Spatial Variability in CDOM Concentrations in Coastal Regions: Influences of Rainfall and Watershed Characteristics

P.G. Coble[1] , B. M. Dixon[2], and R.N. Conmy[1]

[1]College of Marine Science, University of South Florida; [2]Dept. Of Environmental Science, Policy and Geography, University of South Florida, St. Petersburg

Abstract

Understanding temporal trends in CDOM concentration and fluxes in rivers has become increasingly important due to the role of CDOM in water clarity, dissolved organic carbon flux, drinking water quality, and ecosystem health. Our recent work on the West Florida Shelf has shown that variability in river discharge is the major factor controlling CDOM concentrations on the shelf, with volume of freshwater discharge as a secondary factor. Numerous studies showing a link between soil organic matter content and DOC concentrations have led us to attempt a modeling approach to prediction of river CDOM discharge based on watershed characteristics such as land use and land cover, watershed hydrography, basin geography, flow paths, rainfall patterns, and soil composition, especially soil organic carbon and C:N ratios.

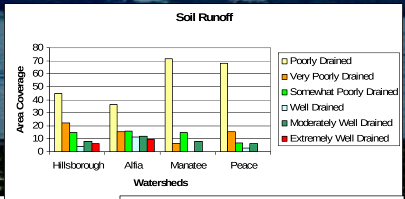
3. Soil properties, geographic factors and land use differ from north (Hillsborough and Alafia Rivers) to south (Manatee and Peace Rivers)

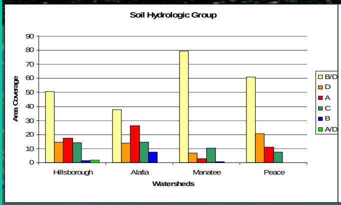
Northern watersheds
- higher elevation
- higher runoff
- better drainage
- more urbanized

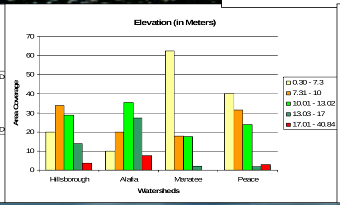
Southern watersheds
- lower elevation
- lower runoff
- poor drainage
- high agriculture

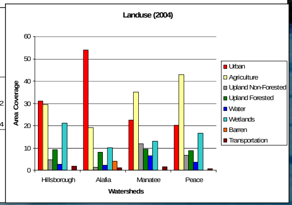
4. High CDOM in poorly drained soils (swamp/forest biome) has been previously observed.

Aitkenhead JA, McDowell WH (2000) GBC 14: 127-138







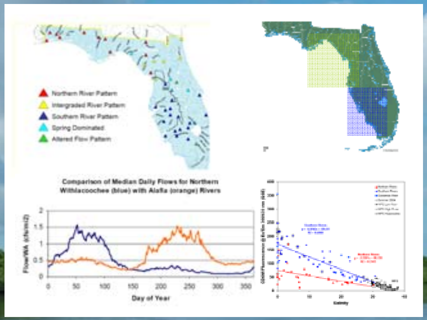


A = low runoff – high infiltration
D = high runoff low infiltration

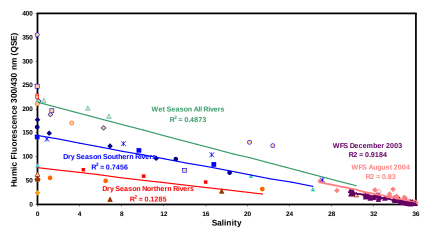
Conclusions

The area around the Peace River has one of the fastest growth rates in the U.S., with a doubling in human population between 1980 and 2000. Land use changes, water management practices, and changes in drainage patterns will all have profound effects on water quality and clarity in the estuaries and coastal waters of SW Florida.

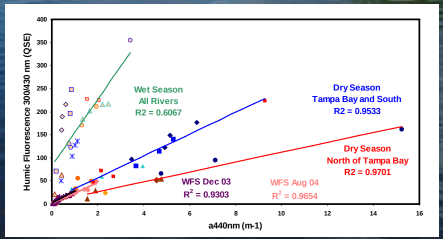
1. River variability is regional – CDOM concentrations increase from north to south. Rainfall max later in north than south



2. River variability is seasonal – CDOM concentrations increase from dry to wet seasons and years



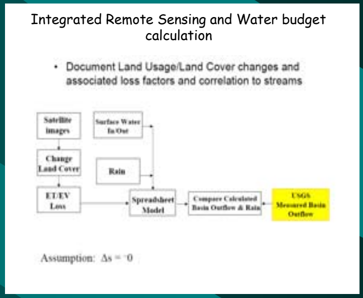
2. River variability is seasonal – CDOM fluorescence efficiencies increase from dry to wet seasons and years



Future Directions

We are developing a soil erosion and flow model for the watersheds using Soil Water Assessment Tool (SWAT) to model long-term historical data to predict historical flow, sediment yield, CDOM, turbidity, and nutrient data. The input to these models will be land use, soil, rainfall, and digital elevation data. The Revised Universal Soil Loss Equation (RUSLE) model will then be used to quantify soil erosion rate within the watersheds and establish relationships between erosion rate, rainfall event, turbidity and CDOM through event based sampling. Our ultimate goal is to assess the contribution of CDOM to the total optical signal in the rivers and estuaries, and establish patterns of variability due to landscape variables, climate variability, hydrological factors, and human-induced influences.

Step 1: Model and calibrate basin outflow



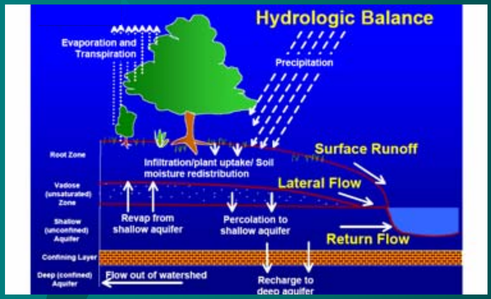


Figure taken from SWAT Manual

Step 2: Predict CDOM and turbidity based on land use and flow