



Florida Department of Environmental Protection

Short-term variability in water quality and weather as an effect of tropical cyclone events in the southeastern United States

Shannon Dunnigan
February 3, 2017



Short-term variability in water quality and weather

The effect of tropical cyclone events in the southeastern United States



Shannon K. Dunnigan, Kathryn M. Petrinec, Nikki Dix

Guana Tolomato Matanzas National Estuarine Research Reserve

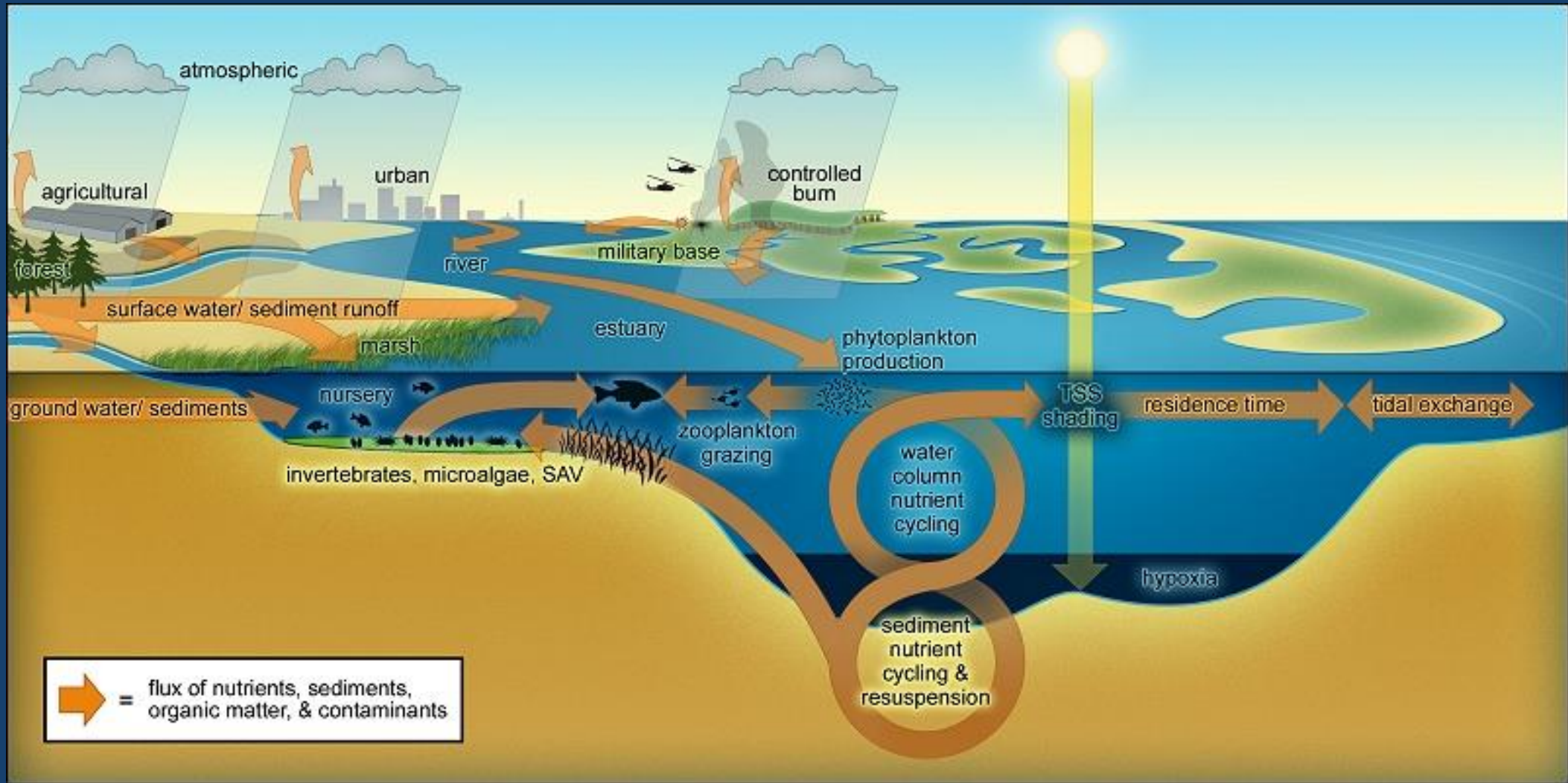


GTMNERR State of the Reserve Symposium: Working Waters

Ponte Vedra Beach, FL February 3rd, 2017



Estuaries

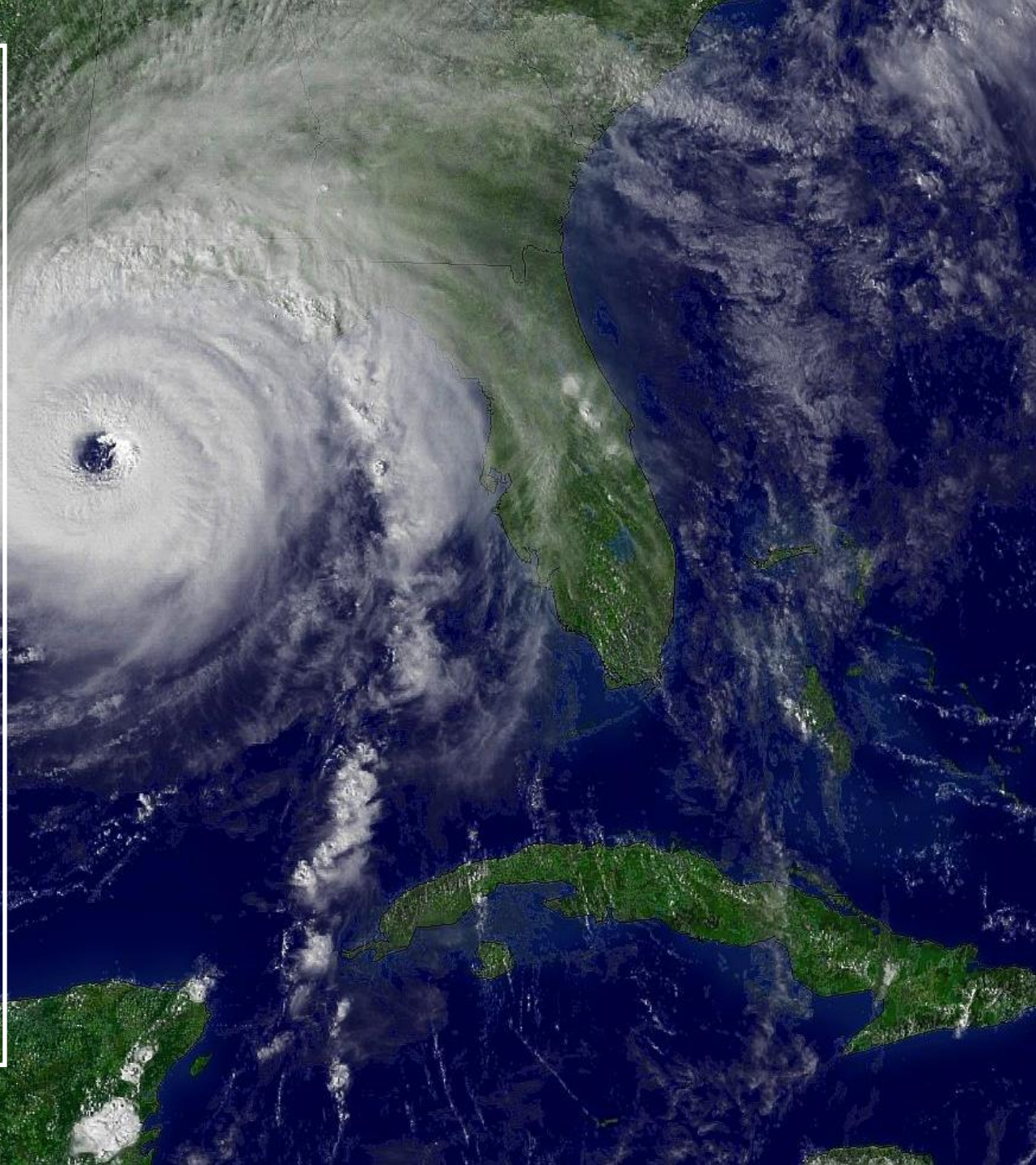


Environmental Variability

- Range of temporal scales and intensities
 - Daily-Seasonal Cycles
 - Long-term Trends
 - Sporadic Events

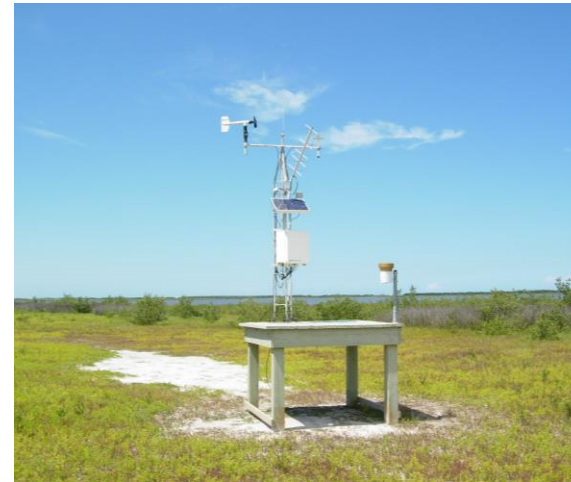


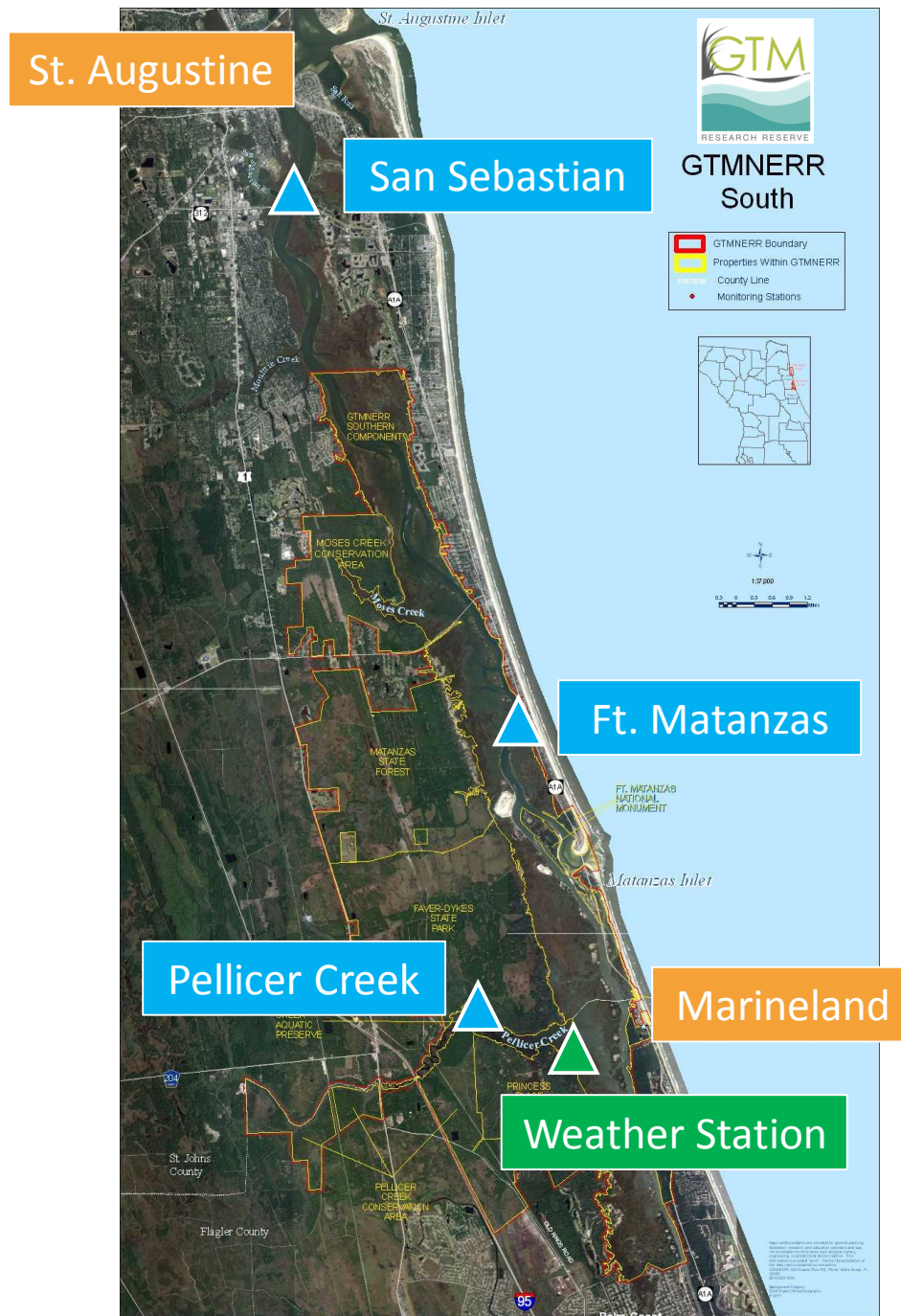
***How do tropical cyclones
affect water quality in the
GTMNERR?***



