

Coastal Processes
Land-Ocean
Exchanges



Atmospheric
Influence



Pushing the
envelope in RS



Coastal
Urbanization

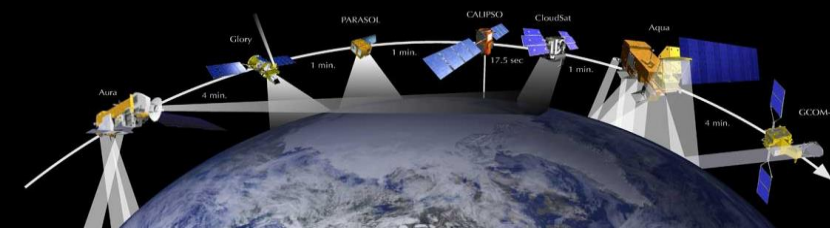


Arctic COLORS



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NOAA·CREST

Theme I: Coastal Resilience



Theme I: Coastal Resilience

CREST Faculty: M. Tzortziou (Lead), A. Gilerson, S. Ahmed, J. Cherrier, K. McDonald, R. Armstrong, R. Rodriguez, J. Munoz

Improving coastal resilience depends critically on coastal intelligence and developing a deeper understanding of coastal processes, dynamics, and vulnerability to anthropogenic and natural stressors.

Theme I addresses this high research priority for NOAA through a combination of **coastal observations**, **advanced modeling**, development of **new remotes sensing tools**, and assessment of **environmental and socioeconomic** efficacy of developed approaches for mitigating these stressors.

Coastal environments are among the most vulnerable yet economically valuable ecosystems on Earth. Comprehensive **integration of social science into research** is a key priority in Theme I.



Land Ocean Atmosphere (LOA) Interactions Lab

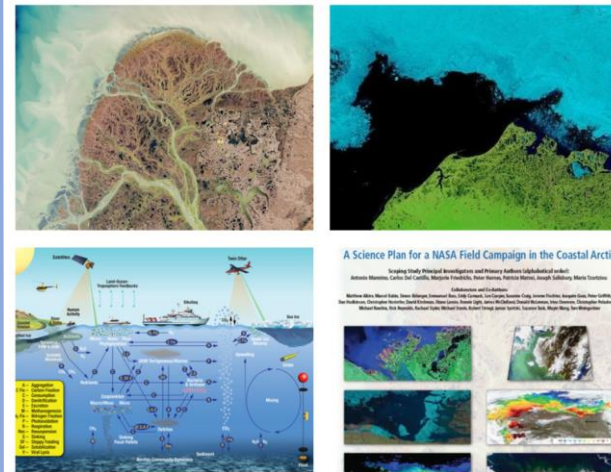
PI: Professor Maria Tzortziou

Tidal wetlands in a changing world



Research in the LOA Lab integrates field measurements with advanced remote sensing observations and new mechanistic carbon cycling modeling to assess the role of marsh soils and tidal **wetland-estuary margins** as sources, sinks, buffers, reactors, and transformers of **carbon and nitrogen**.

Land Ocean Interactions in the Arctic



The Arctic is warming at least twice as fast as the rest of the planet. The impacts on the amount and quality of organic carbon exported to adjacent aquatic ecosystems, and subsequent effects on **nearshore biogeochemistry, ecology and biodiversity**, are unknown and drive our research in coastal Arctic ecosystems.

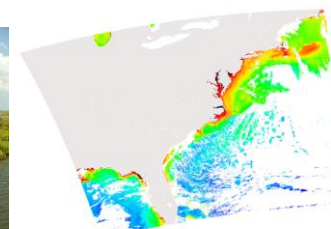
Atmospheric dynamics across land-sea interface

Urban nearshore regions are characterized by strong variability in **atmospheric composition**, associated with both **anthropogenic emissions and meteorological processes** that influence the circulation and accumulation of atmospheric pollutants at the land-ocean interface. A major focus in the Lab is studying these highly dynamic and complex atmospheric processes across terrestrial-aquatic interfaces.

