Land-Ocean-Atmosphere Interactions Lab

Summer Research Opportunity: Remote Sensing of Chesapeake Bay Wetlands

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Why Study Wetlands?

- Ecosystem services!
  - Flood control
  - Pollution control (nitrogen and phosphorus in particular)
  - Carbon transform and sequestration
- Wetlands are excellent at storing carbon
  - There are two simple reasons for this, what are they?

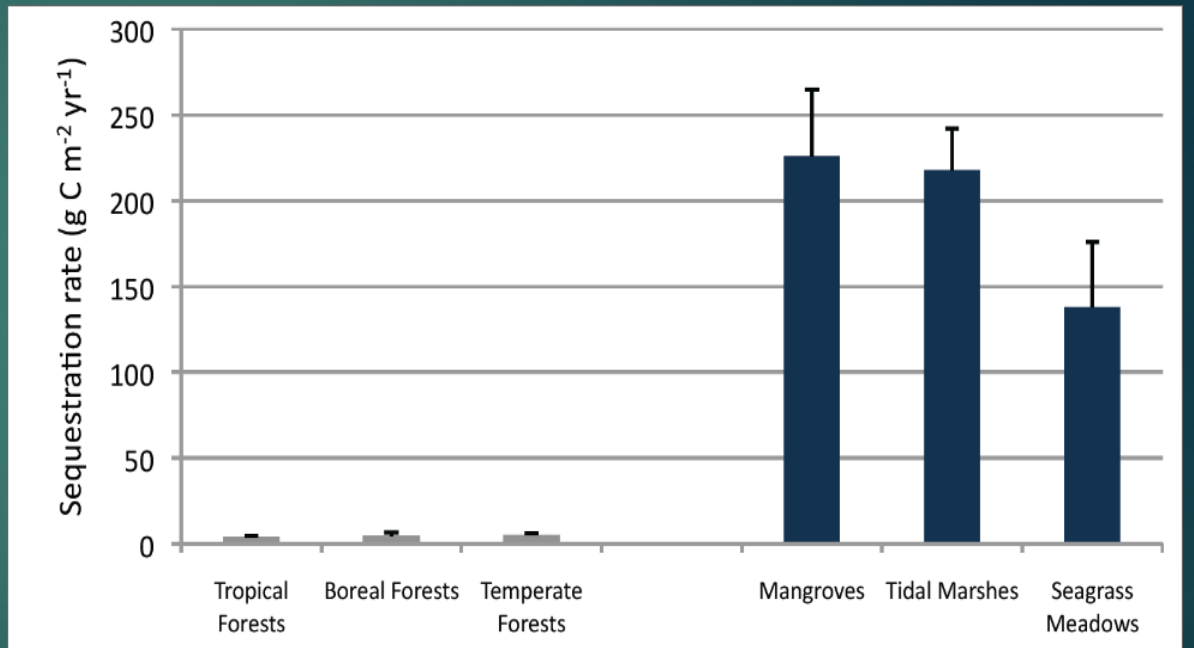


Figure 1. Annual mean carbon sequestration rates for blue carbon habitats per unit area compared to terrestrial forest habitats (error bars indicate standard error). The annual sequestration rate of a given ecosystem is the quantity of CO_2 removed from the atmosphere and/or ocean and trapped in natural habitats (Modified from McLeod et al. 2011).

Source: The Blue Carbon Initiative

Carbon capture in wetlands

- High levels of vegetation growth.
- Low levels of decomposition of dead plant matter because soils are wet
- Factors lead to carbon being *captured* in soils
- However, carbon is also *exported* from tidal wetlands to open oceans