Long-term monitoring networks: **SWMP**

- System-Wide Monitoring Program (SWMP)
 - › Short-term variability
 - › Long-term change
 - › Estuarine function
- Prediction of estuarine response and resilience

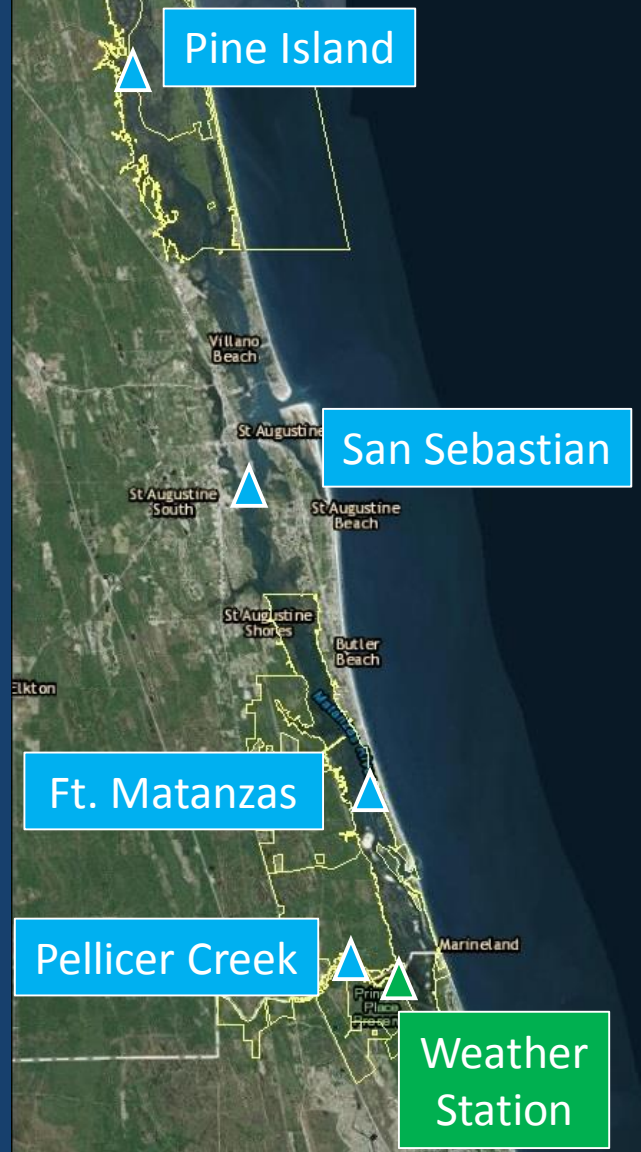




▲ Water Quality Stations
▲ Weather Station
— GTMNERR Boundary



Water Quality

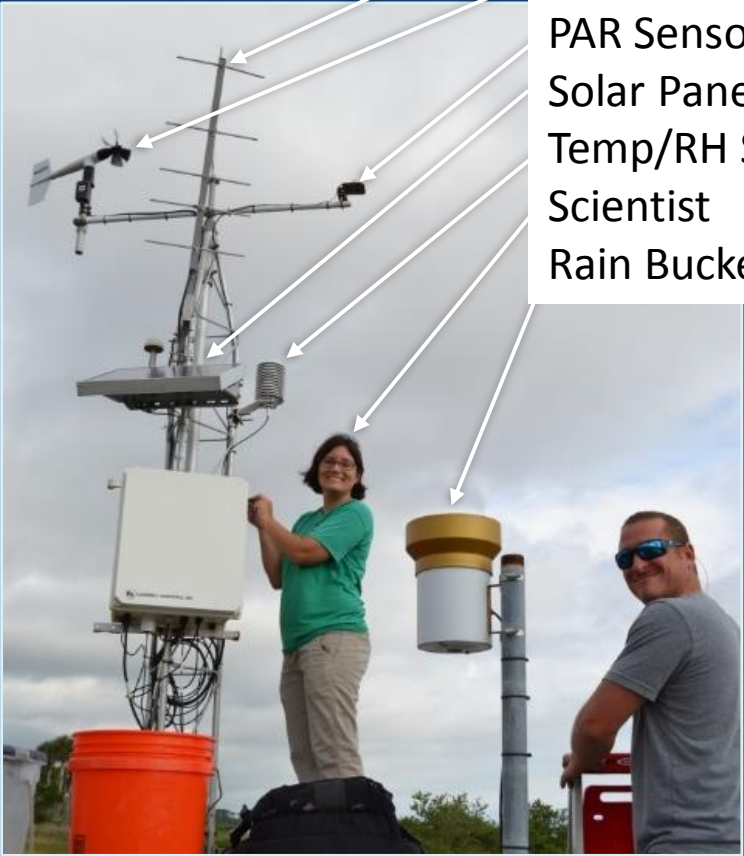


- Salinity
- Temperature
- Oxygen
- pH
- Turbidity
- Water depth
- Nitrogen
- Phosphorus
- Phytoplankton biomass



Weather

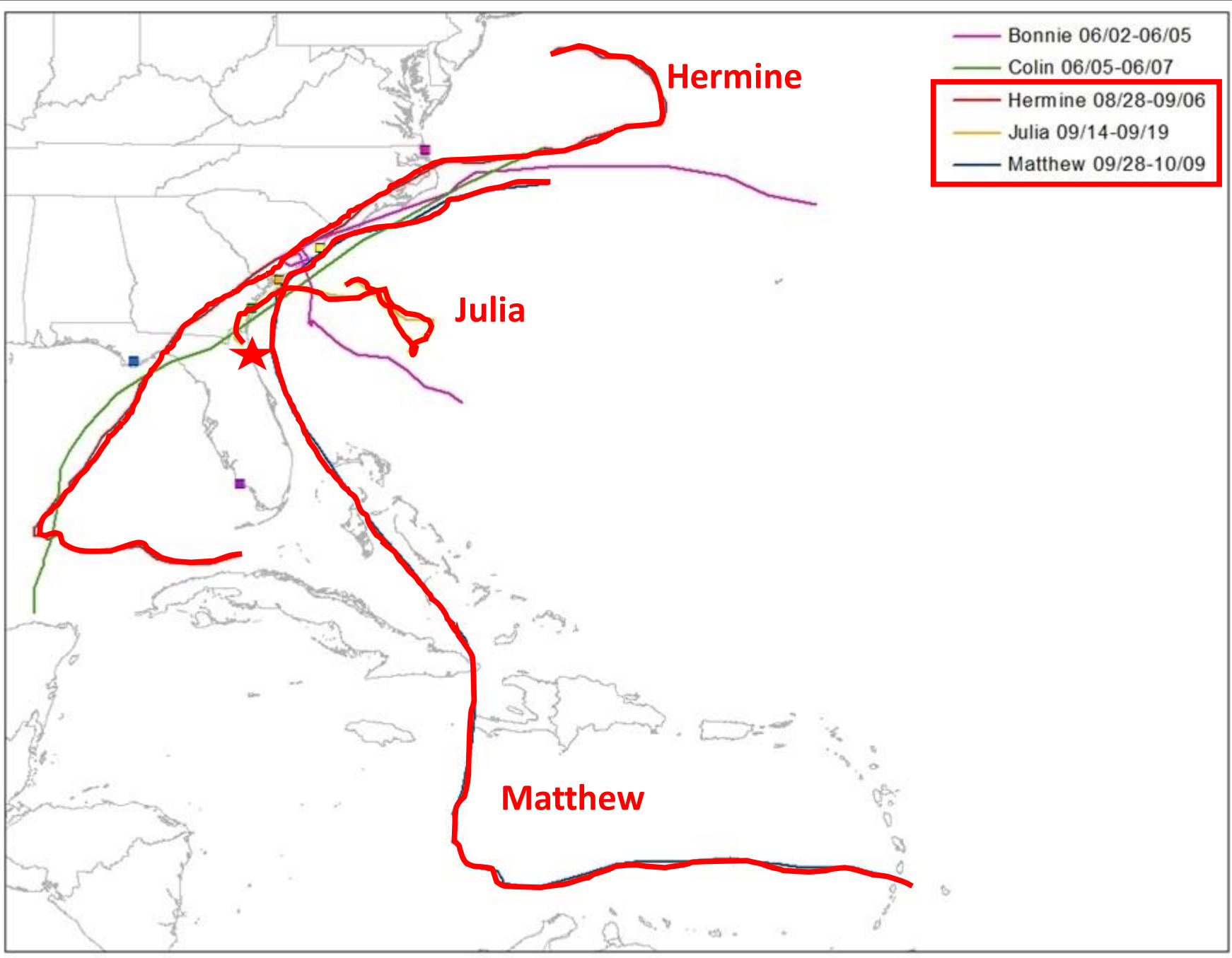
- Yagi antenna
- Anemometer
- PAR Sensor
- Solar Panel
- Temp/RH Sensor
- Scientist
- Rain Bucket





Using SWMP at the GTMNERR to view the short-term effects of tropical cyclones in fall 2016

