

HURRICANE MARIA

4

Category
(catastrophic)

6.9

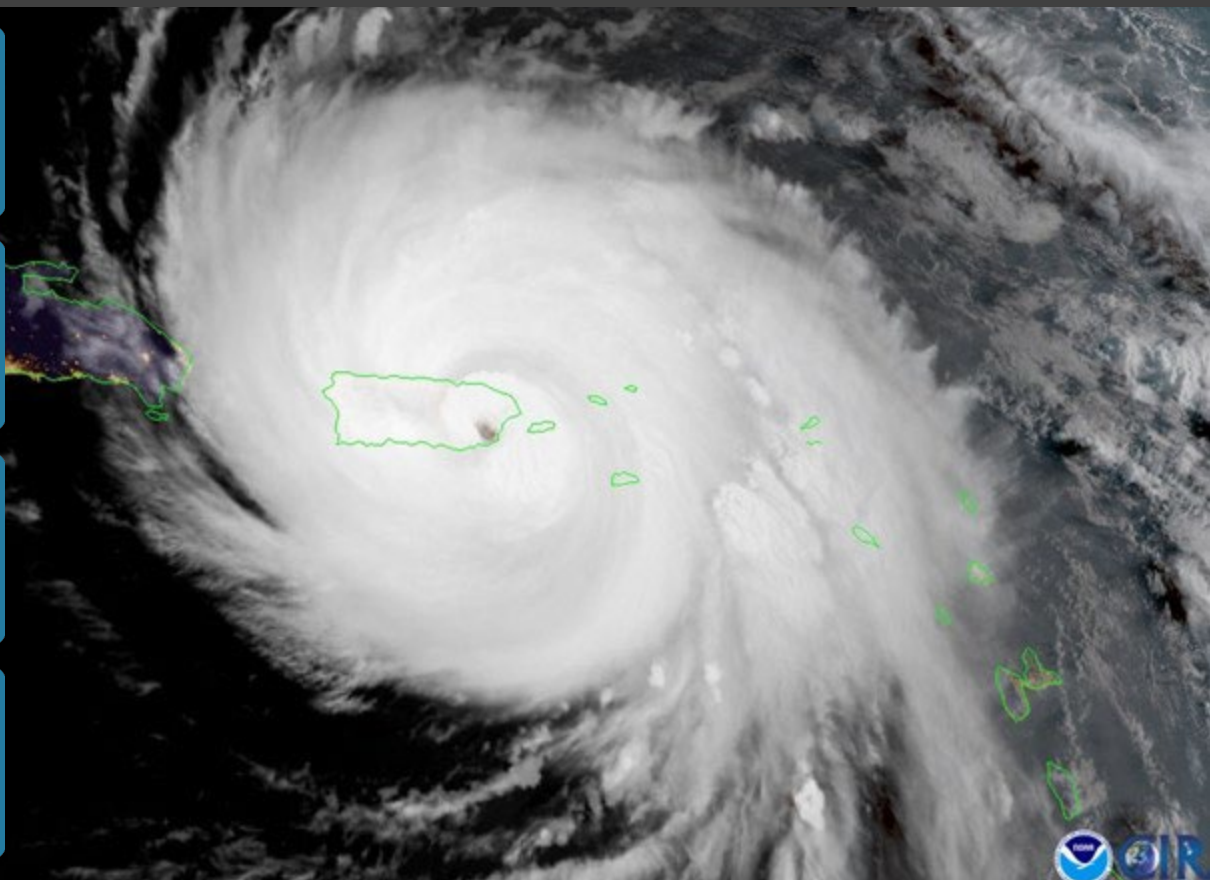
Inches of Rain

63.3

Miles per hour
of Max Wind Speed

3.8

Feet of Storm Tide*



Monitoring the Impact of Hurricane Maria at "Jobos Bay NERR"



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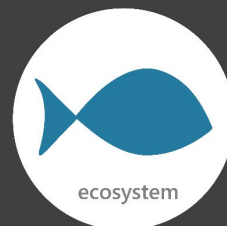
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Hurricane Maria was a very severe storm that ravaged islands in the Caribbean Sea. After devastating the island of Dominica as a category 5 hurricane, it reached Puerto Rico with intensities near the high-end of category 4. Extreme winds and massive floods destroyed much of Puerto Rico. NOAA estimates Maria caused around \$90 billion in damages in Puerto Rico and the U.S. Virgin Islands, making it the 3rd costliest hurricane in U.S. history.

The effects of Maria were observed at the **Jobos Bay NERR (JBNERR) Research Reserve** through the System-Wide Monitoring Program (SWMP), which tracks short-term variability and long-term change of weather and water quality in the areas surrounding the southern coast of Puerto Rico.