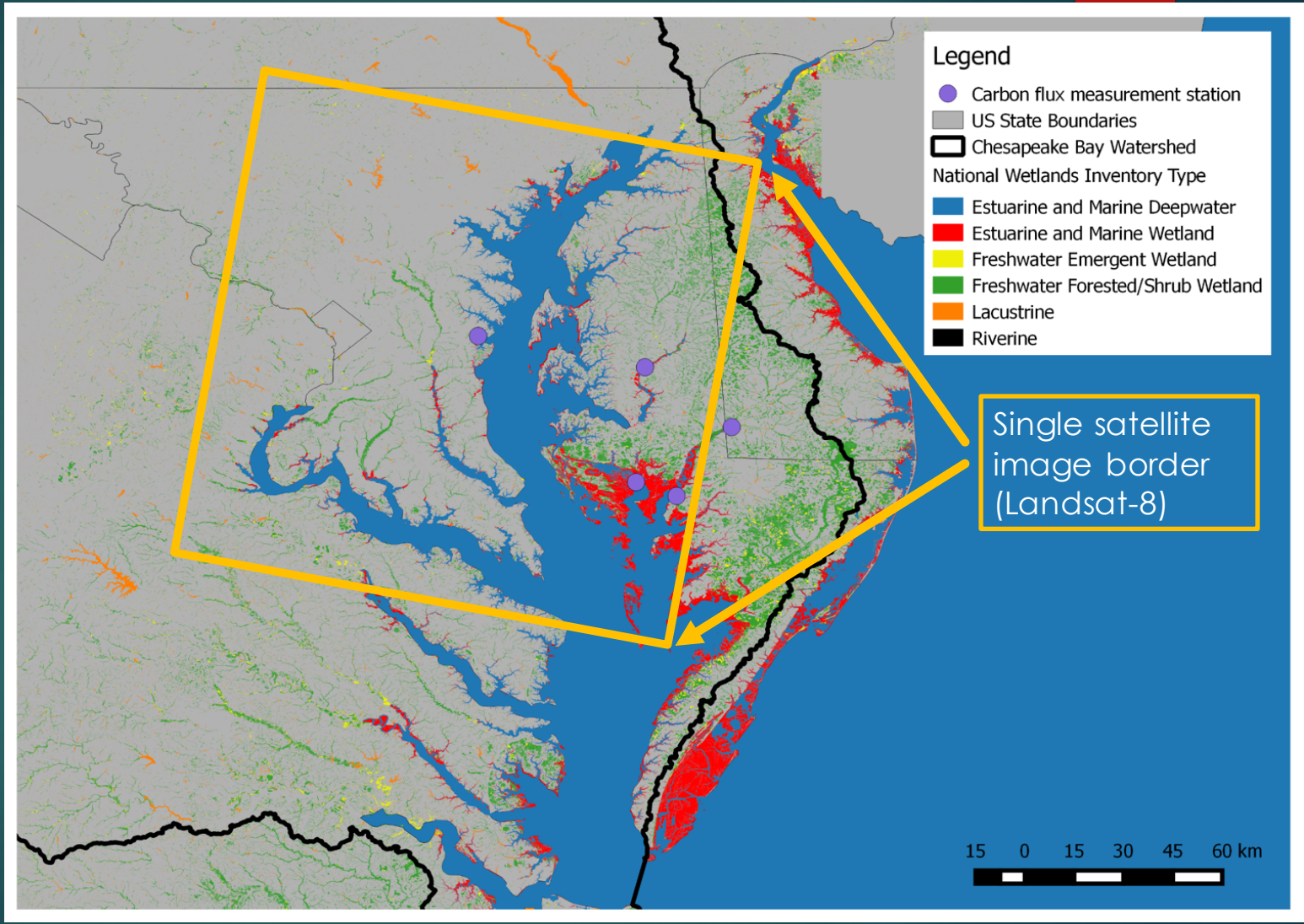
Remote sensing of wetland vegetation to understand wetland carbon cycling

Location: Blackwater National Wildlife Refuge

- Do changes in wetland vegetation through time impact carbon cycling?
- Do different types of wetland vegetation have different impacts on carbon cycling?
- Understanding these processes over large spatial scales requires remote sensing

