

HURRICANE MATTHEW

3

Category
(major hurricane)

7.5

Inches of Rain

65

Miles per hour
of Max Wind Gusts

6-7

Feet of Storm Surge
(max)*



Image Credit: Earth Observatory, NASA

200 km

Monitoring the Impact of Hurricane Matthew at "GTM NERR"



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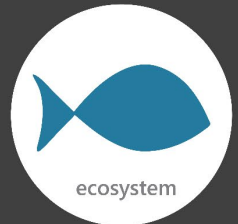
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On October 7th, the eye of Category 3 Hurricane Matthew came within 40 miles of St. Augustine at high tide and resulted in several record-breaking storm surge levels in the southeastern coastal United States. Storm surge flooding affected the St. Augustine area, including inundation levels of 6 to 7 feet above ground level in the vicinity of Matanzas Inlet.

The effects of Matthew were observed at the **Guana Tolomato Matanzas (GTM) Research Reserve** through the System-Wide Monitoring Program (SWMP), which tracks short-term variability and long-term change in weather and water quality in the areas surrounding St. Augustine and St. Johns County, Florida.

STORM
STORIES



NATIONAL
ESTUARINE
RESEARCH
RESERVE
SYSTEM



National Estuarine
Research Reserve System
Science Collaborative

Data shown are based on the GTM weather monitoring site
*USGS storm tide sensor data at Fort Matanzas Beach
Created on April 13, 2022

GTM

Guana Tolomato Matanzas (GTM) is one of 29 sites in the **National Estuarine Research Reserve Systems (NERRS)**. Each site is a state-federal partnership that combines research, monitoring, and education to advance the understanding and management of estuarine environments.



Locally Relevant, Nationally Significant

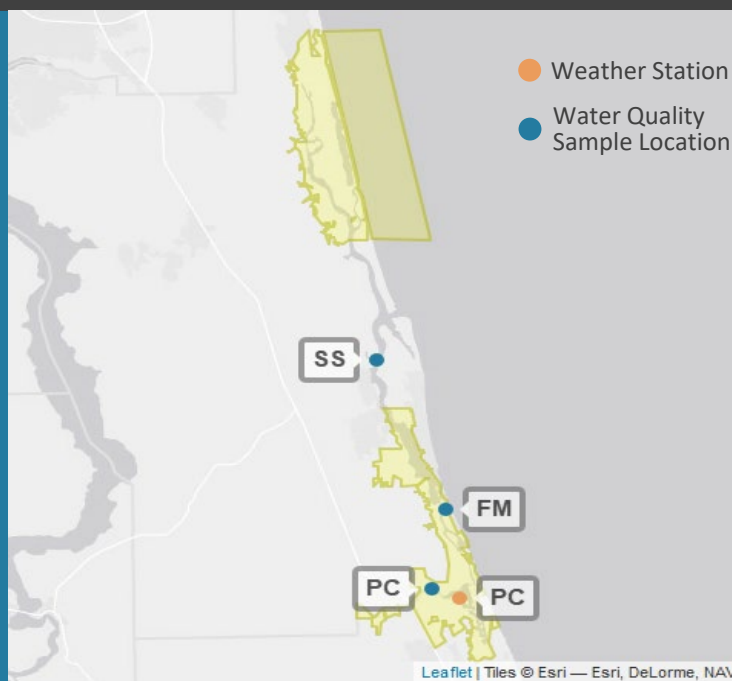
The **System Wide Monitoring Program (SWMP)** tracks weather and water quality as a storm happens and the impacts that follow. Scientific instruments (i.e., data sondes and sensors) are deployed at Reserves along the Atlantic and Gulf of Mexico coastal areas collecting data on the condition of our estuaries 24/7 to help protect people and places.

Data from the extensive monitoring network are delivered to the **Centralized Data Management Office (CDMO)**. Near real-time SWMP data are now available to via smartphone or tablet at: www.nerrsdata.org/mobile

