

Land-Ocean-Atmosphere Interactions Lab

Summer Research Opportunity: Remote Sensing of Chesapeake Bay Wetlands

CITY COLLEGE OF NEW YORK

DEPARTMENT OF EARTH AND ATMOSPHERIC SCIENCES

DR. MARIA TZORTZIOU (PROFESSOR/PI)

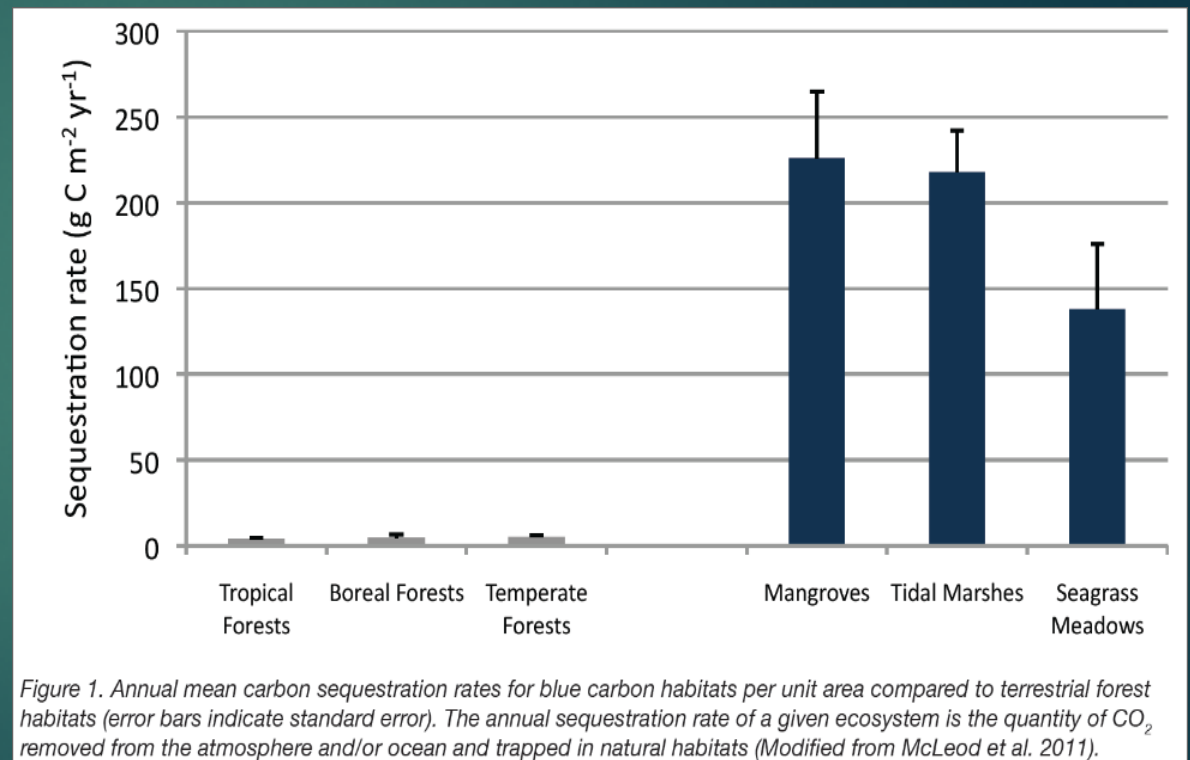
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BRIAN LAMB (PHD CANDIDATE)

ALANA MENENDEZ (MASTERS CANDIDATE)

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?



