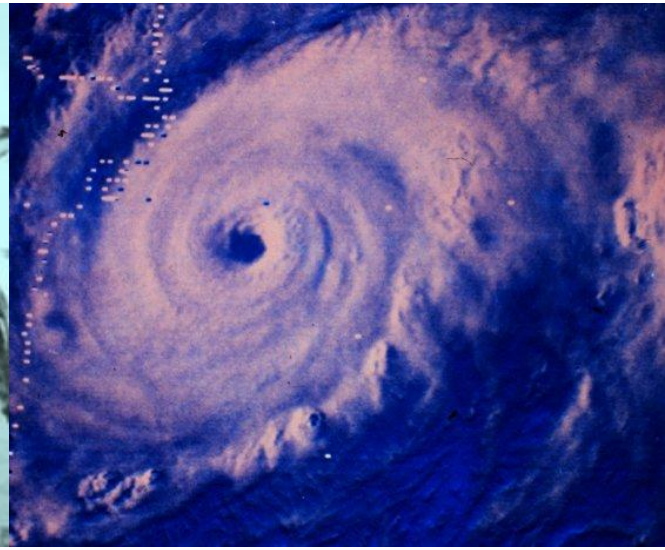
THE FLORIDA STATE UNIVERSITY

Center for Ocean-Atmospheric Prediction Studies



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Building A, Suite 292
Tallahassee, FL 32306-2741
Ph: (850) 644-4581 Fax: (850) 644-4841
www.coaps.fsu.edu

Olmo Zavala and Eric Chassignet

People

COAPS has 59 people working on research grants with expenditures in excess of $3.5 M per year. Current personnel include:

- 8 Faculty (also part of EOAS and Scientific Computing)
- 22 Research Scientists and Post-Docs
- 21 Graduate Students
- 4 Undergraduate Students
- 4 Administrative Personnel

Centers/Consortia

CoCoRaHS
Community Collaborative Rain, Hail & Snow Network

CIMAS
Cooperative Institute for Marine and Atmospheric Studies

GOOFISH

FloridaClimateCenter
Office of the State Climatologist

Florida Climate Institute

HYCOM
HYbrid Coordinate Ocean Model

International Ocean Vector Winds Science Team

RESEARCH VESSEL SURFACE METEOROLOGY DATA CENTER

NGI
Northern Gulf Institute

Southeast Climate Consortium

SAMOS
Shipboard Automated Meteorological and Oceanographic System

MDC
MARINE DATA CENTER
FLORIDA STATE UNIVERSITY

Sponsors

BOEM
Bureau of Ocean Energy Management

GULF OF MEXICO
RESEARCH INITIATIVE

NASA

NATIONAL PARK SERVICE

NOAA

NSF

ONR
Revolutionary Research . . . Relevant Results

SCHMIDT
OCEAN
INSTITUTE

IN GOD WE TRUST

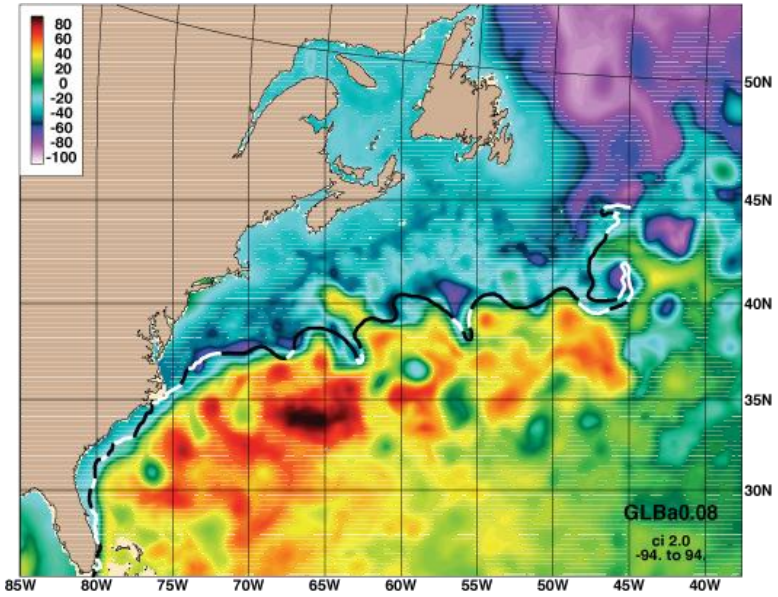
USDA

United Nations

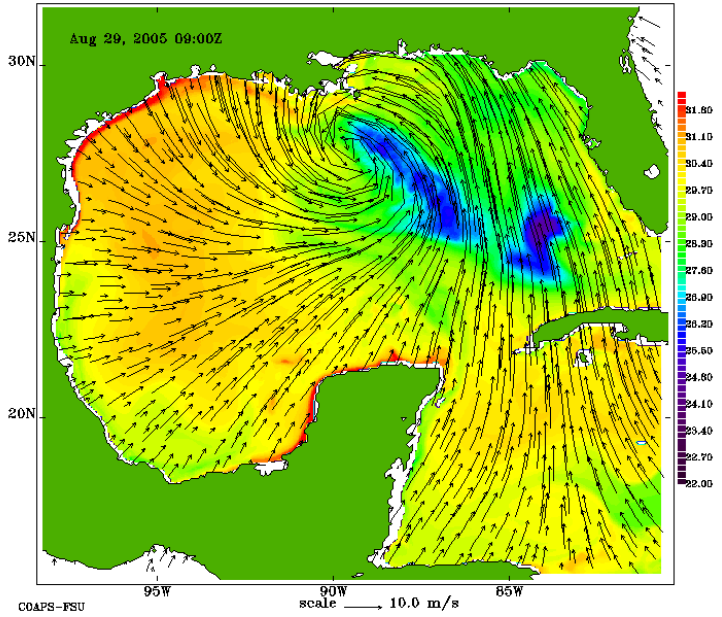
USGS
science for a changing world

Ocean Modeling

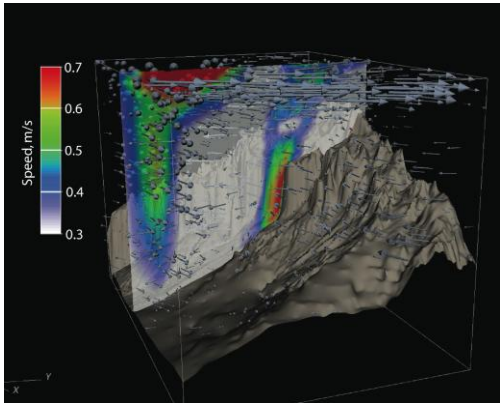
Ocean models are complex computer programs that simulate the physical state and dynamic properties of oceans. COAPS uses global and regional models to study oceanic processes, such as responses to storms, ocean circulation, and water mass formation, and to improve both short- and long-term forecasts.



- Analysis of sea surface height using the HYbrid Coordinate Ocean Model (HYCOM).

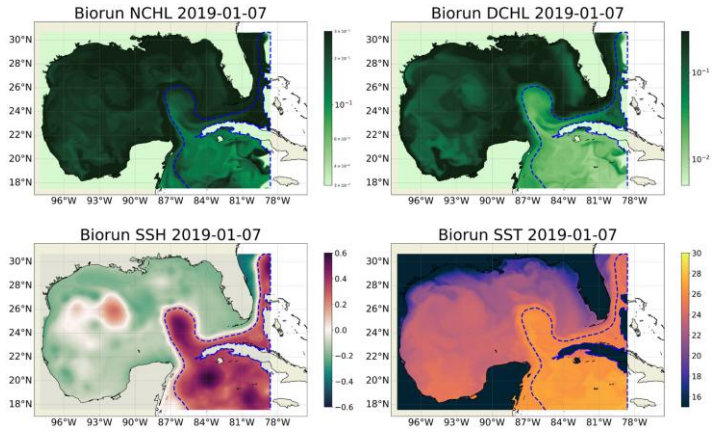


- Sea surface temperature and wind direction during Hurricane Katrina using the Navy Coastal Ocean Model NCOM .



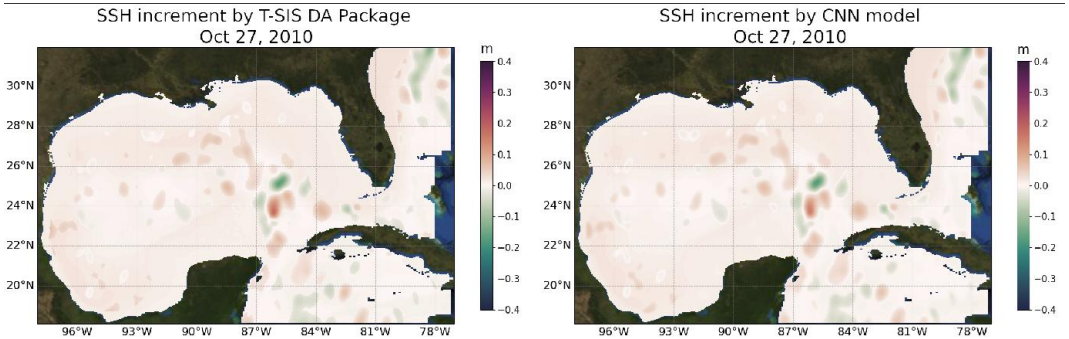
- The simulated velocity of very strong deep currents in the Sigsbee Escarpment in the northern Gulf of Mexico using NCOM.

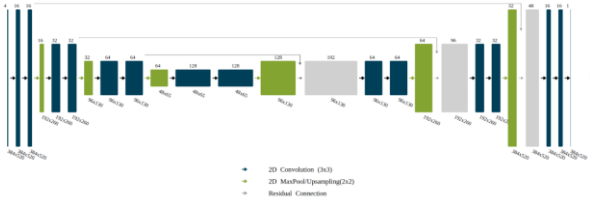
AI and Machine learning



COAPS benefits from a cluster of 4 NVIDIA A100 GPUs for performing cutting-edge AI research. Our focus includes enhancing data assimilation in ocean models and integrating high-resolution satellite data to improve model accuracy in the Gulf of Mexico.

- Apply ML methods to develop analyses of dynamical fields associated with the LC and eddies from satellite ocean color for operational use and for assimilation in forecast models.



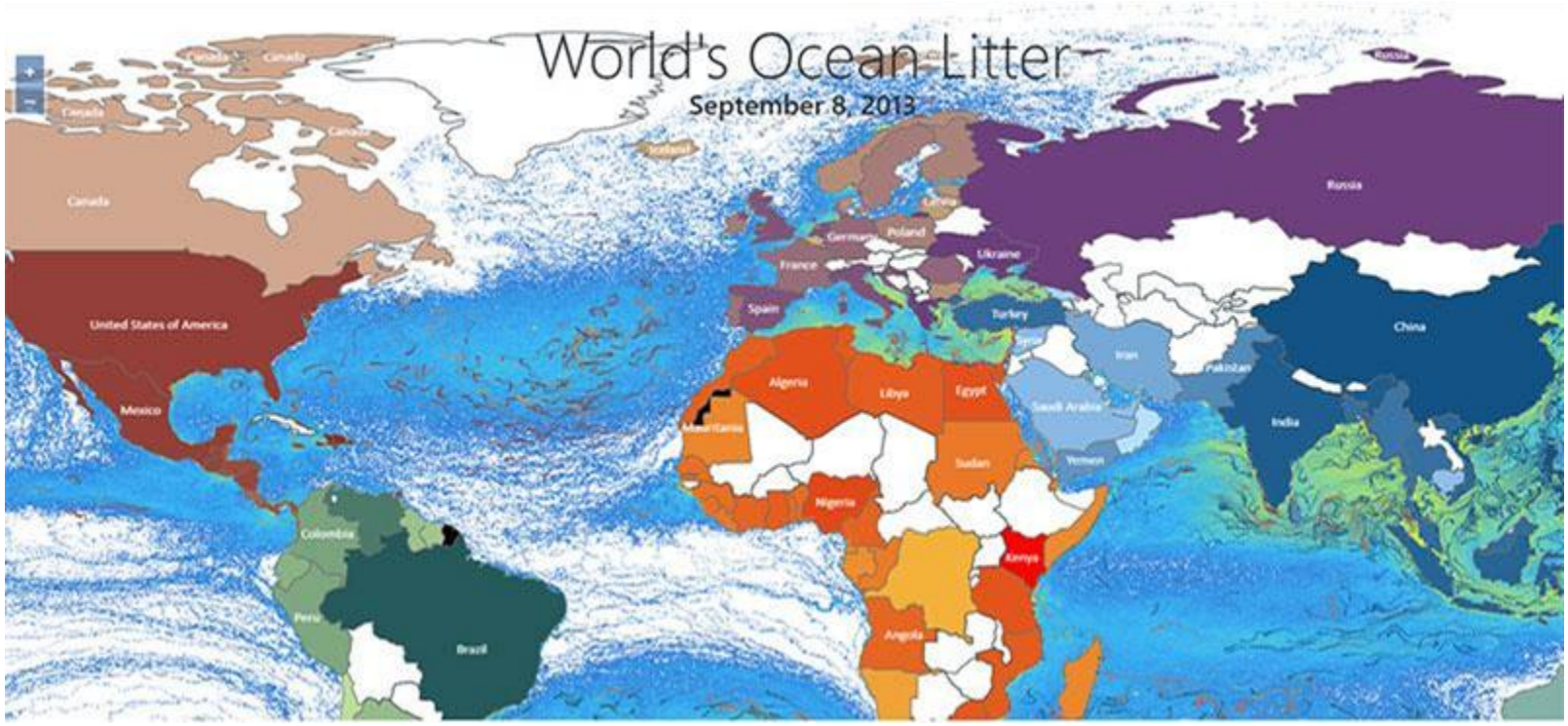


- Speeding up data assimilation system with the use of Convolutional Neural Networks