GTM Storm Monitoring

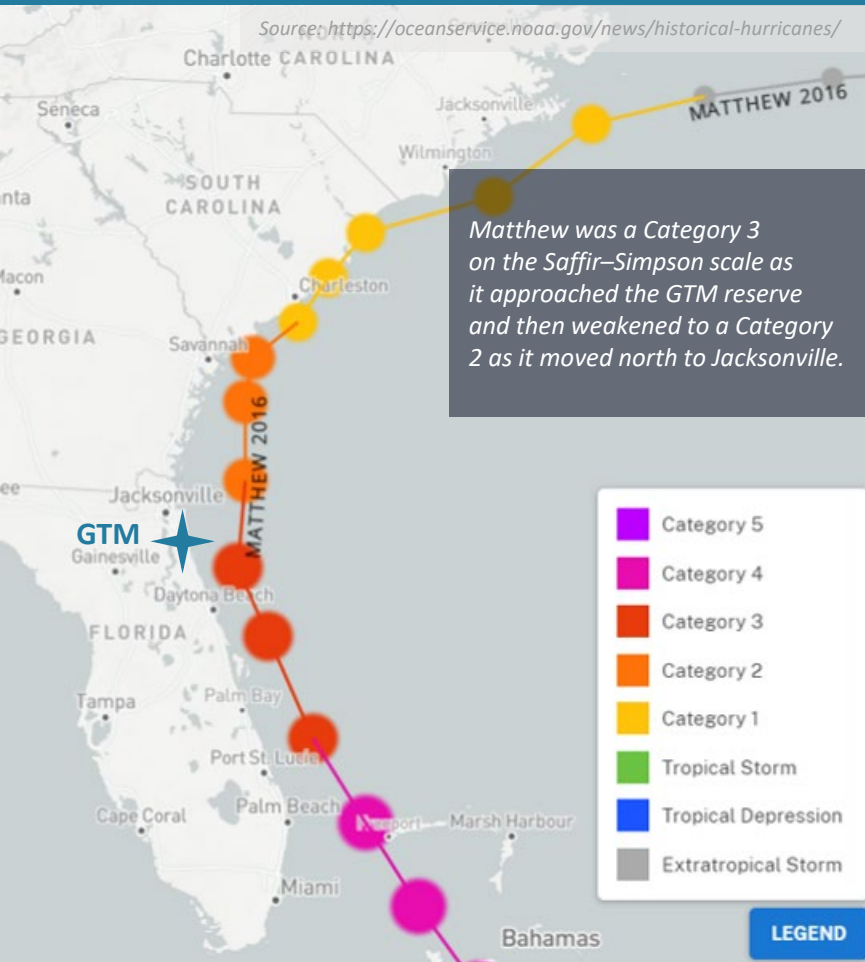
GTM NERR operates a weather station located at Pellicer Creek (PC) and maintains four continuous, long-term water quality stations at Pine Island (PI), San Sebastian (SS), Fort Matanzas (FM), and Pellicer Creek (PC) locations.

GTM NERR is part of the SWMP. As Hurricane Matthew approached Florida, GTM NERR monitored the weather and water quality, collecting data every 15 minutes for the following parameters: air temperature, relative humidity, atmospheric pressure, rainfall, wind speed and direction, water temperature, depth, salinity, dissolved oxygen, turbidity, and pH.



Storm Track

Matthew reached the coast of Haiti as a category 4 hurricane on Oct. 4. Matthew weakened to a category 3 hurricane on Oct. 7 about 35 n mi east of Vero Beach, Florida, and became a category 2 hurricane on Oct. 8 about 50 n mi east-northeast of Jacksonville Beach, Florida.



Event Impacts



Human Health & Safety

- More than 1.2 million customers lost electrical power across the state.
- Water heights up to 4 ft above ground level occurred in the city of St. Augustine, especially near the bayfront and the San Sebastian River.



Economic Losses

- NOAA NCEI estimates that wind and water damage totaled approximately \$10 billion, making Matthew the 10th most destructive hurricane to affect the United States.



Ecosystem Impacts

- Aquatic life, like oysters, crabs, shrimp, fish, phytoplankton, etc. rely on specific levels of salinity and dissolved oxygen to thrive and survive. The weather impacts from Matthew caused significant drops in the levels of salinity and dissolved oxygen for varying periods of time, potentially stressing organisms.