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

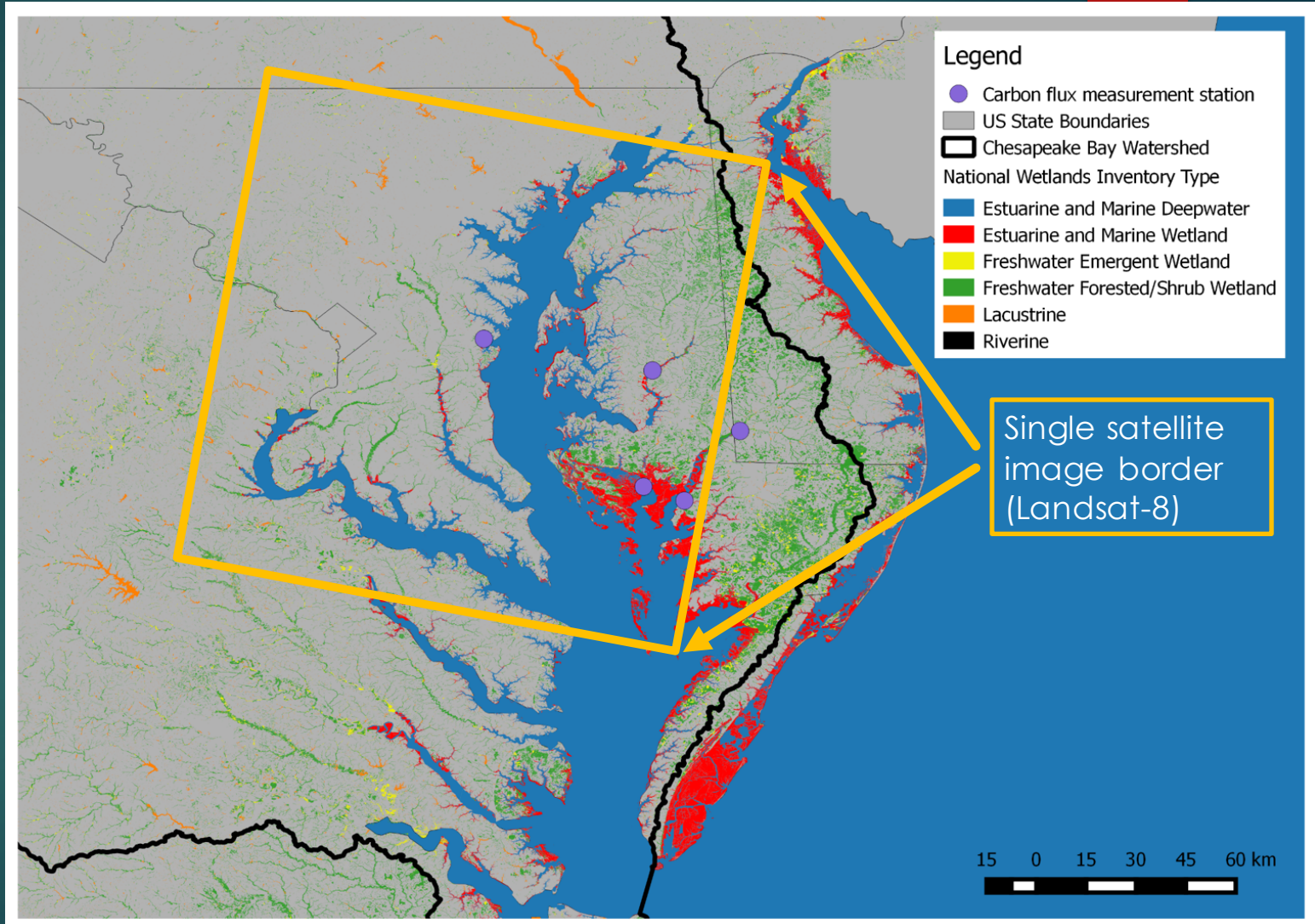


Location: Blackwater National Wildlife Refuge

- ▶ 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

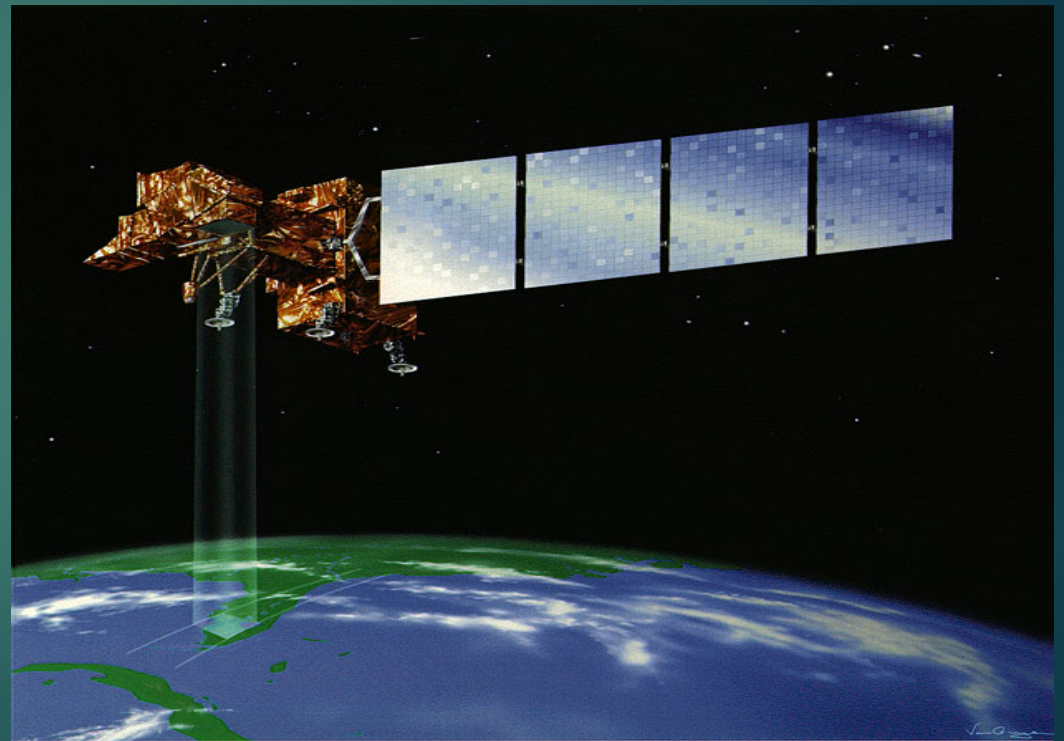
Area of Study

