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Will Warming Lead to a Rise in Hurricanes?

By [CORNELIA DEAN](#)

Correction Appended

When people worry about the effects of [global warming](#), they worry more about [hurricanes](#) than anything else. In surveys, almost three-quarters of Americans say there will be more and stronger hurricanes in a warming world. By contrast, fewer than one-quarter worry about increased coastal flooding.

But as far as the scientific consensus is concerned, people have things just about backward.

There is no doubt that as the world warms, seas will rise, increasing the flood risk, simply because warmer water occupies more space. (And if the Greenland or Antarctic ice sheets melt, the rise will be far greater.)

It seems similarly logical that as the world warms, hurricanes will be more frequent or more powerful or both. After all, they draw their strength from warm ocean waters. But while many scientists hold this view, there is far less consensus, in part because of new findings on other factors that may work against stronger, more frequent storms.

“Global warming is as real as it gets,” Richard A. Anthes, president of the University Corporation for Atmospheric Research, said last month at a weather conference in the Bahamas, where most of the conversation focused on hurricanes. But as for its link to hurricanes, Mr. Anthes said, “I don’t think it’s been proved conclusively.”

In a consensus statement issued last year, the World Meteorological Organization said it was likely that there would be some increase in hurricane wind speeds in a warmer world. But the organization, which is the [United Nations](#) weather agency, noted that decades-long periods of high and low hurricane activity, unconnected to any climate change, had been recorded before. (Climate experts say a period of high activity began in 1995.)

Also, measurement techniques have greatly improved in recent decades, making it difficult to compare data and detect trends.

So as the annual hurricane season begins on June 1, scientists are pressing on a number of fronts to learn how hurricanes form and move, what factors limit or expand their lethal potential and how to tell with greater precision when and where they will strike.

Perhaps the best known proponent of the idea that warming and hurricanes may be connected is Kerry A. Emanuel, an atmospheric scientist at the [Massachusetts Institute of Technology](#). His conclusion that the total power released in Atlantic and western Pacific hurricanes had increased perhaps by half in recent decades, reported in 2005 in the journal *Nature*, is one of the most discussed ideas in the debate.

He is not alone. Last year, researchers led by Carlos D. Hoyos of the [Georgia Institute of Technology](#) analyzed the frequency of Category 4 and 5 storms, the most powerful, and concluded that their increased frequency since 1970 was “directly linked to the trend in sea-surface temperature,” which is increasing. They reported their findings in the journal *Science*.

Other experts challenge the idea that a warmer world means more and stronger storms.

For example, researchers at the National Oceanic and Atmospheric Administration and the [University of Miami](#) have been studying how vertical wind shear — the differences in wind direction or speed at different altitudes — can inhibit hurricane formation.

In work reported last month in *Geophysical Research Letters*, the researchers said that in a warming world, wind shear in the Atlantic would increase, possibly enough to cancel out the hurricane-forcing effects of warmer water.

Last week, researchers at the Woods Hole Oceanographic Institution in Massachusetts [reported](#) in the journal *Nature* that periods of frequent storminess had occurred in the past, even though things were cooler than they are now. They also concluded that wind currents were a crucial factor.

But even these researchers call the question open. “This doesn’t settle the issue,” said Gabriel Vecchi, the lead author of the wind shear study and a research scientist at the NOAA Geophysical Fluid Dynamics Laboratory, in Princeton, N.J.

In February, researchers led by James Kossin, an atmospheric scientist at the [University of Wisconsin](#), recalibrated recent and early satellite data on hurricanes using information from the National Climatic Data Center, a NOAA archive in Asheville, N.C. They concluded that hurricane frequency had increased, but only in the Atlantic, possibly because temperatures there are chronically just about warm enough for storms; so even modest warming makes hurricanes more likely.

But when Christopher W. Landsea analyzed historical records of hurricane activity, he concluded that satellite observations and other new techniques had increased scientists’ ability to detect major storms, skewing the frequency data. Dr. Landsea, a meteorologist at the National Hurricane Center, reported this conclusion this month in *EOS*, an electronic publication of the American Geophysical Union.

This kind of he-said-he-said debate often leads people to dismiss a subject as one about which nothing will ever be known with confidence. In fact, the give and take is an example of the way scientists tug and haul at their own and others’ findings until a consensus takes shape.

