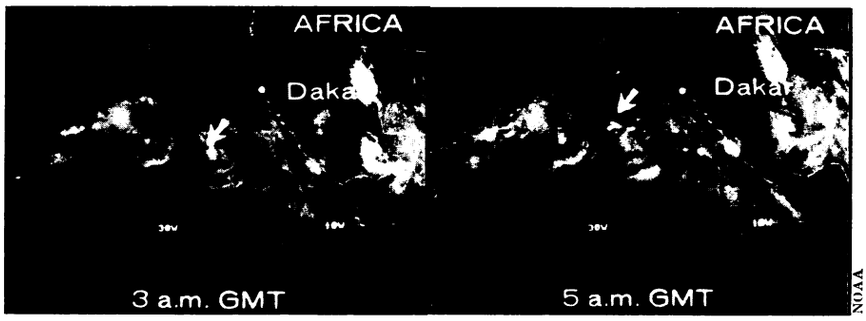
# Supernovas: Quickie tropical storms




*In only two hours, clouds develop into the tight tops of "supernova" storms.*

They appear from nowhere in the middle of the night—huge thunderstorms that reach their full-blown might, sometimes in less than two hours, briefly thrashing the tropical Atlantic with explosive rage before disappearing as quickly as they came. So rapid and violent is their life cycle that meteorologists at the National Oceanic and Atmospheric Administration call them "supernovas," after the sudden, brilliant flaring of a star before it collapses into death.

But where do they come from? The supernova storms were discovered only last summer, during the huge, multinational weather study known as the GARP (Global Atmospheric Research Program) Atlantic Tropical Experiment, or GATE. They were pinpointed thanks to the Synchronous Meteorological Satellite, SMS-1, whose infrared cameras enabled it to photograph the developing clouds by their own heat, even during the darkest night.

GATE is an appropriate acronym. The tropics are the "opening" through which more than half of the solar energy reaching the earth enters to fuel the vast heat engine that drives the world's weather. The push for the winds and other atmospheric circulation systems begins there. At NOAA's Atmospheric Physics and Chemistry Laboratory in Boulder, Colo., Helmut K. Weickmann, the lab's director, is heading a team that is beginning to study how the supernova storms fit into all this.

Are the storms causes—significant contributors to tropical weather dynamics—or mere symptoms, visible signs of some much larger and even more mysterious process? At this stage of research, all bets are open.

One of the surprises that confronted GATE scientists was the discovery of less than the expected amount of convection in the zone where the low-level winds from the Northern and Southern Hemispheres come together. "Some previous investigations," says Weickmann, "suggested that there would be very strong [convection] along the Intertropical Convergence Zone. In fact, we had expected this to be one of the strongest phenomena in the area. But the clouds we found during GATE barely reached up to 40,000 feet, and the air was so dry our aircraft frequently left no vapor trail at that altitude." So where, asks another NOAA official, is the missing violence in the system? The supernova storms would seem to be an eligible candidate, transporting some of the upbound energy that is unaccounted for by the organized convection of the zone.

Yet even though the storms expand during their brief lifetimes to cover thousands of square miles, points out Ray Hoxit, who is working with Weickmann on the problem, they are still only storms—phenomena of a smaller scale than the massive Intertropical Convergence Zone. It is not unreasonable, therefore, that there may be something else making up the difference; something, perhaps, of which the storms are just a visible manifestation.

A more fundamental question, Hoxit says, is that of their origin. "The supernova storms," says Weickmann, "were the kind of system we see in large Colorado hailstorms. They must come out of a strong atmospheric instability somewhere, and we think nocturnal radiation processes play a role in their formation." But land soaks up much more heat during the day than does water, and gives it off more readily when the sun goes down, providing a virtual "hot plate" to motivate potential storms. "We cannot yet explain," says Weickmann, "why and how [the supernova storms] form over the ocean, at night."

The quest, in fact, is just beginning. Weickmann's group is now in the process of assembling and organizing the data from those of GATE's numerous ships that were on station at night in the area where the sudden storms developed. GATE aircraft data could have been of additional value in following the storms' progress, but most of the flights were confined to daylight hours.

The planes did make an important contribution, however, revealing, according to Weickmann, very large counts of ice nuclei, the small particles on which atmospheric water freezes, but very low counts of cloud condensation nuclei, on which water vapor condenses to form clouds. "This," he says, "suggests that the clouds become rained out before the water even reaches the atmosphere's freezing level." Yet cirrus cloud layers above the anvils at the storms' tops showed the characteristic "halos" indicative of well-formed ice crystals at that level.

This could mean (though so far it is only the most preliminary of speculations) that the storms are sometimes linked by some process to the high-altitude waves that are known to exist in the easterly winds. Such a connection, offers Weickmann, could be a candidate to explain how one batch of supernova storms, observed early in August, was able to last long enough to evolve into a hurricane.

For the next several months, Weickmann, Hoxit et al will be poring over GATE data in an effort to understand the role of such factors as radiative cooling, when the atmosphere gives up its stored load of solar heat, and winds, bringing in extra supplies of warmer or cooler air, in creating the pre-storm environment. The fast-growing supernovas are not necessarily a whole new phenomenon, Hoxit points out. It's a matter of degree. But some of the questions they pose are fundamental to an understanding of the tropical birthplace of the world's weather. □

# Worst tornado outbreak ever

Around the National Severe Storms Forecast Center in Kansas City they speak of 1973 in hushed whispers as "the Year of the Tornado." There were more storms, more big storms and more storm-struck states than in any previous year since the Government started counting. The year 1974 did not challenge those records, but it did have one grim distinction, the center reports: the worst single outbreak of tornadoes ever recorded—*anywhere*.

It began at about noon on April 3. When it was over, scarcely 18 hours later, 148 twisters had torn through 13 states, killing 315 people, injuring 5,500 more and doing more than half a billion dollars worth of damage. Yet there was a positive side. "If ever there was a year underscoring the value of advance preparedness against tornadoes," says National Weather Service Director George Cressman, "last year was it." On March 18, 1925, before the advent of many of today's tornado-warning systems, a single tornado ripped through Missouri, Illinois and Indiana. The staggering death toll: 689. □