2016 Hurricane Season



- Water Quality Stations
- Weather Station
- GTMNERR Boundary



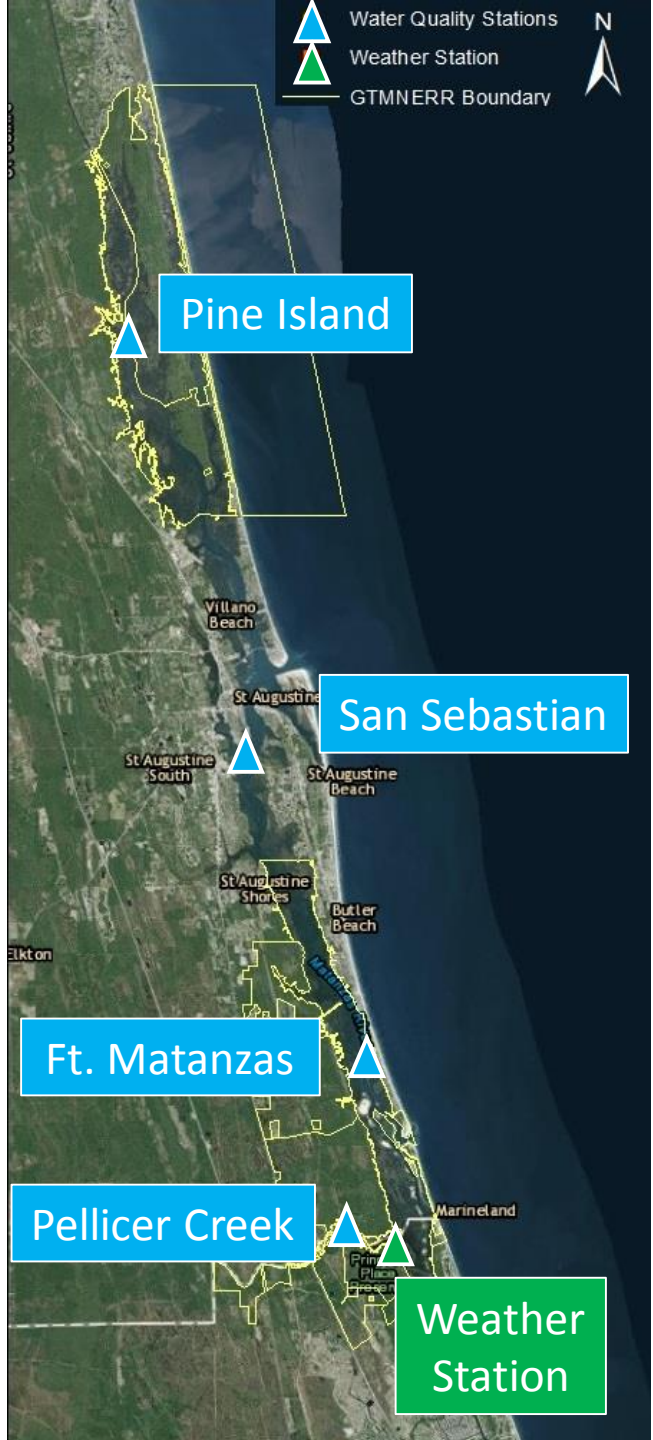
Pine Island

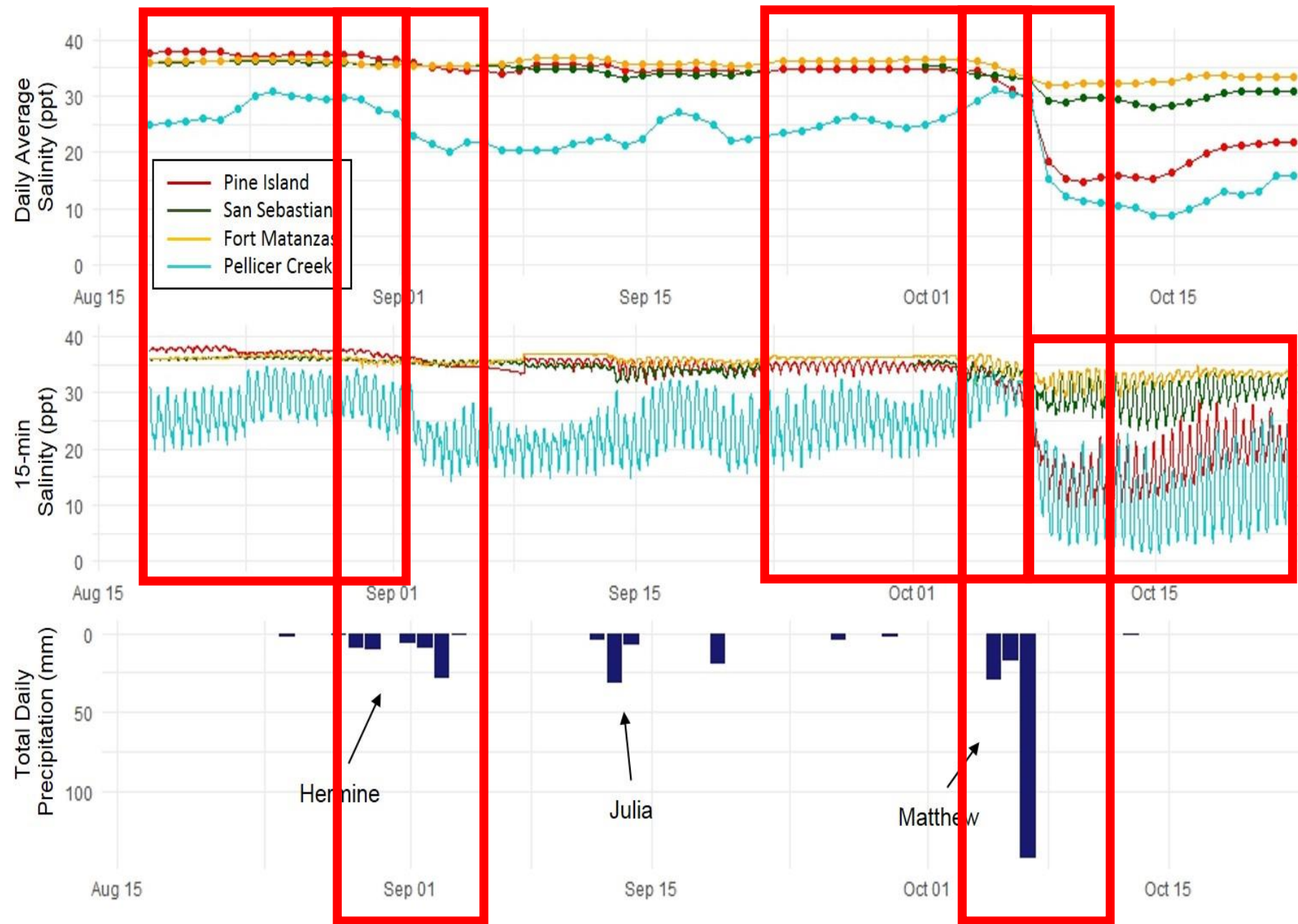
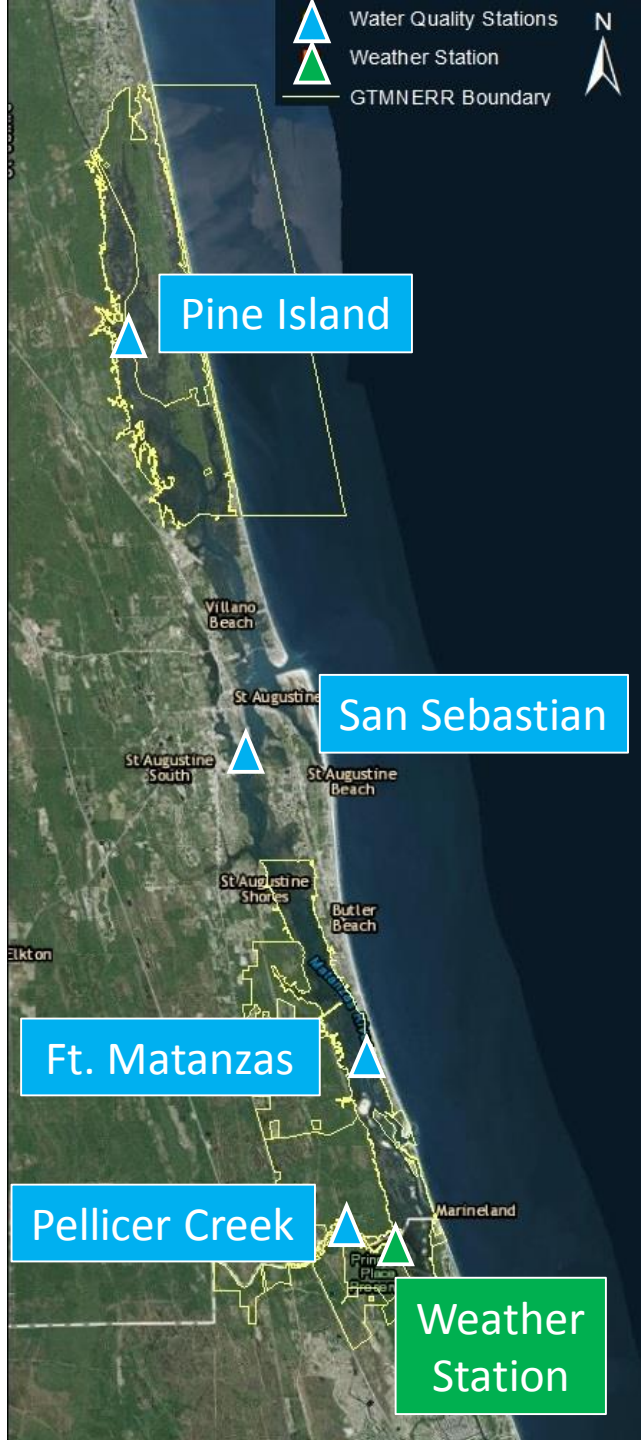
San Sebastian

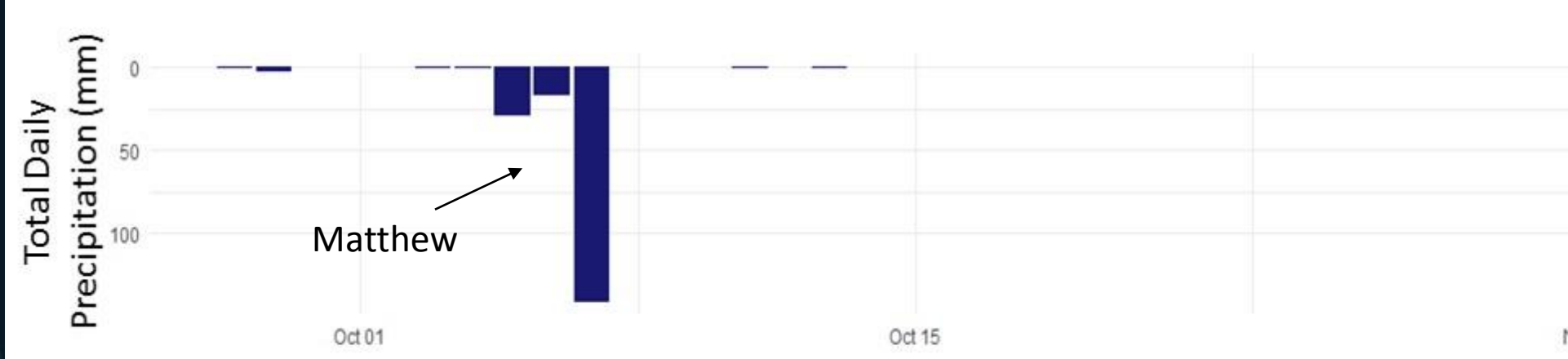
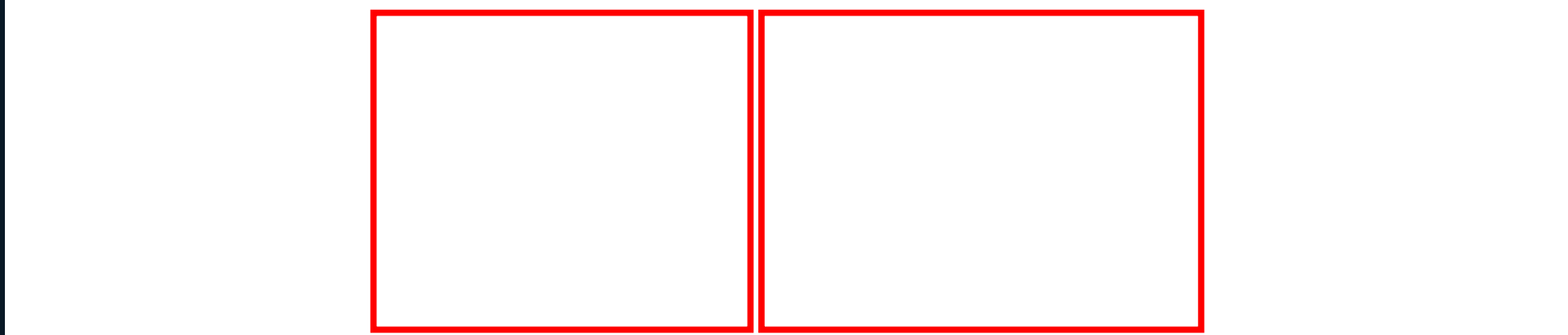
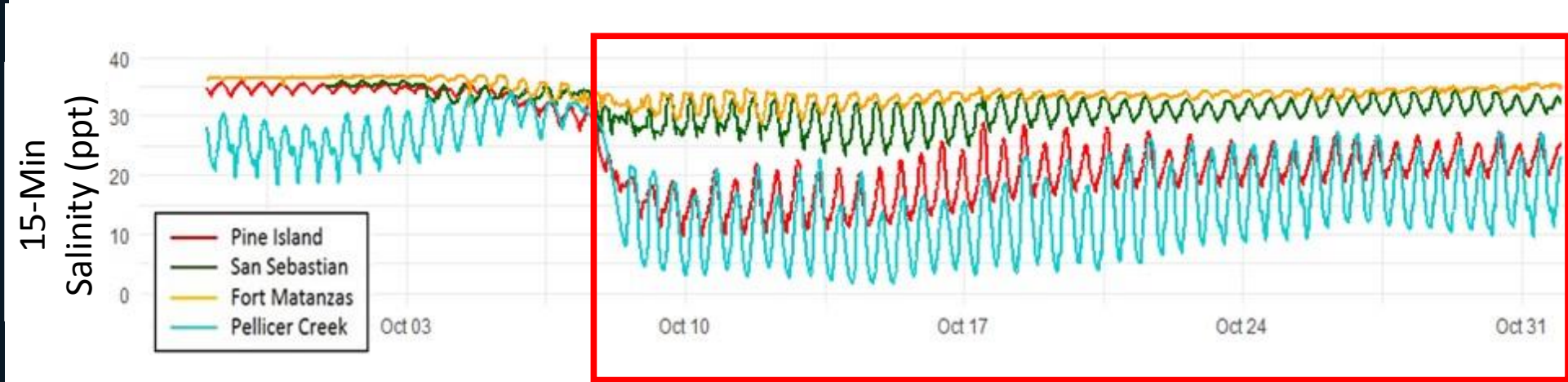
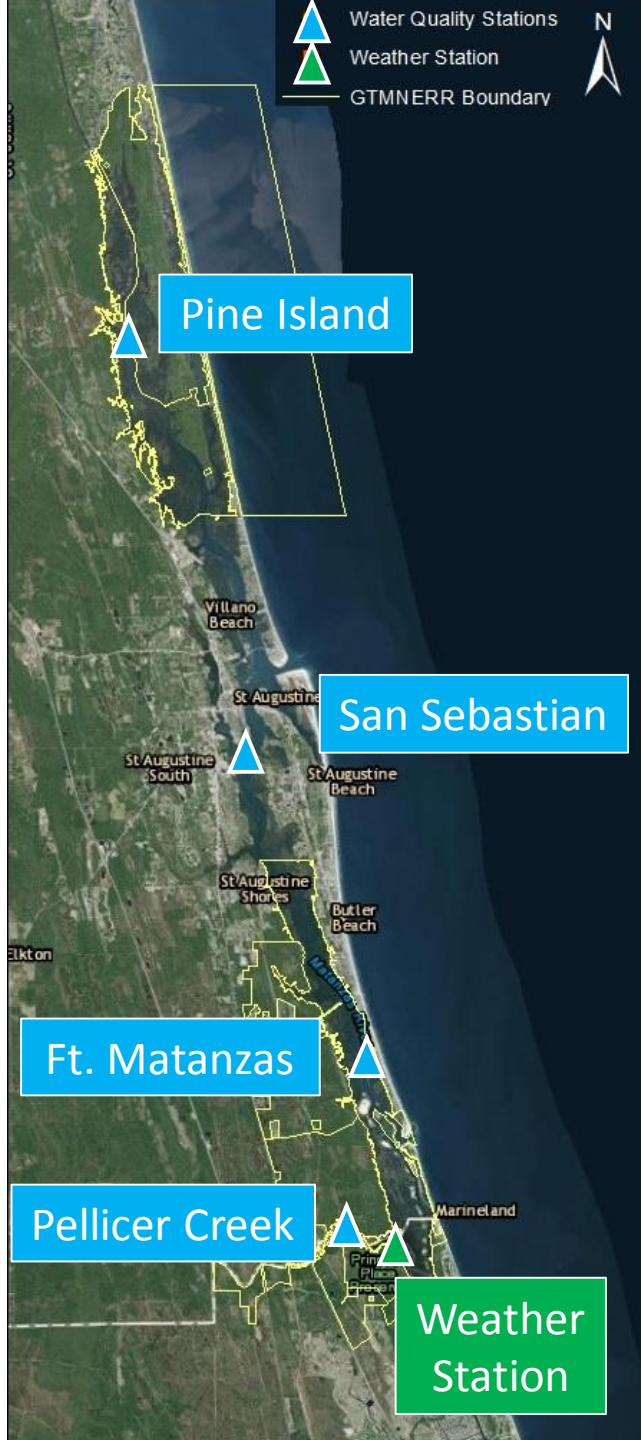
Ft. Matanzas

Pellicer Creek

Weather Station







How about that wind??