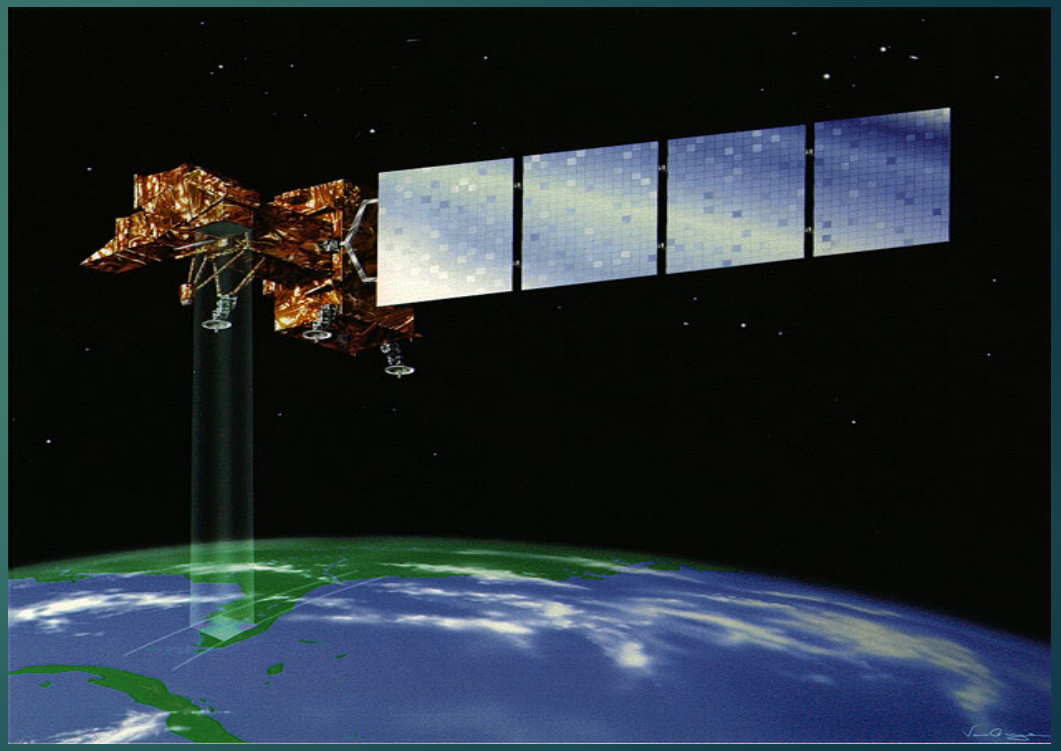
Area of Study

- Chesapeake Bay: Very large region
- Field campaigns are limited relative to size of study area
- Thus, field observations and remote sensing observations must be linked



Use of Remote Sensing Observations from Landsat Satellites

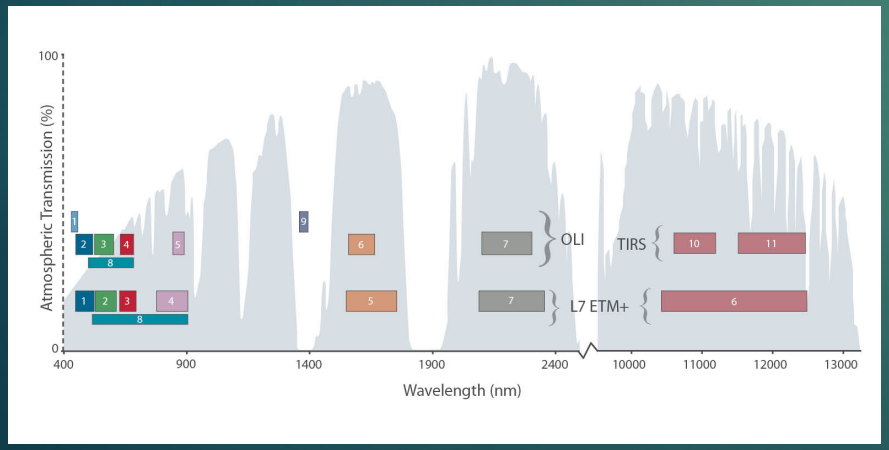
- Landsat is particularly suited for study of wetlands for the following reasons:
  - High spatial resolution of 30 meters (compare to 500 meters for MODIS)
  - Long data record 1972-present
  - 16 day revisit time with current Landsat satellites (7 & 8)
    - Good for detecting seasonal changes in vegetation
    - Also good for understanding water characteristics



Landsat satellite mission

Landsat Satellite for observations of water properties, color, and biology

Landsat **blue, green and red bands** provide important information on the "color" of the water, which we can then use to infer variability in water quality, aquatic biology, and biogeochemistry.



