Glider Observations Improve Hurricane Forecasts
NOAA's Atlantic Oceanographic and Meteorological Laboratory

Underwater gliders are recovered in the waters of Puerto Rico, October 2020. Image Credit: NOAA/CIMAS/CARICOOS.

NOAA Research Improves Models and Forecasts

Scientists and engineers from NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) have annually operated underwater gliders to monitor ocean conditions during every hurricane season since 2014, surveying ocean conditions in over 20 Atlantic hurricanes. Researchers at AOML have worked with many partners to operate these autonomous vehicles. These partners include the University of Miami, US Navy, US IOOS (Integrated Ocean Observing System) Regional Associations in the Caribbean Sea (CARICOOS), Southeast US (SECOORA), and Gulf of Mexico (GCOOS), Mid-Atlantic Regional Association Coastal Ocean Observing System (MARACOOS), the National Maritime Affairs Authority (ANAMAR) of the Dominican Republic, Rutgers University, the University of Puerto Rico-Mayaguez, the University of the Virgin Islands, and Cape Eleuthera Institute (Bahamas).

The observations obtained from underwater gliders allow ocean conditions to be more accurately represented in ocean models. Because of the strong interaction between the ocean and atmosphere during the passage of a hurricane, improved representation of the ocean in hurricane forecast models has been shown to lead to more accurate hurricane intensity forecasts. Studies led by AOML, together with scientists from NOAA's National Weather Service, IOOS, and academic institutions, have shown that underwater glider data have the greatest impact in improving hurricane intensity forecasts of all ocean observing platforms. These gliders provide high-volume, high-resolution data in areas where hurricanes frequently travel and intensify or weaken, but where there may traditionally be a scarcity of ocean observations.

GLIDERS IMPROVE INTENSITY FORECASTS

25,000+
Temperature, salinity, and dissolved oxygen profiles collected by gliders each year

20+
Hurricanes surveyed by Underwater Gliders

+95%
Of upper ocean field observations for hurricane forecasts

Underwater Robots Explore the Upper Ocean to Improve Hurricane Intensity Forecasts

NOAA's Atlantic Oceanographic and Meteorological Laboratory deploys underwater gliders that gather data to increase the accuracy of hurricane intensity forecast models. These autonomous uncrewed vehicles are equipped with sensors to measure salinity, temperature, and other physical, chemical, and environmental parameters as they travel through the ocean.

For the 2021 hurricane season, scientists at AOML and their partners will launch and operate approximately ten glider missions from ships off the coasts of Puerto Rico, Dominican Republic, Bahamas, and the Southeast US, with more gliders launched by partners in the Mid-Atlantic Bight and Gulf of Mexico regions.

These battery-powered, remotely-piloted gliders are operated for up to four months and then recovered. They can operate and transmit data under hurricane wind conditions. Upon reaching the ocean surface, the data are transmitted via satellite for immediate use in scientific analysis and hurricane forecast models.

NOAA's Atlantic Oceanographic and Meteorological Laboratory
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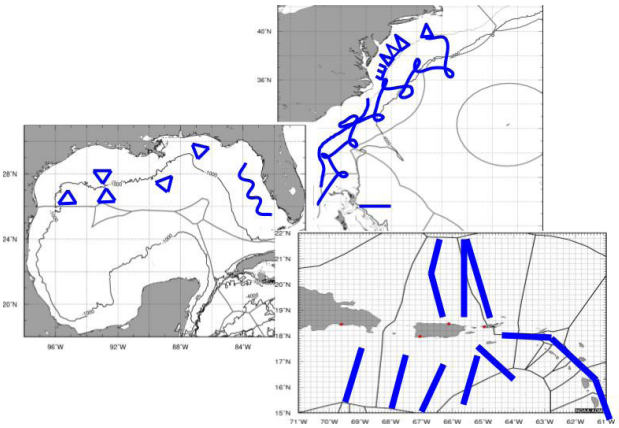
For additional information: www.aoml.noaa.gov/hurricane-glider-project/

Glider Deployments Occur in Areas Where Hurricanes are Frequent

The maps below show the locations where glider operations in 2021 will be carried out by NOAA and its partners to record temperature and salinity data at the sea surface down to a half mile depth. Once launched, the gliders make regular dives along set courses, surfacing several times a day to send their data via satellite to be used in hurricane forecast models.