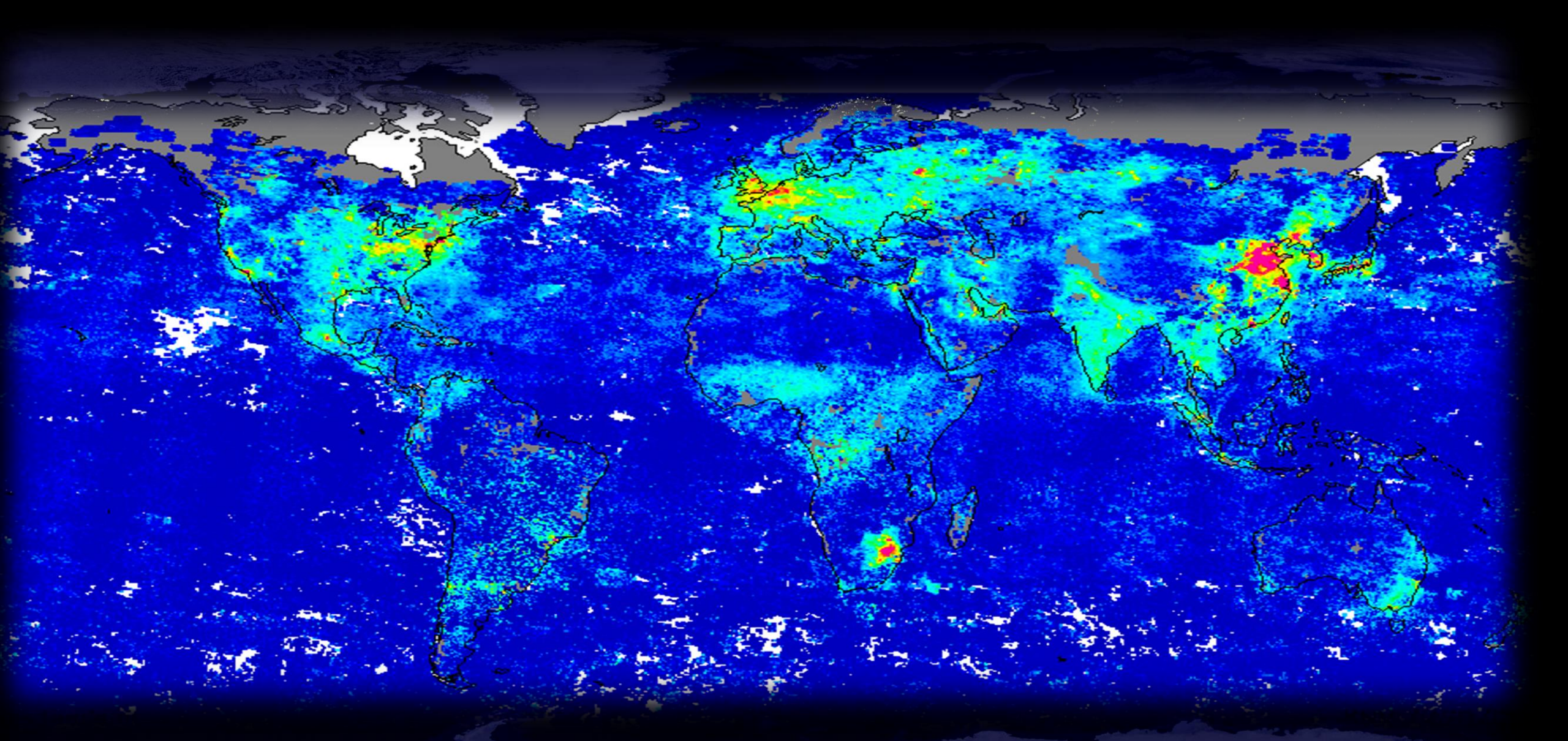


Remote Sensing of Coastal Ecosystems

Remote sensing of land-ocean interfaces in our Lab combines techniques for studying both the terrestrial and aquatic domains of **coastal margin ecosystems**, and understanding land-ocean-atmosphere interactions and exchanges. Some of this work is conducted as part of



future satellite mission preparation efforts for **optimizing the design** of future ocean color sensors and **maximizing the societal benefits** of future satellite missions.



1. Quantify impact of atmospheric pollution on ocean color
2. Characterize atmospheric variability at the land-water interface, and impacts of anthropogenic air pollution on coastal ecosystems

Nitrogen Dioxide Absorption Cross sections (at 293 °K)