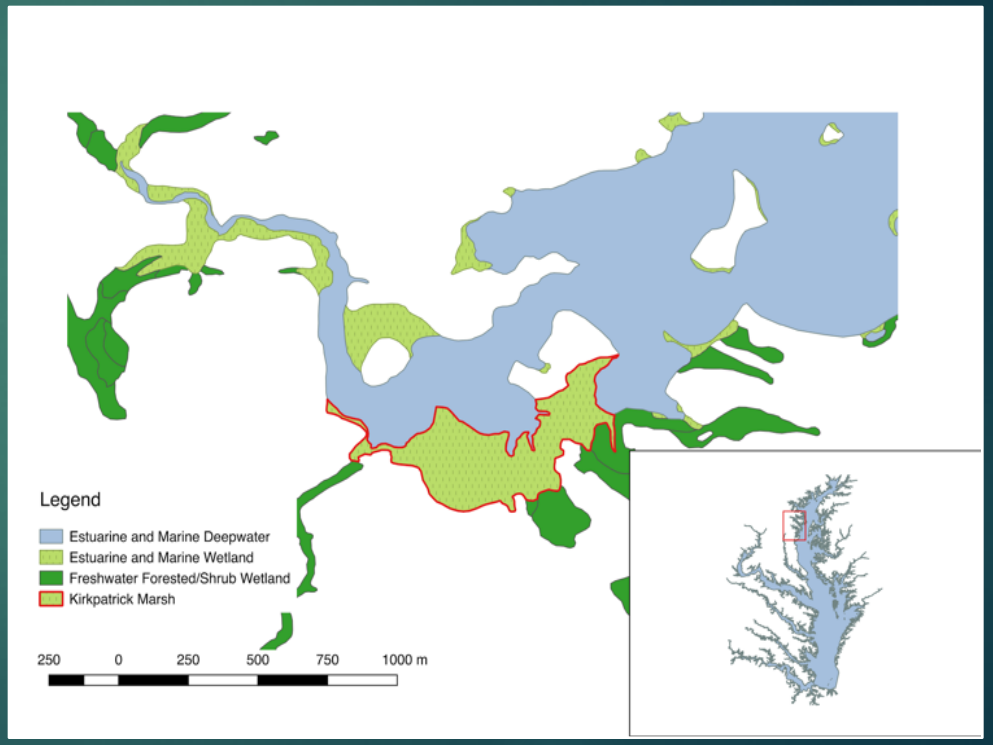
Location: Rhode River Marsh & Estuary

Landsat Satellite for observations of water properties, color, and biology

Rhode River sub-estuary: one of our intensive study sites in the Chesapeake

- Brackish, high-elevation tidal marsh
- Long-term data sets at the site
- Watershed with mixed land-use (forest, row crops, pasture, residential and low- and high-marsh)