2004 Hurricanes near the GTM Research Reserve

- Increased nor'easterly wind speeds prior to storms
- Increased salinities prior to precipitation
- Large decreases in salinity following rainfall events

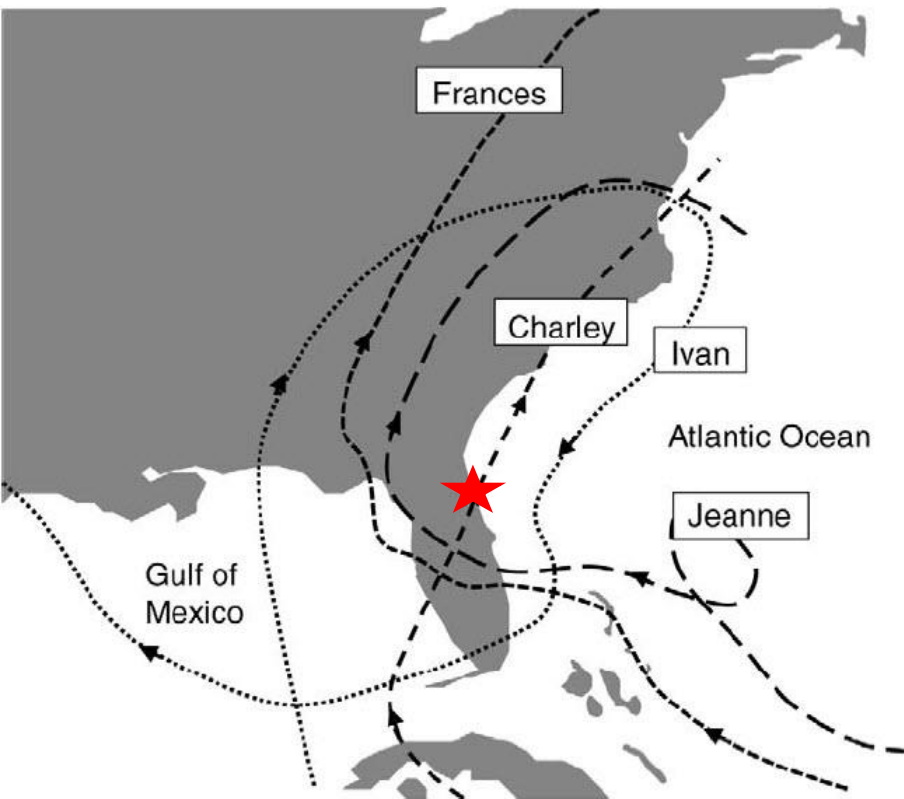


Figure 2. Storm tracks (Charley, France, Ivan, and Jeanne).

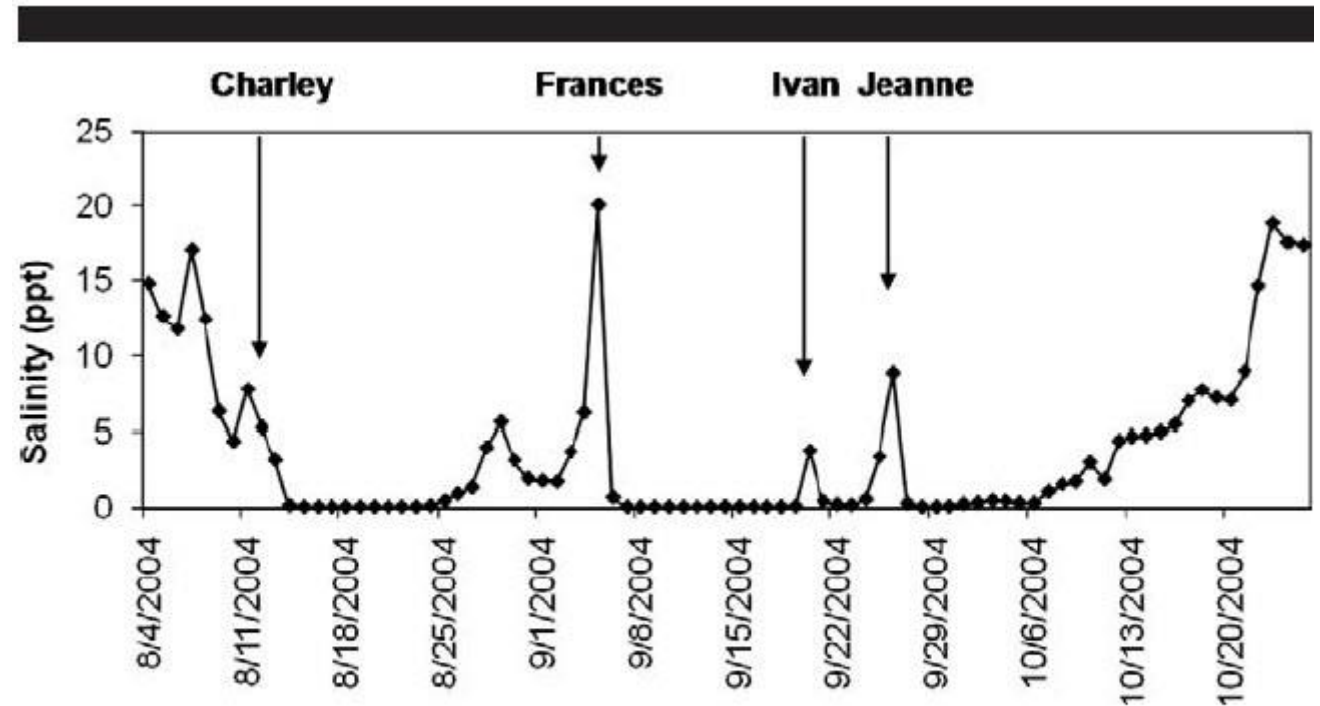


Figure 6. Mean daily salinity at the Pellicer Creek water quality station 2 weeks before Hurricane Charley and 4 weeks after Hurricane Jeanne.

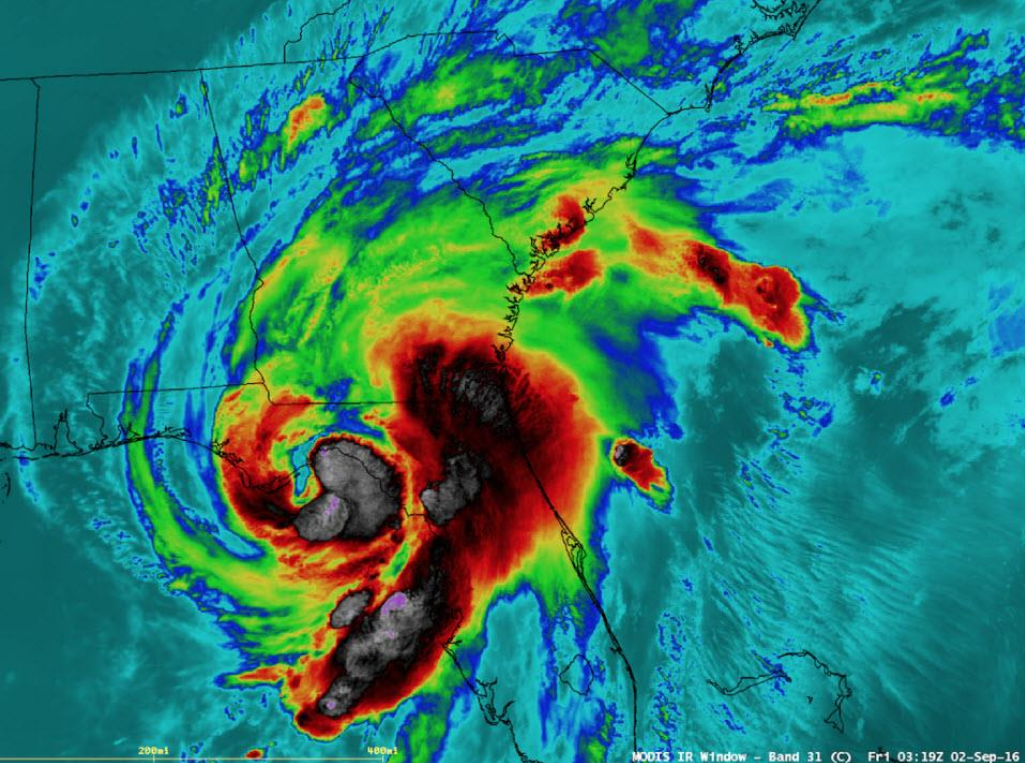
A satellite image showing a large, well-defined tropical storm or hurricane over the Gulf of Mexico. The storm has a clear eye and a dense, swirling cloud structure. The surrounding landmasses, including the United States and Mexico, are visible in green and brown, and the ocean is a deep blue. A dark horizontal bar is overlaid on the bottom half of the image, containing white text.