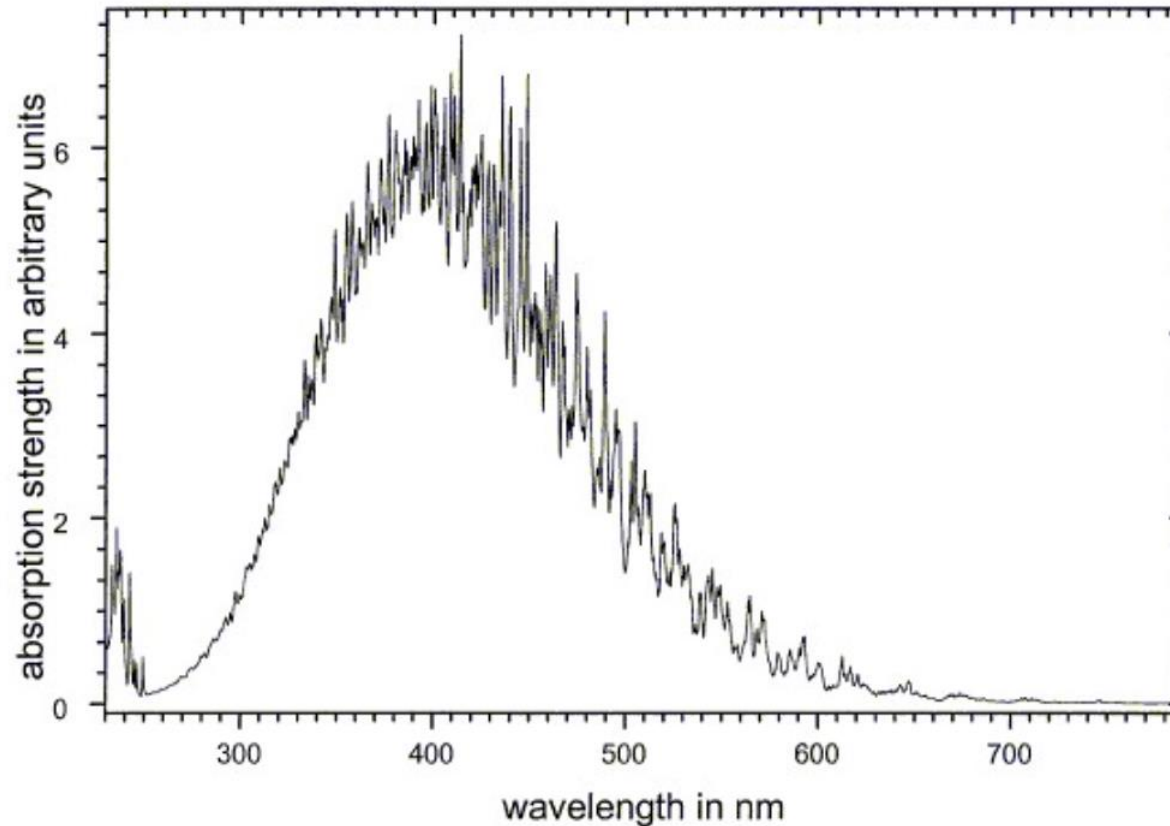
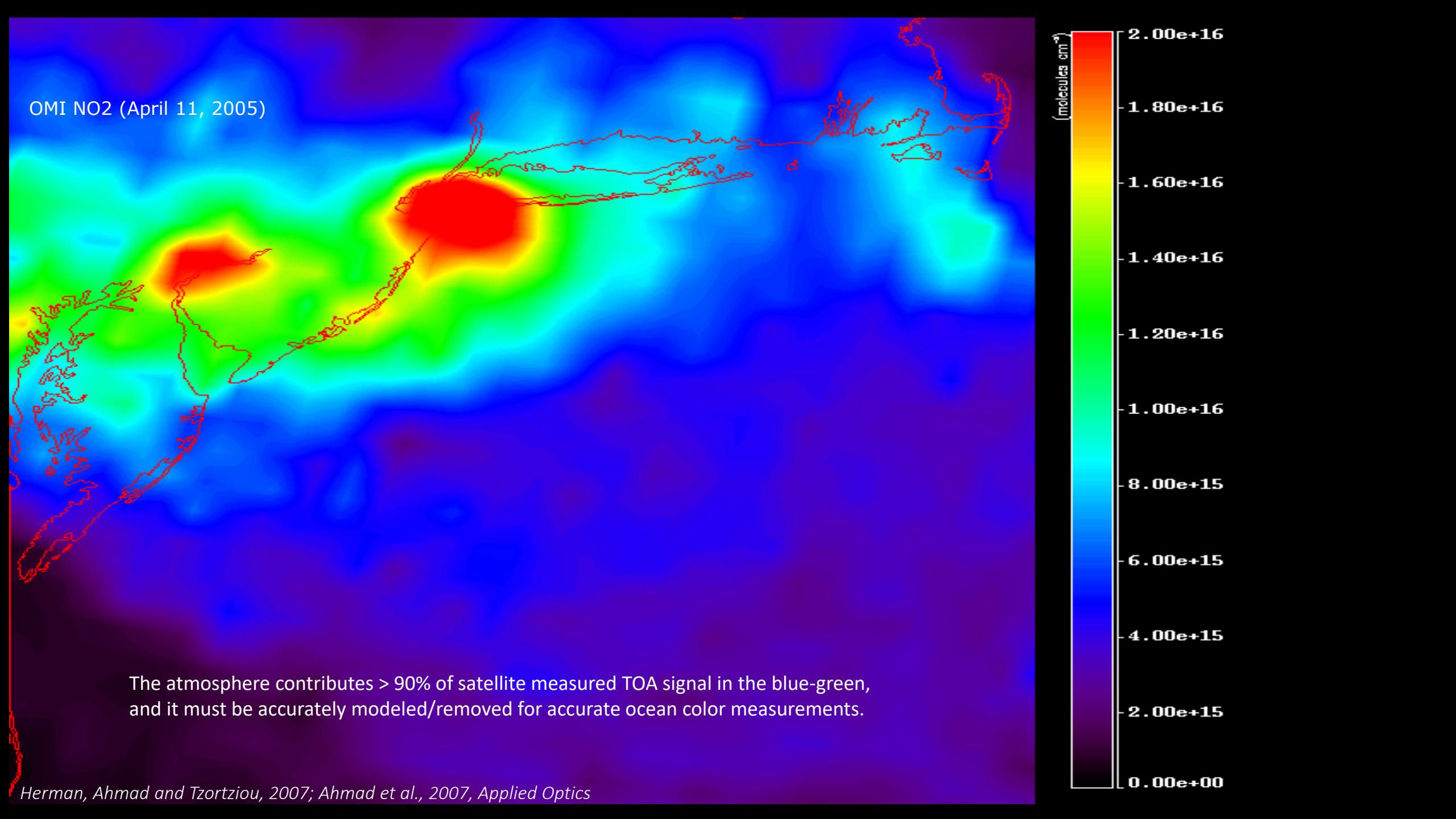


Fig. 1. Relative NO₂ spectrum at 293 K measured by GOME FM between 231–794 nm. The spectral resolution is 0.2 nm at wavelengths below and 0.3 nm above 400 nm.

NO₂ absorbs in spectral regions relevant to ocean color observations, so understanding amount and variability in NO₂ is important for satellite observations of ocean processes

OMI NO2 (April 11, 2005)



The atmosphere contributes > 90% of satellite measured TOA signal in the blue-green, and it must be accurately modeled/removed for accurate ocean color measurements.

