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Deep, warm eddies seen holding clues to hurricane winds

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Sometime this summer in the Gulf of Mexico, a hurricane could suddenly, dramatically raise its wind speed — by 20 or 30 mph overnight — but forecasters will see it coming. They never did before.

Some "ifs" are attached to that scenario but, if it is right, landfall-target populations will have more time than before to prepare for the worst.

The reason: a recurring deep eddy of warm water that University of Miami and government scientists believe caused the surprise intensification of 1995 Hurricane Opal, which devastated Pensacola Beach. This August, they plan to drop deep-sea temperature probes into the eddy from an airplane to confirm what they have learned by analyzing satellite data.

"One of these eddies snaps off from the Loop Current in the Gulf roughly every 11 to 14 months," says Nick Shay, an oceanographer at the UM's Rosenstiel School of Marine and Atmospheric Science.

The warm-water Loop Current traces a wide curve in the Gulf, north of Cuba and west of the Florida Keys. When it grows big enough, a piece about 140 miles wide separates. It doesn't always coincide with hurricane season, but one is growing out there now.

"It will break off in another month," says Peter Black, a wind expert at the NOAA hurricane research division on Miami's Virginia Key. "It will move slowly west, four kilometers (2½ miles) a day on average."

If a hurricane crosses that thing, it's going to grow fast and nasty, the scientists believe.

It would be almost certain to hit something, too. The Gulf is virtually surrounded by land. A hurricane there is never more than about 500 miles from the nearest shore.

Forecasting wind force

Hurricane forecasting skill has improved immensely in the past five years, especially when it comes to direction. But the ability to forecast significant changes in wind power is something else. "It's virtually nonexistent," National Hurricane Center Director Jerry Jarrell says.

He is not convinced that Shay, Black and other researchers are solving that problem, but their evidence looks compelling enough to include in this season's forecasts: "Just for defensive purposes if nothing else, because we're so uncertain about intensity forecasts."

Not very confidently, forecasters predict gradual wind-speed growth based on sea surface temperatures. They have known for many years that surface heat is high-energy fuel to a hurricane. The warmer the water, the stronger the storm.

Now, if deeper water temperatures are as important as the scientists think, it may become possible to predict extreme wind growth.

If so, give credit to the Topex/Poseidon satellite, launched in 1992 to monitor ocean topography. It identified the warm eddy by a bulge of water about a foot higher than the surrounding Gulf surface. It tipped off the researchers that warm water is deeper under the bulge than elsewhere.

Computer model's help

It wasn't supposed to be possible to calculate it, but Gustavo Goni of the NOAA staff has developed a computer model that apparently can do that. The deep-sea temperature probes will check the accuracy of those calculations and could confirm the eddy's influence on hurricane intensification.

In Opal's case, steady wind speed increased as the hurricane moved across the eddy in 1995. Between 2 and 8 p.m. on Tuesday, Oct. 3, the wind jumped from 98 mph to 115. Later that night it grew worse, as Shay noted in a research paper:

"Sudden unexpected intensification occurred within 24 hours of striking the United States coastline while residents were sleeping, which decreased the effective lead time for coastal evacuation procedures."

By 8 the next morning, with the eye of the hurricane next to the peak of that bulge, the wind was up to about 150 mph — an extremely dangerous Category 4 storm. At 2 p.m., soon after the hurricane's eye finished crossing the bulge, the wind diminished to 125. Opal hit the beach later that day as a strong Category 3 storm.

Black, the wind expert, was at the National Hurricane Center when Opal was intensifying.

"They didn't even know there was an eddy out there," he said.

Deep water is key

Forecasters did know the Gulf surface was good and warm, 29 to 30 degrees Celsius (84 to 86 Fahrenheit). It was the same on the bulge of water atop the warm eddy, but here is the difference: the warm water outside the eddy was only a few yards deep. Inside the eddy, it went much deeper — probably between 260 and 400 feet down, Shay said.

What does that matter to a hurricane? Apparently a lot, because water under a hurricane gets churned and cools off. Opal knocked two to three degrees off the surface temperature outside the warm eddy, but only half a degree inside it where the heat supply presumably ran much deeper.

"Inside the eddy you don't get that cooling," Shay said. "If the air temperature is 26 degrees and the warm core ring only cools by half a degree from 29, you can still have a large amount of heat transfer from the eddy to the hurricane."

Jarrell, the National Hurricane Center director, said another school of thought believes that an upper-atmosphere trough of low pressure caused Opal's rapid intensification.

He isn't taking sides. He has been fooled too often by things that should have happened but didn't, and vice versa. He cites an example from August 1998, when Hurricane Danielle spent two days on a trail just cut by Hurricane Bonnie.

"We had this cool track of water that Bonnie had left behind. When the other one crossed over it we said, OK, now here's an opportunity for this thing to diminish. It got stronger instead of weaker. There's one reason we're just so leery of hanging our hat on a single cause. We've been wrong more than right by trying to do that."

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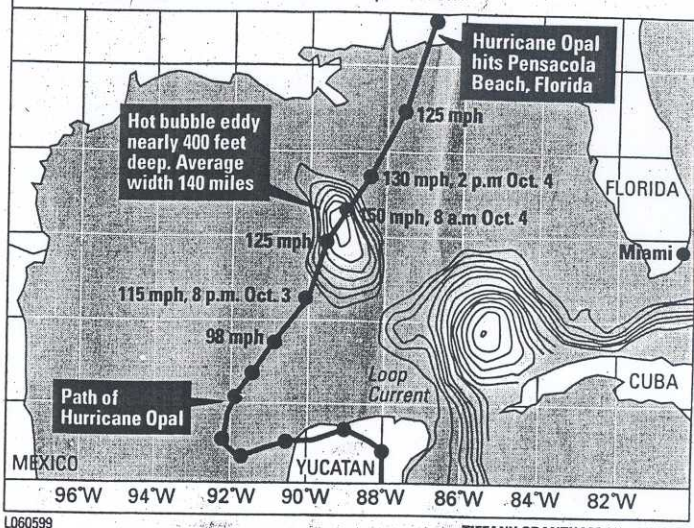
HEATING UP A HURRICANE

Research scientists think deep eddies of warm water are responsible for some sudden increases in hurricane windspeed. A satellite identifies a deep-heat eddy by a surface bulge resembling a wide, low mound. This example from October 1995 illustrates the dramatic intensification of Hurricane Opal as it crossed an eddy that had separated from the warm-water Loop Current.



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