Marine Litter

Litter is found in all the world's oceans and seas, even in remote areas far from human contact due to its transboundary nature. The continuous growth in the amount of solid waste thrown away is leading to a gradual increase in marine litter found at sea, on the sea floor and coastal shores.

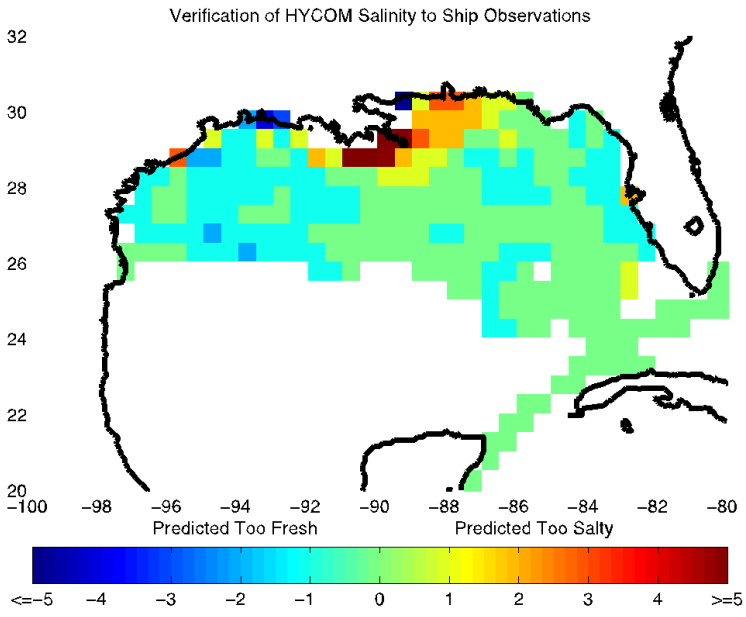
Modeled mismanaged plastic waste that provides statistics of marine litter by country



Marine Meteorology

Marine meteorology includes observing, analyzing, and modeling weather conditions in the marine environment in order to better understand the physics of marine storms and ocean-atmosphere interactions.

COAPS scientists developed the Shipboard Automated Meteorological & Oceanographic System (SAMOS), a network of oceanographic research vessels collecting marine observations



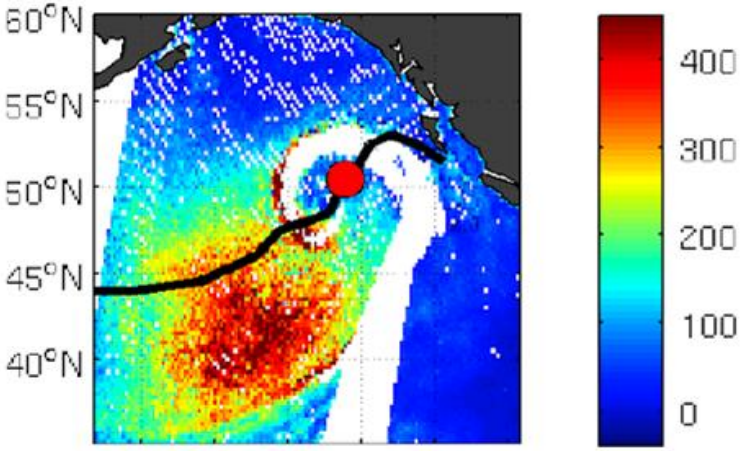
- Each vessel transmits nearly one-million observations per month using ship to shore satellite email communications

- SAMOS data is used to validate ocean model output, satellite products, and is made available to the international research community

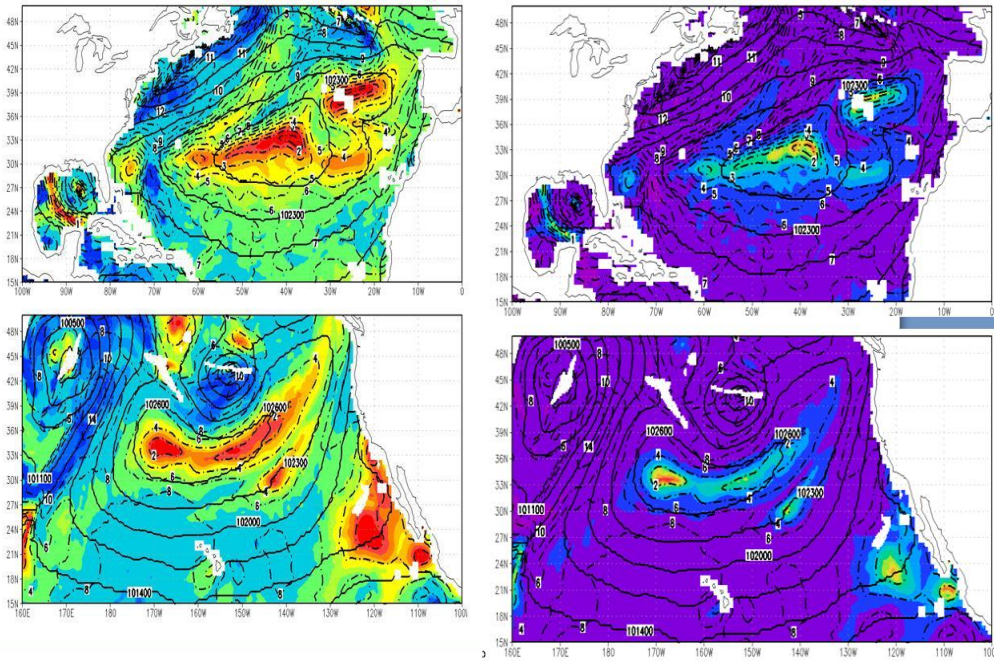
Air-Sea Interaction

Air-sea interaction focuses on the exchange (or *flux*) of quantities, such as heat or moisture, across the ocean surface. These exchanges are sensitive indicators of changes in climate, and are directly related to floods, storm surge, droughts, storm intensity, and storm tracks. We are also improving air sea fluxes in a coupled model.

- The FSU in situ and satellite flux products provide a new set of ocean surface forcing fields which are well-suited for climate prediction studies.

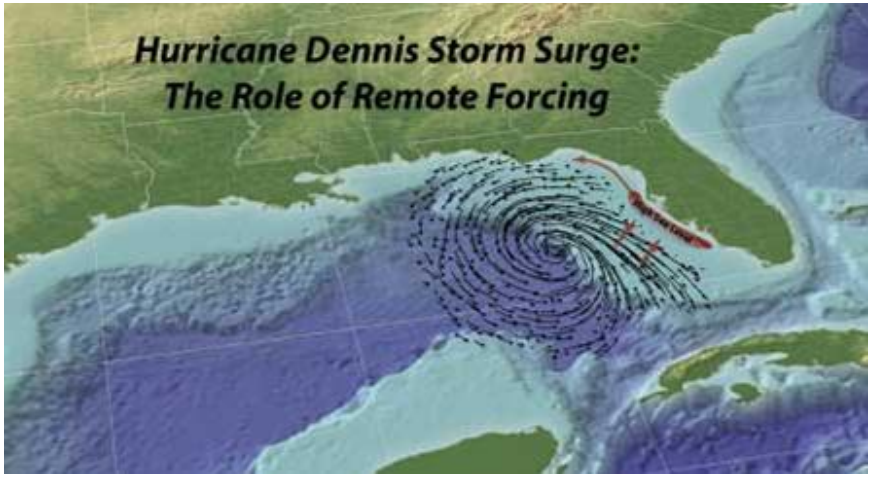


- Fluxes of sensible and latent heat from a warm core seclusion are retrieved from adjacent satellite tracks.



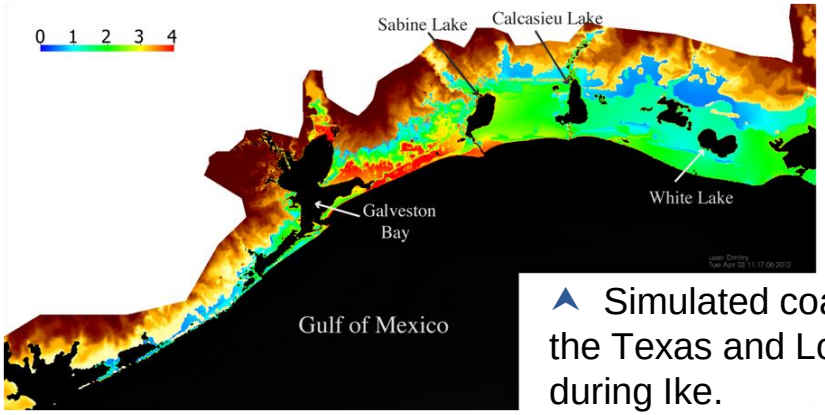
- Diurnal changes in SST (left) contribute to biases in latent heat fluxes (right). Averaged over a season, the tropical biases are typically 8-10Wm^{-2}.

Coastal Studies

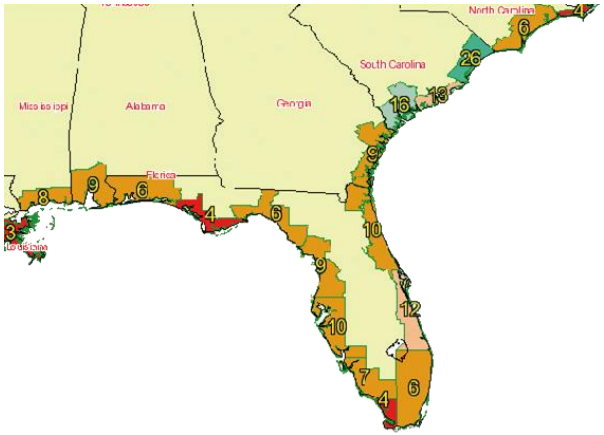


Scientists at COAPS conduct diverse studies in the terrestrial and marine coastal regions. Research topics include sea-level variability, the effects of terrestrial freshwater flux (river discharge) on the ocean and offshore environment, and coastal climate.

- Winds during Hurricane Dennis (2005) caused the sea level to rise along the Florida Peninsula, forming a coastally trapped wave. This wave was amplified by Dennis as it traveled to Apalachee Bay, and added several feet to the local wind-driven surge. New storm surge forecasting methods have been adopted to account for these remote effects.