- ▶ 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

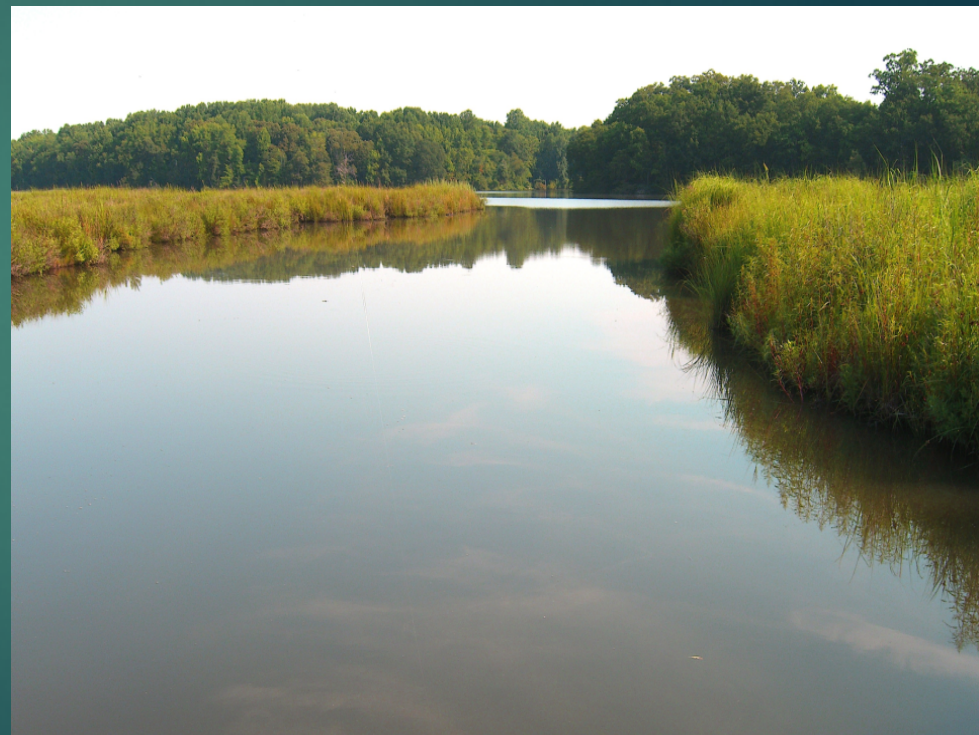
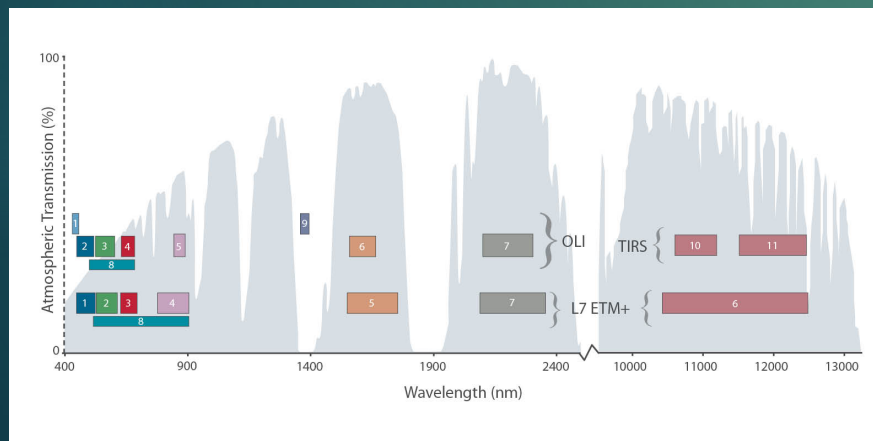
- ▶ Landsat is particularly suited for study of wetlands for the following reasons:
 - ▶ High spatial resolution of 30 meters (compare to 500 meters for MODIS)
 - ▶ Long data record 1972-present
 - ▶ 16 day revisit time with current Landsat satellites (7 & 8)
 - ▶ Good for detecting seasonal changes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



