Atlantic hurricane season could be record-breaker

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From ominous and unsettling to daunting and dire, meteorologists have no shortage of adjectives to describe what the 2024 Atlantic hurricane season has in store.

In their most aggressive outlook ever, forecasters at the National Oceanic and Atmospheric Administration (NOAA) are predicting an above-average season of between 17 and 25 named storms, with eight to 13 becoming hurricanes, including four to seven major cyclones.

Forecasters are 70% confident in those ranges.

It is "a perfect storm" of near-record warm ocean temperatures in the Atlantic, the development of La Niña conditions in the Pacific, and reduced Atlantic trade winds and less wind shear that could make this hurricane season the most active of all time, said Ben Kirtman, a professor of atmospheric sciences at the University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science.

"We're seeing a shift in climate patterns in the Pacific. El Niño, which tends to increase vertical wind shear in the Atlantic and suppress some hurricane development, is ending," explained Kirtman, who is also the William R. Middelthon III Endowed Chair of Earth Sciences. "We're transitioning to La Niña, which does the opposite, reducing the vertical wind shear in the Atlantic and allowing for more hurricane development.

"The other part of this perfect storm is that El Niño is actually having a delayed effect on Atlantic Ocean temperatures," said Kirtman. "Even though we're transitioning to La Niña conditions in the Pacific, ocean temperatures in the Atlantic are still responding to El Niño and have remained warm. And that's the ideal fuel for hurricanes."

NOAA's forecast follows a 2023 Atlantic hurricane season that ranks fourth for the most-named storms (20) in a year since 1950. Yet, few storms made landfall that season, and only one hurricane, Idalia, struck the U.S., battering North Florida and parts of the southeast coast with powerful winds and storm surge.

"That was mostly due to the Azores High, a quasi-stationary high-pressure system over the subtropical Atlantic, being much weaker than normal. So, the steering currents allowed storms to turn north rather quickly," said Brian McNoldy, a senior research associate and tropical cyclone expert at the Rosenstiel School.

"Perhaps we can thank El Niño somewhat for the lack of hurricane formation in the Caribbean Sea and Gulf of Mexico. But that probably won't hold for this year. Long-range models have consistently been showing high rainfall anomalies in the deep tropics during the peak months of the season. Although that doesn't specifically show or track hurricanes, the pattern and time of year is certainly suggestive."

The likelihood of more storm landfalls only worsens the outlook for the 2024 hurricane season, which runs June 1 to Nov. 30.

But could conditions change, resulting in a season that is not as active as predicted?

"At this point, there is a strong consensus of a rapid transition to La Niña this summer," McNoldy said. "El Niño is already decaying week by week. La Niña tends to enhance Atlantic hurricane activity, and the tropical Atlantic is far warmer than it's been in recorded history for this time of year. In fact, the ocean heat content averaged across the Main Development Region (where most tropical cyclones form) already looks like mid-August. So, if the 2024 hurricane season is to end up near average or even relatively quiet, something very major and unexpected will need to happen soon."

Whatever is in store, the University of Miami is prepared, said Matthew Shpiner, executive director of emergency management, noting that the National Weather Service's Miami Office recently renewed the institution's StormReady designation.

"The designation focuses on ensuring preparation and resilience in response to severe weather incidents," Shpiner said. "Robust criteria must be met in order to receive the recognition, including having an established emergency operations center, a multilayered system to receive and disseminate emergency alerts, conducting emergency response exercises, having a robust hazardous weather plan, and conducting training of our University community."

Shpiner noted that less than 10% of higher education institutions in the U.S. have attained the status. "So, we're in elite company," he said.

With an active Atlantic hurricane season predicted and with an increased chance of more landfalling hurricanes, Rosenstiel School hurricane researchers will undoubtedly be busy this year, some of them flying aboard NOAA Hurricane Hunter aircraft directly into storms to deploy instruments that gather vital data. Here's a look at what some of those researchers have planned.

Lynn "Nick" Shay, a professor of oceanography in the Department of Ocean Sciences who is renowned for studying warm water eddies that break off from the Loop Current in the Gulf of Mexico and supercharge hurricanes, will deploy a suite of Electromagnetic Autonomous Profiling Explorer (EM-APEX) floats from C-130 aircraft out of Keesler Air Force Base in Biloxi, Mississippi, as part of his ongoing work with NOAA.

The floats will be adapted for hurricane data collection. "And after hurricane mode, they'll slowly go back into a monitoring mode," said Shay. "The beauty of these floats is that you can change their mission parameters via satellites, which gives them enormous flexibility. We can get up to 300 to 400 profiles per float. And they keep sending data back to us through satellite remote sensing."

Shay's EM-APEX floats will measure ocean temperature, conductivity, and salinity as a function of pressure.

"We'll measure current and current shear, which are important for understanding processes such as upwelling and mixing," Shay explained. "It's the ensuing air-sea fluxes or the heat and moisture transfer from the ocean to the atmosphere that we want to understand more of because that's what helps drive hurricane intensity changes."

Shay is also in the process of submitting a grant proposal to the Navy for further hurricane-related research, using the EM-APEX floats to take coupled measurements of the ocean and atmosphere.

"We're measuring the key parameters that go into intensity and intensity change," he said. "It's sort of like finding why Grandma's cookies taste so good. We know what some of those ingredients are. But what are the correct ratios of the ingredients? No one really knows. My approach is truly a coupled one. We look at the lower part of the atmosphere, and simultaneously, we want to know what's going on at the sea surface with waves and surface winds as well as what's happening in the upper ocean."

Jason Dunion, a scientist at the University of Miami Cooperative Institute for Marine and Atmospheric Studies, will again serve as director of the Hurricane Field Program—a collaboration between CIMAS and NOAA's Hurricane Research Division.

"We'll be flying two small drones this summer that we'll launch from our P-3 Hurricane Hunters," Dunion said. "The Altius-600 and Black Swift S0 will provide data in the very lowest part of hurricanes just above the ocean. We rarely sample this region of the storm with crewed aircraft for safety considerations, but it's an extremely important area to measure, as it's where energy from the ocean is drawn up into the

storm."

Dunion and his team also plan to deploy new experimental mini weather stations from the P-3 called StreamSondes, which he describes as "ultra-lightweight weather devices that can be deployed in a swarm mode in areas of the hurricane where we want to collect super high-resolution data. This will help us better measure the storm's inner core, where the strongest winds are located, and the lowest parts of the storm, where the ocean and atmosphere meet."

Provided by University of Miami

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