

Chasing Tornado Data to Engineer Better Buildings

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Students and researchers use Iowa State's Tornado/Microburst Simulator to study how wind storms affect buildings. (Iowa State University photo by Bob Elbert)

Iowa State University researchers and students will soon be chasing tornado data in the lab and across tornado alley. It's all part of a research project designed to increase scientists' basic understanding of wind storms and develop innovative ways to make homes and buildings stand up to tornadoes, microburst thunderstorms, hurricanes and gust fronts.

The research team is led by Partha Sarkar, an Iowa State professor of aerospace engineering who holds the T.A. and Grace Miller Wilson Endowed Chair. The funding also supports research by Fred Haan, an assistant professor of aerospace engineering; Hui Hu, an assistant professor of aerospace engineering; Vinay Dayal, an associate professor of aerospace engineering; Bill Gallus, a professor of geological and atmospheric sciences; and Gene Takle, a professor of geological and atmospheric sciences and agronomy. The funding will also support as many as eight graduate students.

And it will send Colorado-based researcher Tim Samaras of Applied Research Associates Inc. – whose work has been featured in National Geographic broadcasts and publications – racing ahead of storms to take field measurements of tornadoes.

Gallus said students who have storm-chasing experience and safety training are expected to join Samaras as he travels tornado alley this May and June. The students will help Samaras deploy sophisticated probes containing sensing instruments and cameras.

They'll also test various methods to take tornado wind measurements as close to the ground as possible. Though today's radar technology can measure a tornado's wind speeds, the measurements are typically 100 feet off the ground. Gallus said nobody has ever taken precise measurements at ground level. That's because it's hard – not to mention dangerous – to put instruments in the path of a tornado. And tornadoes tend to destroy any instruments they touch.

Gallus said he may join Samaras and the students if their tornado chasing takes them close to Iowa.

"Wouldn't it be a thrill to be there when they collect the first wind measurements from inside a tornado?" said Gallus, who also noted he probably won't be getting as close to a tornado as Samaras.

Samaras said it makes a lot of sense to combine his field work with Iowa State's laboratory research.

"The collaboration between ISU and our tornado probe deployment team represents a perfect match to gather real, full-scale data for comparisons of ongoing modeling and laboratory experiments with tornadoes," he said.

Back in the lab, the research team will use Iowa

State's Tornado/Microburst Simulator and its Aerodynamic/Atmospheric Boundary Layer Wind and Gust Tunnel throughout the summers of 2006 and 2007 to chase down data.

The researchers will focus on four major projects:

-- Study the flow of storm winds near the ground. The researchers will compare field measurements to lab simulations and try to get the two to match. They'll also visit places hit by wind storms to assess storm damage. Their goal is to understand how terrain and structures affect wind flow.

-- Test models of various structures in Iowa State's Wind Simulation and Testing Laboratory. The researchers will take sophisticated pressure measurements to understand the wind loads that hit buildings during a wind storm.

-- Develop computational models using a technique called finite element analysis that will simulate how wind storms affect buildings. The models can help researchers see what happens to buildings exposed to extreme wind loads. The models should also help researchers understand which parts of a building would be the first to fail during a wind storm.

-- Study new building designs that would be resistant to wind storms. Possible designs include improving structural supports, finding new kinds of siding and making small changes to the shape of buildings that improve their aerodynamics and reduce the wind loads they carry. The researchers will also study how rows of trees and shrubs can reduce wind intensity in rural areas.

Sarkar said this research project will be a big boost to the wind engineering work at Iowa State.

"As part of this federal project, we will be enhancing our existing equipment, facilities and tools at Iowa State," Sarkar said. "That will take us to the next level of sophistication and competence."

And that will help Iowa State researchers develop the know-how to protect buildings and lives whenever the wind starts howling.

The project is supported by \$1 million from the federal government's 2006 Science, State, Justice, Commerce and Related Agencies Appropriations Act. The money will allow a team of Iowa State engineers and meteorologists to focus on reducing the damage caused by wind storms. The money is coming to Iowa State through the National Oceanic and Atmospheric Administration.

Source: Iowa State University

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