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Colorado State University Hosts One of the World's Most Advanced Weather Radars

Note to Editors: Information recorded by CHILL on the May 22 Windsor, Colo., tornado can be found at http://www.chill.colostate.edu/w/CSU_CHILL. Photos of the radar being installed this spring are available with the news release at http://www.newsinfo.colostate.edu/.

CSU CHILL Radar

FORT COLLINS - Colorado State University this spring installed a unique antenna on one of the nation's most advanced polarimetric weather radars to more precisely detect major storms and precipitation. The new antenna gives scientists a "more delicate knife" to evaluate thunderstorms and the size and distribution of rain, hail and snow, said Steven Rutledge, professor of atmospheric science at Colorado State and the scientific director of the CSU-CHILL radar facility.

The radar, located next to the Greeley-Weld County Airport and known as CSU-CHILL, has the capability of seeing a single hail stone in the atmosphere more than 10 miles away. So-called dual polarization technology will be adopted as the new National Weather Service standard starting next year and deployed on the nation's WSR-88D radars, used to warn the public about developing severe weather. The CSU-CHILL radar supports this effort by developing new techniques that will be used on the weather warning radar network.

The CHILL facility is jointly operated by the Colorado State University departments of Atmospheric Science and Electrical and Computer Engineering. In addition to Rutledge, V.N. Bringi and V. Chandrasekar, professors of electrical engineering, serve as principal investigators on the award from the National Science Foundation, which exceeds $3 million over a three-year period.

CHILL has been at Colorado State University since 1990 under continuous support from the National Science Foundation and the state of Colorado. Using its unique dual-polarization technology, the CHILL provided unprecedented data on the July 1997 Spring Creek Flood in Fort Collins, recording a more accurate rain amount by nearly 5 inches than what the National Weather Service radars measured during the storm.

The new antenna technology was installed in February as the result of a three-year, $1.4 million National Science Foundation grant led by Bringi. The antenna was custom designed and manufactured by VertexRSI, a division of General Dynamics, in Killgore, Texas, which provided $250,000 worth of in-kind support for the project. The installation of the antenna marked the first time this type of antenna

Associated images

Installation of CSU CHILL Radar
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technology has been installed on a weather radar anywhere in the world.

"We'll get much more precise measurements with this new antenna technology," Rutledge said. "We can better detect heavy rain and hail. That's important to tracking flooding rains and damaging hail more precisely."

The dual polarization measurements are so valuable that the National Weather Service will adopt this technology in its national network of 150 warning radars. The National Weather Service will implement dual polarization radar capabilities starting in 2009 and expects to complete the installations by 2010. Previous radar network upgrades occurred in 1957 and 1988.

Dual-polarization works by transmitting and receiving both horizontal and vertical radiation. This technique allows better discrimination of particle shapes, which allows more accurate information to be gathered on rain and hail, snowflakes and other particles in clouds.

"The integration of CSU CHILL dual polarimetric capabilities into the nation's weather radar network represents a major milestone in our effort to address the ever increasing demand for accurate forecast and warning services," said Larry Mooney, meteorologist in charge of the National Weather Service office in Boulder.

CHILL is an S-band frequency radar - the frequency currently used by the National Weather Service - that operates at 3 gigahertz. The antenna is housed within an inflatable dome for protection against wind and precipitation.

"Some of the most exciting developments in radar took place over the last decade, and we played a role," said Bringi. "The new technology helps us understand the finer structure in storms. We can demonstrate the advancement of the science of meteorological radar right here at CSU."

The radar can give scientists an idea of what's coming about four hours in advance. But the information also helps make models used in weather forecasting more intelligent.

"We use the observations and the radar as the primary tools to improve the modeling," Bringi said.

Chandrasekar has used the radar as part of testing a sophisticated network of radars in Oklahoma's tornado alley to improve early warning systems for tornadoes and severe thunderstorms The radars are in or near Chickasha, Lawton and Cyril and Rush Springs, Okla., but Colorado State faculty and students monitor the radars 24 hours a day, seven days a week from computers in the College of Engineering.

In 2003, Colorado State teamed with universities across the nation in the National Science Foundation Engineering Research Center for Collaborative Adaptive Sensing of the Atmosphere, or CASA, to develop a network of radar systems. The University of Massachusetts at Amherst is the lead institution. The radar system in the Oklahoma test bed is the result of a multidisciplinary collaborative effort among all of CASA's partners: Colorado State, UMass, the University of Oklahoma and the University of Puerto Rico.

CASA's primary mission is to develop a Distributed Collaborative Adaptive Sensing radar network at higher frequencies than CHILL radar such as X-band. The S-band frequency is used by the current nationwide deployment of weather radars. X-band is about three times the frequency of S-band. This higher frequency is needed to make smaller and less expensive radars compared to a radar like CHILL.

More fun facts about the CSU-CHILL radar:

- History: The original CHILL radar was assembled in 1970 by the University of Chicago and the Illinois State Water Survey, which is where the radar gets its name. It was moved to CSU in 1990.

- Staff: Requires three full-time staff - Pat Kennedy, Dave Brunkow and Bob Bowie. (A fourth staff member, recent electrical engineering master's graduate Jim George, is being hired.)

- Antenna: When the antenna is looking straight up, the highest point of the antenna is approximately 50 feet above the ground. The antenna is made of aluminum and weighs nearly 6,000 pounds.

- Dome: 64 feet tall and 100 feet in diameter at the base; weighs 8,000 pounds; consists of the same nylon-reinforced vinyl used in the concourse tents at Denver International Airport. Dome cost is $500,000.

- Power: CHILL transmits a peak power of 1 million watts.

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