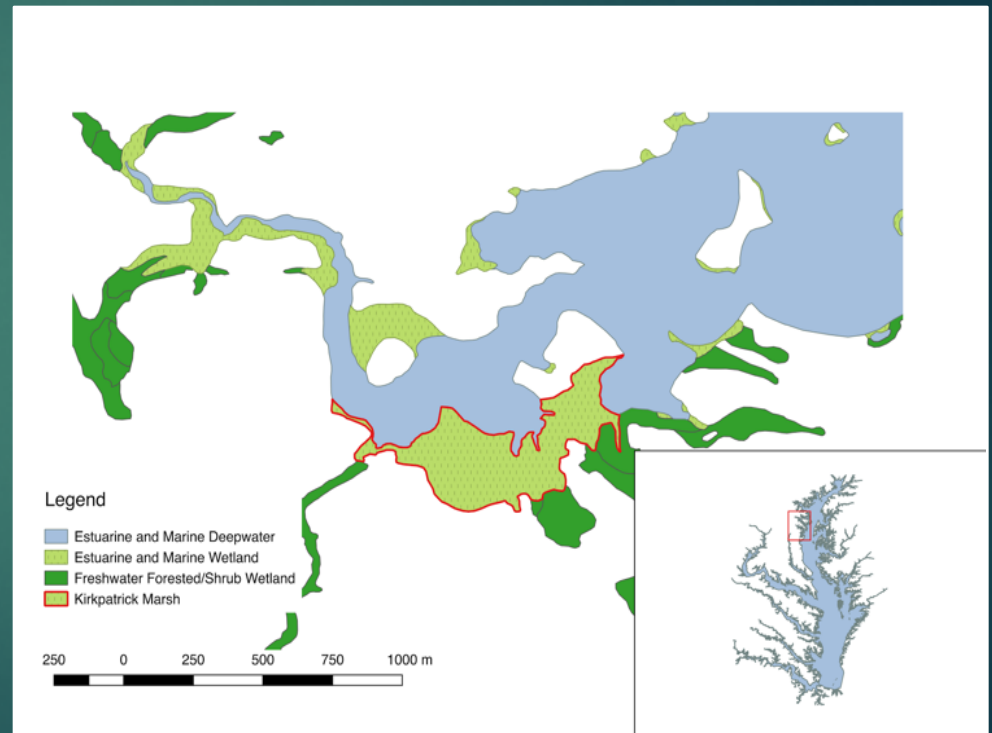
Location: Rhode River Marsh & Estuary

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



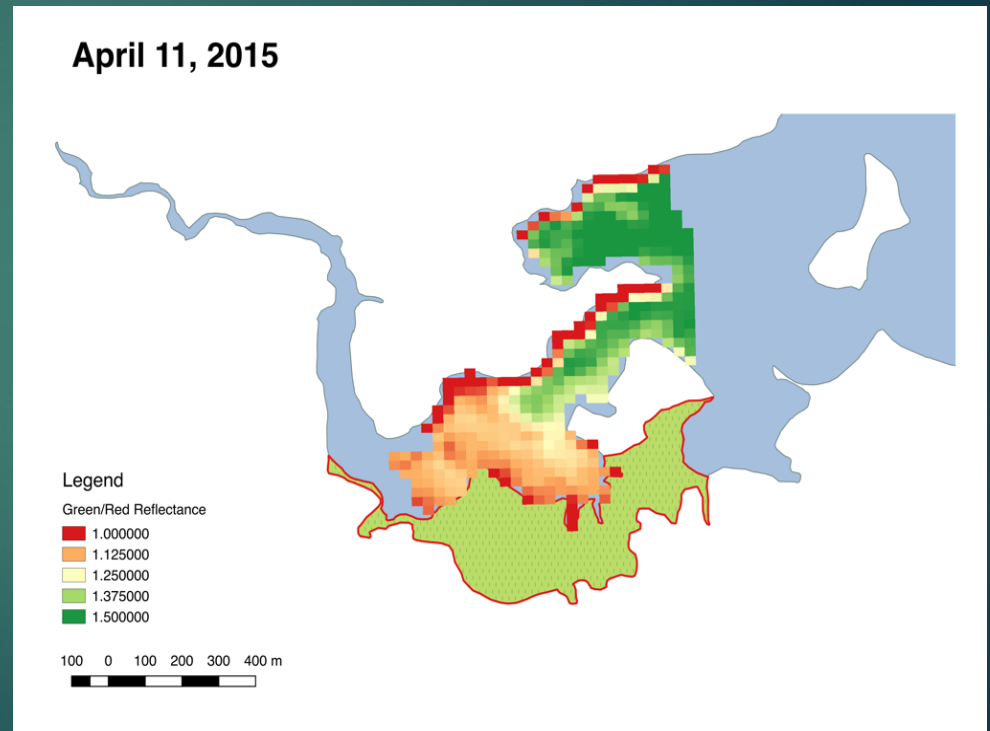
(from Logozzo, Menendez, Rappa and Telano)