STORM
STORIES



NATIONAL
ESTUARINE
RESEARCH
RESERVE
SYSTEM



National Estuarine
Research Reserve System
Science Collaborative

Data shown are based on the JBNERR weather monitoring site

*USGS Storm Tide Sensor at Jobos Bay

Created on May 17, 2022

JBNERR

Jobos Bay NERR (JBNERR) 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

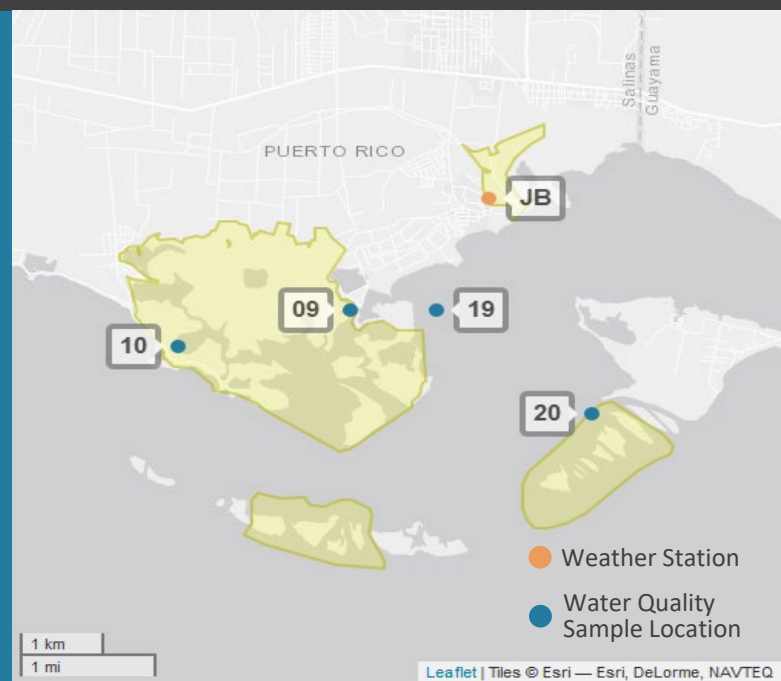
The **System Wide Monitoring Program (SWMP)** tracks weather and water quality as a storm happens and the impacts that follow. Scientific instruments (i.e., data sondes and sensors) are deployed at Reserves along the Atlantic and Gulf of Mexico coastal areas collecting data on the condition of our estuaries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

JBNERR Storm Monitoring

JBNERR operates a weather station located at Jobos Bay (JB) and maintains four continuous, long-term water quality stations including Station 9, Station 10, Station 19, and Station 20.

JBNERR is part of the SWMP. As Hurricane Maria approached Puerto Rico, JBNERR 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

Maria strengthened extremely rapidly as it neared Dominica and became a category 5 hurricane. Maria made landfall on the island on Sept. 19. It continued moving and reached peak intensity 25 n mi south of St. Croix on Sept. 20. Afterwards, Maria made it to Puerto Rico as a category 4 hurricane later that same day.

Source: <https://oceanservice.noaa.gov/news/historical-hurricanes/>



Event Impacts



Human Health & Safety

- Puerto Rico experienced devastating winds and storm surges that resulted in record flooding. Hundreds of families had to be rescued from their rooftops. Essentially all of the island's 3.4 million residents lost power. Practically all cell phone service was lost and municipal water supplies were knocked out.



Economic Losses

- Buildings, homes, and roads along the east and southeast coasts were destroyed. Marinas and harbors were severely damaged due to storm surge. Maria knocked down 80 percent of Puerto Rico's utility poles and all transmission lines.



Ecosystem Impacts

- Aquatic life (i.e., oysters, crabs, fish, aquatic plants, phytoplankton) rely on specific levels of salinity and dissolved oxygen to thrive and survive. The water quality in the reserve was impacted by Maria with significant drops in salinity levels and dramatic changes to the typical diurnal variation of dissolved oxygen. These shifts potentially stressed organisms in the area.