Location: Rhode River Marsh & Estuary



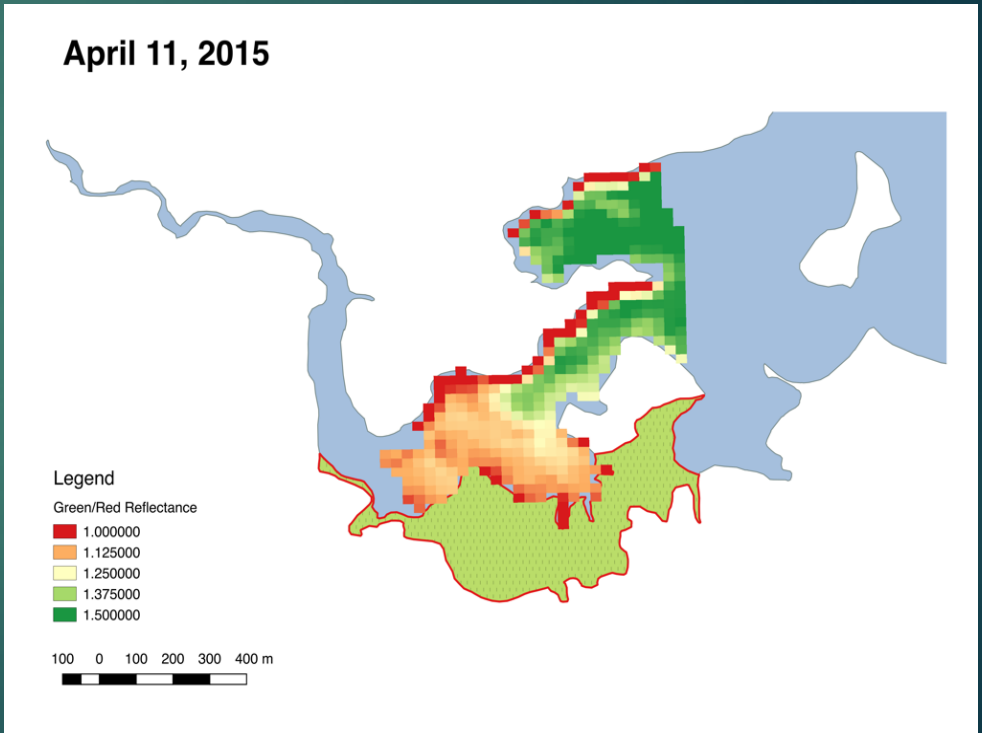
(from Logozzo, Menendez, Rappa and Telano)

Landsat Satellite for observations of water properties, color, and biology

Location: Rhode River Marsh & Estuary

A combination of blue-red-green bands can be used to study chlorophyll and sediments in the estuarine waters

- These properties will depend on tidal stage and tidal range
- They will also depend on distance from source of materials (e.g., marshes, forest, river, phytoplankton production)



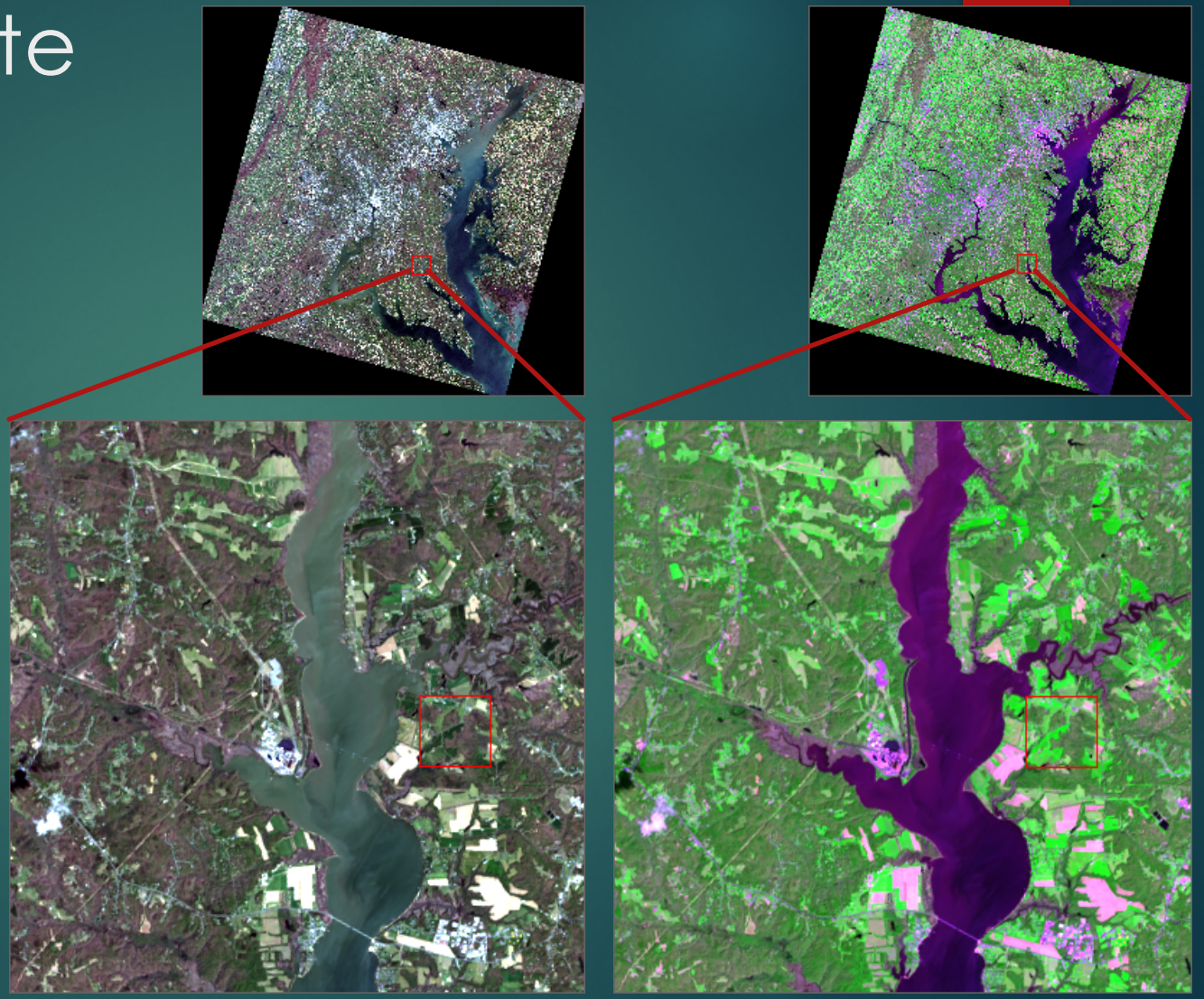
(from Logozzo, Menendez, Rappa and Telano)

