METEOROLOGY

Stormy Weather

WHY ARE ATLANTIC HURRICANES ON THE RISE? BY MARK ALPERT

Florida residents will long remember the hurricane season of 2004. From early August to late September, six major hurricanes (category 3 or above, in which maximum wind speeds hit at least 178 kilometers per hour) formed in the North Atlantic basin. Four of them—Charley, Frances, Ivan and Jeanne—slammed into the Sunshine State. (Ivan's eye actually made landfall in Alabama, but the hurricane's winds roughed up Florida's panhandle.) Although the targeting of Florida seems to be mostly a case of bad luck—the tracks of Atlantic hurricanes depend on the chaotic vagaries of pressure highs and lows along the eastern seaboard—many researchers are convinced that overall hurricane activity in the Atlantic is on the upswing.

HURRICANE CHARLEY, a category 4 storm, pounded Port Charlotte, Fla., after making landfall on August 13.

Since 1995 the annual number of major Atlantic hurricanes has averaged 3.8, significantly higher than the 60-year average of 2.3. In fact, the occurrence of these hurricanes seems to be oscillating on a decades-long cycle, with activity high from the late 1920s to the 1960s, low from 1970 to 1994 and then rebounding about 10 years ago. The oscillation is by no means smooth; hurricane activity in the Atlantic also swings sharply from year to year. (Overall, however, global hurricane activity is remarkably stable—busy seasons in one ocean are typically counterbalanced by calm seasons in another.)

Many researchers believe the year-to-year changes may be partly the result of El Niño warming events in the eastern Pacific Ocean, which may disrupt the formation of Atlantic hurricanes by increasing the difference between wind speeds at upper and lower altitudes. La Niña cooling events may have the opposite effect. But the reasons for the long-term hurricane trends are more mysterious.

Some scientists have searched for corresponding trends in the thermodynamics of the Atlantic Ocean. Hurricanes can form only over waters that are warmer than 26.5 degrees Celsius, and sea-surface temperatures in the North Atlantic were relatively high during the decades of above-average hurricane activity and low during the inactive period. William M. Gray, a veteran hurricane researcher at Colorado State University, believes the long-term hurricane cycle may be linked to global ocean currents that bring warm salty water from the tropics to the far North Atlantic. When this thermohaline circulation is strong, the North Atlantic warms, and more major hurricanes are born; when the circulation weakens, perhaps because of an injection of freshwater from Arctic ice, hurricane activity decreases. According to Gray, the eastern U.S. will have to endure an above-average number of major hurricanes for the next 20 to 30 years. "I'll be in my grave before it's over," says Gray, who is 74.

Other researchers are skeptical of this neat picture because the process of hurricane creation is so devilishly complicated. Meteorologist Kerry A. Emanuel of the Massachusetts Institute of Technology notes that hurricane genesis depends not so much on ocean temperatures alone but on the difference in temperature between the sea surface and the upper atmosphere. James B. Elsner, a climatologist at Florida State University, is focusing his attention on the North Atlantic Oscillation (NAO), a poorly understood climate mode that periodically shifts the tracks of storms crossing the ocean. When the NAO weakens, a pressure high moves southwest from the Azores to Bermuda; this prevents hurricanes from turning north, so they gain strength and head for the Caribbean and the southeastern U.S. The NAO weakened dramatically in late July, just before the spate of hurricanes.

Whatever the cause of the renewed activity, scientists agree that Florida and other southeastern states are particularly vulnerable because so much seacoast development occurred during the 25-year lull in major hurricanes. Because a weak El Niño event is currently under way, the 2005 hurricane season may well be more moderate, but catastrophic storms could return in force in following years. Says Elsner: "There is some indication that 2004 is a harbinger of things to come."

WARMER WORLD, STRONGER STORMS?

For the past two decades, scientists have debated whether global warming will increase the frequency or intensity of hurricanes. The question is difficult to answer because researchers do not fully understand how hurricanes develop. But a computer-modeling study at the Geophysical Fluid Dynamics Laboratory in Princeton, N.J., recently predicted that the maximum wind speeds of a typical hurricane could climb 6 percent by 2080 if sea-surface temperatures rise because of emissions of heat-trapping carbon dioxide. This increase would translate to a half-step jump in the classification of the hurricane on the Saffir-Simpson scale; for example, a hurricane that would currently be at the high end of the category 4 range would be a category 5 storm by the end of the century.