Visualization of storms through the lens of the NERRS SWMP

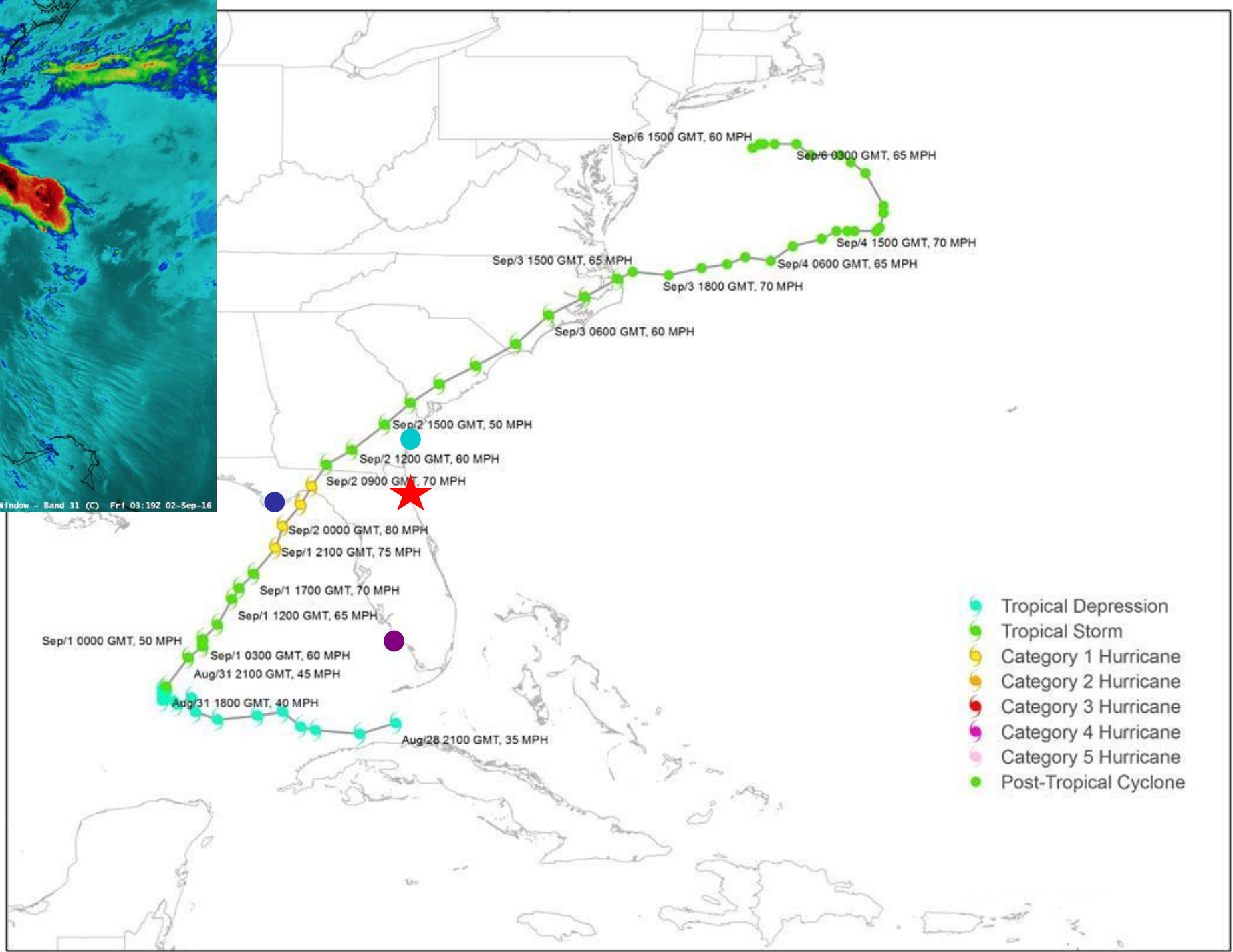


NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM





Hurricane Hermine



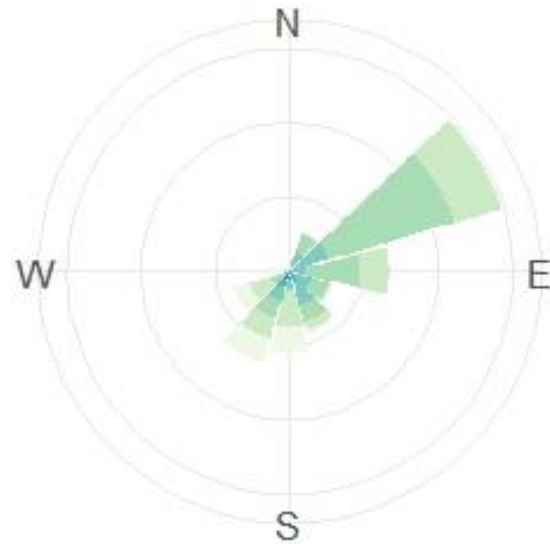
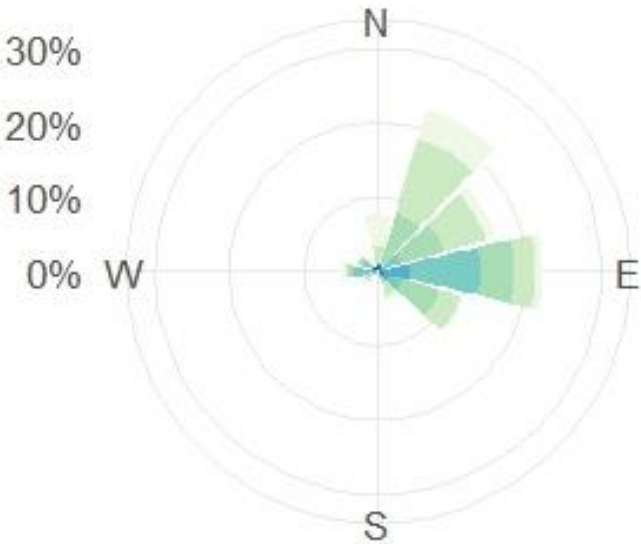
- Tropical Depression
- Tropical Storm
- Category 1 Hurricane
- Category 2 Hurricane
- Category 3 Hurricane
- Category 4 Hurricane
- Category 5 Hurricane
- Post-Tropical Cyclone

Comparing winds during Hermine

- Primarily from the northeast
- Strongest in the Atlantic coast

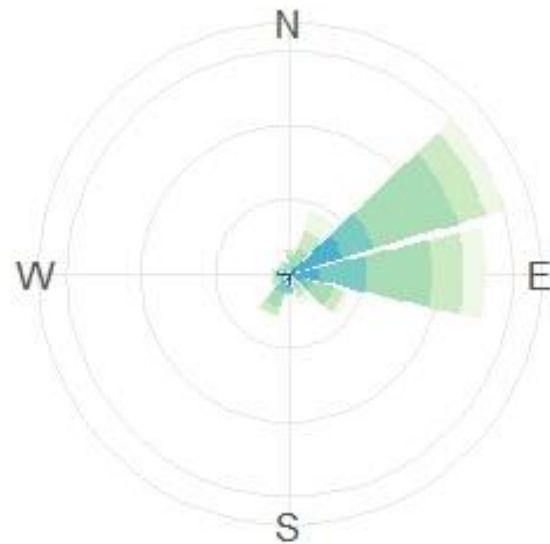
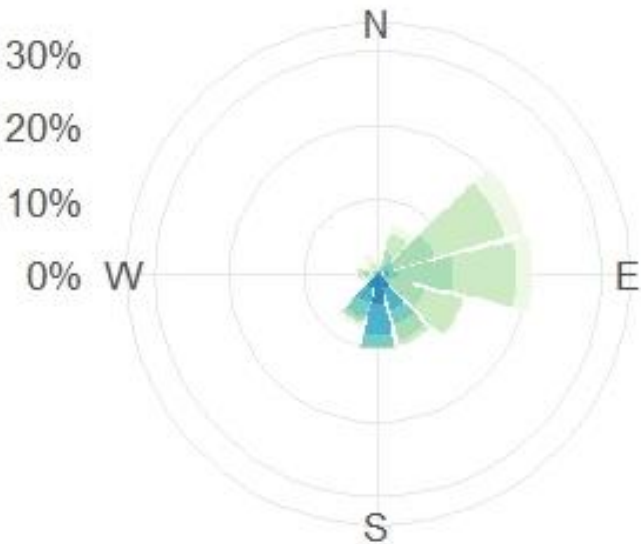
Apalachicola NERR

Guana Tolomato Matanzas NERR

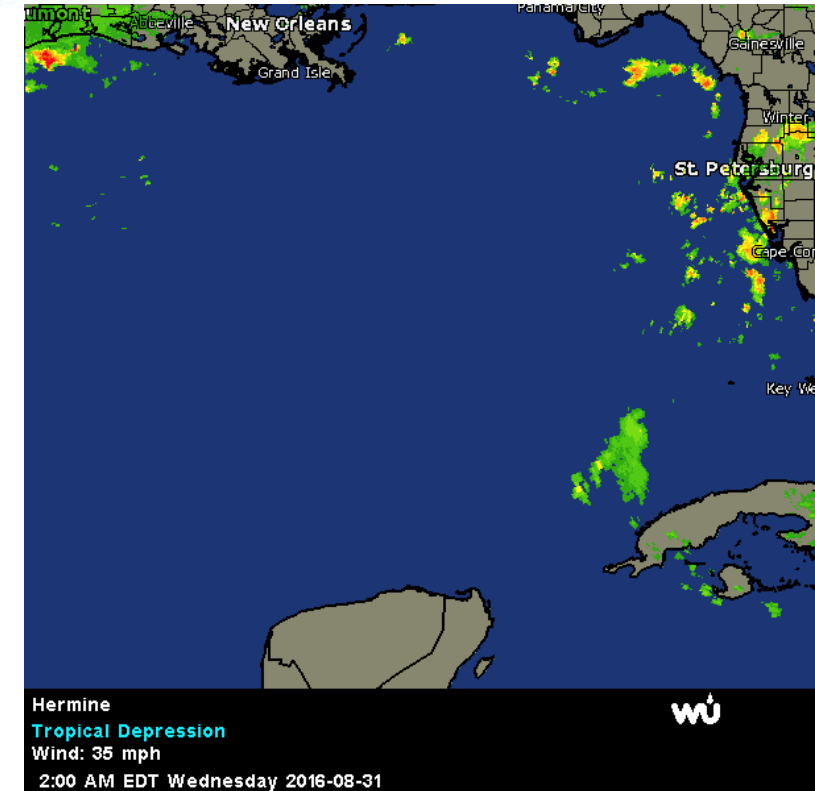
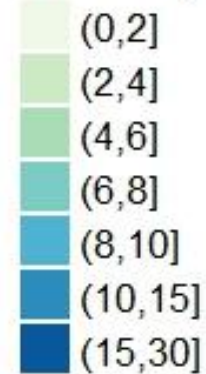


