Using surrogate technologies to estimate suspended sediment concentrations in Cape Sable, Everglades National Park, FL

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INTRODUCTION

Suspended sediment concentration (SSC) can significantly influence the health of aquatic ecosystems. An increase in SSC can cause decreased light penetration in the water column thereby decreasing primary productivity. This could continue with a cascading effect to those larger organisms that depend on primary production. Sediment plays a significant role in both nutrient cycling and pollution in United States waterways since both nutrients and metals can sorb to sediments (Gray and Gartner, 2009).

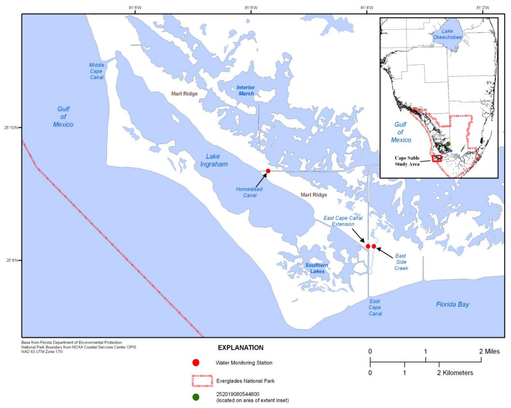
Traditional methods for determining SSC require time consuming travel and fieldwork. Continuous sampling is impractical due to the limited capacity of the automatic samplers, in which the sample bottles need to be manually replaced when full. Laboratory analysis of suspended sediment samples is also time consuming and costly.

Surrogate technologies, including turbidity and acoustic backscatter (ABS), have become available and offer new opportunities to estimate SSC continuously without taking routine water samples. This equipment can be deployed at monitoring stations to collect continuous measurements, which can be related to SSC through regression models. Additional benefits may include more consistent and accurate measurements, as well as decreased sampling expenses (Gray *et al*., 2010).

OBJECTIVES

1. Develop regression models to determine if turbidity and ABS are adequate surrogate variables for determining SSC in the Cape Sable area.
2. Determine if the regression models hold across seasonal variations in SSC in the Cape Sable area.

STUDY AREA



The study area in Cape Sable, Everglades National Park, FL

METHODS

Surrogate Parameters

- A YSI 600 OMS multi parameter water quality sonde was used to collect turbidity data.
- A Sontek SL acoustic Doppler velocity meter (ADVM) was used to collect acoustic backscatter data.

Sediment Samples

- An ISCO 6712 automatic water sampler was used to collect water samples.
- Cross sectional water samples were collected using either a DH-81, DH-95, or a weighted bottle sampler.

Sampling Events

- Data was collected during both wet and dry seasons during 2009 and 2010 over a variety of tidal cycles.

Dates of the Synoptic Sampling Events Performed

Dry Season Synoptic	Wet Season Synoptic
April 27-30, 2009	September 8-10, 2009
March 15-18, 2010	September 7-10, 2010

Photograph of USGS monitoring station at East Side Creek taken during a sampling event in May 2010.

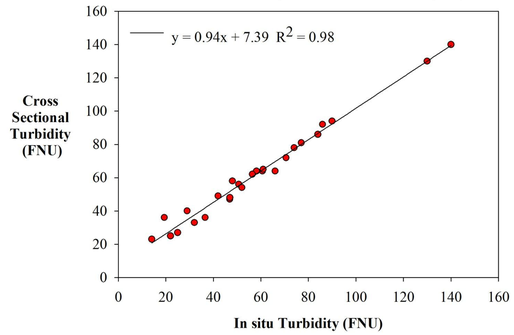
Photograph of the YSI and Sontek SL equipment mounts out of the water during a routine servicing.

Model Development

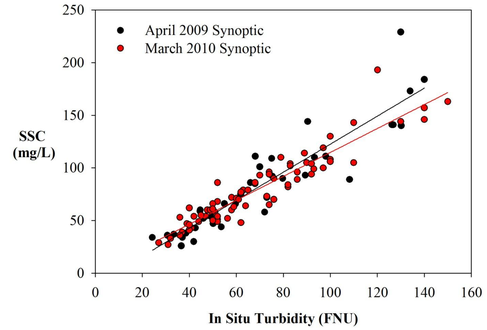
- Both linear and log based models will be analyzed using the surrogate parameters and the SSC samples collected from the ISCO.

RESULTS

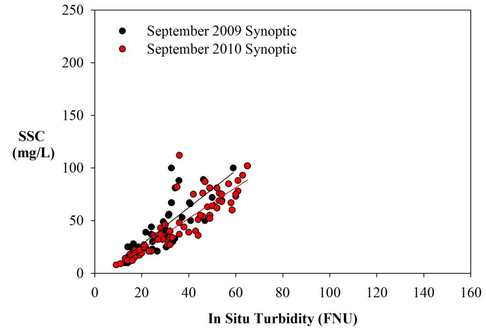
In situ and Cross Sectional Turbidity Relation from all Synoptic Events



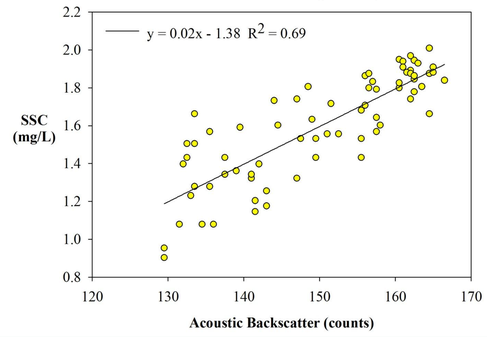
Comparison of the Dry Season Turbidity Models from 2009 to 2010



Comparison of the Wet Season Turbidity Models from 2009 to 2010



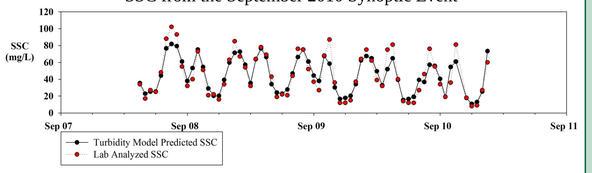
Preliminary Acoustic Backscatter Model using the September 2010 Data



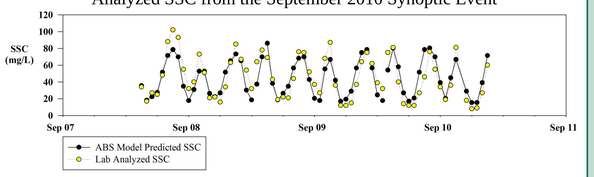
CONCLUSIONS

- No difference was observed when comparing the cross section and in situ turbidity samples.
- A difference was observed between the dry season and wet season turbidity models.
- A larger range of turbidity values and sediment concentrations were observed in the dry season.
- Both the turbidity model and preliminary ABS model do a good job predicting SSC.

Comparison of the Turbidity Model Predicted SSC and the Lab Analyzed SSC from the September 2010 Synoptic Event



Comparison of the Acoustic Backscatter Model Predicted SSC and the Lab Analyzed SSC from the September 2010 Synoptic Event



Future Directions

- Continue the development of the ABS model for the entire data set.
- Investigate if the surrogate models continue to hold since the completion of the Cape Sable Canals Dam Restoration Project in March 2011.

REFERENCES

Gray, J.R., and Gartner, J.W. (2009), Technological advances in suspended-sediment surrogate monitoring, Water *Resources Research*, 45, W00D29, doi:10.1029/2008WR007063.

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