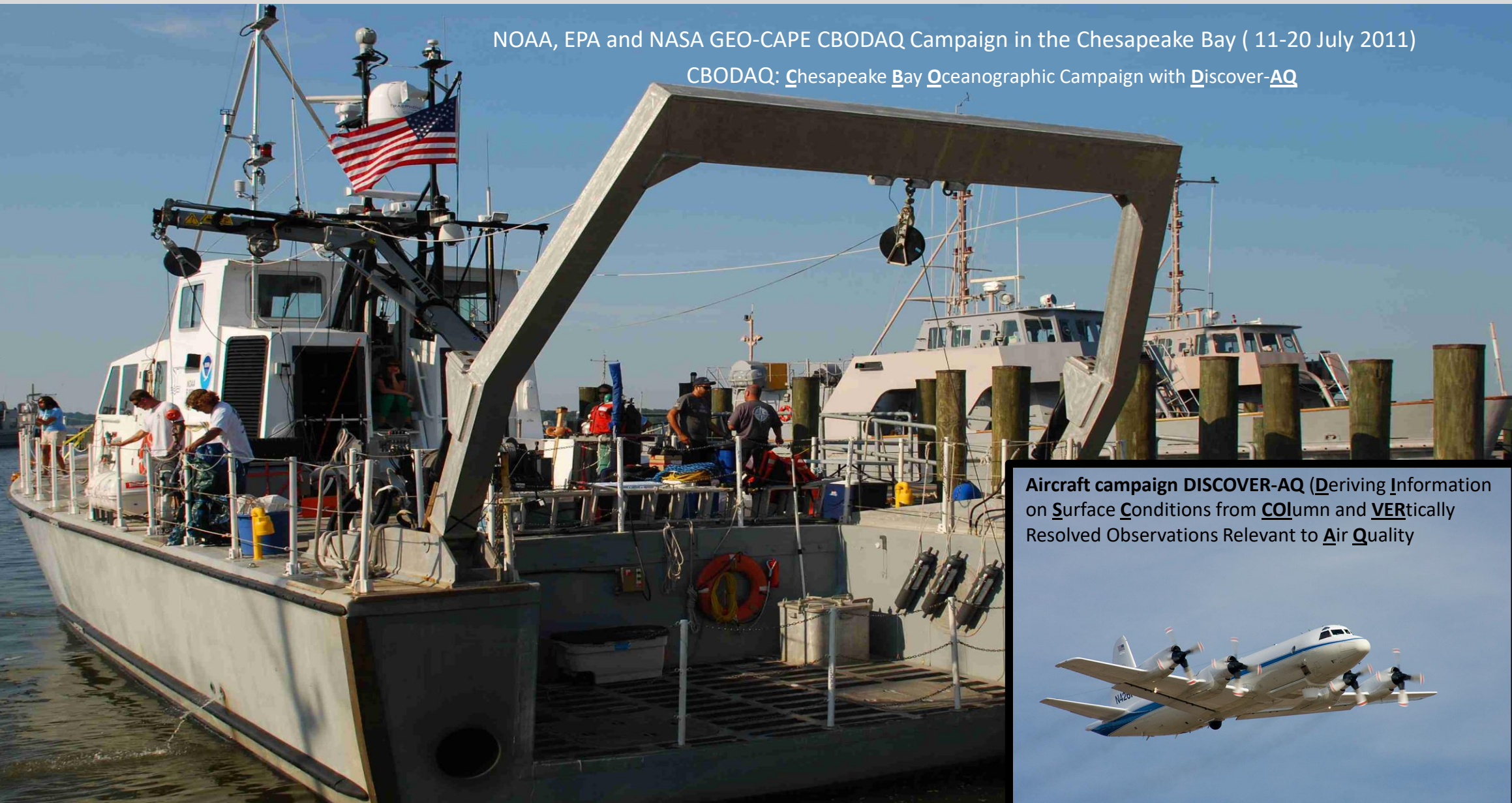
- Characterize **spatial and temporal (day-to-day and diel) variability** of total column amounts of trace gases over coastal waters
- Capture variability in atmospheric composition across **onshore-offshore gradients, spatiotemporal variability at the land-water interface, and impacts of meteorological processes (e.g., sea breezes)**.
- Compare **ground-based measurements of atmospheric trace gas variability** (using Pandora) with **satellite observations** of atmospheric composition (e.g., using the Ozone Monitoring Instrument OMI on Aura)
- Assess potential impacts on satellite ocean color retrievals



Methods: Use observations from past field campaigns in coastal waters

NOAA, EPA and NASA GEO-CAPE CBODAQ Campaign in the Chesapeake Bay (11-20 July 2011)

CBODAQ: Chesapeake Bay Oceanographic Campaign with Discover-AQ



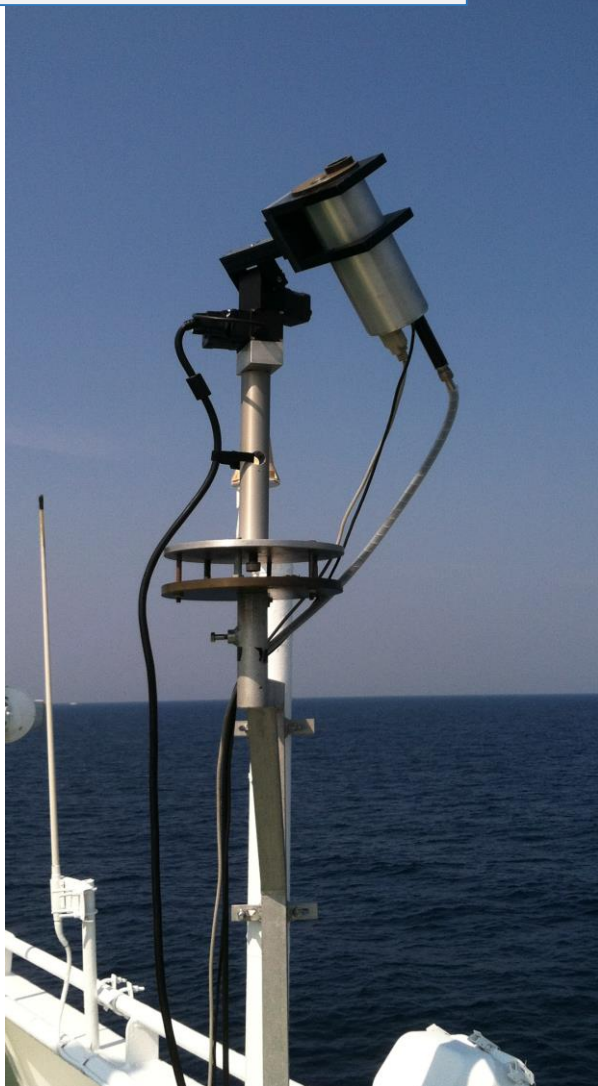
Aircraft campaign DISCOVER-AQ (Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality)



