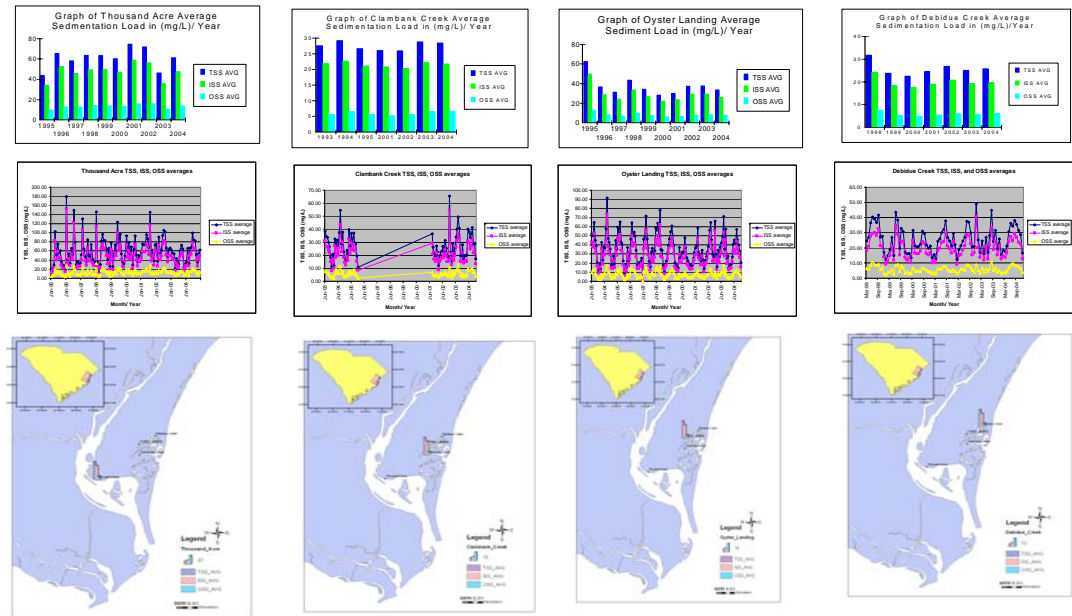


Data Collection Methods

As stated before, the maps produced for this project were based on sedimentation data from 1993 to 2004. This information was made available through Dr. Murphy and his continuing research in the North Inlet-Winyah Bay area. The monitoring sites details can be found to the right. Their locations are as follows: Clambank Creek, -79.1930W, 33.3339N, Debidue Creek, -79.1681W, 33.3603N, Oyster Landing, -79.1928W, 33.3494N, and Thousand Acre, -79.2600W, 33.2992N. These monitoring sites measure sediment flows, chemical fluxes, tidal heights, storm events, and other ambient meteorological events which could affect the sedimentation and chemical fluxes.

Results and Discussion

Because the North Inlet-Winyah Bay area drains 46,736 km² of upland and marshland, including the Peedee, Little Peedee, Black, Waccamaw, Lynches, and Sampit Rivers, the sediment load can vary significantly. At the Thousand Acre site, an anomaly in January of 1996 increased the total suspended sediment flow to 180mg/L, well above the data for later years. In the Clambank Creek site, an anomaly of above 65mg/L in July of 2002 occurred. At the Oyster Landing site, a January 1994 anomaly sent the total suspended sediment load above 90mg/L. Finally, in the Debidue Creek site, a peak in January of 2003 sent the total suspended sediment to nearly 50mg/L, but the more interesting anomaly was the dip of ISS below OSS in January 2004. I have deduced that these anomalies do not seem to have any relation to each other. There is little exchange between the estuary's (Thousand Acre site) sediment flow and the tidally controlled sediment in the marsh. The longshore current is flowing from the north to the south, so the sediment from the estuary could rarely enter the tidal marsh. The Oyster Landing site is in the littoral zone, so the sediment rate is higher for this station than for the two farther out in the marsh. This makes obvious the fact that the sediment rate for Thousand Acre is much higher than that of Clambank Creek because the Thousand Acre site receives the sediment from all six rivers and has a much higher water volume passing through it, while Clambank Creek, Oyster Landing, and Debidue Creek sites receive sediment from only the tides and which is a low volume. Studies have concluded that water temperature plays a crucial role in the total suspended sediment rate. The higher temperatures stimulate higher activity of the fiddler crabs that live in the area. These animals are cold blooded and become less active with colder water temperatures. During the summer, these crabs dig in the mud and loosen up the sediment so that it is more easily eroded when the high tide comes in. Also important in determining erosion rates is the tide level during a rain event. When the tide is out, the rain drops can mechanically erode the sediment in the marsh, increasing the volume that will erode during a given storm event. When the tide is in, the water prevents the rain from bombarding the marsh soil and slows the erosion process.



Thousand Acre Monitoring Site, 2001

Prior to 7/1999, the collection site was 30 meters NE of the marsh's west bridge. Because of heavy siltation that caused inaccurate water quality measurements, the site was moved to the NW bridge corner. The Thousand Acre Rice field, pine forested uplands, and vegetated wetland drain into the estuary. Salinity ranges from 0-26ppt and the tidal flux is 1m. The bottom is composed of detritus and fine sediments.

Clambank Creek, 2001

Located in the center of the NIWR, this site is surrounded by a Spartina marsh. Salinity ranges from 0-36ppt. The bottom is comprised of some fine sediment and mostly oyster shell hash.

Oyster Landing, 2001

Located in a pristine area, the collection site is on the pier's floating dock which is 2.8km from the Crab Haul Inlet headwaters in the North Inlet. Drainage areas include wetlands and pine forested uplands. Salinity ranges from 0-36ppt and tidal flux is 1.4m. The bottom is comprised of fine sediment, detritus, and oyster shell hash.

Debidue Creek, 2001

Located in the ocean dominated Spartina marsh, the site is 1km south of the Debordieu Colony, a development built on man-made canals. Salinity ranges from 0-36ppt and tidal flux is 2m. The bottom is comprised of fine sediment, detritus, and oyster shell hash. This creek was dredged in 2002.