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Hurricane Scientists Aren't Afraid to Make Eye Contact

Research crews fly into storms to measure speed, assess strength before landfall



By

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As Floridians fled Hurricane Irma in droves last week, scientists raced toward the storm to clock its wind speed.

Its sustained winds topped out at 185 miles per hour—one of the strongest hurricanes on record in the Atlantic.

Wind speeds collected before a hurricane reaches land help meteorologists predict the size of storm surges that will inundate coastlines and the strength of air blasts that will pummel obstacles in the storm's path.

Instruments installed on land, buoys, ships and satellites measure wind constantly, but to take stock of a hurricane, scientists must fly into the storm.

“Land and ocean measurements won't get much in a hurricane,” said Sim D. Aberson, a meteorologist with the National Oceanic and Atmospheric Administration's hurricane research division in Miami. “Satellites frequently miss the storms. So we send out the aircraft.”

Up to 20 people, including scientists, engineers and a flight crew from NOAA's

Aircraft Operations Center in Lakeland, Fla., board a P-3 turboprop aircraft and fly into the hurricane's eye every 12 hours until the storm makes landfall.

Additional missions are flown by the 53rd Weather Reconnaissance Squadron of the Air Force Reserve.

“We get gigabytes and gigabytes and gigabytes of data,” said Dr. Aberson, who flew on two Irma research flights.

The National Hurricane Center uses the data to estimate a hurricane's maximum sustained surface wind, which it defines as the average speed over one minute at an elevation of 10 meters, a height expected to be unobstructed.

Tracking Irma

Maximum sustained winds for Irma in 6-hour intervals



Source: National Oceanic and Atmospheric Administration
THE WALL STREET JOURNAL

To collect storm data, the scientists aboard the aircraft deploy as many as 80 devices known as dropwindsondes that are suspended from parachutes. Each is about 16 inches long, 2.75 inches in diameter and weighs less than a pound. As the devices drift to the surface of the ocean, they transmit measurements of pressure, humidity, temperature and wind every quarter second.

The aircraft is also equipped with multiple radars that measure wind speed wherever there are clouds or precipitation and a stepped frequency microwave radiometer that measures wind speed and the rate of rain directly below the aircraft.

“You get an idea of what's going on everywhere in the hurricane from top to bottom,” Dr. Aberson said.

On land, hurricane winds press against structures with an intensity that depends on the wind speed but also the structure's dimensions.

“You have the pressure of the wind and the load the structure feels depending on the shape and the area exposed to wind,” said Chris Letchford, who heads the department of civil and environmental engineering at Rensselaer Polytechnic Institute in Troy, N.Y. “Pressure goes up by velocity squared. Force goes up by area.”

A 100-mph wind is twice as fast as a 50-mph wind, but it will exert four times the pressure. And when bombarded by the same wind, a two-story home will experience twice the load as a one-story home half its size.

“The bigger the area, the bigger the force,” Dr. Letchford said.

The basic formula for calculating wind load is Area x Pressure x Drag coefficient (the relative drag based on the shape of an object).

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For a wall that is 10 feet by 20 feet, a typical side of a one-story house, the wind load in 185 mph winds would be 22,500 pounds, or about 11 tons.

In Miami-Dade County, a high-velocity hurricane zone, residential buildings are required to withstand three-second gusts of 175 mph winds, according to Jaime Gascon, a county building official. Essential buildings, like hospitals, are expected to withstand 186 mph gusts.

Senior Hurricane Specialist Lixion Avila, left, and Lt. Phil Manougian, an operations officer for the National Oceanic and Atmospheric Administration, monitored Hurricane Irma on Sept. 10 from the National Hurricane Center in Miami. PHOTO: ANDY NEWMAN/ASSOCIATED PRESS

To put the effects of storm winds into perspective, Steve Ackerman, director of the Cooperative Institute for Meteorological Satellite Studies at the University of Wisconsin in Madison, compared a brisk wind to hurricane-level gusts.

“A 15 mph wind is a pretty good, steady wind,” he said. “An umbrella will fold up. At 150 mph, the force of wind is 100 times greater. It will knock you over.”

By late Monday, after causing dozens of deaths and billions of dollars in damage, Hurricane Irma’s maximum sustained winds had dropped to 35 mph.

But the Atlantic hurricane season isn’t over until the end of November.

Next up: Tropical Storm Jose.

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