# Dynamics of Chromophoric Dissolved Organic Matter (CDOM) in Tropical Marine Environment


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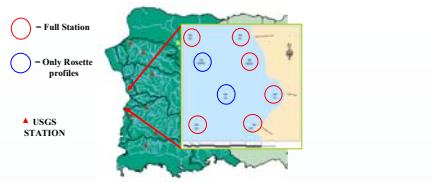
## ABSTRACT:

Mayagüez Bay is a semi-enclosed bay in the west coast of Puerto Rico that suffers spatial and temporal variations in phytoplankton pigments (Chl-a), Total Suspended Sediments (TSS) and Cromophoric Dissolved Organic Matter (CDOM) due to seasonal discharge of local rivers and bathymetry. Several years ago a joint project with researchers from NASA-Stennis Space Center and the University of Puerto Rico at Mayagüez intended to use remote sensing for a better understanding of the land-sea interface in this bay. It a previous work (Rosado, 2000) it was demonstrated that the major sources of error for the Chl-a concentration estimates were due the high concentrations of CDOM and TSS. The main working hypothesis establishes the possible physical interactions between CDOM and the clays from terrestrial origin in the river discharge during the rainy season. We are taking also in account possible dilution factor by marine water end members. Cold fronts during the dry season can be related to bottom resuspention of TTS and CDOM absorption increase observed in profiles and in discrete samples in shallow water stations (<4 m).

Our aim to is improve the remote sensing techniques for a better estimation of water quality parameters in coastal waters specifically Chl-a, CDOM, and TTS the development of regional algorithms and their Calibration and Validation.

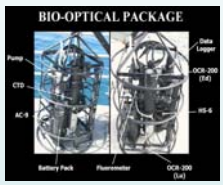




Study Area on the Western Coast of Puerto Rico

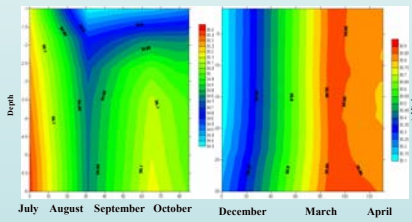
R/V Sultana

Añasco River Plume During High River Discharge

Temperature
Salinity
Chlorophyll-a Fluorescence
Total Suspended Sediments
Absorption of Particles
Absorption of CDOM
Backscattering Coefficient
Bean Attenuation Coefficient
Extinction Coefficient
Remote Sensing Reflectance

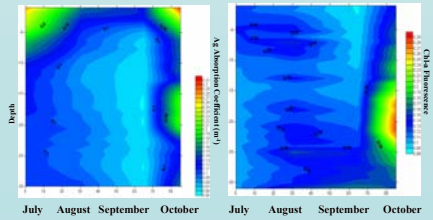



### Variability of Selected Parameters Between High River Discharge and Dry Season




Salinity Profile on Station A1 High River Discharge

Salinity Profile on Station A2 Low River Discharge




CDOM Profile on Station A2 Low River Discharge

Chlorophyll-a Fluorescence Profile Station A2 Low River Discharge

## RESEARCH OBJECTIVES:

Determine the spatial and temporal variability of the CDOM on the bio-optical properties between High river Discharge and dry season in the Mayagüez Bay and it's implications in calibration and validation issue.

How is the CDOM signal transformed due to the interaction with clays, sunlight photodegradation and marine water dilution from coastal to oceanic waters.

## INTRODUCTION

Chromophoric Dissolved Organic Matter (CDOM) is one of the components that gives natural water it's color. It is one of the main components that absorb visible light at the lower end of the visible spectrum (blue light) in a region similar to chlorophyll-a. CDOM is ~ 40%, of the Dissolved Organic Matter (DOC) pool, and being the DOC one of the most important reservoirs of carbon in the biosphere. This makes it's study very important from the biogeochemistry stand point of the carbon cycle it's budget and the know implication with the issue of global warming. The CDOM of terrigeniuos origin transported by rivers to the coastal zone an the use of Remote Sensing Techniques to monitor this transport can help us to understanding it's role and effects on the primary productivity in costal marine systems and possible consequences on the Carbon Cycle budget. The CDOM signal is detected from space sensors combined with the signal of chlorophyll-a on the lower end of the visible electromagnetic spectrum near (400 nm) and is considered noise in the signal. The algorithms applied to determine chlorophyll-a + it's degradation products concentration, overestimate the pigment concentration in coastal zones were CDOM concentration are highest (Carder., et al 1989). CDOM is also important because it also affects light quality and quantity by attenuating light in the Photosynthetically Active Radiation (PAR) area and it's effects on phytoplankton photosynthesis (Kirk, 1994).

This work will address the spatial and temporal variability observed for CDOM absorption coefficient on eight fixed station monitored on aproximally monthly basis on the Mayagüez-Añasco Bay located on the West Coast of Puerto Rico. The emphasis will be on the seasonality (rainy vs. dry seasons) variability related to CDOM absorption coefficient determined between water samples taken in the surface and in deep to salinity profiles, and total suspended solids between the stations.