Landsat Satellite for vegetation observations

- Image on the left is true color Red, Green, Blue image (same as standard photograph)

- Image on right is image with infrared band assigned to visible green channel
  - Vegetation is highly reflective of infrared light!

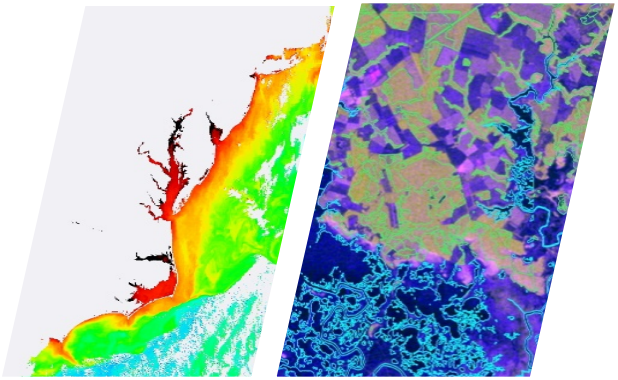
- Compare images



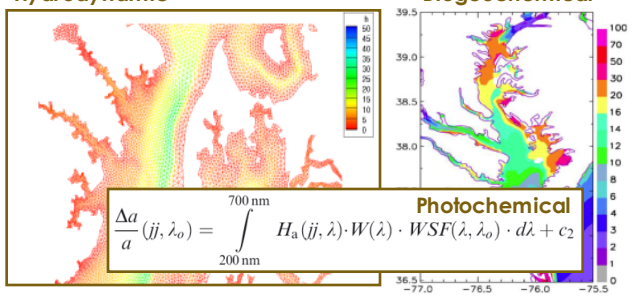
Overarching Objective: Link field observations with RS and models

Field data & Lab experiments

Remote Sensing Products



Modeling Framework



Assess the role of tidal wetlands as Carbon sources & sinks

Decision Making

- *Stake Holders*
- *Scenario Analysis*
- *Integration into enhanced decision support systems*

Student activities

- Analyzing field data
  - Measurements include: TSS, turbidity, Chlorophyll-a, CDOM
- Comparing field data to tidal data
  - Do these field measurements change with different points in tidal cycle?
- Analyzing satellite data
  - Do observations from space compare to measurements on the ground?
- What software and/or programming languages you use is very open ended.


NOAA
R 8501

Google:

"Land Ocean Atmosphere Lab CCNY"

- Should be first result!

Or go to:

www.mariatzortziou.com