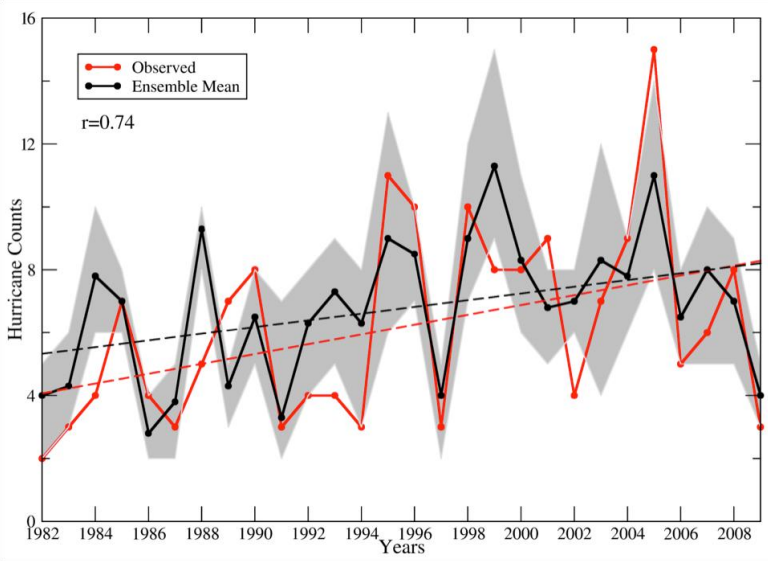


- Simulated coastal inundation along the Texas and Louisiana coasts during Ike.



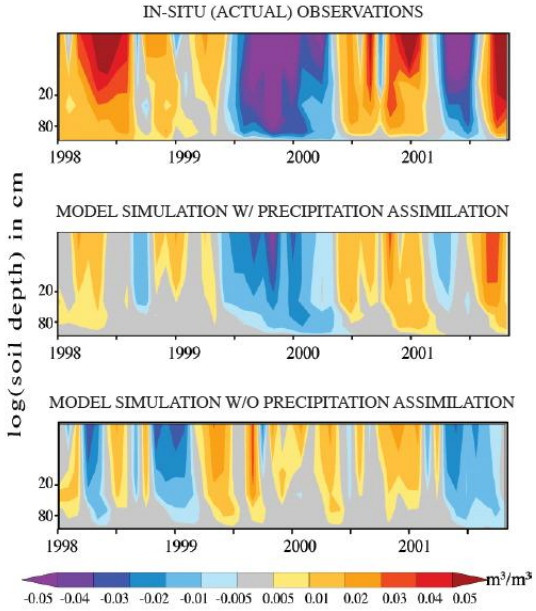
- The return frequency of a tropical storm or hurricane landfall. A return frequency of “9” indicates that, on average, a landfall occurs once every 9 years.

Seasonal Prediction

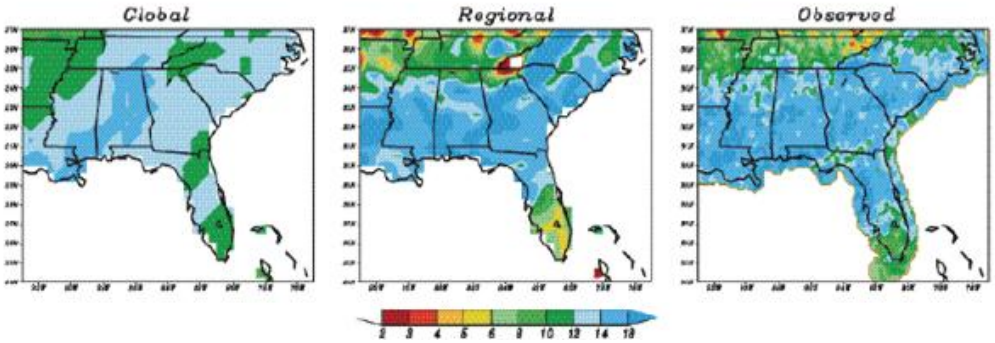


Simulated and observed numbers of tropical cyclones in the Atlantic from 1982 to 2009.

Scientists at COAPS use global and regional atmospheric climate models to make seasonal predictions about hurricane activity in the Atlantic. These models are also used to help farmers in the Southeast United States increase their crop yields.

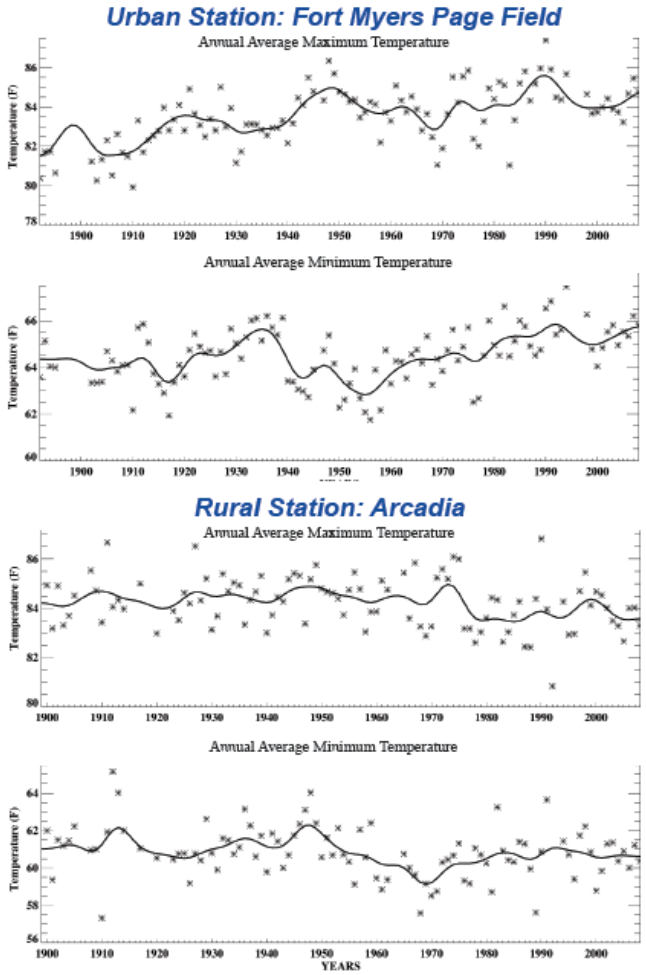


Vertical profile of average soil moisture anomalies across Illinois.



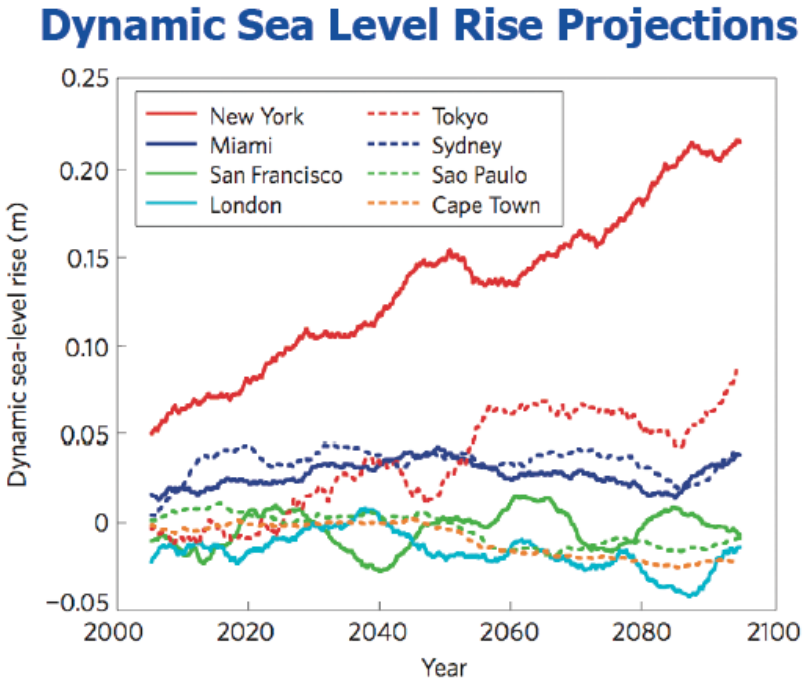
Global and regional model predictions of the number of rainfall events greater than 12 mm/day for a winter season. The regional model proved more accurate than the global model.

Climate Change



- Most rural weather stations in Alabama, Florida, and Georgia exhibit 1 to 3°F cooling over the last century, while stations influenced by the “urban heat island” effect show warming temperatures.

Climate change can occur under both natural and anthropogenic influences. As part of the Florida Climate Institute, COAPS is developing state-of-the-art climate models, identifying regional climate variability, and locating biases and uncertainties that can lead to inaccuracies in climate predictions. We are also studying changes in global tropical cyclone activity in the mid to late 21st century resulting from anthropogenic and natural climate variability.



Outreach & Education

Through outreach and education, COAPS engages students, policy makers, and the general public in the process of scientific discovery and encourages a sense of stewardship for our natural environment.

▲ ➤ Through classroom and summer camp presentations, the FSU Young Scholars Program, and teacher professional development projects, we reach over 1,000 K-12 students each year.

➤ We regularly setup booths at local festivals to showcase COAPS research and engage the public in hands-on activities and demonstrations.

▲ We provide briefings to state policy makers on topics such as offshore wind energy and offer trainings and other materials to encourage our scientists to develop their communications skills.

OverFLoW Center

FSU—RIDER Center

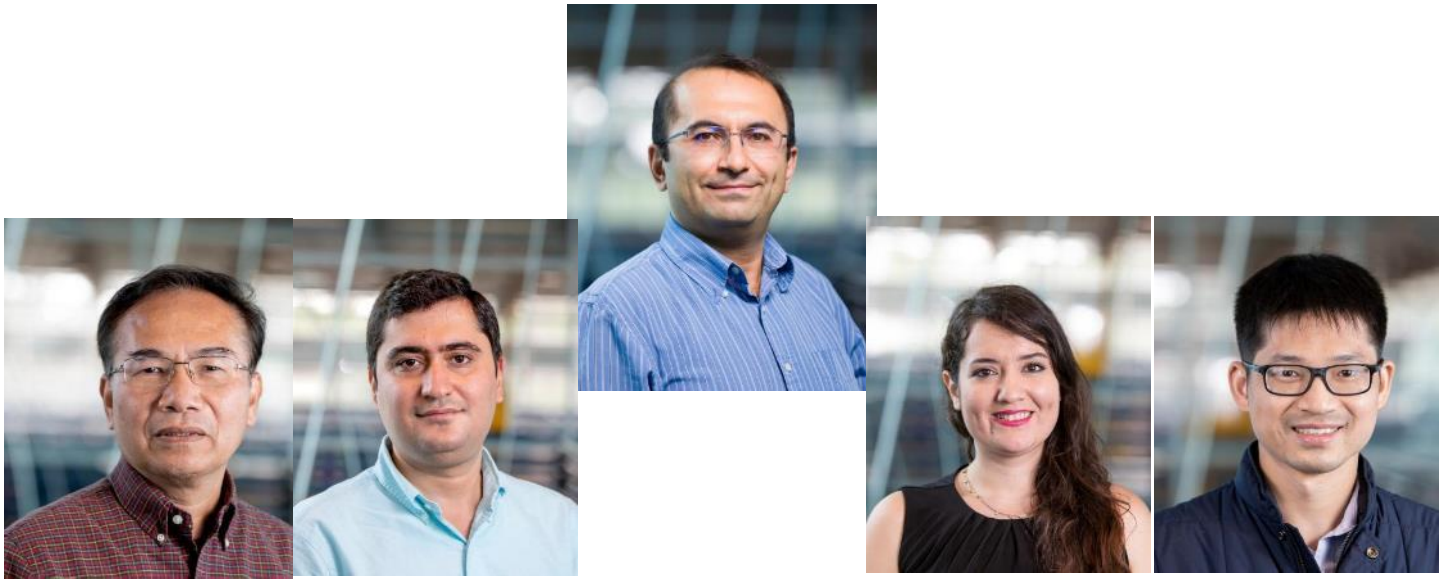
Resilient Infrastructure & Disaster Response