Weather Data

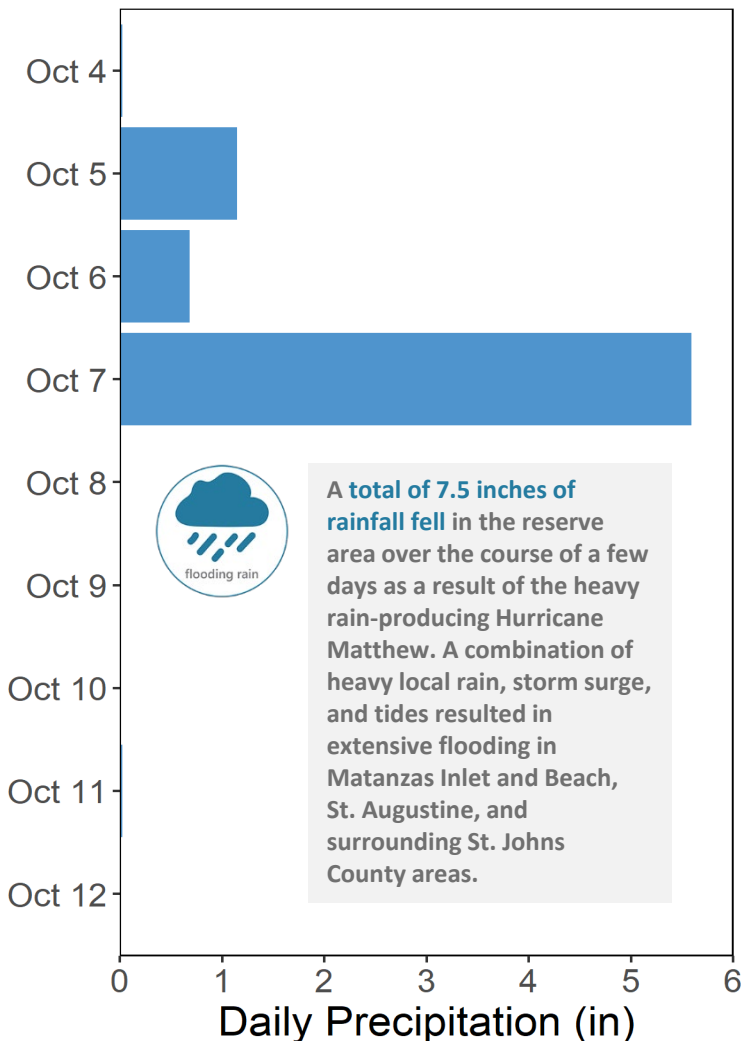
Station	Date	Total Precipitation (in)	Average Intensity Precipitation (in/hr)	Max Wind Speed (mph)	Average Wind Speed (mph)
Pellicer Creek	10/5/2016	0.96	0.040	23.0	15.5
Pellicer Creek	10/6/2016	0.78	0.032	30.0	19.4
Pellicer Creek	10/7/2016	5.60	0.233	64.6	38.7
Pellicer Creek	10/8/2016	0.11	0.005	31.5	17.8
Pellicer Creek	10/9/2016	0.00	0.000	21.9	12.3

The highest local rainfall and wind measurements were recorded when Matthew reached the Florida coast on Oct. 7.

Data reporting time periods for Hurricane Matthew: 10/5/2016 - 10/9/2016

RAINFALL

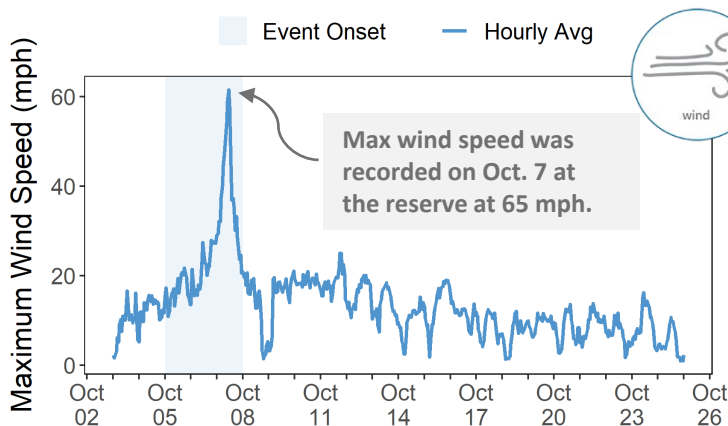
Pellicer Creek (PC)



Rainfall measurements at the weather station from Oct. 4 through Oct. 12.

WIND SPEED

Pellicer Creek (PC)



Maximum Wind Speed readings at the weather station from Oct. 3 through Oct. 25.

Matthew brought heavy rains, high winds, storm surge, and freshwater flooding to Florida.



Photo from the FL National Guard, taken in St. Augustine (St. Johns County) on October 9, 2016.



Torrential rains fell over east-central/northeastern Florida with 7.48 total inches of rainfall recorded at the Pellicer Creek weather station. The combined effect of storm surge and tide produced max inundation levels of 5-7 ft above ground level along the coasts of Flagler, St. Johns, and Duval Counties. USGS storm tide pressure sensors measured max inundations of 6-7 ft above ground level in the vicinity of Matanzas Inlet. The combination of storm surge and inland freshwater flooding caused by excessive rainfall resulted in damage to more than one million structures, forcing businesses from Florida to North Carolina to temporarily close.

The strongest winds were measured at Cape Canaveral with gusts of 104-107 mph. The max wind speed recorded at Pellicer Creek was 65 mph. Matthew's wind field caused structural damage to homes and businesses. Downed trees and utility lines caused massive power outages with more than 3.5 million customers from Florida to Virginia losing electrical power. Across the southeastern and eastern portions of the state, Matthew caused at least \$1.5 billion in property damage to 100,000 buildings, left 900,000 people without electrical power, and caused environmental problems.