GEO-CAPE GOMEX campaign in the Gulf Of Mexico (9-22 September 2013)



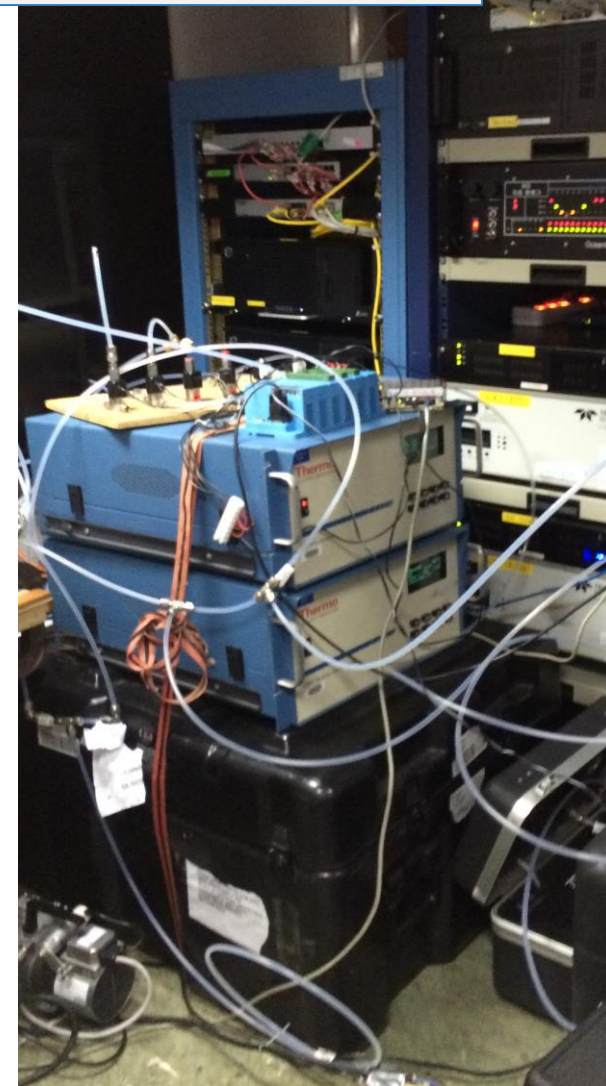
1. Continuous measurements of TCNO_2 and TCO_3 over land and over the ocean from the Pandora network



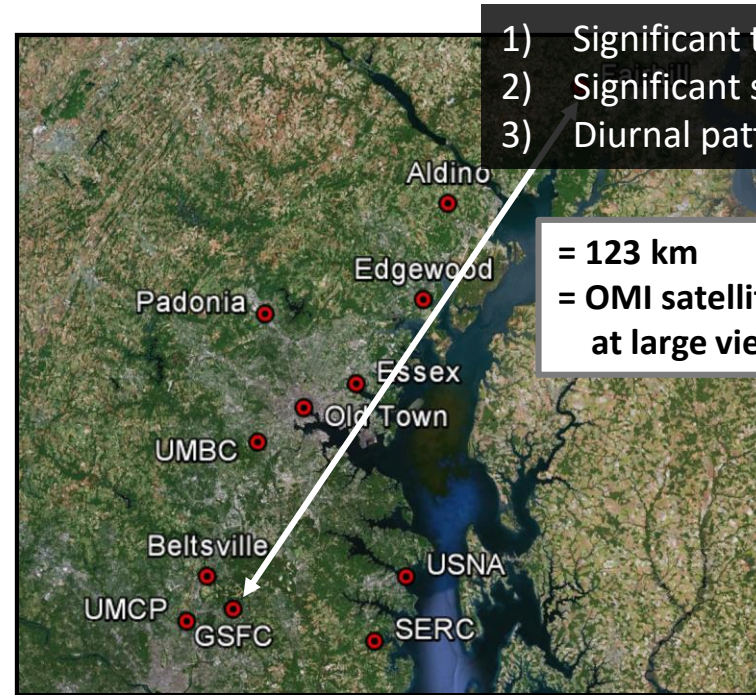
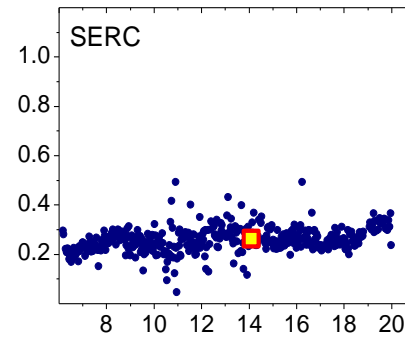
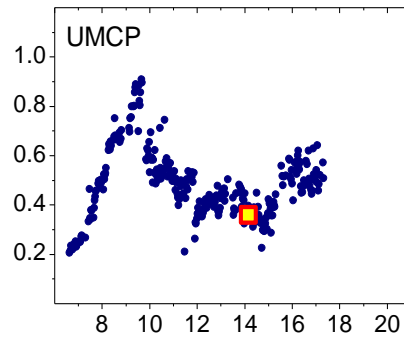
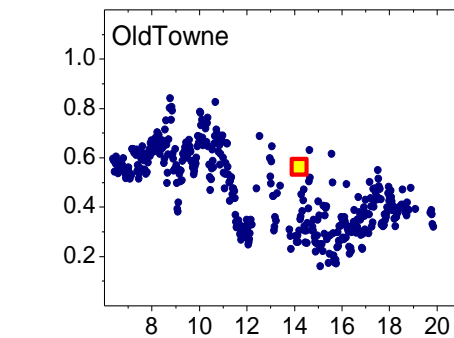
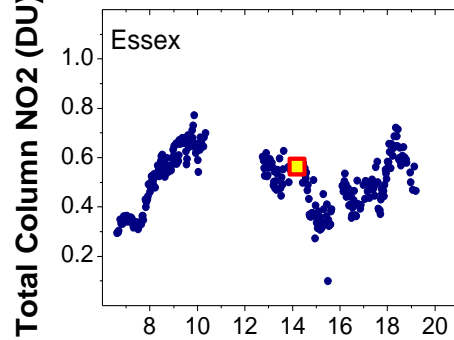
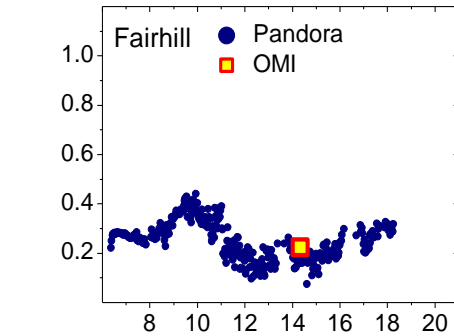
2. Aerosol optical properties over the ocean (spectral AOT, 340-936 nm, Angstrom par.) using Microtops