Ebrahim Ahmadisharaf

Nasrin Alamdari

Oct 8, 2024

Overview



- Initiated in 2020
- Hosted by CEE Department: Interdisciplinary
- Joint between FSU and FAMU
- **$3 million** in **annual research expenditures**
- 22 core faculty and 17 affiliates
- 5 administrative staff
- 80 graduate students and 8 postdocs

Labs

LABORATORY FOR RESILIENT MATERIALS AND STRUCTURES (ReMS)

[redacted]

WATER SUSTAINABILITY AND COASTAL HAZARD (WaSCH) LAB

[redacted]

LABORATORY OF ADVANCED OPERATIONS RESEARCH AND RESILIENCE APPLICATIONS (LAORA)

[redacted]

LABORATORY FOR SUSTAINABLE INFRASTRUCTURE MANAGEMENT (SIM)

[redacted]

METHANE EMISSION REDUCTION INITIATIVE

CH_4

MERI

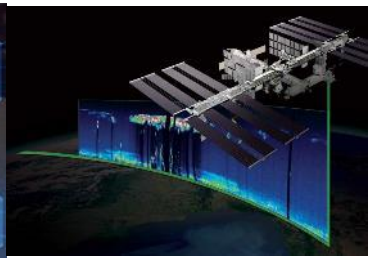
WaSCH Lab

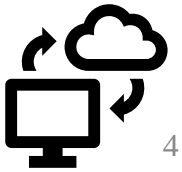
Main Goal:

Characterize hydroclimatic extremes and surface water pollution to support physical infrastructure design and risk mitigation plans

Main research areas:

- Compound weather events
- Future climate projections
- Climate and land cover change impacts
- Urban hydrology
- Surface water quality



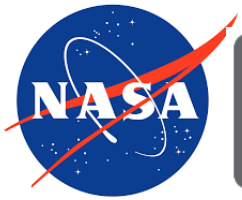


WaSCH Lab

Water Sustainability & Coastal Hazards

RIDER

Sponsors (~$6 million)



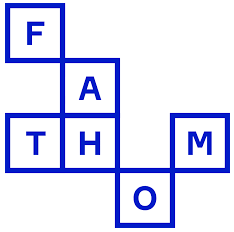
PENSACOLA & PERDIDO BAYS
ESTUARY PROGRAM

TAMPA BAY
ESTUARY PROGRAM

Jacobs

Collaborators

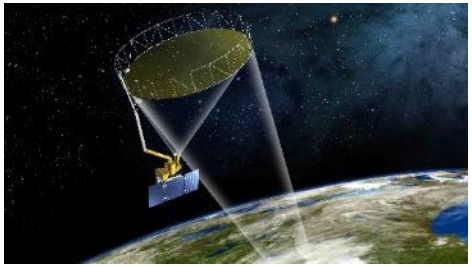
RIDER



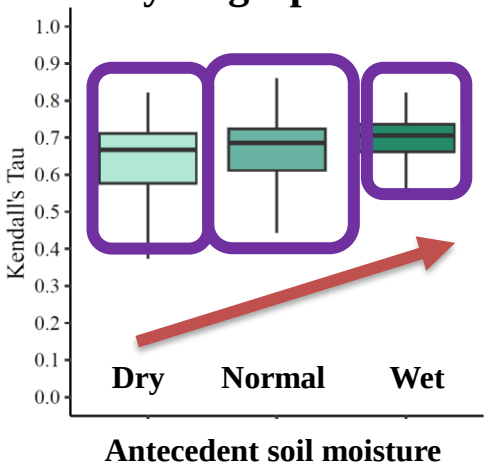
Causes of Flooding

RIDER

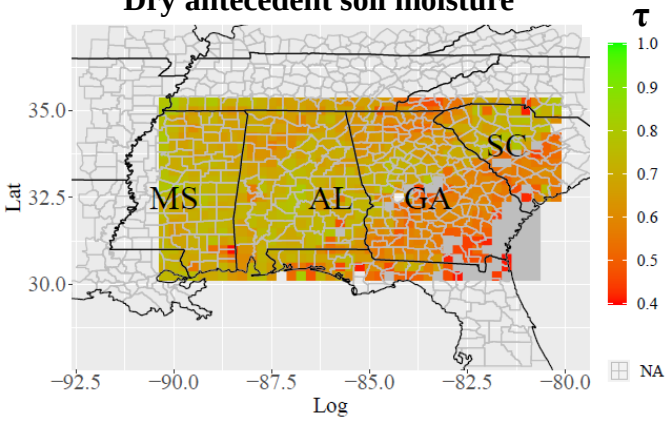
Statistical techniques for understanding the causes of flooding



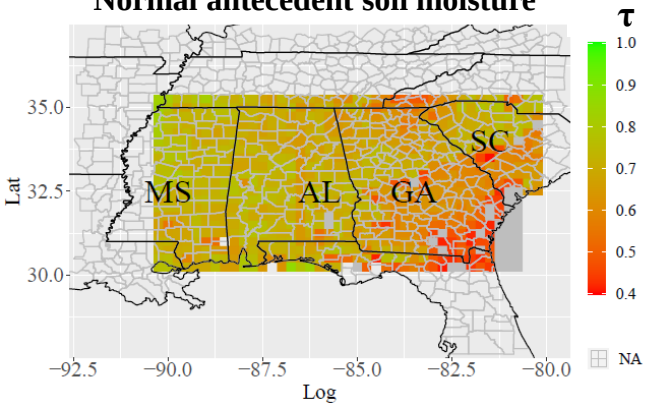
Dependencies between flood hydrograph attributes



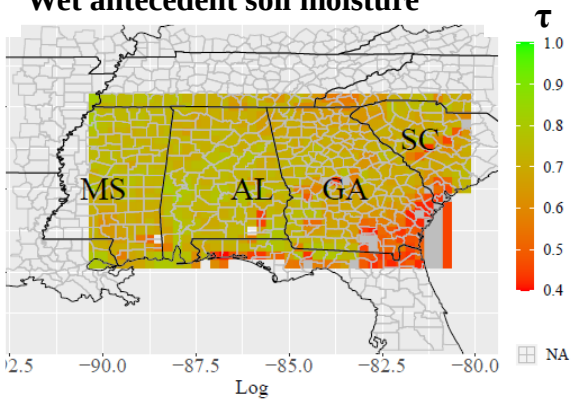
Dry antecedent soil moisture



Normal antecedent soil moisture

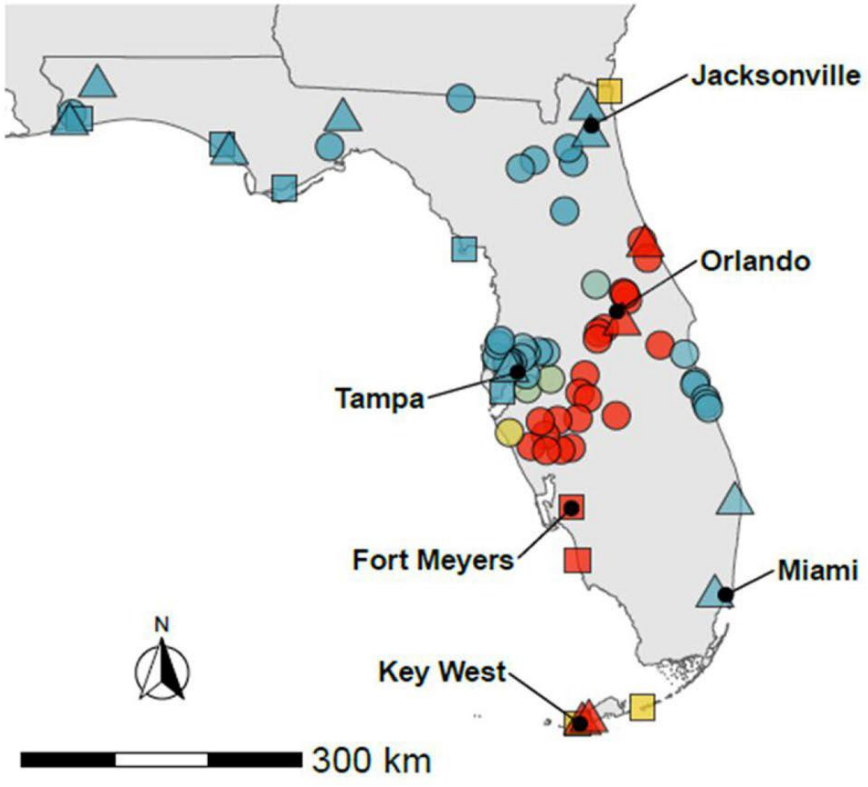


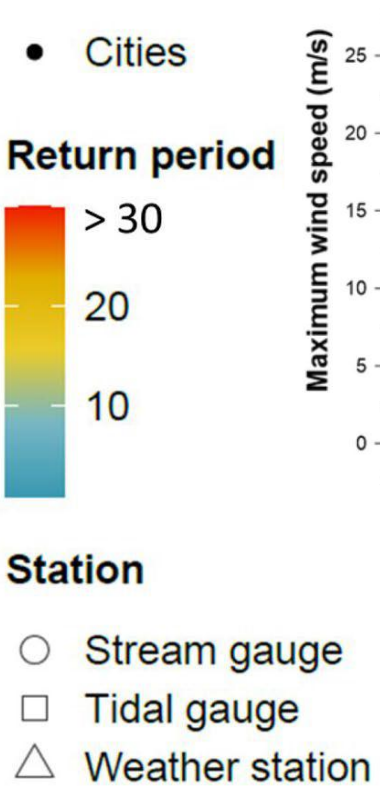
Wet antecedent soil moisture

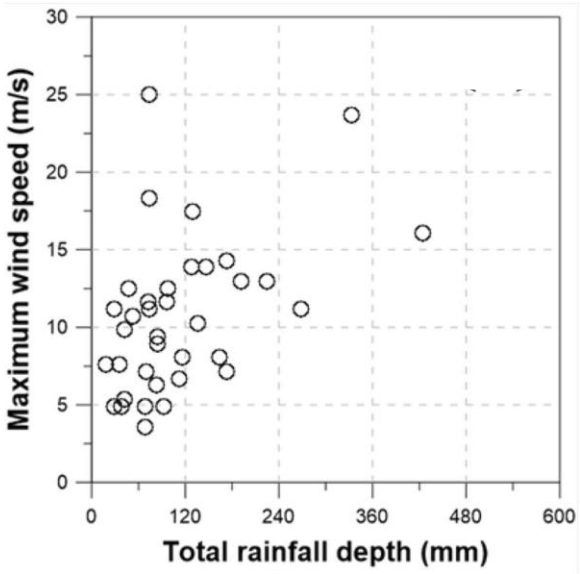


Compound Event Characterization

Statistical techniques for estimating probability of extreme weather events (flooding & hurricanes)