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

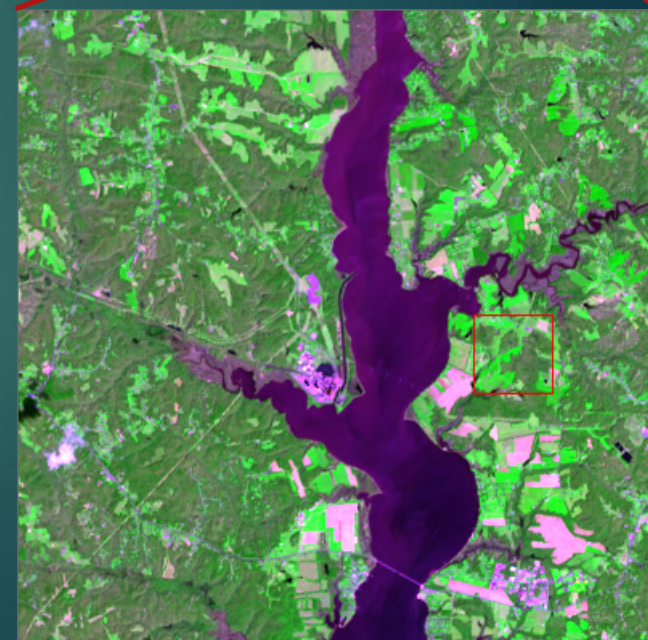
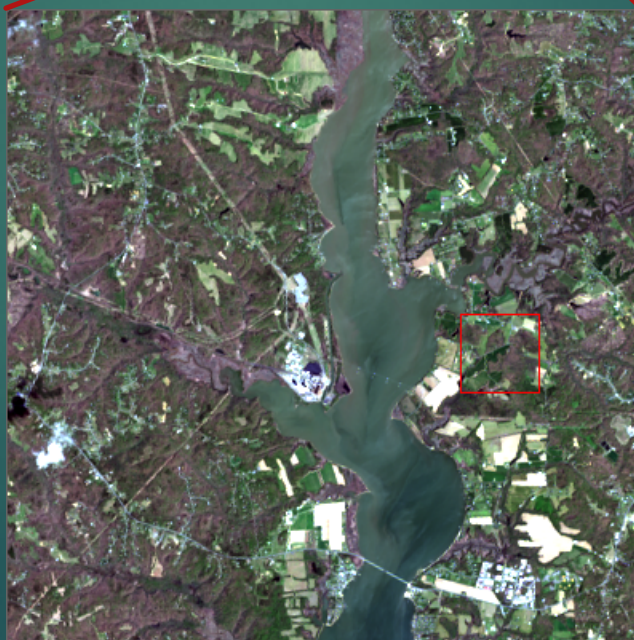
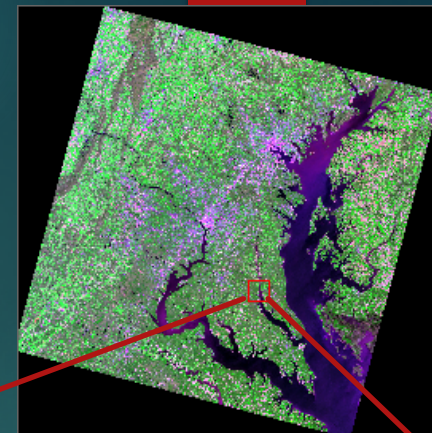
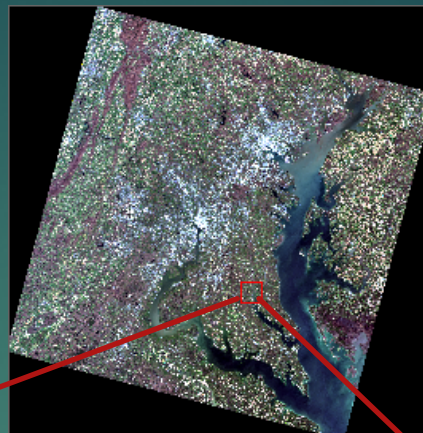
- ▶ These properties will depend on tidal stage and tidal range
- ▶ They will also depend on distance from source of materials (e.g., marshes, forest, river, phytoplankton production)



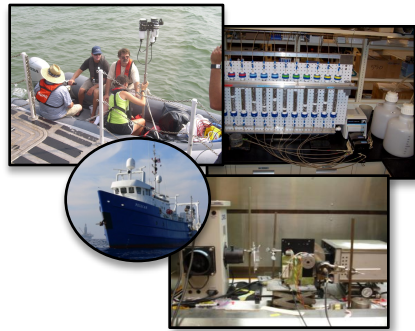
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Landsat Satellite for vegetation observations

