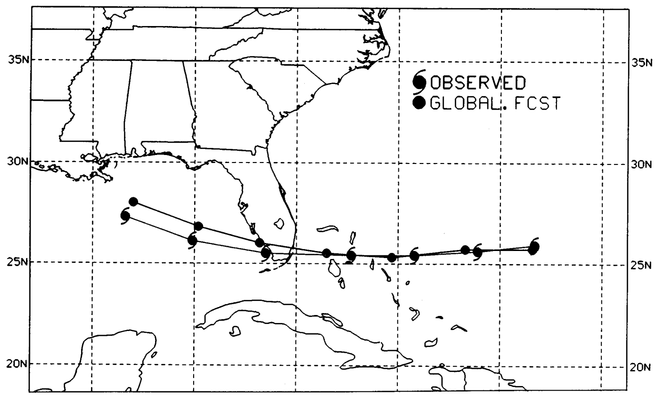
Unusual weather spurred Andrew's growth

Only three days before Hurricane Andrew mauled southern Florida last week, it looked as if this tropical storm might never make it to hurricane status. After crossing the Atlantic, the storm began weakening as it moved north of Puerto Rico. But then Andrew unfortunately ran into some very favorable conditions and, as meteorologists say, the bottom fell out of the storm.

"It intensified quite rapidly compared to normal hurricanes," says Kerry A. Emanuel, an atmospheric researcher at the Massachusetts Institute of Technology in Cambridge.



Swirls show course predicted by NMC global model. Dots represent actual hurricane path. Symbols are 12 hours apart.

In a 48-hour period, Andrew's winds strengthened from 52 to 140 mph, quickly turning an average tropical storm into one of the most intense hurricanes to hit Florida this century, according to the National Hurricane Center in Coral Gables, Fla.

As the name implies, tropical storms start in the tropics, at latitudes between 5° and 20°. When low-pressure systems leave the African continent, the warm water and favorable winds permit a few of these systems to develop into tropical storms and then fewer still into hurricanes. North of the tropics, however, the upper winds usually blow in a different direction from the winds near the surface—a factor called wind shear, which hinders the development of hurricanes. Wind shear disrupts the tall thunderclouds that form the core of a hurricane.

Unlike most hurricanes, Andrew grew into a major hurricane outside the tropics in an area that would normally have too much wind shear. But as Andrew left the tropics, the upper-level winds were blowing—against character—toward the west, in the same direction as the lower-level trade winds. This created a situation with relatively little wind shear. At the same time, Andrew moved over warm water, which also helped the storm gather strength, says William M. Gray, a meteorologist at Colorado State University in Fort Collins.

"The environment was extremely favorable for this storm to intensify," Gray says.

Andrew's path paints a clear picture of the upper-level winds. For several days, the storm chugged almost straight westward, keeping between 26°N and 25°N, almost as if it were following a latitude line on a map. Because Andrew took such a straight course, forecasters had a relatively easy job predicting its path, says Stephen Lord, a researcher at the National Meteorological Center (NMC) in Camp Springs, Md.

When it became clear that Andrew would hit southern Florida, home to the National Hurricane Center, several hurricane specialists traveled north to the NMC to set up a backup unit in case the storm disabled the Coral Gables facility. Gusts of up to 164 mph did, in fact, blow down a radar dome and inactivate several satellite dishes on the roof of the center, but meteorologists there continued to issue forecasts with help from the NMC and other weather service offices.

To make hurricane forecasts, meteorologists use a suite of statistical and dynamical models. The statistical models make predictions on the basis of past weather behavior, while the dynamical ones rely on physical laws and calculate how air circulation will evolve.

Andrew marked the first instance in which NMC meteorologists used their global weather forecasting model to help predict a hurricane's path. "We're quite pleased with the results," says Lord, who developed the technique. The global model was among the most accurate, although Lord cautions that this trial represents only one test.

For the present, he thinks the limited-area dynamical models will typically achieve greater accuracy than the global model because they have higher resolution. But as the resolution of the global model improves, it should outperform limited-area models because it can include interactions among widespread weather systems that influence hurricanes, Lord says.

While forecasters have been developing skill in predicting hurricane paths, intensity forecasts have lagged behind. "We have absolutely no skill in forecasting the change in hurricane intensity," says Emanuel. *—R. Monastersky*

Comets and planets: A noble link appears

More than 30 years ago, a young chemist fascinated with the origin of life made a startling discovery. Mixing together water, ammonia, and hydrogen cyanide—three compounds believed to be carried by comets—John Oró of the University of Houston found that this hellbrew formed adenine, a fundamental component of DNA and a relative of adenosine triphosphate, the molecule that provides a key fuel for most living things. Citing his laboratory findings, Oró proposed in a 1961 NATURE article that as comets struck the planets early in the history of the solar system, these icy bodies brought with them the chemical precursors of life.

Although Oró's article became a landmark, over the years many researchers ignored the role of comets in planetary evolution because they didn't believe these objects contributed significantly to the chemical composition of the terrestrial planets. After all, they reasoned, rocky planets like Venus, Earth, and Mars probably originated as agglomerations of rocky, meteoritic bodies. And it seemed that meteorites striking the young planets might account for the concentrations of noble gases — chemically inert substances—in the atmospheres of these planets. Comets simply weren't needed.

But during the past decade, researchers uncovered a major problem with this explanation for the evolution of planetary atmospheres. They discovered that the meteorites that have fallen to Earth contain a far greater abundance of xenon, a heavy noble gas, than that found in the atmosphere of Earth and Mars. At first, scientists suggested that the missing xenon might lie hidden in underground rock or ice deposits, but no extra xenon was ever found.

Now, a team of space scientists proposes a way out of this dilemma. New laboratory experiments suggest that noble gases trapped within the icy nuclei of comets may account for the abundance of xenon in the atmospheres of Earth and Mars, as well as the unusually large amounts of argon found on Venus. Tobias Owen of the University of Hawaii in Honolulu presented the findings this week at the World Space Congress in Washington, D.C.

Two of Owen's colleagues, Akiva Bar-Nun and Idit Kleinfeld of Tel Aviv University in Israel, conducted experiments crucial to understanding the influence of comets. They found that at a certain temperature, amorphous water-ice — a laboratory stand-in for comets—trapped the noble gas argon but relatively little xenon. Such a pattern approximates, but doesn't precisely match, the relative abundance of these gases in the atmospheres of Mars and Earth, Owen notes. In