## MATERIALS AND METHODS

Temperature and salinity profiles are obtained with a Sea-Bird Electronics SBE-19 CTD coupled to a bio-optical package that includes a Hydroscatt-6 (Hobi Labs) two OCR-200 radiometers measuring downwelling, and upwelling irradiance (Satlantic) and an AC-9 (WET Labs) attenuation and absorption meter that measures in 9 channels wavelengths at (412, 440, 488, 532, 560, 620, 650, 676, and 715 nm).

CDOM absorption coefficients are measured with a Perkin-Elmer® dual beam spectrophotometer (Lambda 18 model) is used. The readings are made using a 10 cm path length quartz cell. Absorption spectrum is taken between 250-750 (nm), at 1.0 (nm) interval. on amber 1 liter plastic bottles and a known volume filtered using Whatman GF/F filters (0.7 µm nominal pore size). Absorption spectrum Were measured between 250-750 (nm), at 1.0 (nm) interval. The absorption coefficient spectrums are corrected for scattering and by subtracting the blank measurement at 700 nm (Bricaud et. al., 1981). The absorption coefficient for CDOM (ag) was calculated from the absorbance using the, following equation:

$$ag(\lambda) = \frac{2.303\ A(\lambda)}{L} \qquad (1)$$

Where:
ag (λ) = CDOM
A(λ) = absorption,
L = Light path length in meters

Total Suspended Solids (TSS):
The water samples were collected in 3.8 liter plastic containers for oceanic water or 2.0 liter containers for coastal waters. Duplicated water samples were taken at each station at the surface and at depth. The water was filtered thought Millipore® HA 0.45 µm white nylon HNWP 47 mm diameter membrane. These filters were previously oven-dried over-night at 60°C and pre-weighed in and analytical balance ± .0001g. The filtered water volumes varied between station samples (depending on the sediment load of each sample). From each container two water sub-samples were taken after agitating the container to resuspend the sediments in the samples. The filters will then dried at 60°C over-night and then weighted. Total Suspended Solids (TSS) is expressed in TSS (mg /L).

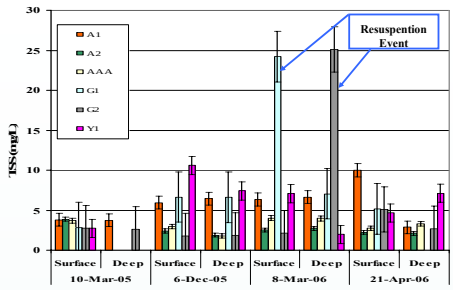
## CONCLUSIONS

Mayagüez Bay has significant spatial and temporal variability of CDOM and TSS and Chl-a fluorescence between the high river discharge and dry seasons.

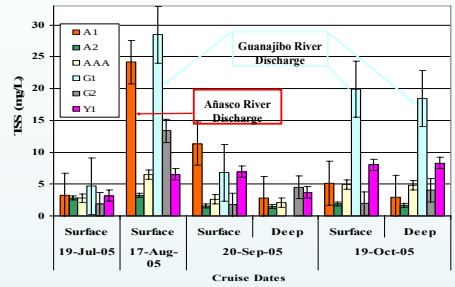
The key processes controlling the bio-optical properties are:

1-Concentration of CDOM and Total Suspended Sediments asociated to river discharge during the rainy season.

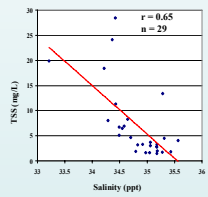
2-Bathymetry an climatological conditions in (G1 and G2) station located in southern stations



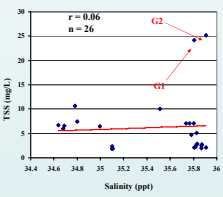

Total Suspended Solids in the Surface an Depth During the Dry Season



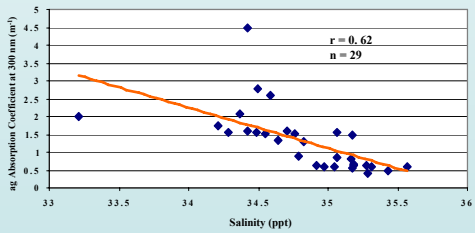

Total Suspended Solids in the Surface an Depth During High River Discharge

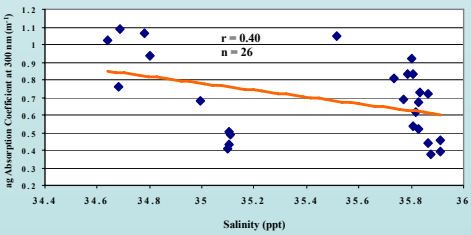



Salinity vs. Total Suspended Solids (TSS) Correlation During High River Discharge




Salinity vs. Total Suspended Solids (TSS) Correlation During the Dry Season

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