3. Surface concentrations of O_3 , NO , NO_2 , NO_y , SO_2 and CO using a suite of spectrophotometers



Spatial & temporal variability in TCNO₂ - Washington DC/Chesapeake Bay area (July 18, 2011)



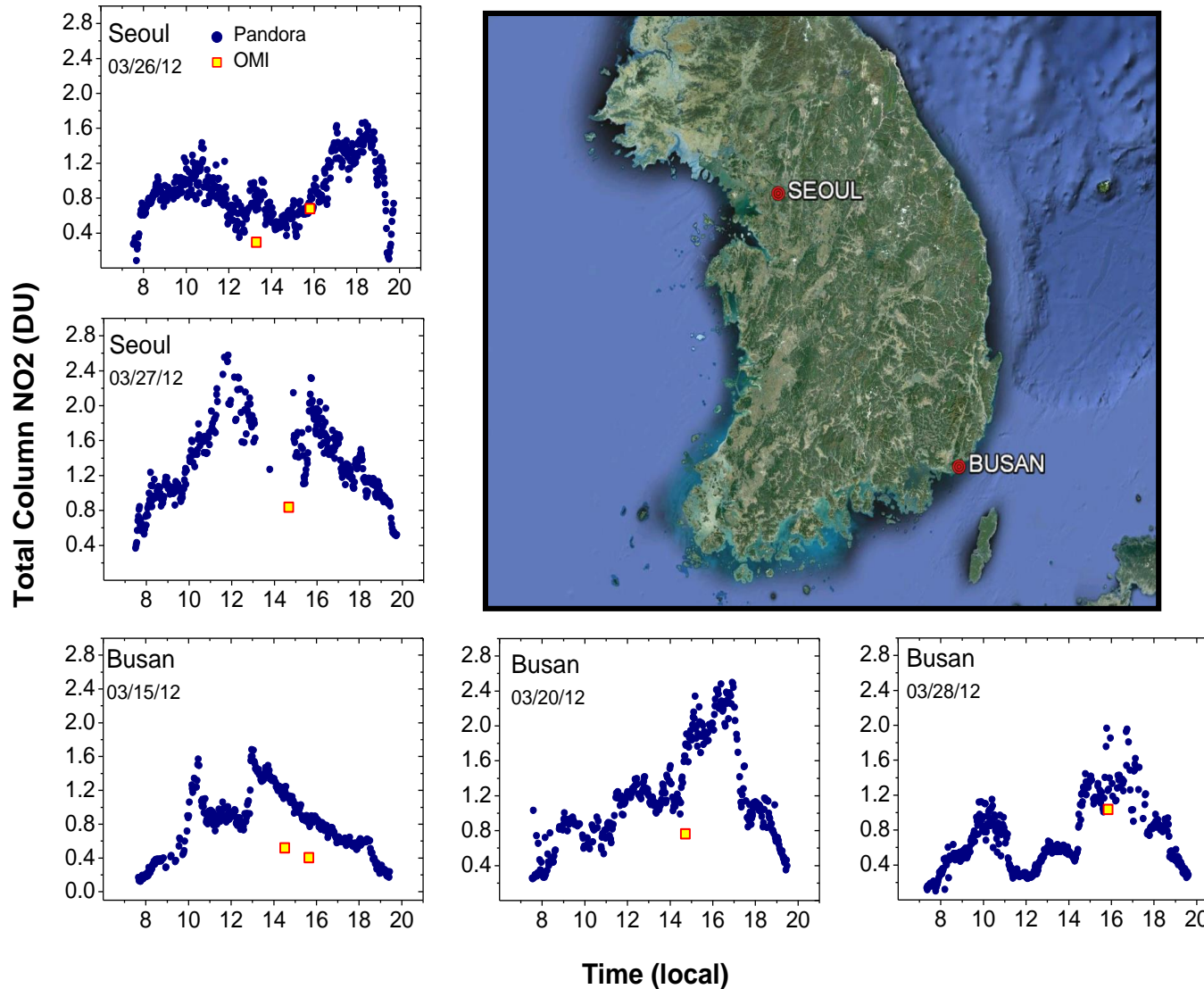
- 1) Significant temp variability (0.7 DU)
- 2) Significant spatial variability (~0.7-0.8 DU)
- 3) Diurnal patterns are different at different sites

= 123 km
= OMI satellite footprint
at large viewing angles

Blue symbols: Pandora
Yellow square: satellite observation
Because the satellite provides ONLY 1-2 measurements per day, it cannot capture the strong diurnal variability in NO₂. Also, the satellite spatial resolution is very coarse (14x24 km for OMI).
The coarse spatial and temporal resolutions of satellite atmospheric observations create problems with satellite retrievals of ocean color, and with validation of air quality models.

