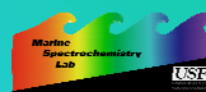


# Seasonal and Regional Patterns of CDOM Optical Properties on a River-Dominated Margin

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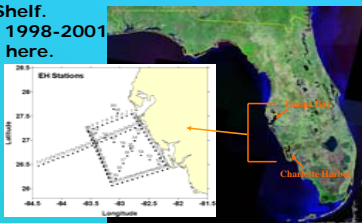


## Abstract

Colored Dissolved Organic Matter (CDOM) is a dominant factor controlling light penetration in the coastal ocean that interferes with remotely sensed measurements of chlorophyll. While the optical characteristics of chlorophyll are well known, the optical properties of CDOM vary considerably with composition, region, and season. This can be particularly challenging in river-dominated regions, such as the West Florida Shelf in the Gulf of Mexico, where multiple CDOM-chlorophyll relationships have been established.

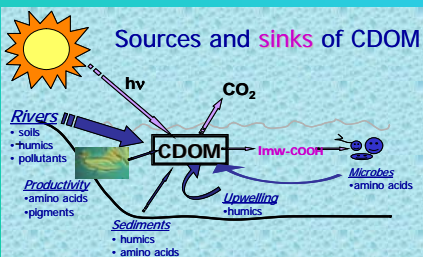
Investigation of spatial and seasonal patterns in CDOM optical properties has afforded a greater understanding of how these parameters co vary on the West Florida Shelf, and in turn have allowed for improved predictive bio-optical models. Presented here is a portion of an extensive dataset collected over eight years, with specific focus on the relationship between spectral slopes, absorption coefficients, fluorescence efficiencies and Dissolved Organic Carbon.

**Map of Florida denoting station locations on the West Florida Shelf. Samples from 1998-2001 are presented here.**



## CDOM Optical Properties What are they....?

- |                           |                            |
|---------------------------|----------------------------|
| <b>Absorption</b>         | <b>Fluorescence</b>        |
| • Spectral Slopes         | • Intensities              |
| • Absorption Coefficients | • Positions of peak maxima |
|                           | • Efficiencies and ratios  |



Courtesy of Dr. Paula G. Coble

## CDOM Optical Properties ...and what do they tell us?

- Information about
- Chemical Compositions
  - Biogeochemical pathways

## Acknowledgements

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## Methodology

West Florida Shelf (WFS) surface waters were sampled monthly with niskin bottles aboard the R/V Suncoaster between 1998 and 2002.

CDOM (Colored Dissolved Organic Matter) samples were Gf/F filtered and stored frozen in pre-combusted amber bottles. Samples were analyzed for absorption (Hitachi U-3300 double-beam spectrophotometer with matching one and ten centimeter quartz cells) and High-resolution fluorescence spectroscopy (Spex Industries' Fluorolog-II spectrofluorometer) according to Del Castillo, 1998 and Coble, 1996.

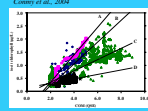
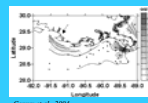
DOC (Dissolved organic Carbon) samples were collected during 2001 in the same manner as CDOM samples. Analysis was conducted by thermal catalysis using a Shimadzu TOC-5000, following Del Castillo, 1998.

In addition to discrete samples, underway fluorescence measurements were made with a SAFire in situ fluorometer. Using underway data will offer additional information for current bio-optical algorithms for estimating CDOM and chlorophyll.

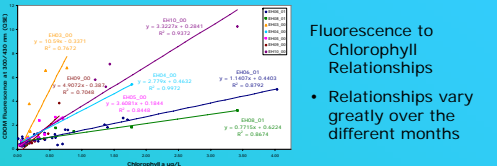
Chlorophyll a samples were collected, extracted and analyzed by Dr. Gabe Vargo (USF). *Karenia brevis* counts were provided by Dr. Cynthia Heil (Florida-FWCC).