Rookery Bay NERR

Sapelo Island NERR

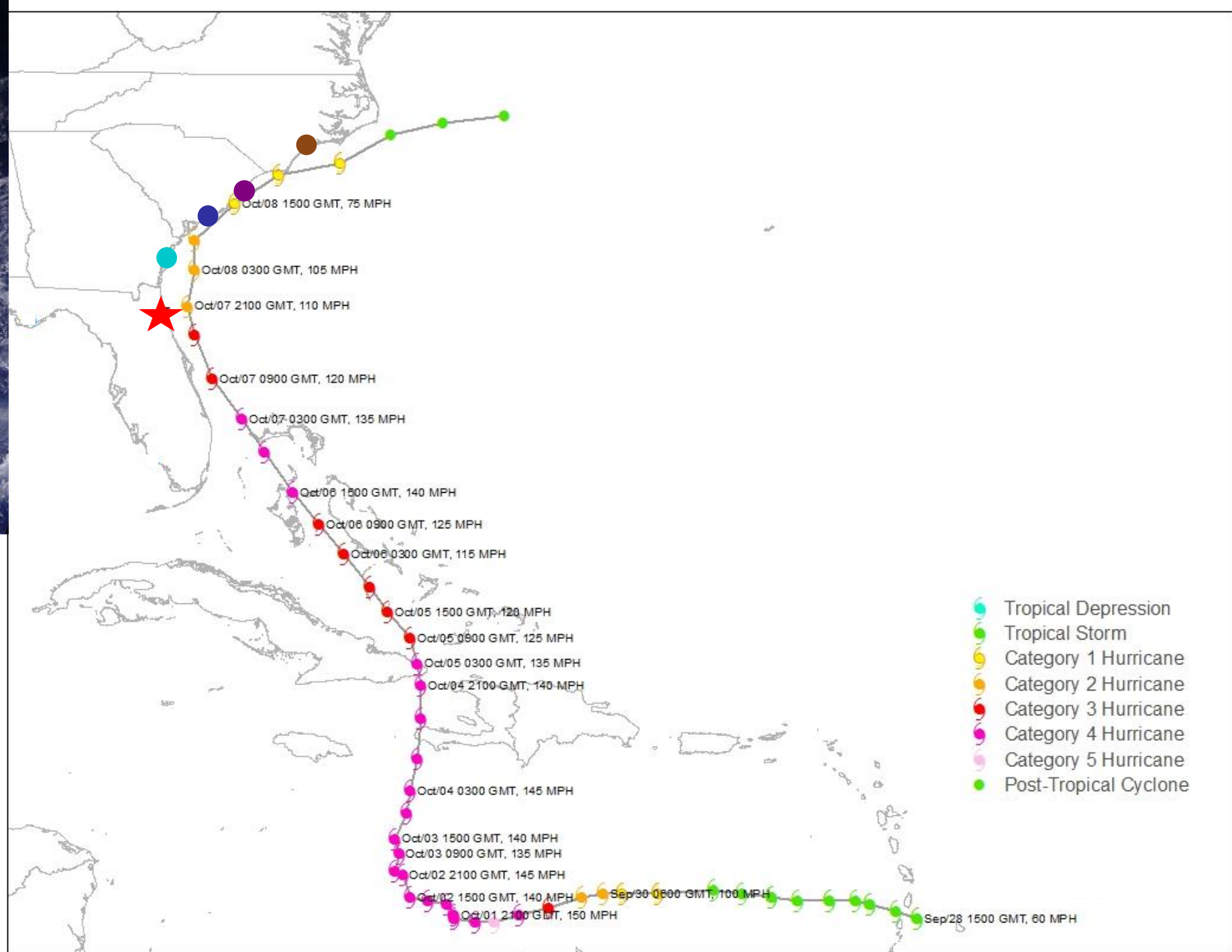


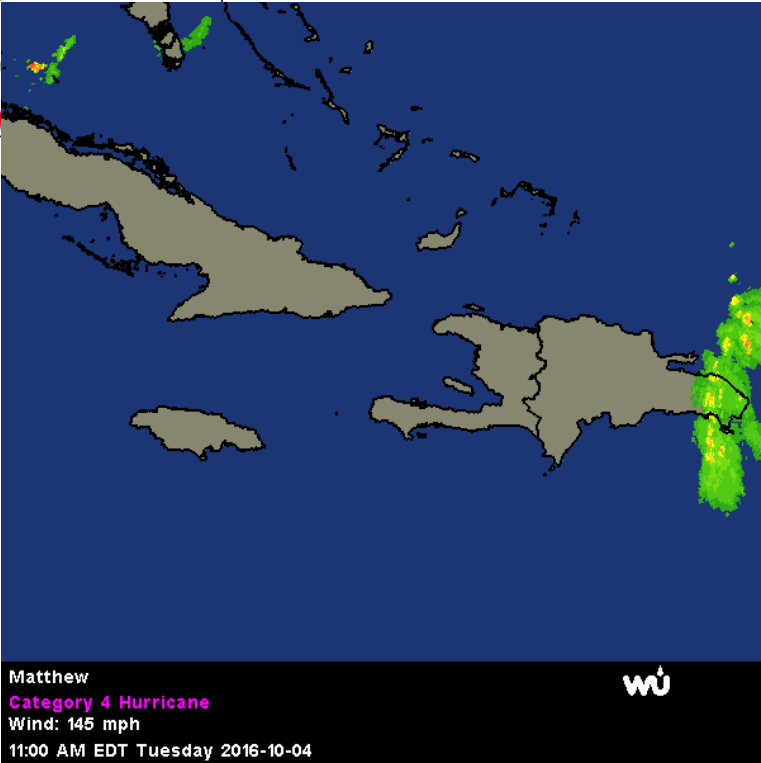
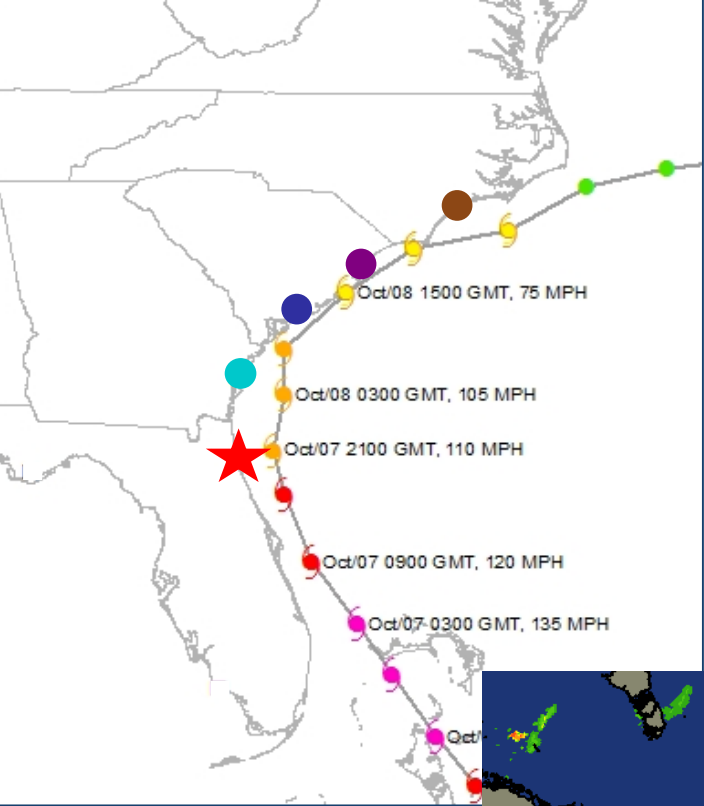
Wind Speed (m/s)





Hurricane Matthew

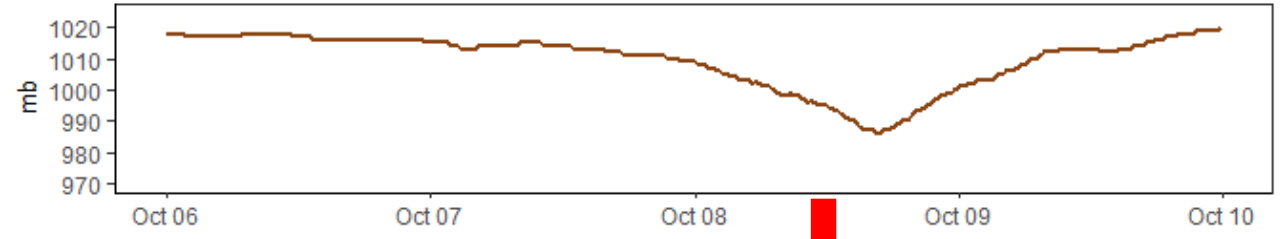




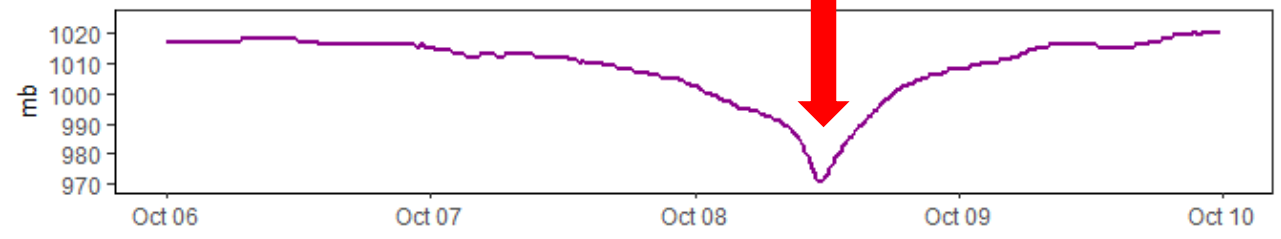
Matthew
 Category 4 Hurricane
 Wind: 145 mph
 11:00 AM EDT Tuesday 2016-10-04