Time (local)

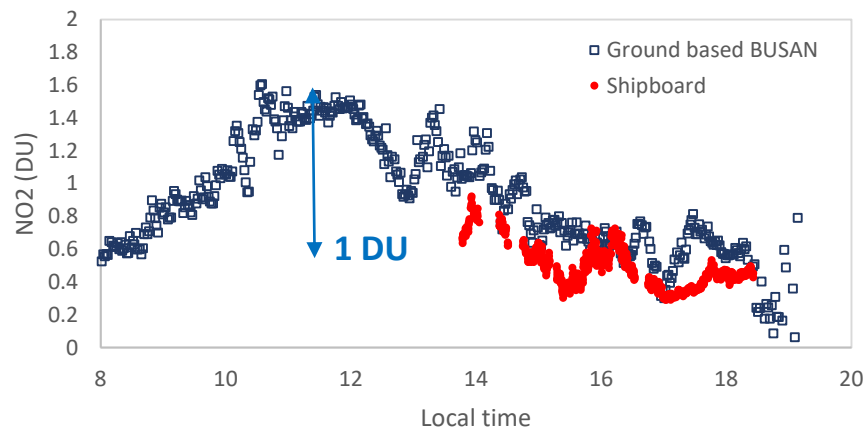
Spatial & temporal variability in TCNO₂ – Seoul and Busan in Korea



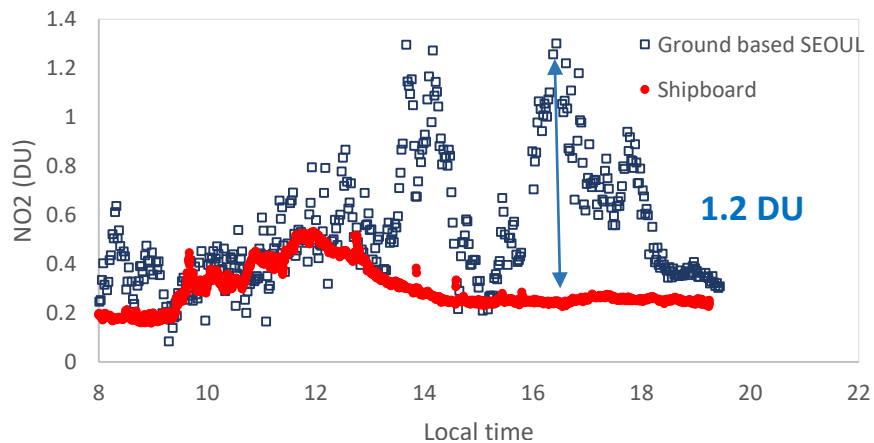
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Recent field campaign in South Korea

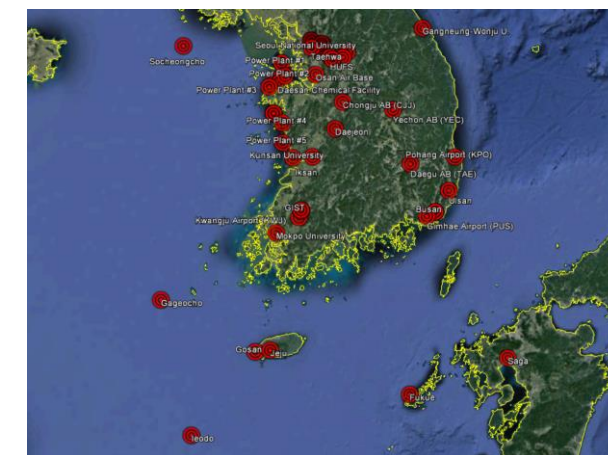
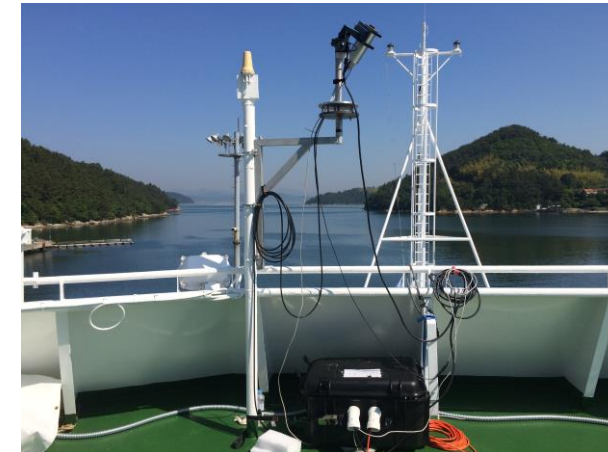
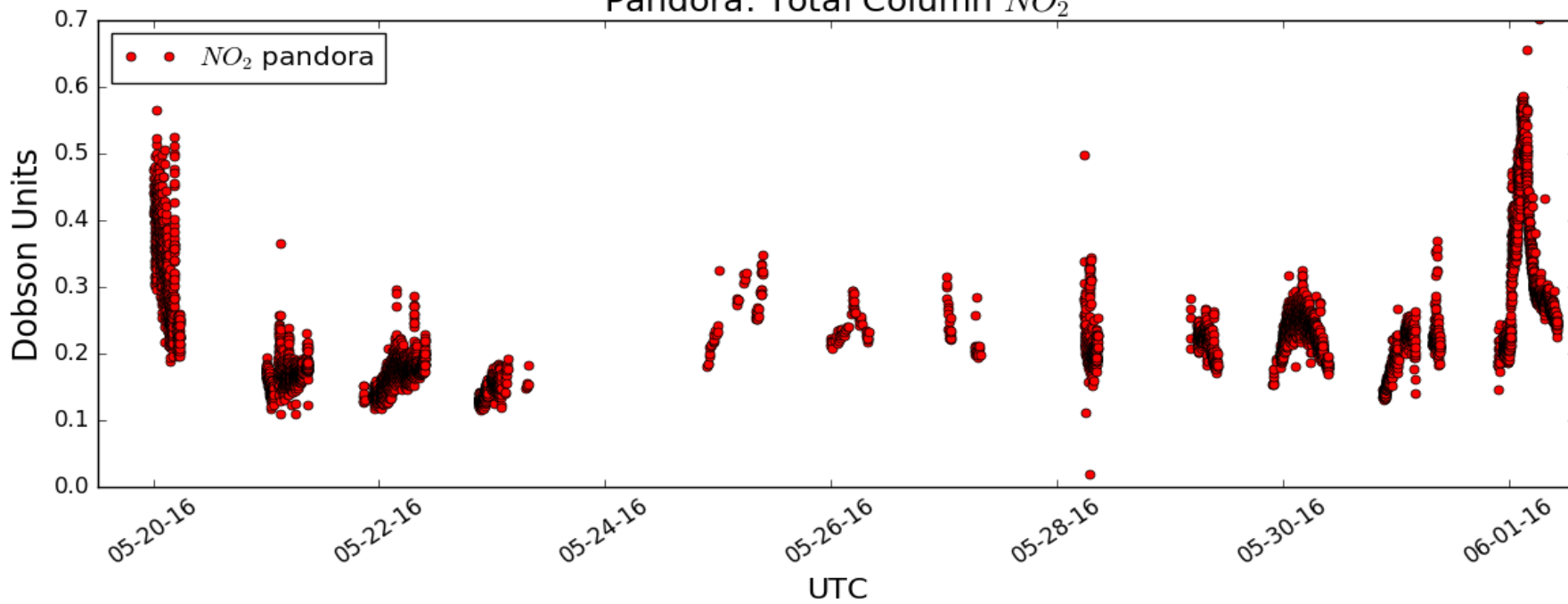
Busan, 18 May 2016