Water Quality Data

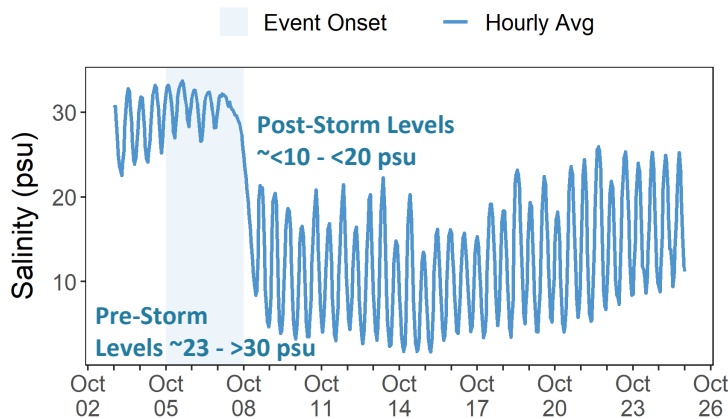
As Matthew traveled along the Florida coast on Oct. 8, both salinity levels and dissolved oxygen levels quickly dropped at Pellicer Creek.

Station	Date	Depth Maximum (ft)	Salinity Minimum (psu)	Salinity Maximum (psu)	Dissolved Oxygen Minimum (mg/L)	Dissolved Oxygen Maximum (mg/L)
Pellicer Creek	10/5/2016	7.02	25.0	33.8	3.7	6.2
Pellicer Creek	10/6/2016	7.41	26.0	32.6	3.1	6.0
Pellicer Creek	10/7/2016	9.88	27.7	32.2	3.5	6.4
Pellicer Creek	10/8/2016	8.99	8.1	29.1	1.3	5.7
Pellicer Creek	10/9/2016	6.86	3.8	20.6	0.1	3.1

Data reporting time periods for Hurricane Matthew: 10/5/2016 - 10/9/2016

SALINITY

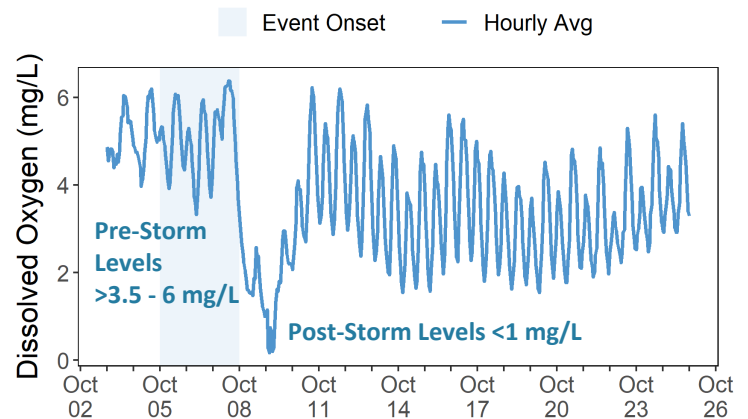
Pellicer Creek (PC)



Salinity levels from Oct. 3 through Oct. 25.

DISSOLVED OXYGEN

Pellicer Creek (PC)



Dissolved Oxygen levels from Oct. 3 through Oct. 25.

Salinity and dissolved oxygen levels recorded at Pellicer Creek show initial and post-storm impacts on water quality. Salinity levels quickly dropped as Matthew traveled along the Florida coast and remained at lower levels for more than a week after the hurricane had passed. Dissolved oxygen levels were impacted as well but the post-storm levels rebounded to pre-storm levels within a few short days.

Dramatic changes in salinity and lower levels of oxygen (<4 mg/L) can cause stress to some aquatic organisms depending on the species and how long the levels deviate from what is normal. Water quality stresses can impact survival and future populations.



Oyster reef in the Matanzas River south of St. Augustine, Florida.

About NERRS

Established in 1972, the NERRS is a network of 29 ecologically significant, locally treasured estuarine places in 23 states and Puerto Rico. Each Reserve is a partnership between NOAA and a state agency or university. Most of the 1.3+ million acres of estuary lands and waters that Reserves help to protect and steward are open to the public. Reserves work with local decision makers, states, universities, nonprofits, and others to set natural resource management priorities and address them through research, environmental monitoring, education, training, and stewardship.

The health of every reserve is continuously monitored by the System Wide Monitoring Program (SWMP). SWMP is a robust, long-term, and versatile monitoring program that uses the NERRS network to intensively study estuarine reference sites for evaluating ecosystem function and change. Reserve-generated data and information are available to local citizens and decision makers. For more information, go to: <https://coast.noaa.gov/nerrs/>



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DATA

Visit www.nerrsdata.org to view and download weather and water quality data from GTM NERR.



EXPLORE

Interested in learning more? Visit www.gtmnerr.org. For video, news updates, and online storm data and prediction visualization tools, check out our Storm Story Map at www.stormstorymap.url.



National Estuarine Research Reserves Protect People & Places

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Connect with us!

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