In the current debate over global warming and hurricanes, the problem is relatively new and the data are hard to obtain and analyze.

For example, atmospheric researchers are wrestling with an enormous amount of new data as they study factors that contribute to the formation and maintenance of the hurricane’s characteristic eye and the bands of wind and rain that howl around it.

They hope to use the data to better predict how strong hurricanes will be when they strike land. But the effort is complicated by the way storms gain or lose strength as they move over warm or cool water, and by the way their structures evolve.

The researchers studied the movement of air, moisture and heat energy as a hurricane's inner eyewall degrades, and the way an outer band can move in to replace it. Basing their conclusions on aircraft, satellite and ground observations during Hurricanes Katrina, Ophelia and Rita in 2005, the researcher, led by Robert A. Houze Jr. of the [University of Washington](#), reported their eyewall findings in the journal Science in March.

Forecasting storm tracks is easier, because they are generally determined by large-scale wind patterns that are relatively easy to observe by satellite and aircraft. But the ease of prediction is relative. Forecasters still worry, many of them obsessively, about the difficulty of providing landfall forecasts with few false alarms, in time for escape from threatened areas.

One question meteorologists and climate experts can answer quickly is an obvious one: What happened to the hurricane season of 2006? Viewed from the perspective of the Atlantic and Gulf Coasts, it was a bust (or a boon). Not a single hurricane struck the United States.

But last year a persistent Bermuda high, sitting unusually far out in the Atlantic, and air currents from an unexpected and quick-forming El Niño system, which developed in the Pacific in August, diminished the storms' potential to strike the United States. As a result, it felt like a year with no storms, even though there were only slightly fewer named storms than average (9 instead of 11), about as many became hurricanes as on average (5 instead of 6) and, as in an ordinary year, 2 hurricanes with winds of more than 111 miles per hour, the standard for Category 3 on the Saffir-Simpson Hurricane Scale.

This year, we will probably not be so lucky, forecasters at the National Hurricane Center said at a news conference last week. They said they expected 13 to 17 named storms this season, 7 to 10 of them hurricanes and 3 to 5 of them major storms. The first of the named storms, Andrea, formed off the southeast coast in mid-May, more than three weeks before the season's official start. No matter what happens this year, and no matter how the debate over global warming and hurricanes is resolved, there is wide agreement that residents of the East and Gulf Coasts can expect harsh treatment from storms, possibly for decades.

So even scientists who disagree on the hurricane-and-warming question agree that people should be discouraged from putting themselves in harm's way. In a statement issued at this time last year, Dr. Anthes, Dr. Emanuel, Dr. Landsea and other researchers said the main hurricane problem facing the United States was "the ever-growing concentration of population and wealth in vulnerable coastal areas," much of it subsidized by federal insurance and other programs.

"We are optimistic that continued research will eventually resolve much of the current controversy over the effect of climate change on hurricanes," the scientists added. "But the more urgent problem of our lemminglike march to the sea requires immediate and sustained attention."

This idea is nothing new. The United States Commission on Ocean Policy made the point in its 2004 report, and many scientists have long advocated for more and better coastal hazard mapping, building restrictions and other steps to discourage development in high-risk areas.

But as several NOAA officials noted at their news conference last week, 53 percent of Americans live within 50 miles of a coast.

The polling data on public perceptions about global warming were presented May 5 in a conference at

the [John F. Kennedy School of Government](#) by Robert J. Blendon, executive director of the Harvard Opinion Research Program. The conference focused on looming crises in which governments and other institutions seem unwilling to act.

But anyone who listened to the NOAA news conference last week might be forgiven for concluding that it is already too late. Although Gerry Bell, a lead forecaster at the National Hurricane Center, and Xavier William Proenza, the center's director, pointed with obvious pride to the agency's ever-improving forecasting ability, and agency officials cited new disaster-planning efforts, they and others acknowledged that even the best forecasts could do little to prevent property damage in a major hurricane.

Michael Chertoff, the secretary of homeland security, said people living in vulnerable coastal areas should stockpile enough food and water to last at least 72 hours. "Your state and federal responders — they will not be there instantly when a hurricane arrives," he said.

Correction: June 2, 2007

An article in Science Times on Tuesday about the possibility that global warming could lead to an increase in hurricanes misstated part of the name of an organization that studies hurricane formation. It is the National Oceanic and Atmospheric Administration, not "Oceanographic."

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