Seoul, 1 June 2016



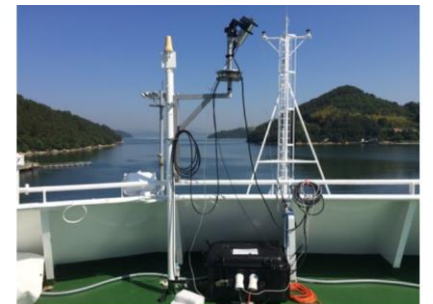
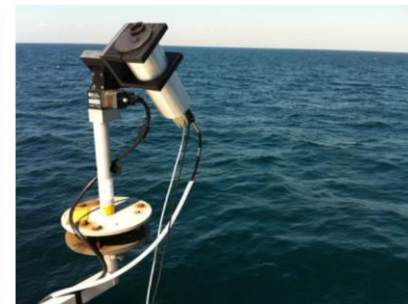
Pandora: Total Column NO_2

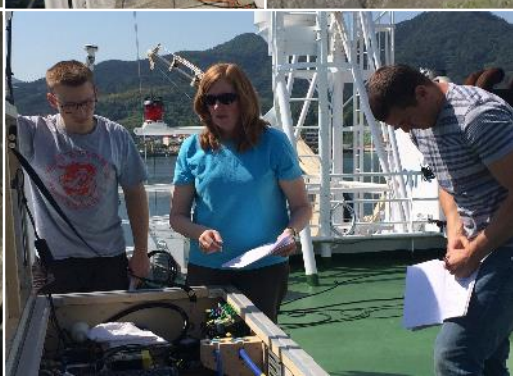
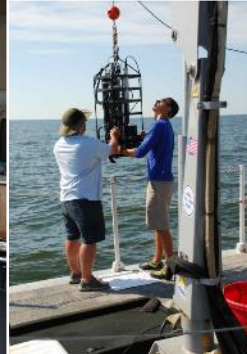


Learn about **spatial and temporal patterns** in nearshore atmospheric composition, **transport of air pollution across urban-terrestrial-aquatic interfaces**, and **impacts on coastal ecosystems and human health**.

Students will have the opportunity to **use satellite observations and measurements from past and ongoing air-quality and oceanographic field campaigns** (Pandora ground-based network and shipboard observations, Aura OMI satellite data)

Gain **experience in statistical and GIS software** to quantify and map atmospheric pollutant concentrations along heavily urbanized coastlines, and **develop new skills in satellite data analysis and remote sensing techniques** fundamental to understanding and monitoring physical and biogeochemical processes in economically and ecologically important coastal environments.





Google:

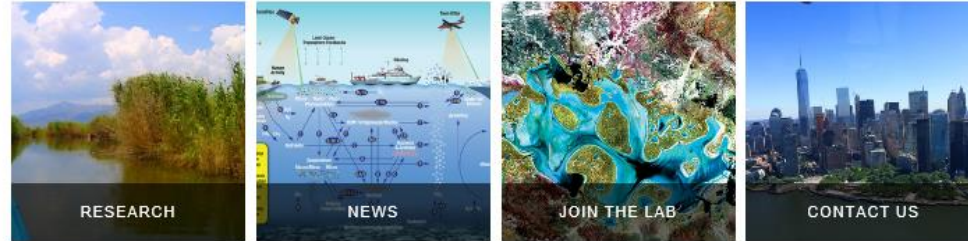
“Land Ocean Atmosphere Lab
CCNY”

- 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: 4.644)
- [New L&O paper](#) on CDOM dynamics in a transboundary river and its Ramsar protected wetland
-more Lab news....



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