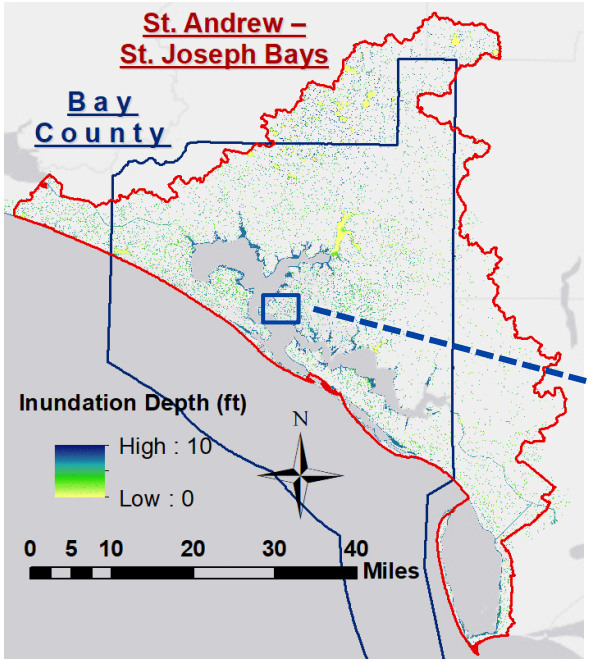


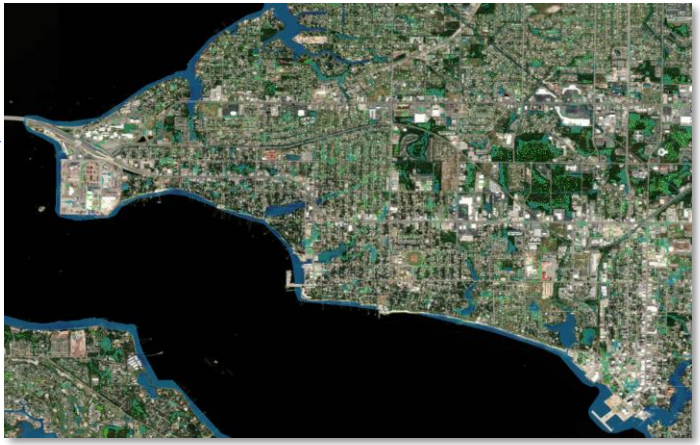


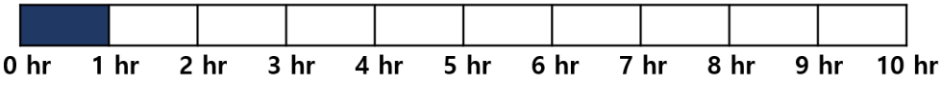


Flood Inundation Modeling

Flood predictions using physics-based models

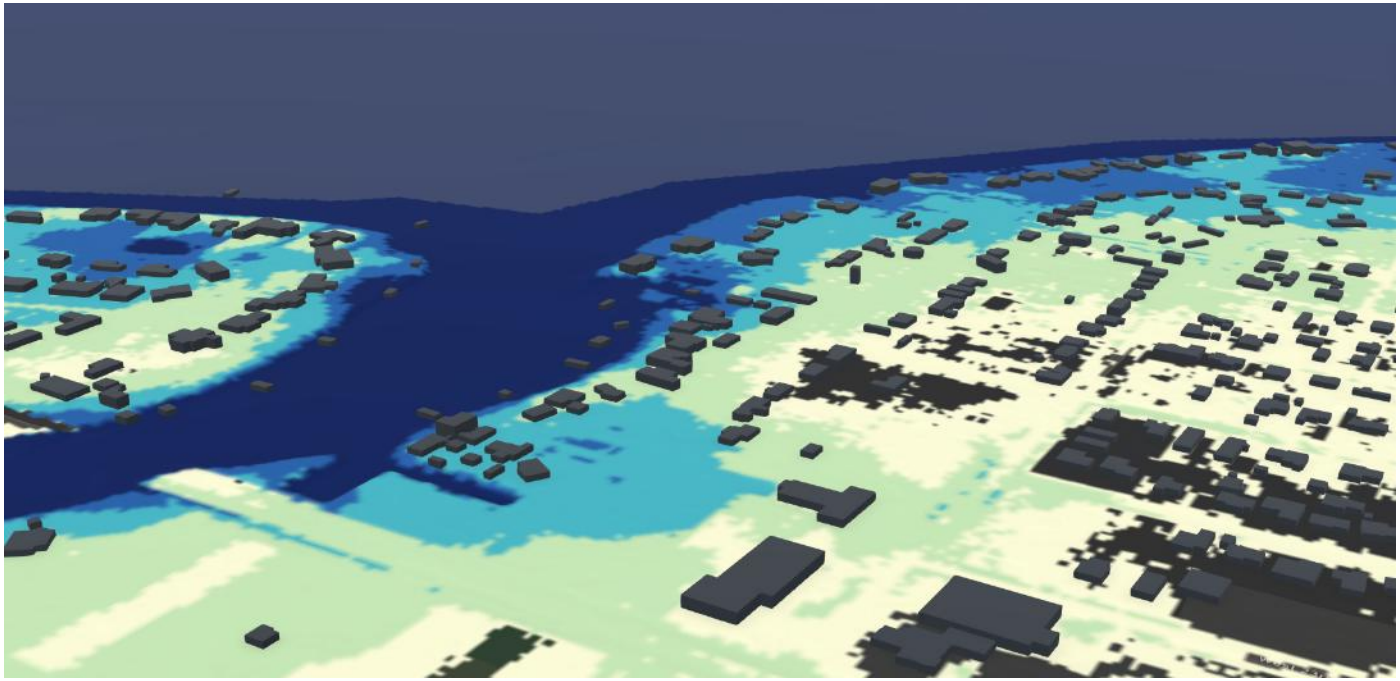


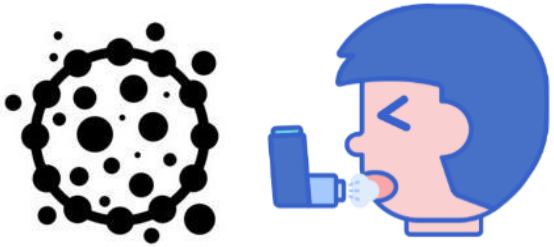




Flood Impact Assessments

Structural damages & human health





Flood Data Reconstruction

Flood hindcast reconstruction/reanalysis using ML

SWOT
SURFACE WATER & OCEAN TOPOGRAPHY

Synthetic Aperture Radar

Uncertainty

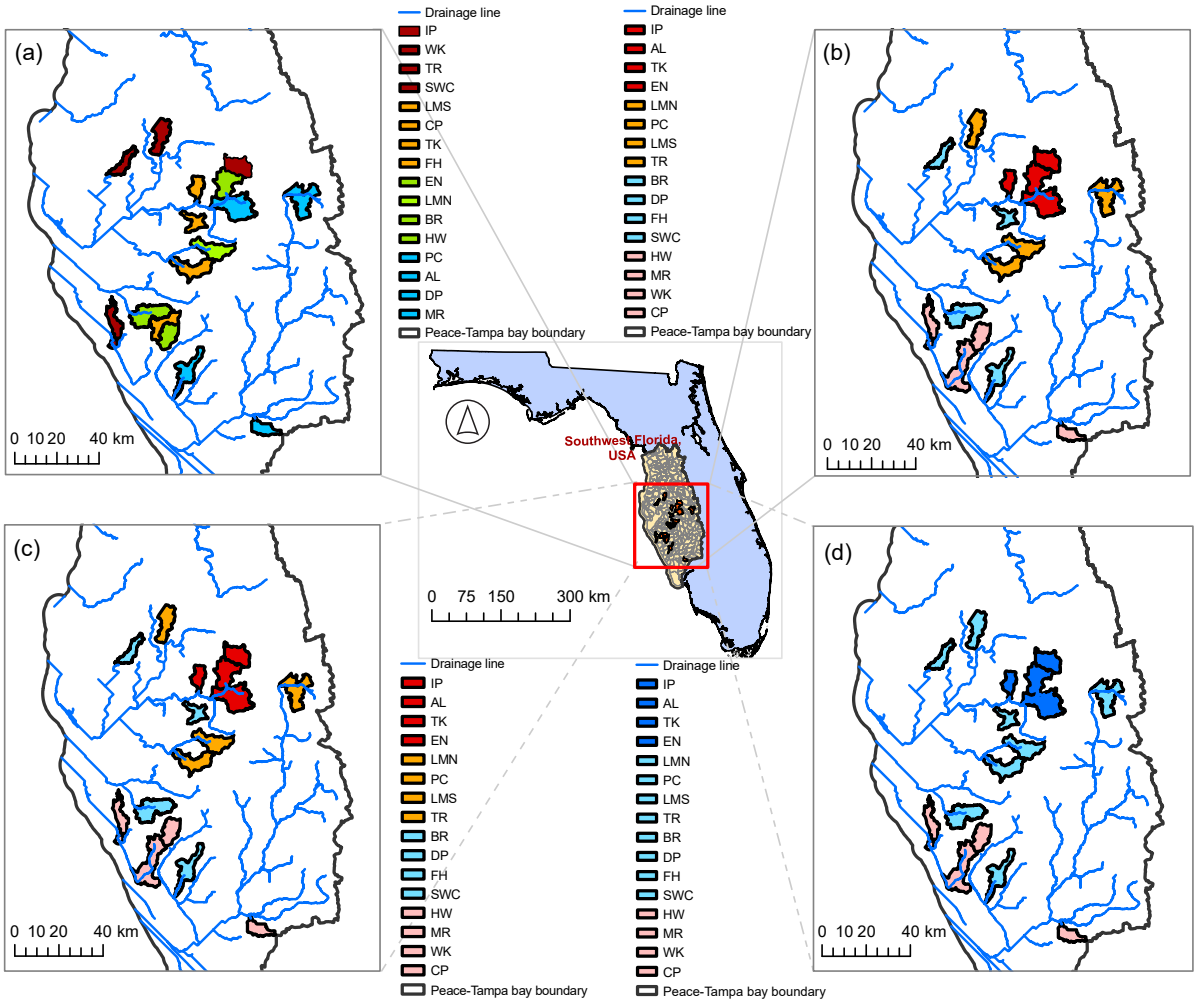
Transferability

AI-ML

Hurricanes Sandy, Ida, Ian & Harvey

Poorly Gauged Watersheds

Water quality predictions in ungauged/ poorly gauged watersheds

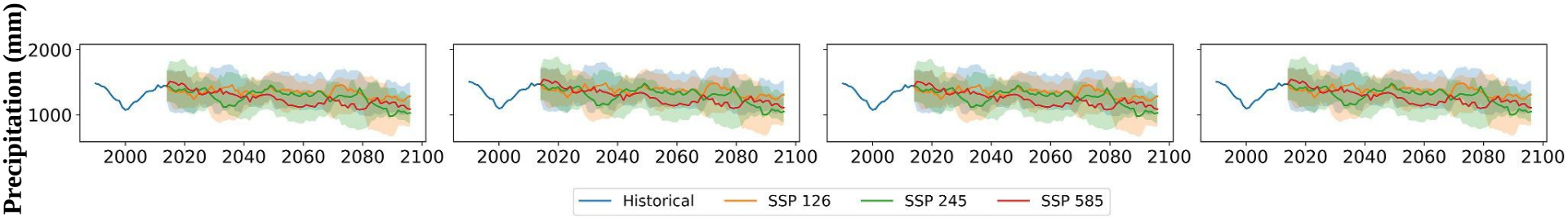


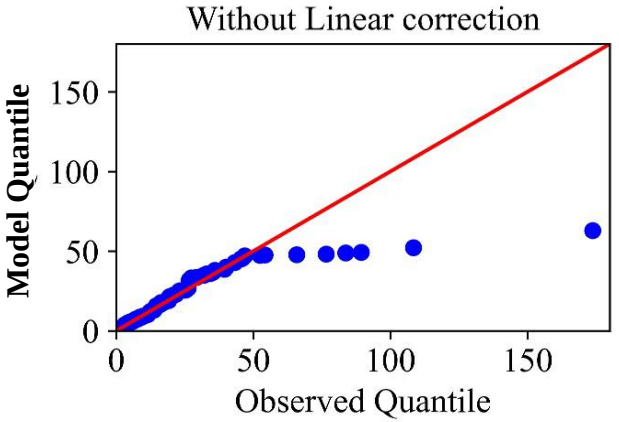
Water Quality Similarity

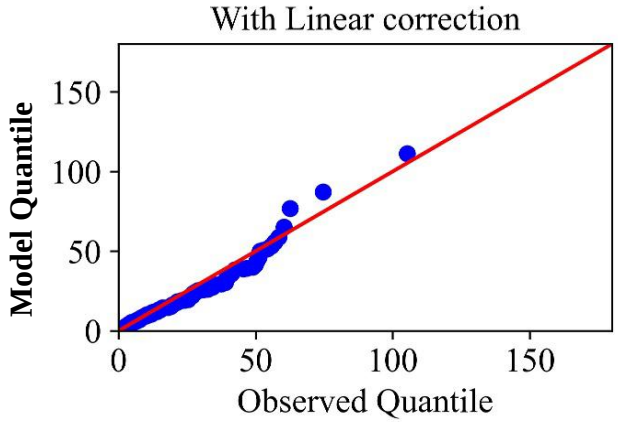
Transfer Learning

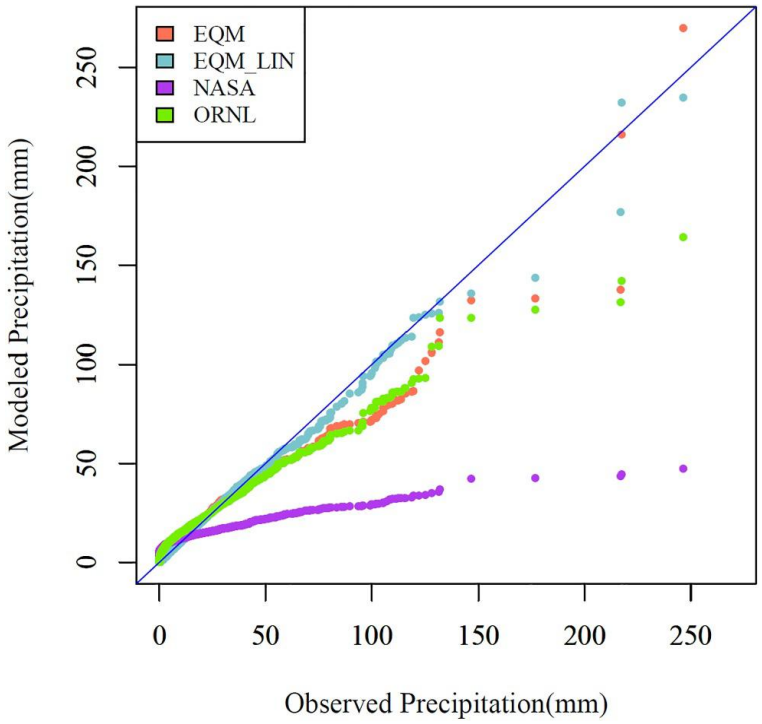
Future Climate Projections

Emphasis on extreme events





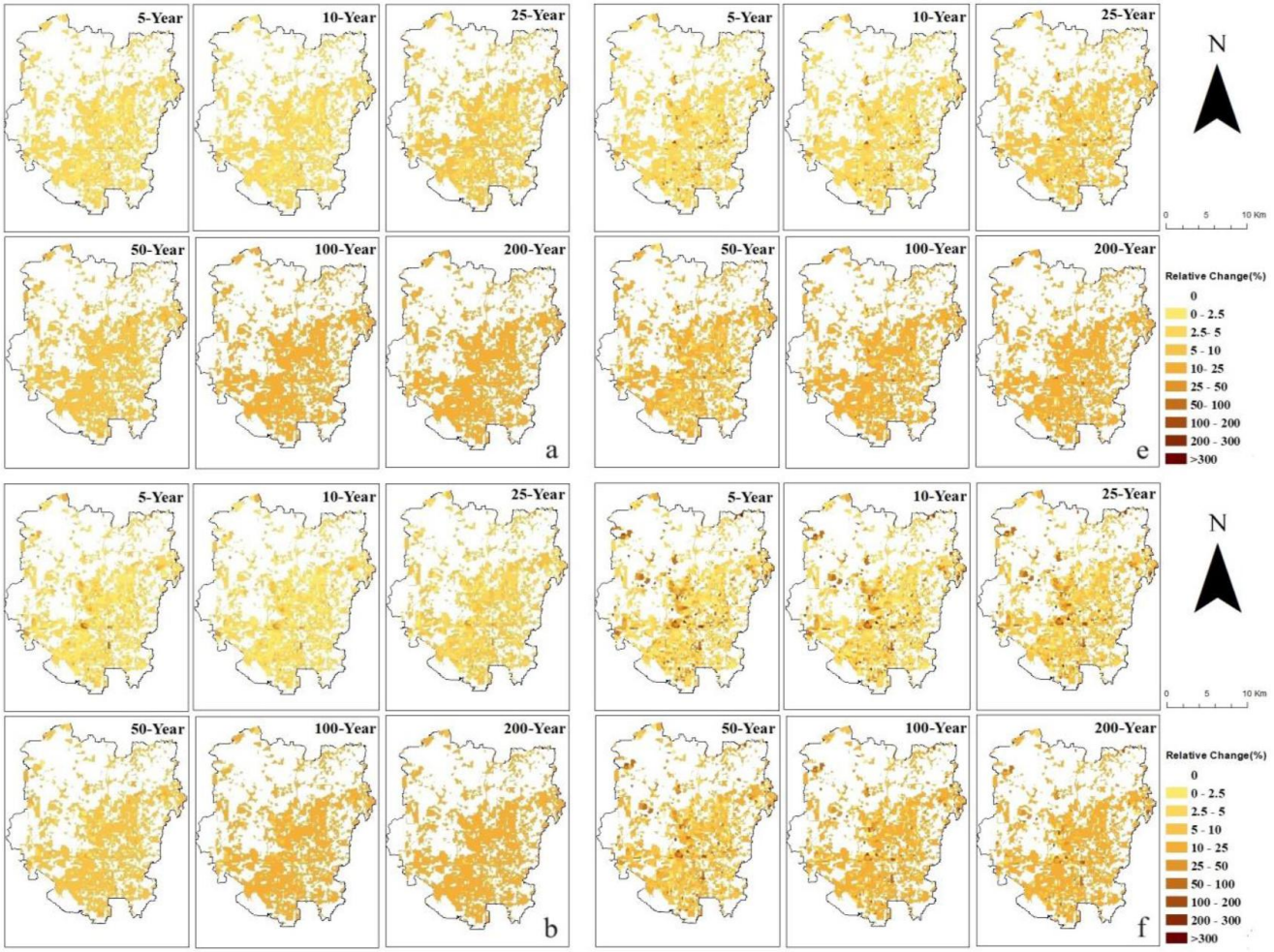