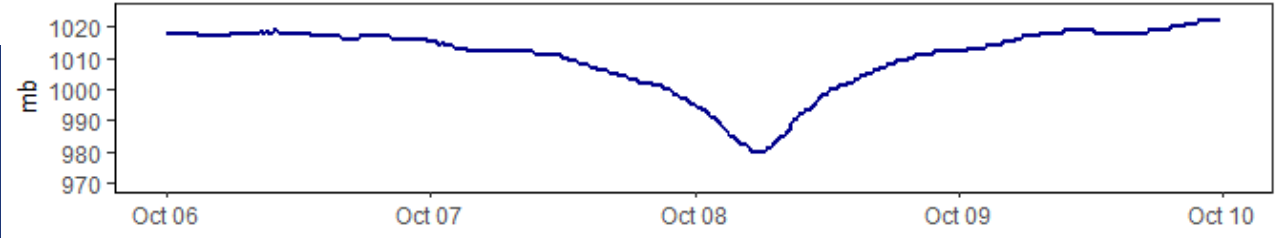
North Carolina NERR



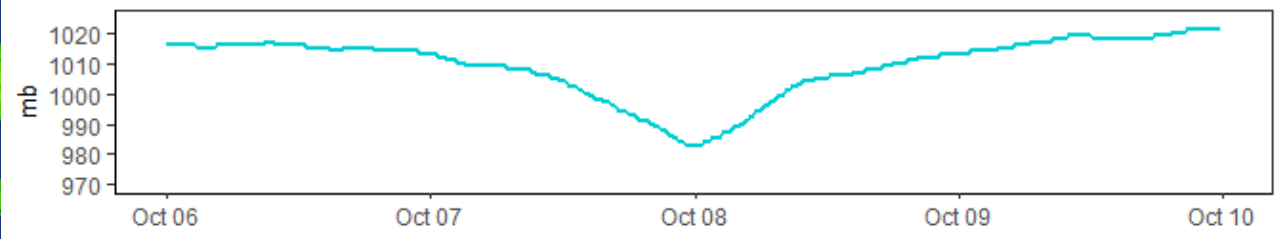
North Inlet-Winyah Bay NERR



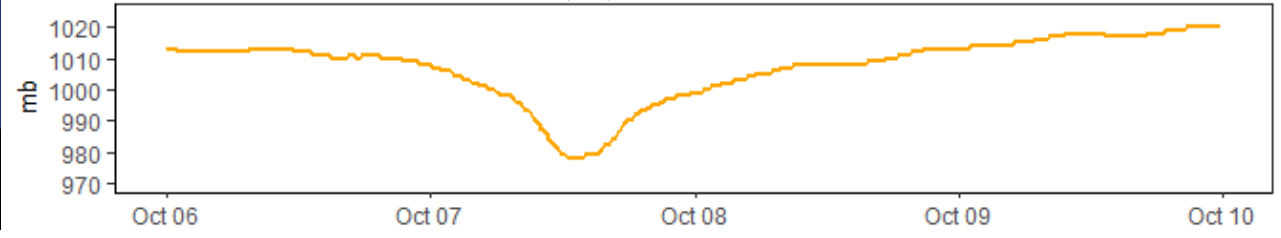
ACE Basin NERR



Sapelo Island NERR



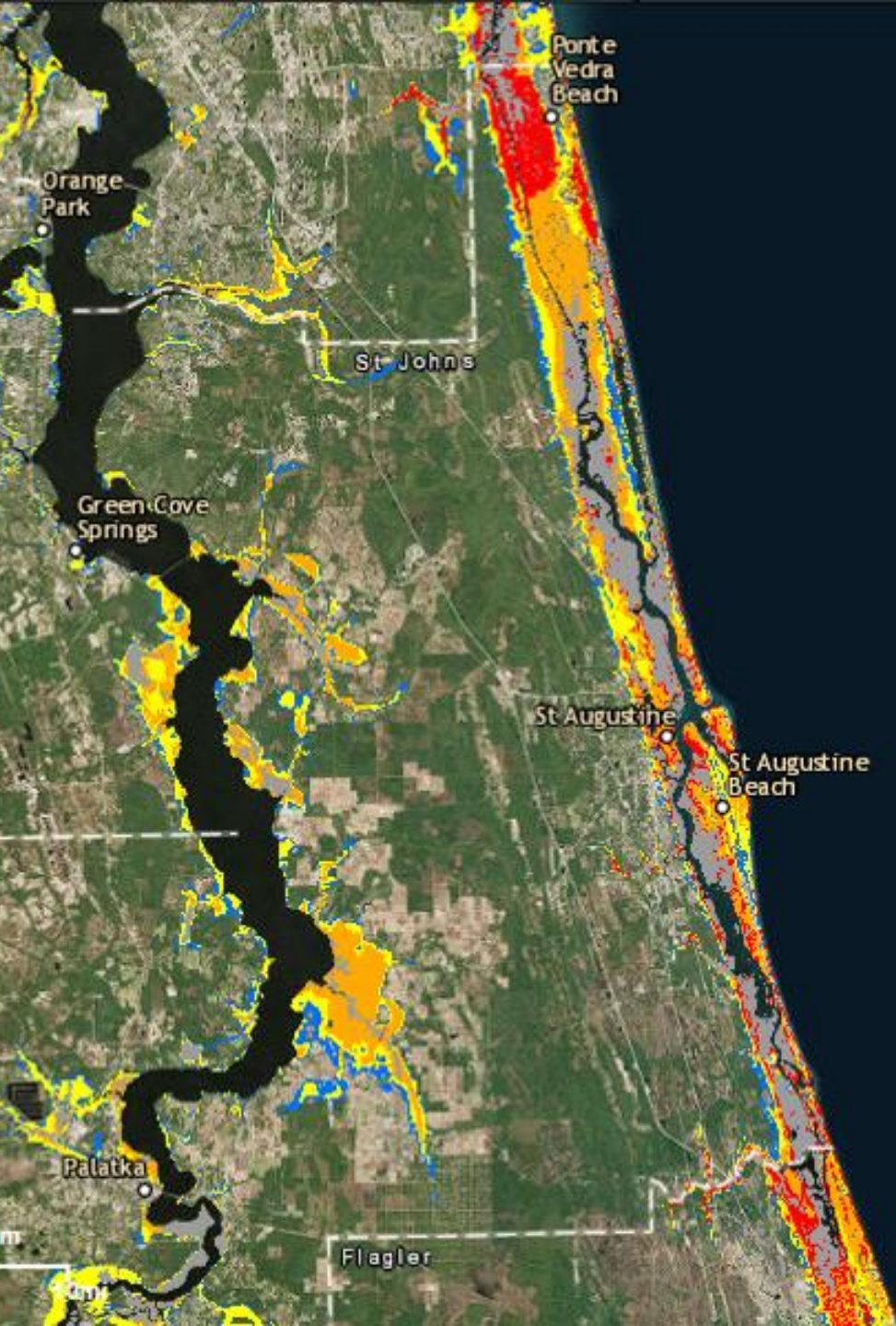
Guana Tolomato Matanzas NERR

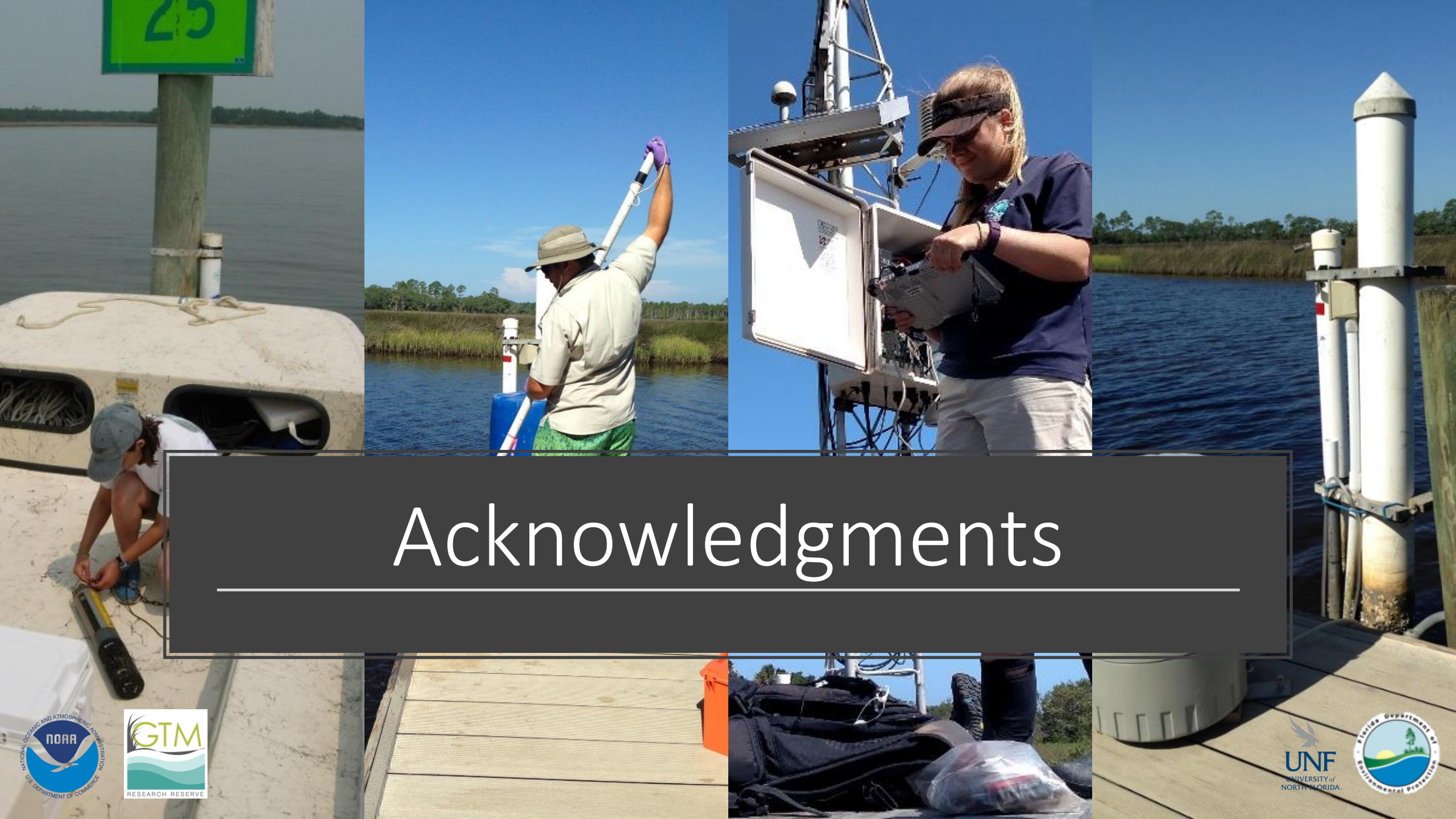




Storms are like *snowflakes*....

- Value of SWMP
- Next steps
 - › Stabilize and survey sondes so depth can contribute to **NHC** storm surge modeling
 - › **IOOS/NERRS**
 - › Developing R code and time series methods as a system





Acknowledgments





Questions? Contact me!



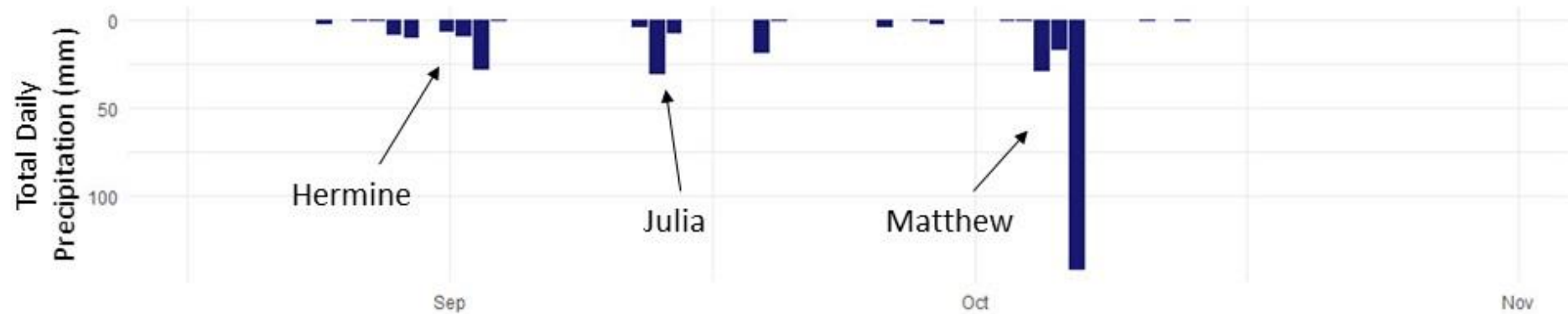
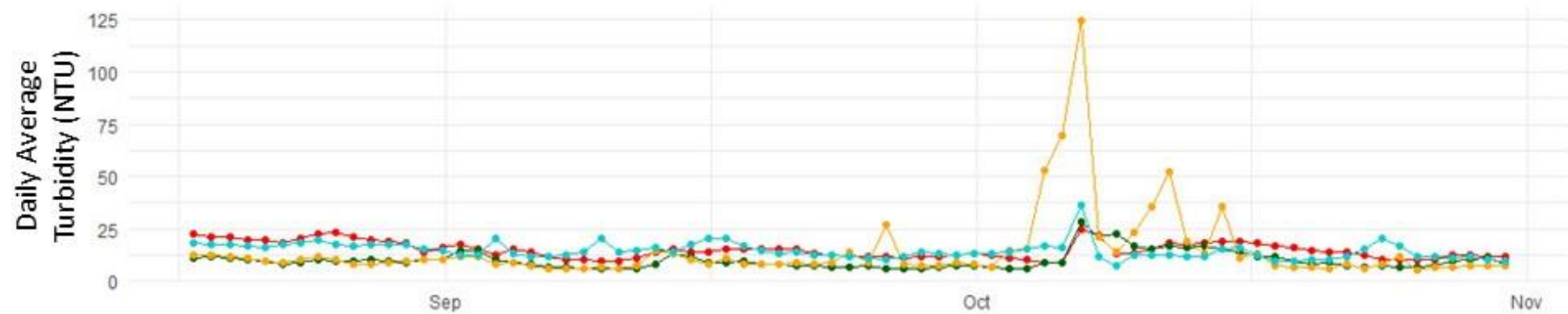
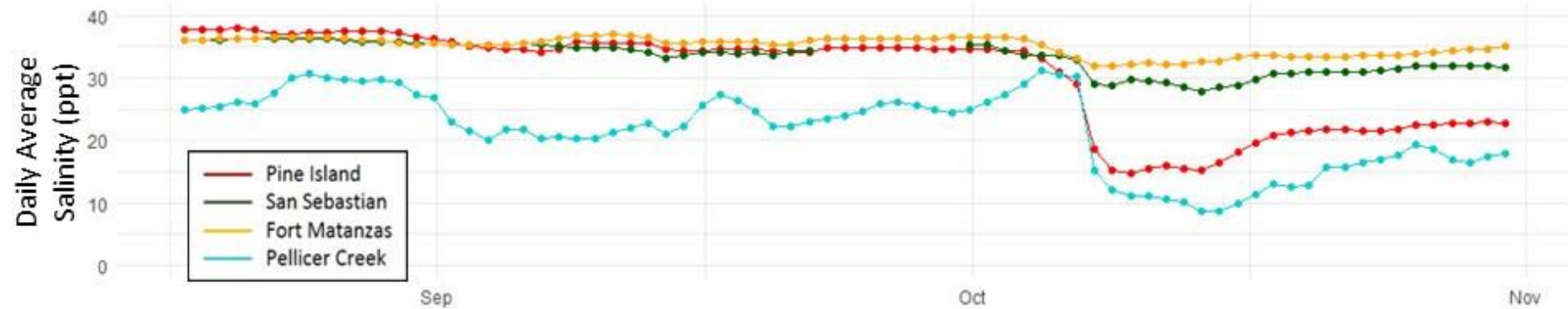
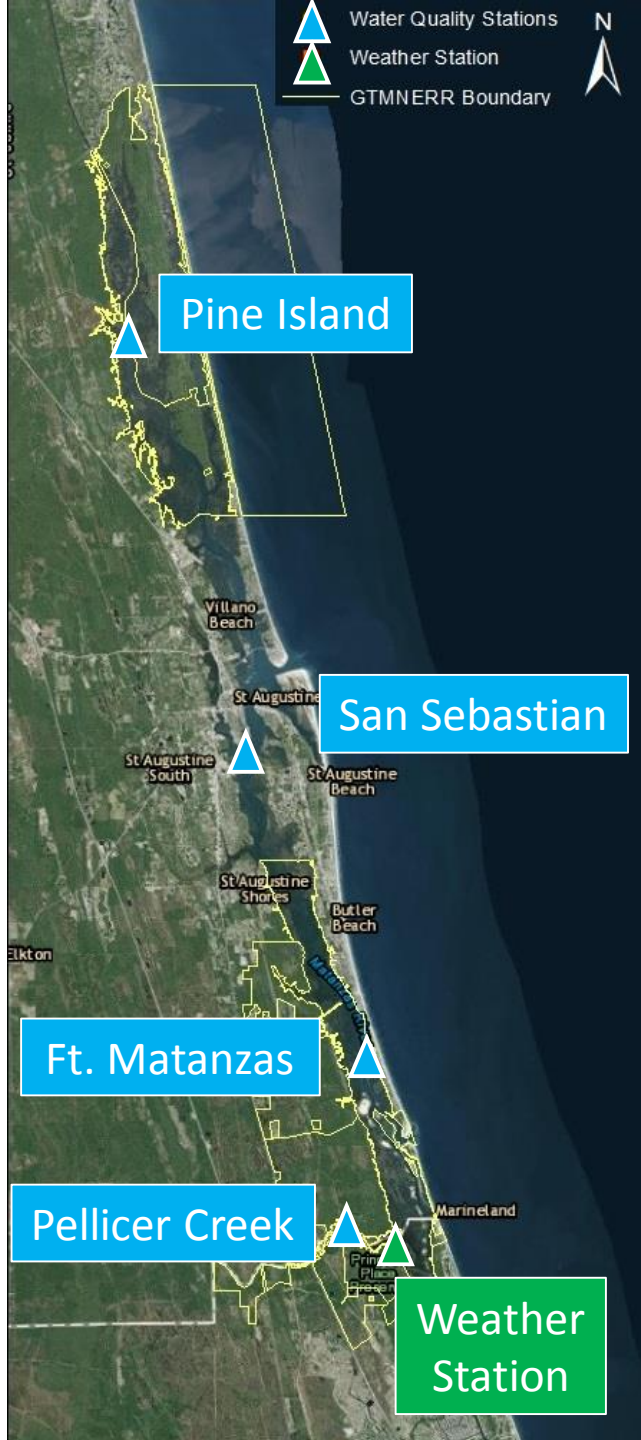
Shannon Dunnigan
SWMP Manager