Weather Data

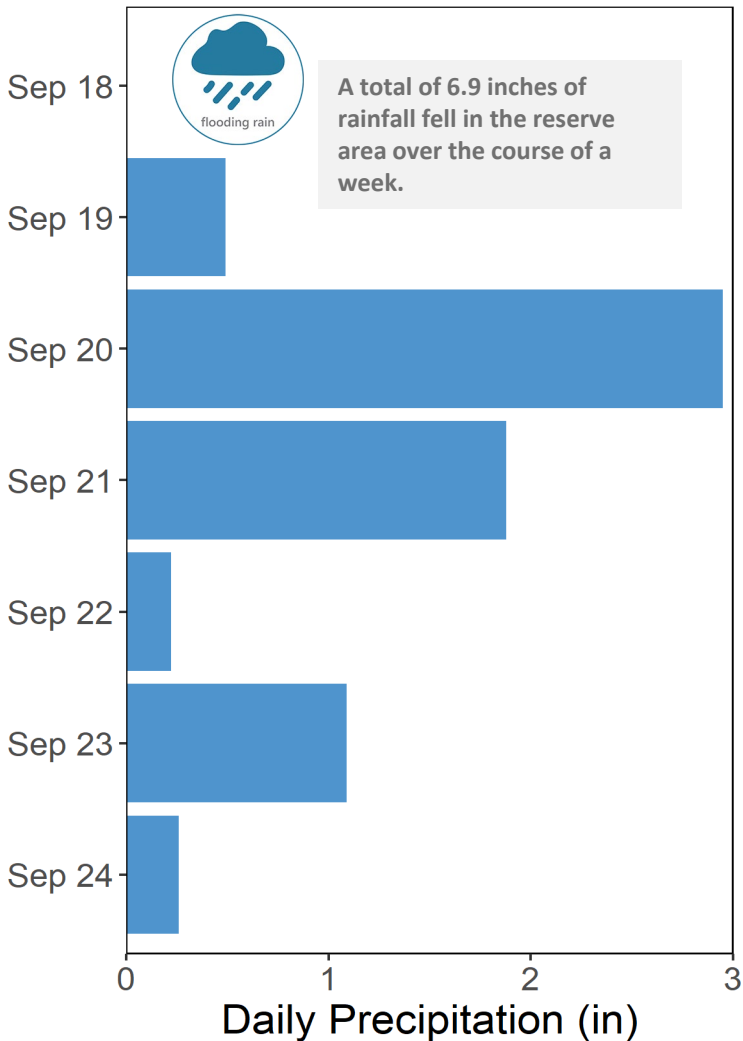
Station	Date	Rainfall Total (in)	Barometric Pressure Average (mB)	Wind Speed Max (mph)	Wind Speed Average (mph)
Jobos Bay Weather	9/19/2017	0.38	29.8	21.0	6.6
Jobos Bay Weather	9/20/2017	3.00	29.3	63.3	33.9
Jobos Bay Weather	9/21/2017	1.89	29.7	31.8	20.5
Jobos Bay Weather	9/22/2017	0.21	29.8	21.3	15.0
Jobos Bay Weather	9/23/2017	1.14	29.8	22.1	10.1

The highest local rainfall and wind measurements were recorded when Maria made landfall and crossed the island on Sept. 20.

Data reporting time periods for Hurricane Maria: 9/19/2017 - 9/23/2017

RAINFALL

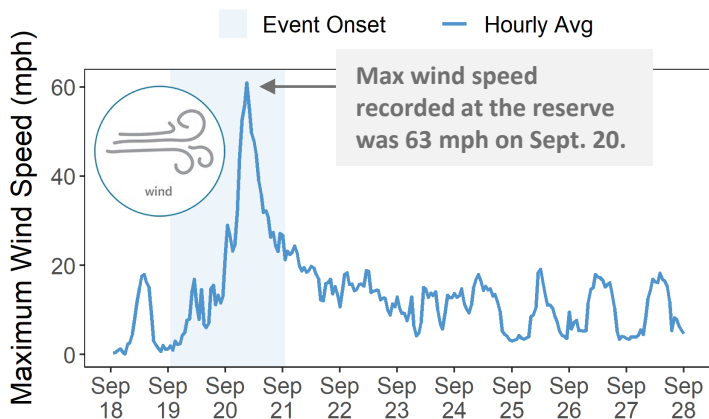
Jobos Bay Weather (JB)



Rainfall measurements at the Jobos Bay weather station from Sept. 18 through Sept. 24.

WIND SPEED

Jobos Bay Weather (JB)



Maximum Wind Speed readings at the Jobos Bay weather station from Sept. 18 through Sept. 28.



Impacts to Puerto Rico from Hurricane Maria resulted in property damage, street flooding, power outages, and mud slides. Heavy rains fell over Puerto Rico with 6.9 total inches of rainfall recorded at the Jobos Bay weather station. In areas along the northeastern and southeastern coasts of Puerto Rico, maximum inundation levels of 3 to 5 ft above ground level occurred. The USGS Storm Tide Sensor in Jobos Bay recorded a storm tide of 3.84 ft. The maximum wind speed recorded at Jobos Bay weather station was 63.3 mph.