Climate & Land Cover Change Impacts

Fine-scale watershed modeling

Impacts on water quality and quantity



Estuarine HAB Predictive Tool

Chlorophyll-a predictions under changing conditions

Online Streamlit Tool

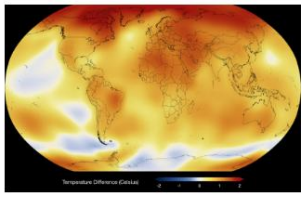
Web-based predictive tool

This is a web-based application to predict chlorophyll-a (an indicator of Harmful Algal Blooms) in four bay-estuary systems of the Florida panhandle and evaluate the vulnerability of each system under different hypothetical (what-if) scenarios

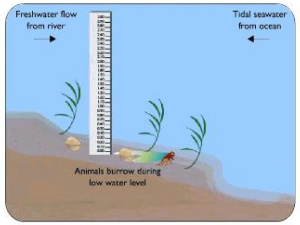
Please expand from the following to see the systems and the scenarios:

Bay-Estuary Systems

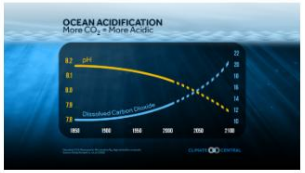
What-If Scenarios for Vulnerability Assessment:



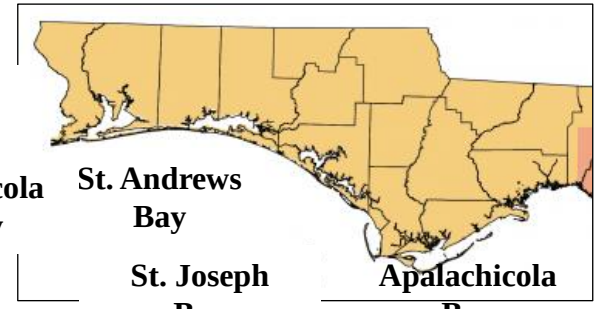
Cool-Warm Climate (Increase/Decrease in Daily Maximum Temperature)



Shifting Salinity Regimes (Increase/Decrease in Salinity



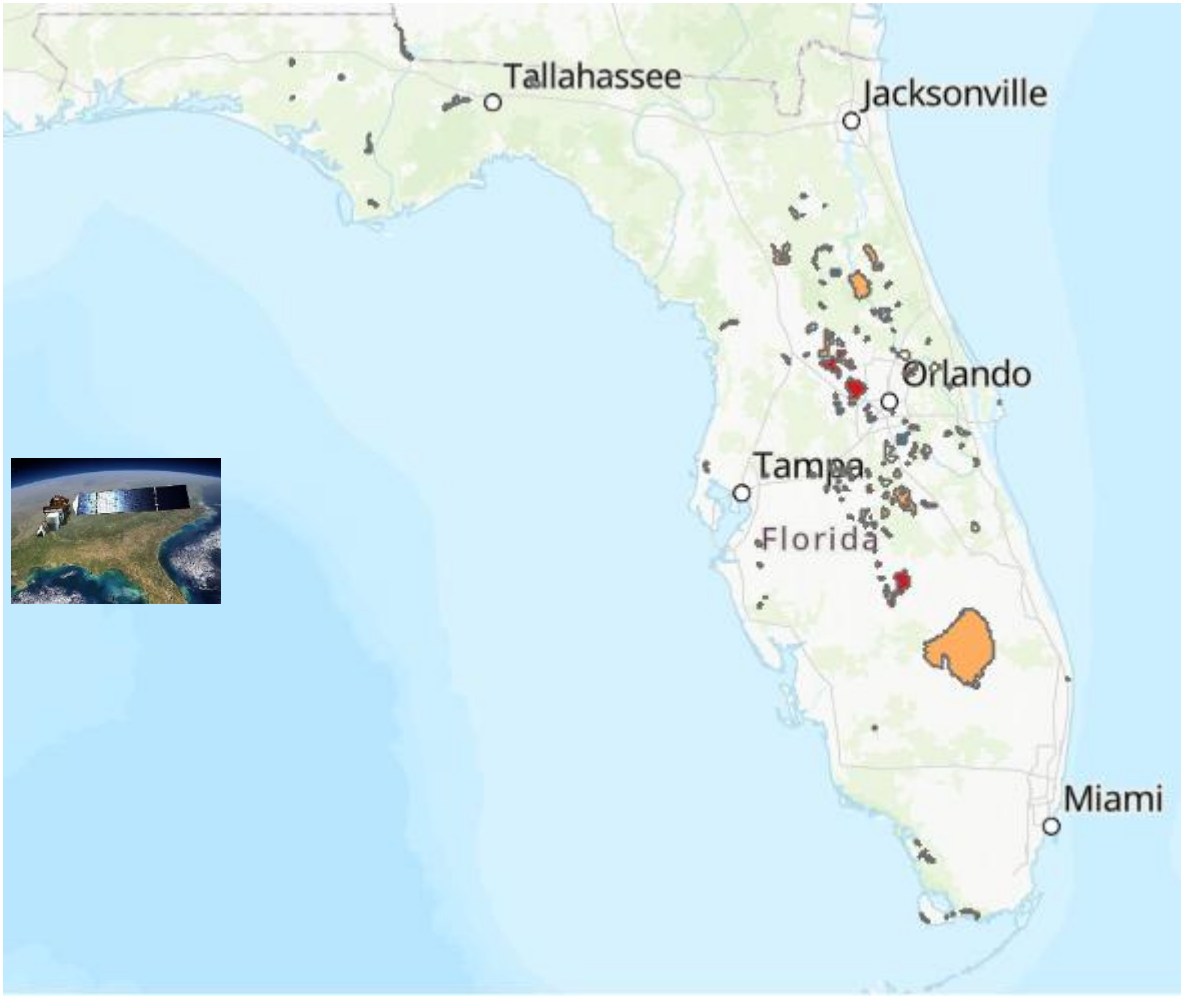
Ocean Acidification Status (Increase/Decrease in pH)