## The Importance of CDOM investigations

- Water mass tracking
- Complex estuarine mixing
- groundwater discharge
- Primary Productivity estimates
- Regional CHL-CDOM relationships
- Monitoring projects
- Sewage outfalls, pollutants
- Possible food source
- Bacteria
- UV shading
- Toxic algae, corals



Del Castillo et al., 2001



## Relationships to Chlorophyll Relationships

- Relationships vary greatly over the different months

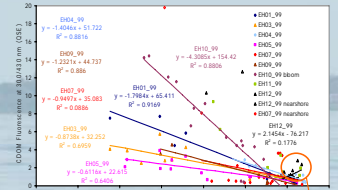
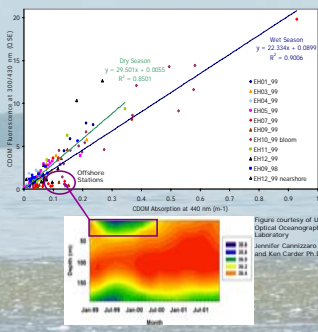
## Findings

- CDOM optical properties on The West Florida Shelf are temporally and regionally variable.
- CDOM concentrations are highly variable throughout all the sampled period.
- Upwelling conditions result in positive CDOM-salinity relationships.
- Organic material during dry conditions possesses highest fluorescence efficiencies, due to refractory nature.
- CDOM distribution on the West Florida Shelf is controlled by mixing of fresh and marine waters, where as DOC is not.
- Next step will be to compare discrete and flow-through fluorescence with SEAWIFS data to see how current algorithms are estimating both CDOM and chlorophyll.

## 1998 and 1999

### Fluorescence Efficiencies (F/a)

- Higher efficiency during the dry season due to more refractory organic material
- Offshore stations exhibited the lowest efficiencies, and appear chemically different from the rest of the shelf. This is most likely due to the presence of remnant water from the Mississippi region that remained on the shelf for all of 1999 (see salinity time series of station 11 at right).



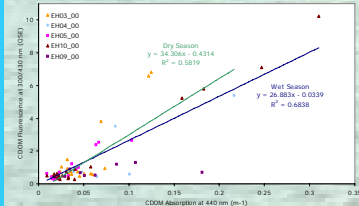
### Fluorescence to Salinity Relationships

- Slopes are much lower and extremely variable than routinely measured on the WFS. The presence of less colored material may also be due to the remnant northern river plume, which contains less organics as compared to the Florida rivers, heavily mixing with WFS water.
- A red tide near Tampa Bay occurred during October 1999. Highest CDOM concentrations were found during this month, although the fluorescence efficiencies did not change.
- December 1999 exhibited a positive slope and is attributed to an upwelling event that occurred on the shelf, bringing salty, organically-rich bottom water to the surface.

## 2000

### Fluorescence Efficiencies (F/a)

- According to the Palmer drought severity index ([www.cpc.ncep.noaa.gov/products](http://www.cpc.ncep.noaa.gov/products)), the WFS region experienced moderate to severe drought conditions during 2000.
- This drought year resulted in higher efficiencies for surface waters due to the refractory nature of the CDOM and seasonality still existed during this year.



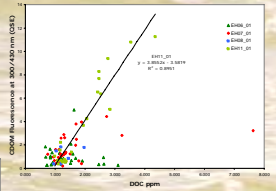
### Fluorescence to Salinity Relationships

- Nearshore stations exhibited relationships typically observed on the West Florida Shelf.
- Offshore stations show extremely low CDOM concentrations. Linearity could not be established for these stations because all are blue-water marine endmembers. This indicates that river discharge is the primary factor controlling the organic material distribution for this region.
- May 2000 exhibited a positive fluorescence to salinity relationship, again, attributed to upwelling on the shelf at that time.

## 2001

### Fluorescence Efficiencies (F/a)

- The efficiencies followed similar trends to those observed during the 1999 wet season.
- A red tide occurred during October 2001, but did not affect the efficiencies. However, the highest concentrations of CDOM were observed during this time.



### Fluorescence to Salinity Relationships

- November 2001 demonstrated a fluorescence to salinity relationship usually observed on the West Florida Shelf.
- July shows a positive slope due to upwelling conditions.