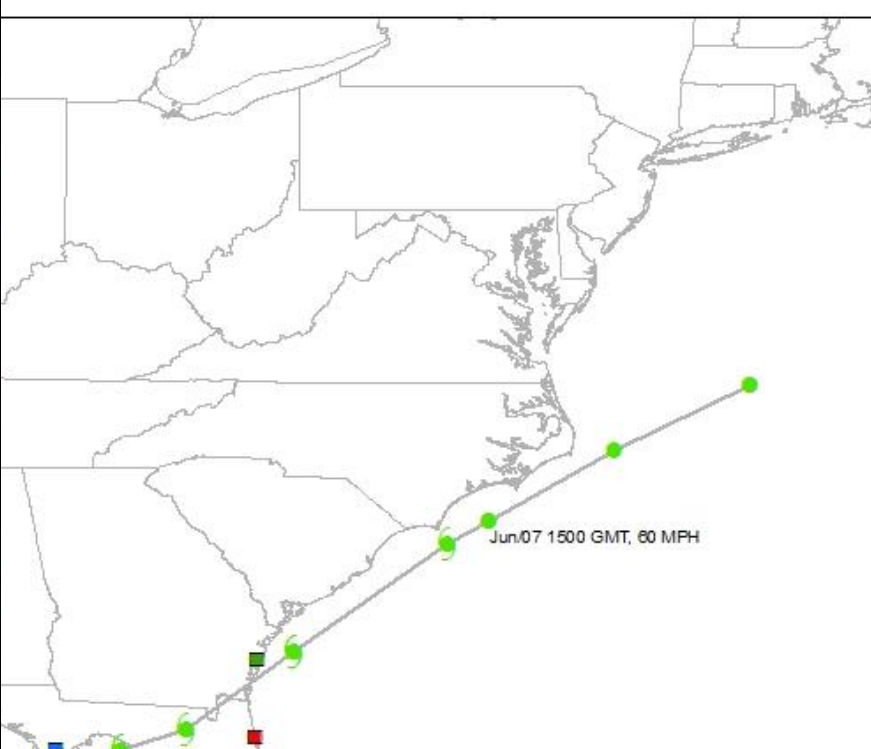
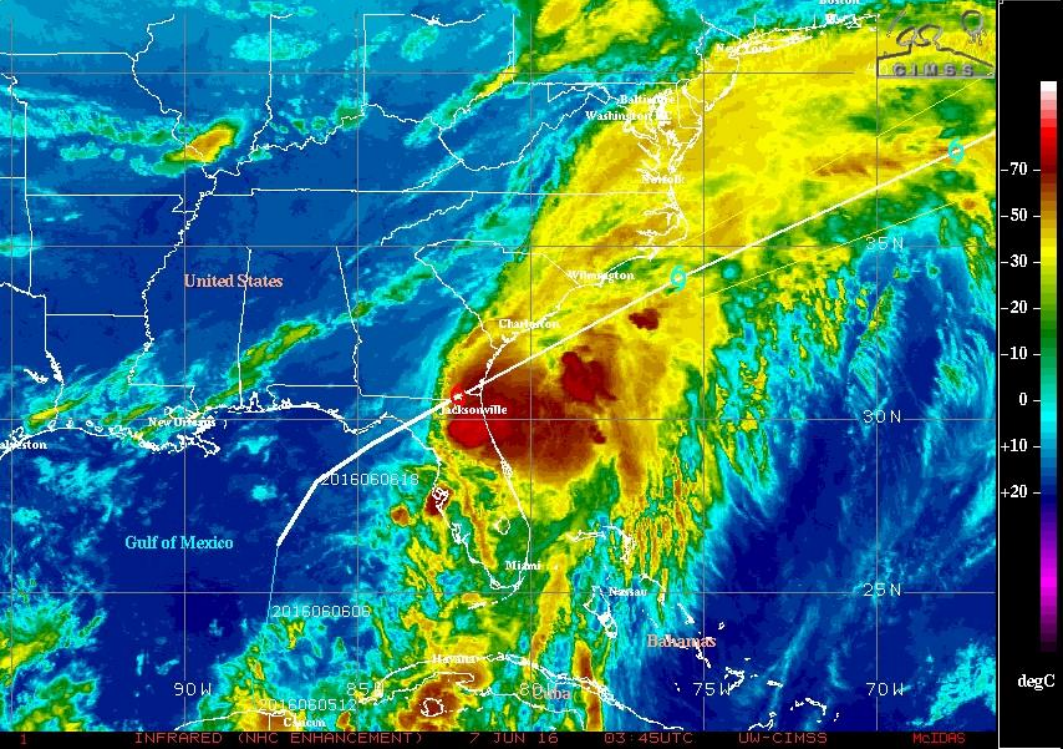
Phone:
904-823-4525

Email:

Shannon.Dunnigan@dep.state.fl.us

Check out our more in-depth piece on Hurricane Matthew within your program!





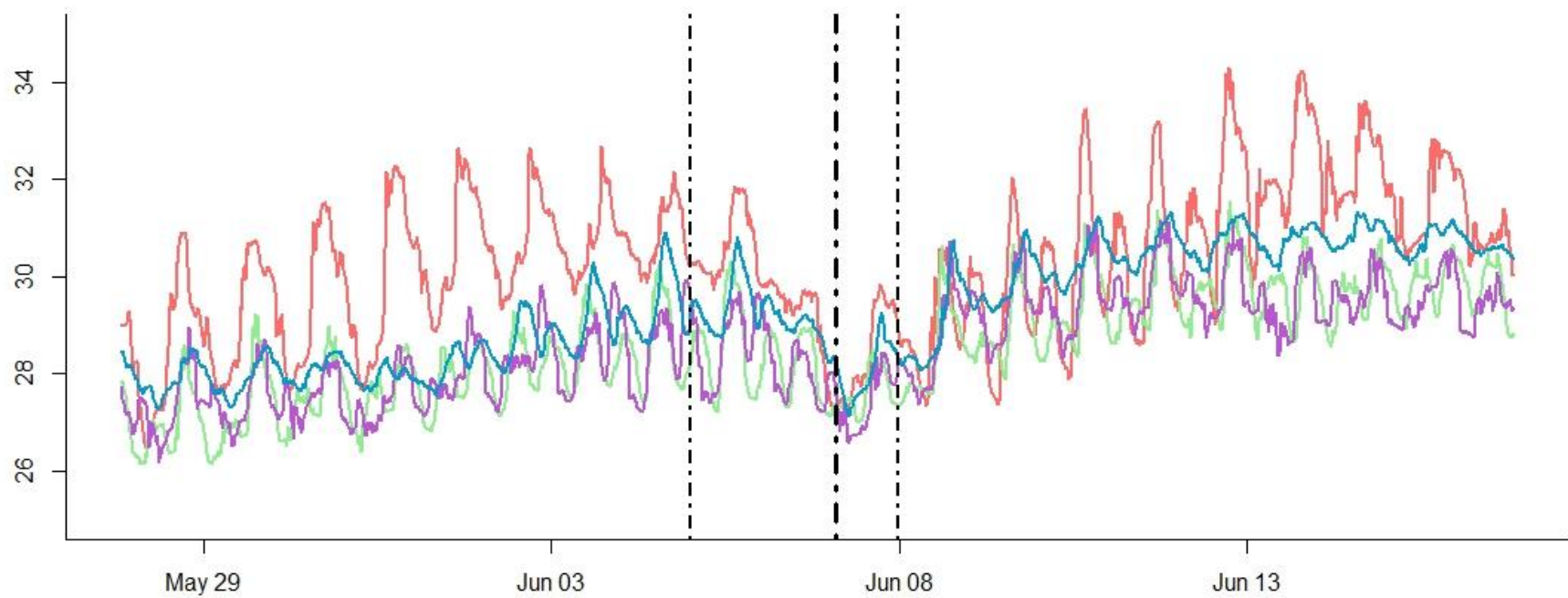
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- Apalachicola NERR
- Rookery Bay NERR
- GTM NERR

Tropical Storm Colin

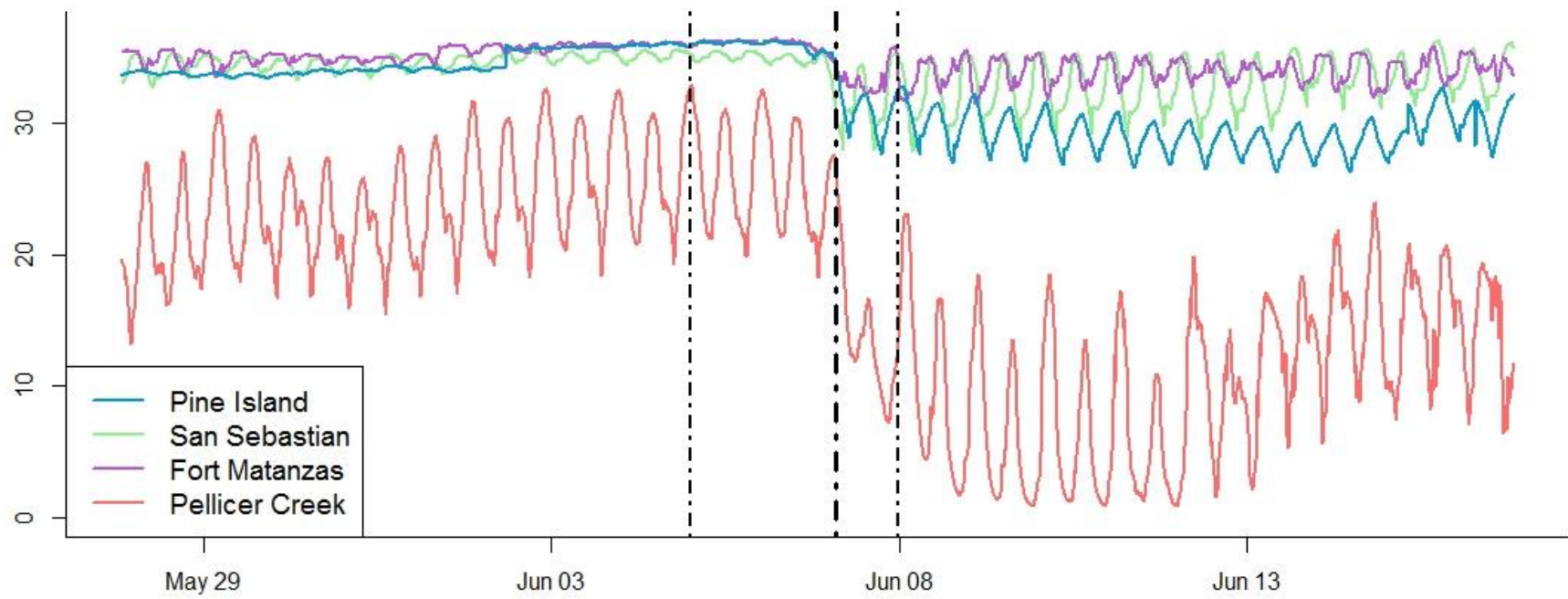
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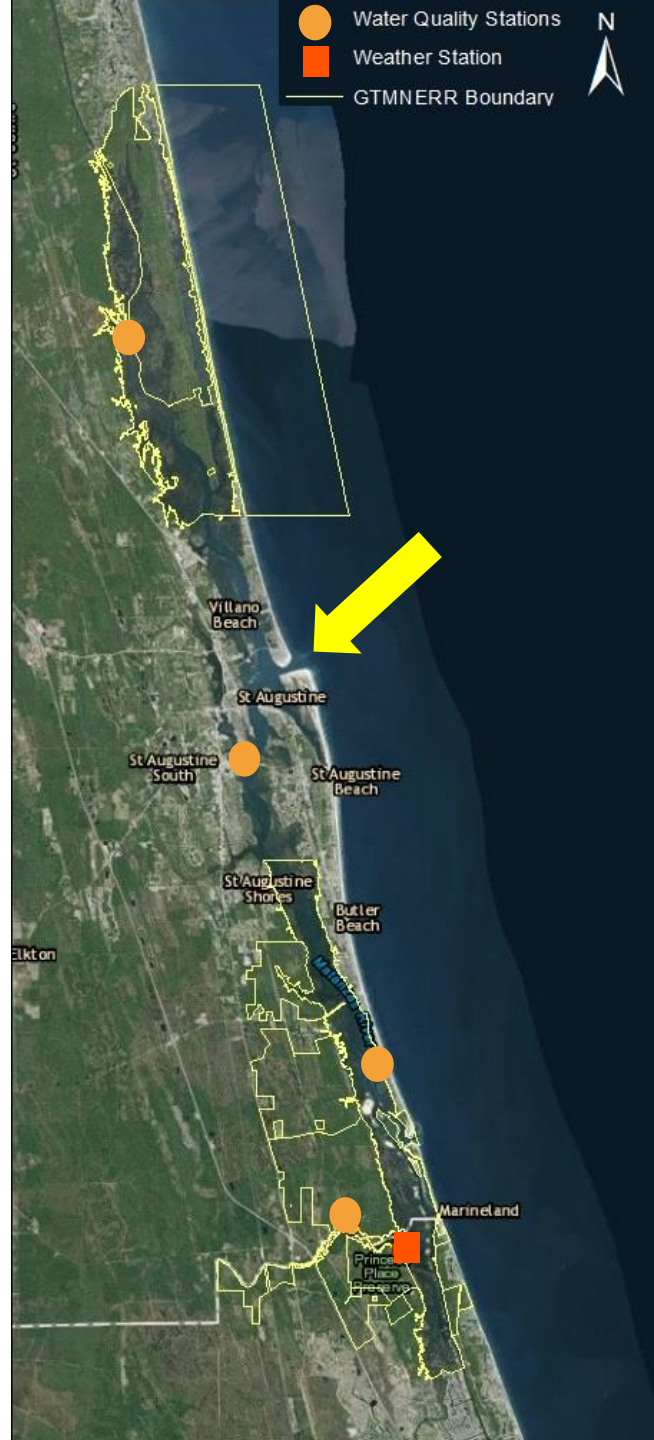
Temperature (°C)



Salinity (psu)



- Pine Island
- San Sebastian
- Fort Matanzas
- Pellicer Creek



September 6, 2014



October 13, 2016