Maria is the strongest hurricane to make landfall in Puerto Rico since a category 5 hurricane in 1928 (known as Segundo San Felipe). When Maria's center crossed the southeast coast of Puerto Rico, the hurricane's maximum winds were near 135 kt which is just below the threshold of category 5. Despite Maria's designation as a category 4 hurricane as it crossed the island, winds of category 5 intensity were almost certainly felt at some elevated locations on the island.



Water Quality Data

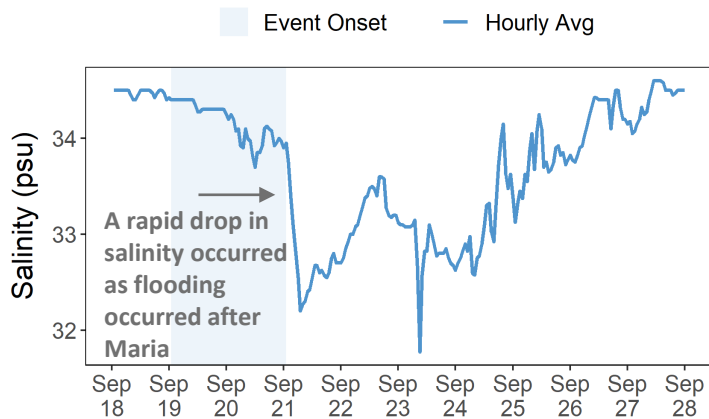
At Station 20, a dramatic spike in turbidity occurred on Sept. 20. Salinity levels gradually began dropping at the onset of Maria and experienced a rapid decline on Sept 21 after Maria had passed the island.

Station	Date	Turbidity Maximum (ft)	Salinity Minimum (psu)	Salinity Maximum (psu)	Dissolved Oxygen Minimum (mg/L)	Dissolved Oxygen Maximum (mg/L)
Station 20	9/19/2017	29	34.2	34.5	5.0	7.2
Station 20	9/20/2017	725	33.7	34.3	5.8	6.2
Station 20	9/21/2017	97	32.2	34.0	6.0	6.6
Station 20	9/22/2017	14	32.6	33.6	5.7	6.9
Station 20	9/23/2017	9	31.3	33.2	5.6	7.9

Data reporting time periods for Hurricane Maria: 9/19/2017 - 9/23/2017

SALINITY

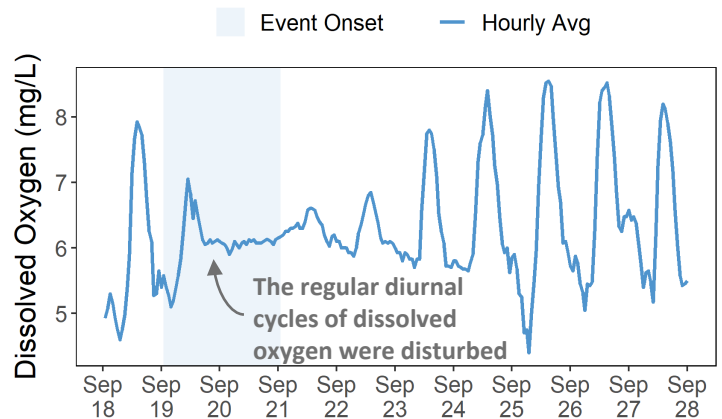
Station 20 (20)



Salinity levels from Sept. 18 to Sept. 28.

DISSOLVED OXYGEN

Station 20 (20)



Dissolved oxygen levels from Sept. 18 to Sept. 28.

Salinity and Dissolved Oxygen levels that were recorded at the Jobos Bay NERR Station 20 show initial and post-storm impacts on water quality in this area. Salinity levels gradually dropped at the onset of the storm, and then quickly declined once Maria had passed the island. Recovery was gradual as the area experienced extreme flooding. Dissolved oxygen levels were impacted as well, and the impacts could be seen earlier at the onset of the storm. The regular diurnal cycle was compressed, and levels stayed in a lower range (< 1 mg/L) during the flooding. Dramatic changes in salinity and lower levels of oxygen 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.



Every plant and animal species have habitat preferences and requirements. Understanding these habitats is critical to understanding populations.

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 Jobos Bay NERR.



EXPLORE

Interested in learning more? Visit <https://www.drna.pr.gov/jbnerr/>. For video, news updates, online storm data and prediction visualization tools, check out our Storm Story Map at www.stormstorymap.url.



National Estuarine Research Reserves Protect People & Places

This work is/was sponsored by the National Estuarine Research Reserve System Science Collaborative, which supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is funded by the National Oceanic and Atmospheric Administration and managed by the University of Michigan Water Center (NA19NOS4190058).

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