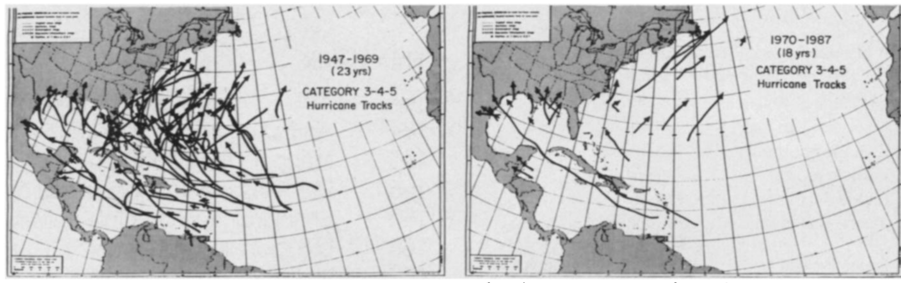
African Rains Foretell Stronger Hurricanes



Tracks of major hurricanes during wet period (left) and drought (right) in the Sahel.

When Hurricane Hugo slammed into South Carolina last year, it jarred a fading memory among Eastern Seaboard residents, who had passed through almost two decades without feeling the fury of a devastating storm. The next decade will bring no such reprieve, predicts one noted meteorologist.

Looking back over historical weather records, William M. Gray of Colorado State University in Fort Collins found that strong hurricanes tend to lash the eastern United States and Caribbean when summer rainfall increases in the western portion of the Sahel, a semiarid region south of the Sahara desert. Because of recent changes in Sahel weather, Gray suggests the eastern states and the Caribbean will likely face growing numbers of intense hurricanes in the next decade or two.

"The relationship is very strong between intense storms and West African rainfall," says Gray, who describes his work in the Sept. 14 SCIENCE.

For example, 13 strong hurricanes (category 3 or higher) struck the eastern United States or the Florida peninsula between 1947 and 1969, when the Sahel was wetter than normal, Gray notes. In contrast, only one category 3 hurricane (Gloria) hit the region during the Sahel's debilitating drought from 1970 to 1987.

According to weather records dating back a century, the Sahel climate has swung between wet and dry periods, each lasting a decade or two. The region faced drought from 1900 through 1914, grew wet from 1915 through 1935, and then dried up again from 1936 through 1946, says Gray.

Rainfall in the Sahel increased during 1988 and 1989, possibly signaling the end of the most recent drought. If so, warns Gray, the number of intense hurricanes hitting the Eastern Seaboard and Caribbean will probably rise dramatically. The intense hurricanes of 1988 and 1989 – Hugo, Gilbert and Joan – may represent the beginning of the shift, he says.

Conditions in West Africa do not appear closely linked to the number of strong hurricanes in the Gulf of Mexico, or to the number of less intense East Coast hurricanes, Gray's analyses indicate. This suggests that a wetter Sahel may not spell an increase in the absolute number of storms striking the United States or Caribbean, he says.

Previous studies have not turned up a relationship between Sahel rainfall and Eastern Seaboard hurricanes, Gray observes, although he and other scientists say the new evidence of a connection does not surprise them. Moist summertime conditions in the Sahel tend to reduce the strength of key winds over West Africa, and Gray suggests this might allow better development of low-pressure systems there. As these pressure waves travel through the atmosphere toward the United States, they can develop into tropical depressions and then into hurricanes.

The proposed relationship between African rainfall and hurricanes could provide important clues for meteorologists seeking to understand how hurricanes develop, says Jerry Jarrell, deputy director of the National Hurricane Center in Coral Gables, Fla. "We know almost nothing about what causes storms to form and what determines whether they'll be strong or large," he says.

Whether or not the relationship holds in the future, Gray's prediction of strong storms in coming years dovetails with the National Hurricane Center's efforts to keep East Coast residents prepared for the return of hurricanes that rival those of the '50s and '60s.

"Within everybody's memory, they haven't felt these big ones and they haven't seen the destruction," says Jarrell. He notes that some political forces are now trying to weaken southern Florida's building codes, which were strengthened in the wake of several severe storms during the 1940s and 1950s.

– R. Monastersky

Analyzing polar ice to track solar activity

Scientists have a complete, consistent record of solar activity – expressed as the number of sunspots – going back to 1843. Clues to solar activity in even earlier periods come from historical documents containing references to auroras and sunspots. However, despite concerted efforts to extend the sunspot record further, data from the period before 1600 remain incomplete and uncertain.

Researchers in Switzerland have now demonstrated that the levels of the radioactive isotope beryllium-10 in samples of polar ice follow variations in solar activity. Peaks in isotope concentration correlate well with solar minima, when few sunspots appear, providing a way of tracking the well-known, 11-year solar cycle over a longer time span.

"Our study proves that [beryllium-10] in polar ice is a useful tool to extend significantly the historical record of solar activity," the team reports in the Sept. 13 NATURE. "This opens up the possibility of studying the long-term behaviour of solar activity and the history of solar-terrestrial relationships." Such studies could provide insights into how solar activity influences climate and what processes drive the solar cycle.

Scientists have known for several decades that solar activity appears to modulate the flux of cosmic rays reaching Earth's atmosphere. Magnetic fields in the solar wind emanating from the sun apparently deflect low-energy cosmic rays, especially during periods of intense solar activity, and that shift depresses the normal rate of production of radioactive isotopes in the atmosphere by as much as 25 percent.

The most promising isotope for tracking solar activity is beryllium-10, the researchers say. Produced by cosmic-ray-induced nuclear reactions in the atmosphere, beryllium-10 initially clings to particles floating in the air. Precipitation flushes the beryllium-laden particles out of the air, depositing them on Earth's surface within a year or two of their appearance.

To test whether beryllium-10 might be useful for tracking solar activity, the researchers analyzed part of an ice core from Greenland and compared the measured beryllium-10 concentrations with sunspot records from 1783 to 1985. Despite short-term fluctuations in beryllium-10 concentrations due to changes in precipitation patterns and other atmospheric effects, they could easily pick out an 11-year cycle and other, longer-term trends in the beryllium data that closely match the sunspot record. *– I. Peterson*