SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

Press Release

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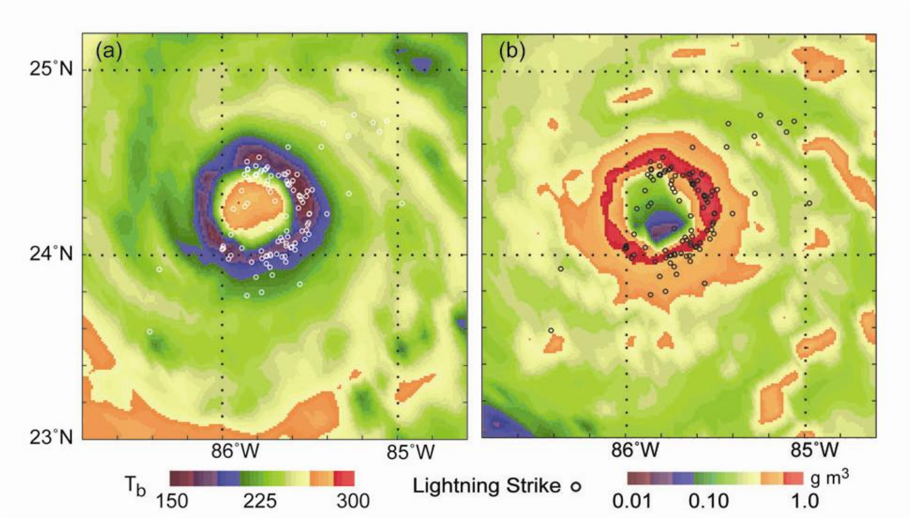
NEW LIGHTNING SENSORS WARN OF HURRICANE'S POWER FROM FAR AWAY

Honolulu, HI – A recent study supported by the U.S. Office of Naval Research and NASA introduces a new way of detecting lightning outbreaks within a hurricane over the ocean in real time from thousands of miles away, giving forecasters new insight into just how powerful an oncoming storm may be. As a result, researchers can investigate with greater accuracy whether the rate of lightning strikes produced within a hurricane's eyewall is tied to the changing strength of that hurricane. The hurricane eyewall is that inner heat-driven region of the storm where the most intense rainfall and most powerful winds occur.

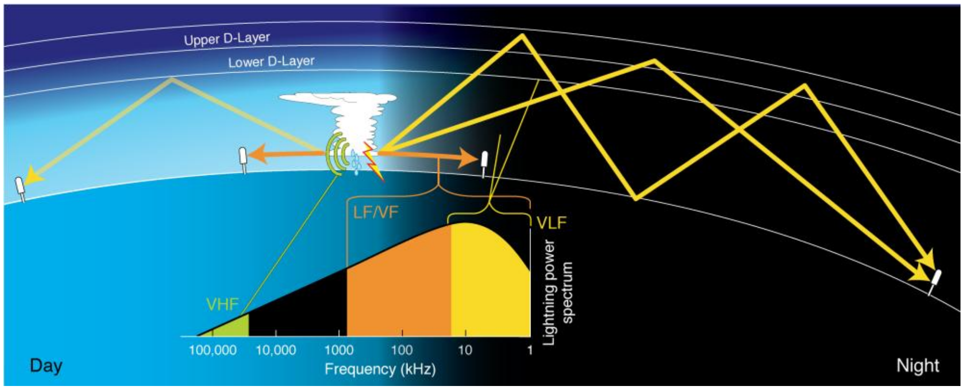
The groundbreaking study, to appear in an upcoming issue of the American Meteorological Society's Monthly Weather Review, uses data from a growing network of new long-range lightning sensors, a NASA satellite, and aircraft-based instruments to explore the effect eyewall lightning outbreaks had on the intensity of two of the most severe Atlantic storms on record before they made landfall – category-five hurricanes Katrina and Rita.



TRMM's Microwave Imager collected data as the satellite passed over the center of Hurricane Rita overlaid with lightning strike locations on September 21, 2005. The colors on the left indicate the temperature of the ice particles, whereas on the right the colors indicate the concentration ice particles in the hurricane eyewall as assessed from imager's data. These images demonstrate that ice is an important ingredient for charge separation needed to produce lightning in clouds. Image by Squires and Businger

"There are very few observing systems that offer a broad view of a storm over the open ocean where hurricanes tend to build or lose strength," said study co-author Steven Businger, a senior professor of meteorology at the University of Hawaii in Honolulu. "What's really compelling about the new PacNet sensors is their increased sensitivity to pick up lightning's electromagnetic signal over the water from such a long distance. As a result, we can see thunderstorm activity over the ocean from thousands of miles away for the first time. This development provides a new way for meteorologists to look at a growing storm and to alert us about just how harsh it will be."

As explained by Businger, when water condenses from vapor into a cloud droplet, “latent” or hidden heat is released, which in turn builds updrafts – air moving upwards in a cloud. Latent heat provides the energy that fuels hurricanes. These updrafts, if they are strong enough, cause the separation of charge that produces lightning. Thus, there is a relationship between the rate of lightning strikes, the amount of rainfall, and the heat released in the eyewall of a storm. This fact allows the lightning rate data to be used in computer models that forecast hurricane track and intensity.



Schematic diagram of the Earth-ionosphere wave-guide, which allows VLF (5-25 kHz) emissions from thunderstorms (sferics) to propagate thousands of kilometers through reflection. The best propagation is observed over the ocean at night. Image by Pessi and Businger.

"Hurricane forecasters and researchers are very interested in developing methods that allow a continuous examination of the structural growth of the eyewall within hurricanes," said lead author Kirt Squires, a recent graduate of the meteorology program at the University of Hawaii. "We know that the intensity of lightning outbreaks near the storm's epicenter directly relates to the heat energy released in the storm. The relationship between the lightning activity and the storm's energy source means it's crucial for us study and pick apart the evolution of the lightning."

Dr. Businger with a long-range, lightning sensor (manufactured by Vaisala) located at Lihue airport in Kauai, Hawaii. The lightning sensor works 24 hours a day, 365 days a year to detect electromagnetic signals produced by lighting. Photo credit: Businger

At the core of Businger and Squires' research are data from two devastating 2005 hurricanes, Katrina and Rita. The researchers specifically combined data from NASA's Tropical Rainfall Measuring Mission satellite, with data from instruments onboard the National Oceanic and Atmospheric Administration’s P-3 “hurricane hunter” aircraft that fly through the hurricanes, and with data from the enhanced sensor capability of the NASA-co-funded PacNet sensor network.

Though Businger acknowledges that more research is needed, results from this study show that the growth and density of lightning strikes in a hurricane's eyewall provide important insight into the inner workings of the most powerful storms on Earth, information that may help save lives in future through improved hurricane forecasts.

Release by Gretchen Cook-Anderson, NASA Goddard Space Flight Center 301-879-9200. For information about NASA and agency programs on the Web, visit: http://www.nasa.gov

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NASA Feature http://www.nasa.gov/centers/goddard/news/topstory/2007/lightning_hurricane.html

The Morphology of Eyewall Lightning Outbreaks in Two Category Five Hurricanes - Monthly Weather Review; Volume TBA (http://www.ametsoc.org/journal_abstracts/get_pta.cfm?sJcode=MWR)