Lake HAB Predictive Tool

Cyanobacteria predictions in lakes

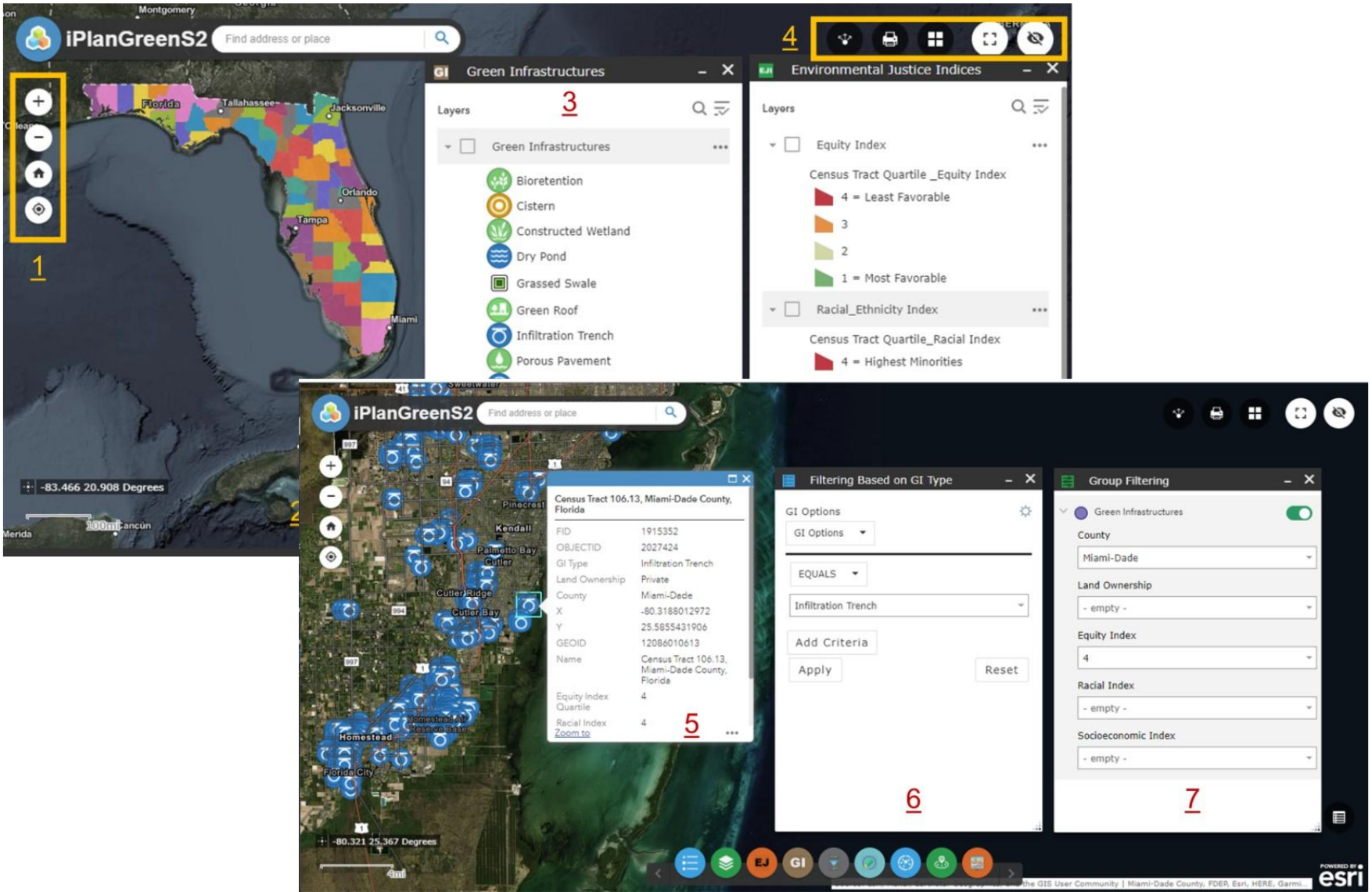
[ArcGIS Online Interactive Map]



iPlantGreenS2

Green infrastructure planning for nutrient removal

[ArcGIS Online Interactive Map]



Thank You!

eahmadisharaf@eng.famu.fsu.edu
nalamdari@eng.famu.fsu.edu

RIDER

FLORIDA A&M UNIVERSITY
CENTER FOR WATER RESOURCES
COLLEGE OF AGRICULTURE AND FOOD SCIENCES

The Center for Water Resources (CWR) is a research unit within the College of Agriculture and Food Sciences.

Mission Statement:

"To protect, improve, restore, and maintain Florida's water resources and reduce water quality problems associated with agricultural practices and other human activities through **research**, **education**, **extension**, and **technology transfer**."

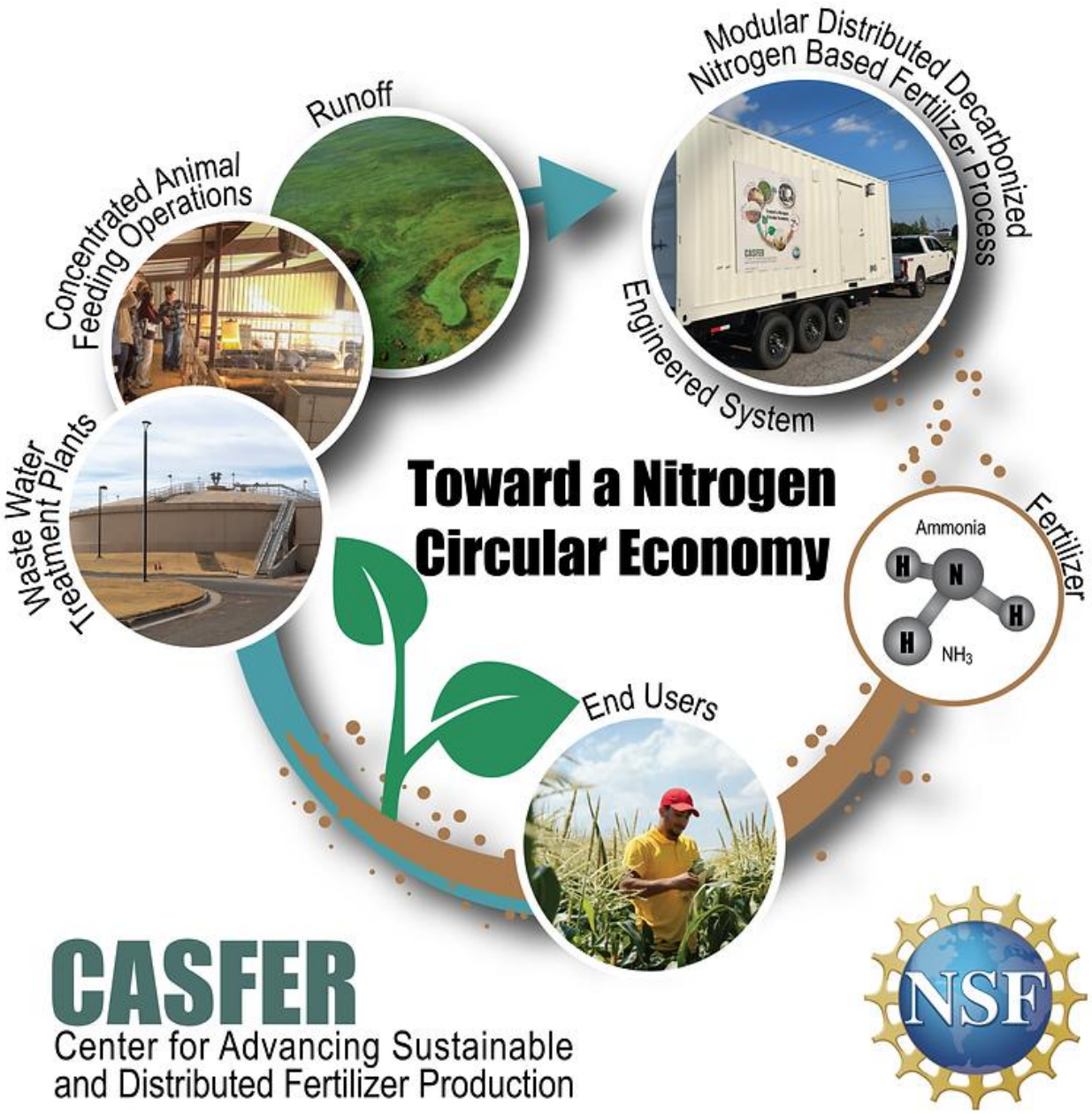
Selected Research Projects

and in Partnership with Industry

https://www.casfer.us/

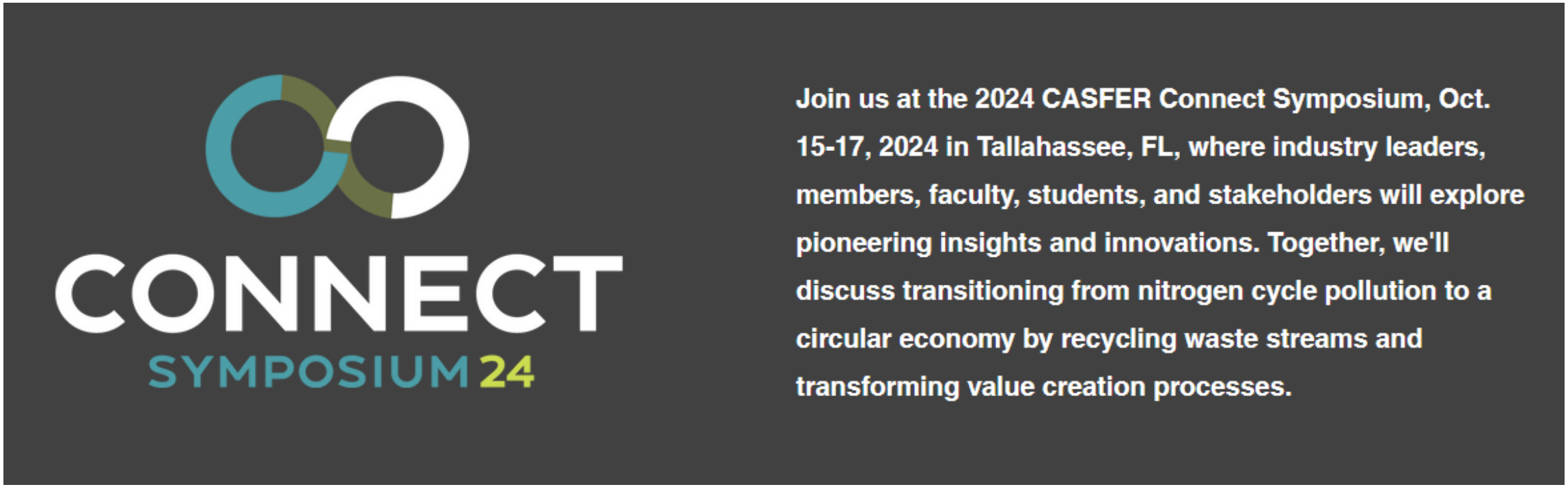
CASFER is an NSF Engineering Research Center dedicated to promoting a **nitrogen circular economy**.

The concept of a nitrogen circular economy envisions the recycling of N fertilizer in a manner that is economically sustainable.



CASFER is developing new technologies to recover N from human and animal waste streams and runoff at the source.