- 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



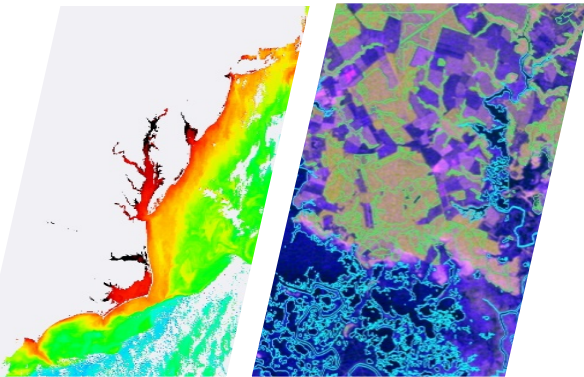
Overarching Objective: Link field observations with RS and models



Field data & Lab experiments



Remote Sensing Products

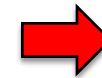
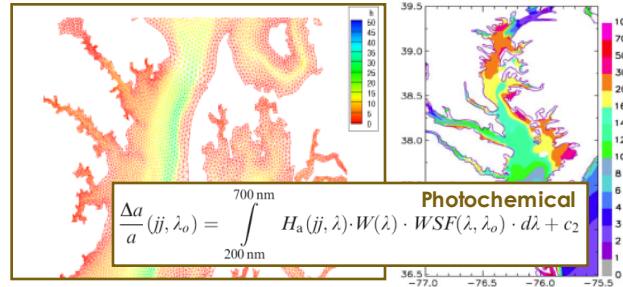


Modeling Framework



Hydrodynamic

Biogeochemical



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.



Google:

“Land Ocean
Atmosphere Lab CCNY”

- Should be first result!

Or go to:

www.mariatzortziou.com

Welcome to the Land-Ocean-Atmosphere Interactions Lab



Research in the Tzortziou Land-Ocean-Atmosphere Interactions Lab focuses on understanding and quantifying atmosphere-land-ocean biogeochemical exchanges across temporal and spatial scales, and assessing impacts of environmental change on coastal ecosystem processes, functioning, and services. Our [research](#) addresses the direct and indirect impacts of increasing coastal urbanization, anthropogenic air pollution, sea level rise, nutrient enrichment, and changes in the frequency and severity of weather and climate extremes ([MORE](#)).

Research in our [lab](#) includes development of new ground-based and shipboard remote-sensing sensors with advanced capabilities, development of enhanced satellite bio-optical retrievals, and integration of rigorous observational approaches with sophisticated high-resolution air-quality modeling and novel coupled hydrodynamic - photochemical - biogeochemical models optimized for complex coastal systems. Partnering with relevant stakeholders, key objective is incorporating advanced remote sensing and modeling tools into enhanced decision support systems for predicting potential responses of coastal ecosystems to future pressures and assessing the services these ecosystems may provide in a changing climate ([MORE](#)).



Latest Laboratory News!

- INTERNSHIP OPPORTUNITIES: Learn more about [Laura Logozzo's](#) and [Brian Lamb's](#) summer internships
- New NASA funding to participate in the [GEO-CAPE KORUS-OC](#) oceanographic field campaign
- The [Arctic-COLORS Field Campaign Strategic Science Plan](#) is ready for community review and public comment
- Check out the [Press Release](#) for our NASA-funded WETCARB project (Wetland Estuary Transports and Carbon Budgets)
- Visit the website of our NASA-funded project [MARSHCYCLE](#) (Tidal Wetlands as sources and sinks of Carbon in a Changing World)
- Tzortziou invited to join the Editorial Board of [Biogeosciences](#) (5-yr IF: 4.844)
- New L&O paper on CDOM dynamics in a transboundary river and its Ramsar protected wetland
- [...more Lab news...](#)

A dark footer banner. On the left is a circular image of a satellite. To the right, text reads: 'Prof. Maria Tzortziou, City University of New York, Office: 212 650 5769, Email: mtzortziou@ccny.cuny.edu'. On the far right is a small portrait of Prof. Tzortziou.