Study targets warm water rings that fuel hurricane intensification in the Caribbean Sea

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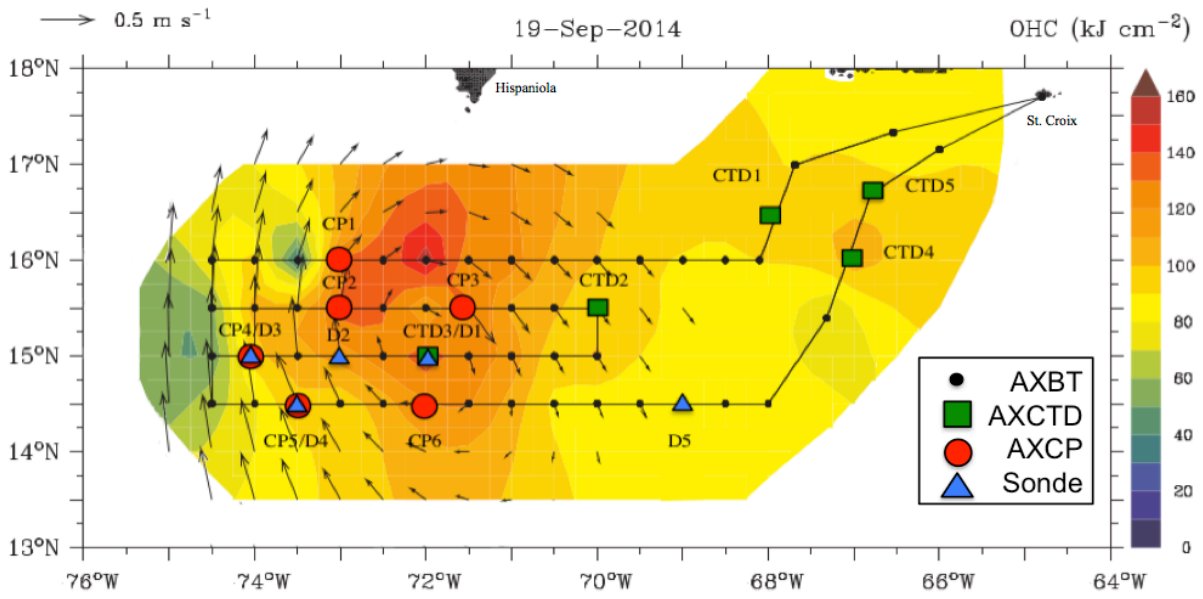

Ocean survey flight path and instrument deployment points over shaded ocean heat content (OHC) that was calculated from survey data. High areas of OHC indicate warm, deep water. Vectors indicate observed surface currents. Black line indicates flight path. Black circles indicate Airborne eXpendable BathyThermographs (AXBT). Names of specific instruments are indicated as follows: CP for Airborne eXpendable Current Profilers (AXCP), CTD for Aircraft eXpendable Current-Temperature-Depth (AXCTD) profilers, and D for dropwindsondes (lower atmospheric profilers). Two names and symbols indicate two instruments were dropped at that same location. Credit: Rudzin, Jaimes, et.al.

Last year's devastating category-5 hurricane—Matthew—may be one of many past examples of a tropical storm fueled by massive rings of warm water that exist in the upper reaches of the Caribbean Sea.

In a study conducted in the region two years prior to when Matthew's trekked across the Caribbean Sea, the research team in the Upper Ocean Dynamics Laboratory at the University of Miami (UM) Rosenstiel School of Marine and Atmospheric Science deployed 55 aircraft ocean instruments from the National Oceanographic Atmospheric Administration's WP-3D aircraft. The purpose of the scientific mission was to measure ocean temperature, salinity, and currents to understand the structure of these warm-water eddies.

The science team obtained vital information about the physical characteristics within one large warm-water eddy, which likely originated from the North Brazil Current, and analyzed its potential influence on sub-surface ocean conditions during the passage of tropical cyclones.

When analyzing the data, they found a barrier layer, an upper ocean feature created by the Amazon-Orinoco freshwater river outflow, that makes mixing in the upper ocean waters less efficient during wind events. This feature, and the fact that warm ocean eddies are known to assist in the intensification of hurricanes due to deep warm thermal layers, lead the researchers to theorize that the barrier layer within a warm ocean eddy may result in an even more favorable upper ocean environment for hurricane intensification.

"Our study is important because tropical cyclone intensity forecasts for several past hurricanes over the Caribbean Sea have under-predicted rapid intensification events over warm oceanic features," said Johna

Rudzin, a PhD student at the UM Rosenstiel School and lead author of the study.


AXC
16
12/12
R13-01
R14

UM Rosenstiel School Ph.D. candidate Johna Rudzin is staging ocean instruments for deployment in the WP-3D NOAA Aircraft, Sept. 19, 2014. Credit: Credit: Benjamin Jaimes, Ph.D., UM Rosenstiel School of Marine and Atmospheric Science

Tropical storms receive energy from their surrounding ocean waters. As a storm moves across the water, it may interact with rings of warm water known as eddies. As the storm moves forward over these eddies, the warm ocean waters below help fuel the storm's intensity through enhanced and sustained heat and moisture fluxes.

Similar warm ocean eddies exist in the Gulf of Mexico, a result of their separation from the warm-water Loop Current, are also of interest to the research team involved in this study.

Last year, Hurricane Matthew rapidly intensified from a tropical storm to hurricane status as it moved over the Caribbean Sea in the location where a warm ocean eddy exists, and in close proximity to where these measurements were taken for this study two years prior. Matthew continued to intensify to a category-5 storm and into one of the strongest in Atlantic basin history, which made landfall and devastated portions of Haiti, Cuba, and the eastern United States.

According to the researchers, to better understand if Matthew's intensification was aided by the warm-water eddies and the residing barrier layer in the Caribbean Sea's upper ocean, more ambient and in-storm upper ocean observations in this basin are needed to improve forecast models for the region.

More information: J. E. Rudzin et al, Upper ocean observations in eastern Caribbean Sea reveal barrier layer within a warm core eddy,

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