CASFER
Center for Advancing Sustainable and Distributed Fertilizer Production

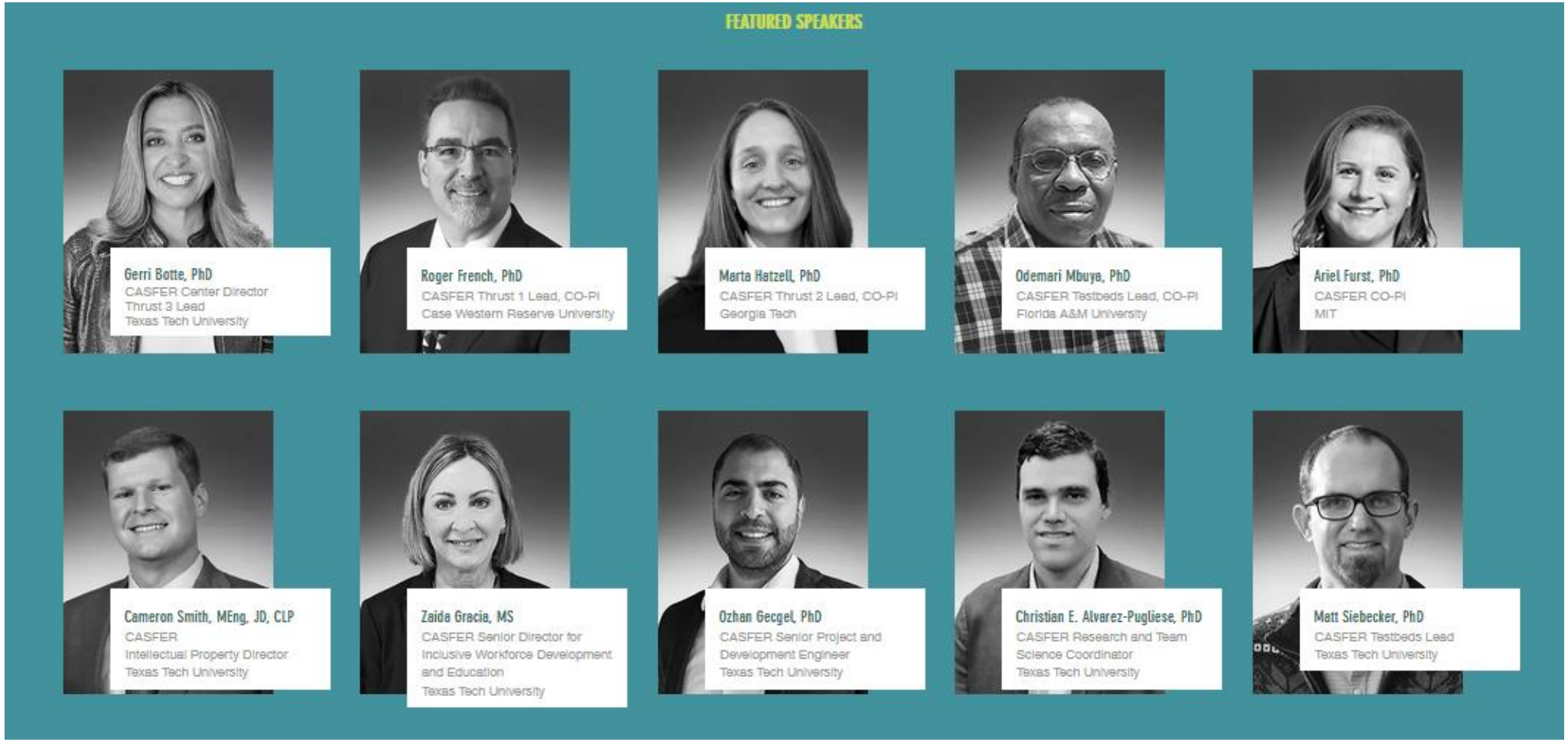


https://www.casferconnect.com/

CASFER Annual Symposium will be held at FAMU October 15-17 (next week). Please come. It's free to register and attend.

CONNECT
SYMPOSIUM 24

Join us at the 2024 CASFER Connect Symposium, Oct. 15-17, 2024 in Tallahassee, FL, where industry leaders, members, faculty, students, and stakeholders will explore pioneering insights and innovations. Together, we'll discuss transitioning from nitrogen cycle pollution to a circular economy by recycling waste streams and transforming value creation processes.



https://www.casferconnect.com/

THE FLORIDA AGRICULTURAL AND MECHANICAL UNIVERSITY

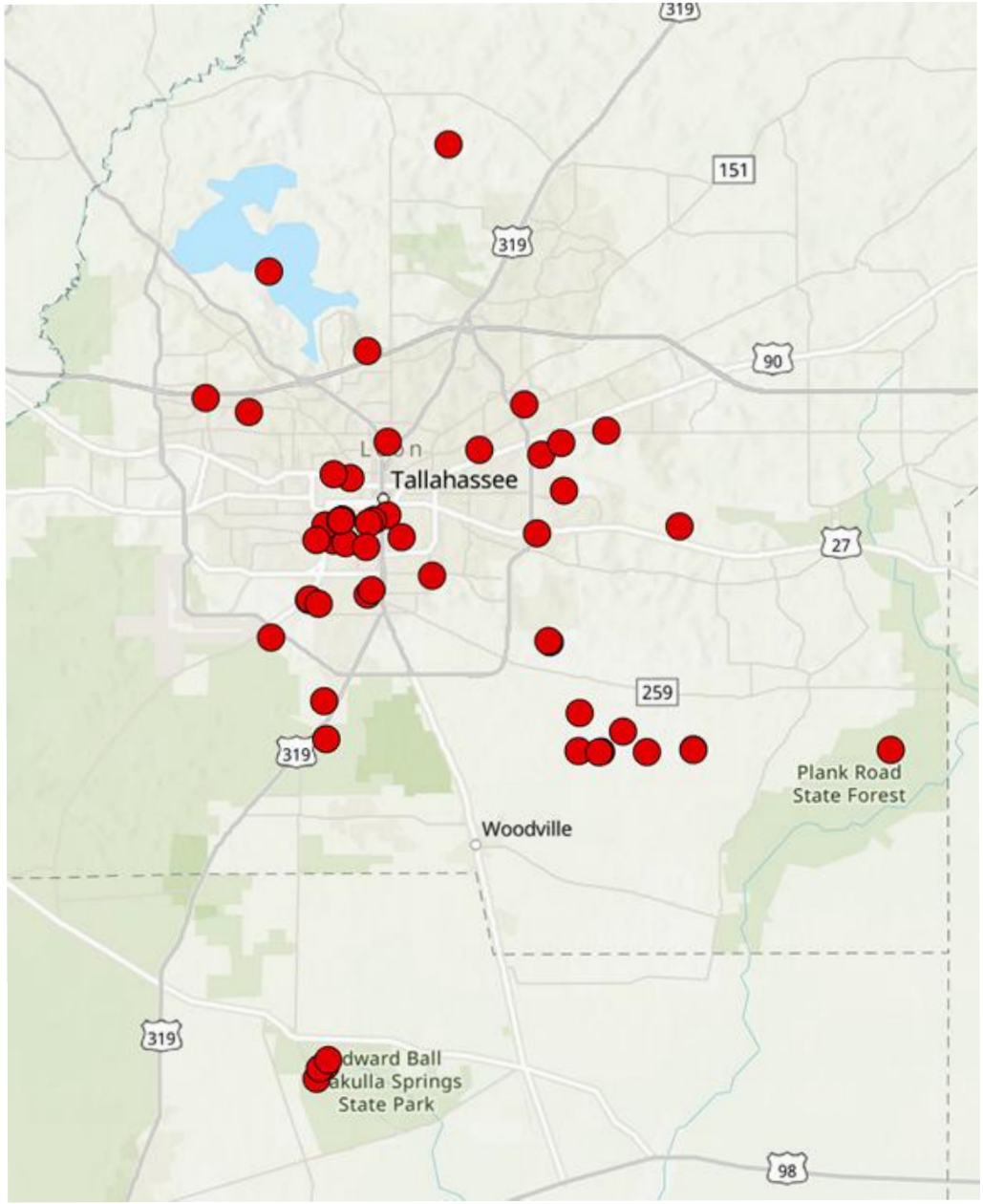
COLLEGE OF AGRICULTURE AND FOOD SCIENCES

CHARACTERIZING THE OCCURRENCE AND DISTRIBUTION OF MICROPLASTICS IN AN URBAN/RURAL REGIONAL HYDROLOGICAL SYSTEM: CASE STUDY TALLAHASSEE, FLORIDA.

By:

Ogechi Judith, Madukwe

https://go.openathens.net/redirector/famu.edu?url=https://www.proquest.com/dissertations-theses/characterizing-occurrence-distribution/docview/3091489720/se-2?accountid=10913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Tallahassee
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Plank Road
State Forest
Woodville
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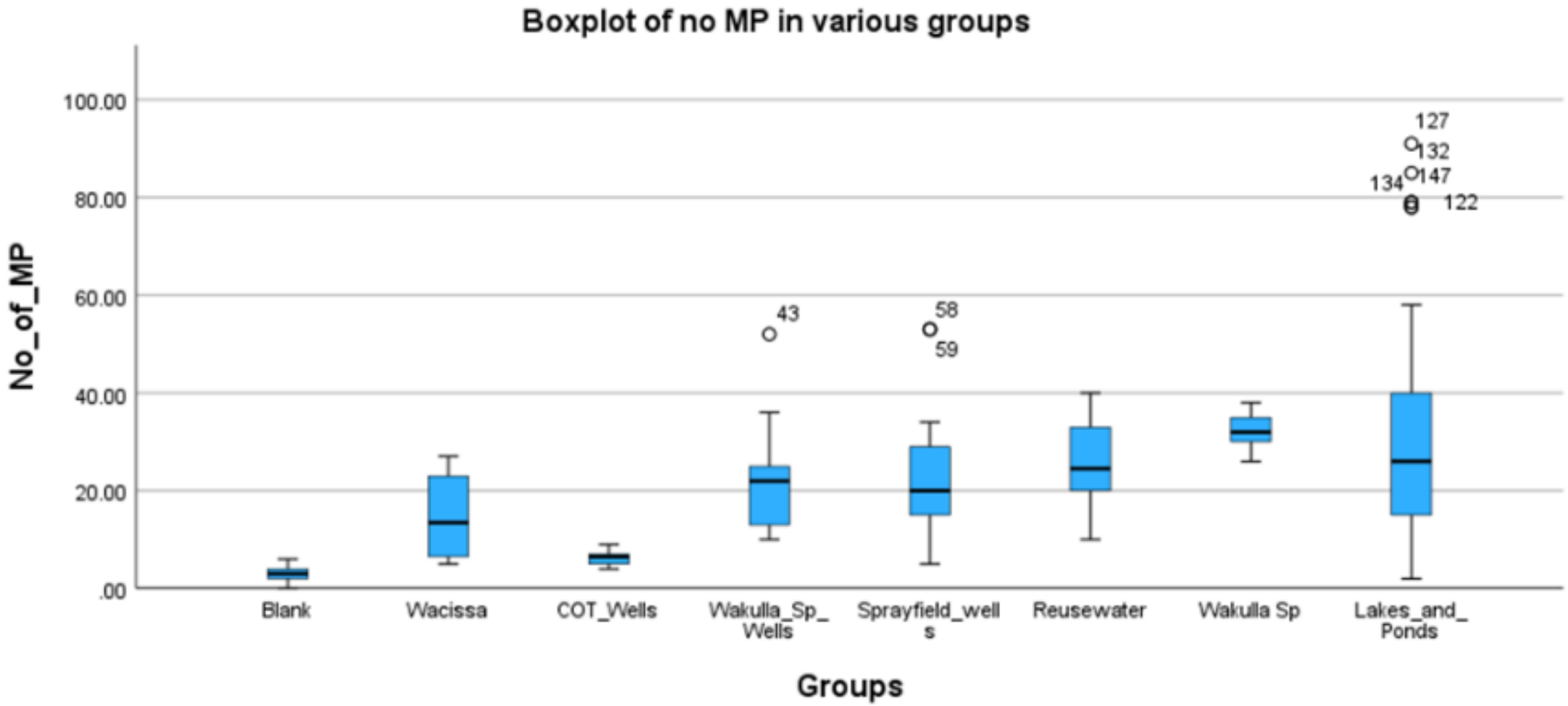
State Park
98


Boxplot of no MP in various groups
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60.00
40.00
20.00
.00
127
132
147
134
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58
59
Blank
Wacissa
COT_Wells
Wakulla_Sp_ Wells
Sprayfield_wells
Reusewater
Wakulla Sp
Lakes_and_ Ponds
Groups

Outreach/Extension

FAMU is a GLOBE Program Partner

LEARN ABOUT GLOBE

The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process, and contribute meaningfully to our understanding of the Earth system and global environment.

Learn More >

GLOBE by the Numbers

127	Countries
42,031	Schools / Informal Education Organizations
51,746	Educators
285,138	GLOBE Observers
259,165,734	Measurements
186,249	Measurements this month

View GLOBE Countries >

EXPLORE AND LEARN ABOUT THE EARTH SYSTEM

GLOBE Partners teach teachers to make environmental measurements. The teachers teach their students

RECENT MEASUREMENTS

Enter Data | Visualize Data

Recent Measurements: Last 7 Days

- Rain Depth
- Cloud Cover
- Maximum Daily Temperature