The locations surveyed by the gliders are characterized by the presence of ocean features, such as warm rings and eddies, warm currents, warm surface waters of riverine origin, and subsurface cold waters, all of which have been linked to changes in hurricane intensity.



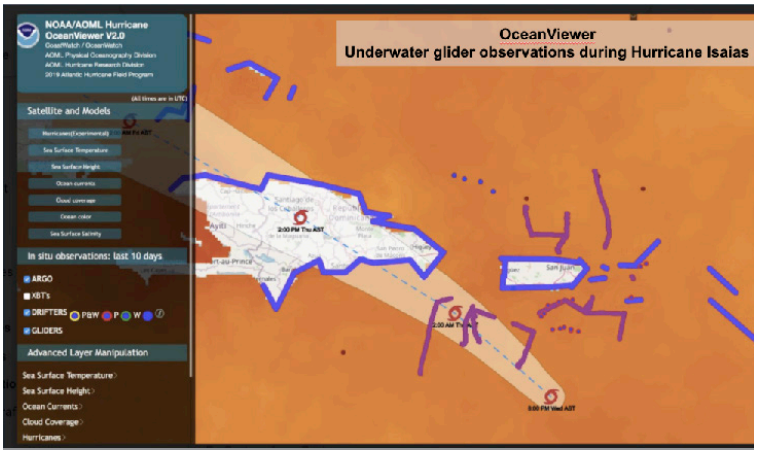
The 2021 Observational Plan for the Underwater Gliders
Image Credit: NOAA/AOML

Sea surface temperature and salinity provide important information about the intensity of a hurricane. As a hurricane passes by overhead, warmer surface water is mixed with cooler water below the surface, reducing the energy available to fuel the passing storm. However, if there is a layer of fresher, warmer water of riverine origin at the surface, it can serve as a cap that prevents mixing of ocean waters and keeps heat energy at the ocean's surface, continuing to fuel the passing storm that, therefore, may gain strength. Knowing if a storm will pass over predominantly warm water or areas where cold water may be stirred up from below helps scientists and forecasters better predict whether a storm will intensify or weaken as it travels. The observations obtained from gliders allow these features to be better identified, monitored, and be represented more accurately in the ocean component of hurricane forecast models.

AOML will deploy 8 NOAA gliders and 1 US Navy glider in 2021 to transmit ocean profile data in real-time for assimilation into ocean and ocean-atmosphere forecast models. The autonomous characteristics of these vehicles and the strong collaborations in place with regional, academic, and governmental partners have been key to the success of the project. In addition, AOML is partnering with the National Weather Service to assess the impact of underwater glider and other ocean data on NOAA's new generation of hurricane models.

Ocean Observations Viewer Displays Recent Ocean Conditions

AOML and NOAA CoastWatch host NOAA's Ocean Observations Viewer, which is used as an interface for tropical cyclone research and operations. The interactive maps enable researchers to monitor ocean conditions and NOAA to plan its field operations by providing a user friendly interface with easy access to global and regional ocean-atmospheric observations and products. Researchers at AOML also use these maps to assess ocean and atmospheric conditions prior to, during, and after the passage of a tropical cyclone. The large set of targeted ocean observations featured in this product, including ocean gliders, drifters, and floats, will enable AOML to better monitor ocean conditions in support of hurricane forecasts during 2021. As glider deployments are made throughout hurricane season, the data will become available for viewing on this site.



For a view of ocean conditions that can inform hurricane forecasts, visit: https://cwcgom.aoml.noaa.gov/cgom/OceanViewer/index_hrd.html

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