VORTEX2

VORTEX2: Verification of the Origins of Rotation in Tornadoes Experiment2

A field experiment to study tornadoes from all angles

The National Severe Storms Laboratory (NSSL) is gearing up for the largest and most ambitious attempt to explore tornadoes – their origins, structure and evolution. From May 10-June 13 of 2009 and 2010, VORTEX2 (V2) will collect intensive data sets to help answer questions about tornadoes. Research results are expected to increase the accuracy and timeliness of tornado forecasts and warnings. V2 is a National Science Foundation/National Oceanic and Atmospheric Administration-funded program bringing together collaborators from around the United States. Key players are NOAA's National Severe Storms Laboratory, the University of Oklahoma, the NOAA/OU Cooperative Institute for Mesoscale Meteorological Studies, the Center for Severe Weather Research, Penn State University, Texas Tech University, National Center for Atmospheric Research, Lyndon State College, University of Colorado, Purdue University, North Carolina State University, and Rasmussen Systems.

The legacy VORTEX program collected unprecedented data sets on tornadoes in the central Great Plains during 1994 and 1995. One of the greatest successes of the VORTEX project was documenting the near-ground weather conditions close to tornadoes. Recent improvement in National Weather Service severe weather warning statistics may be partly due to the application of VORTEX findings. V2 will build on the progress made with VORTEX and further improve tornado warning skill and short-term severe weather forecasts.

Data from the Dimmitt, TX tornado intercept during VORTEX helped scientists answer some questions about how tornadoes form, but raised important new ones.

To get more complete data, NSSL scientists collaborated to build mobile Doppler radars capable of scanning and penetrating an entire storm from a close-in location.

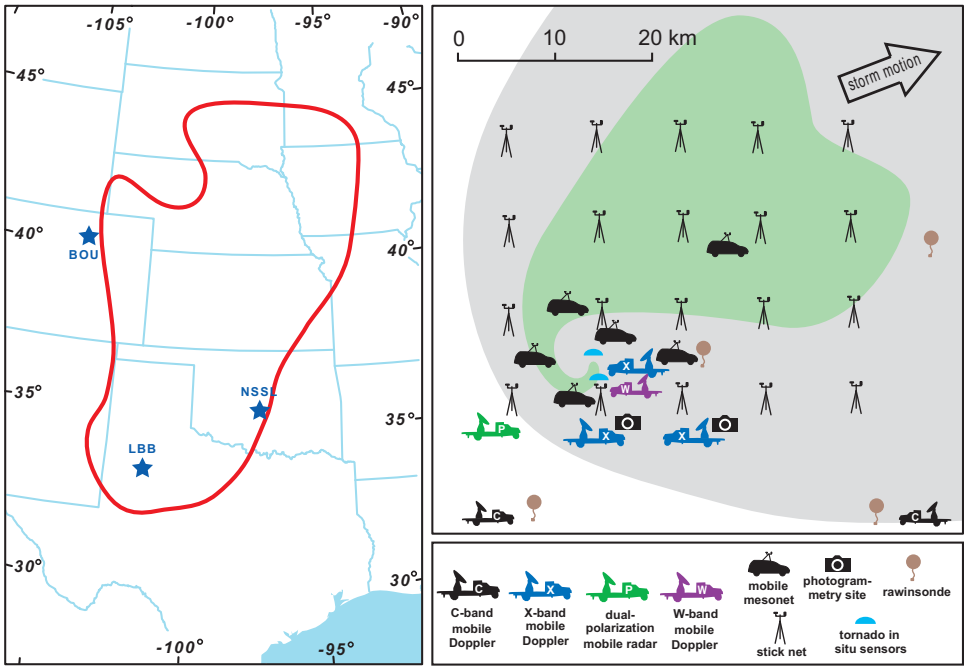
VORTEX findings lead to new questions in V2

More specific questions have emerged from the broad successes of the original VORTEX. This project will focus on gaining new insight about how, when, and why tornadoes form, why some thunderstorms produce tornadoes and others do not, the structure of tornadoes, and the relationship of tornadic winds to damage. V2 will take advantage of cutting-edge technology to build a complete observation network around and under an entire supercell storm. V2 researchers are convinced as they improve their understanding of tornado formation they can use that knowledge to significantly improve tornado forecasts and warnings, even possibly including details about a tornado's strength, track, and lifetime.

"The VORTEX2 experiment is designed to obtain a large number of measurements near the surface in and around the storm to better understand the relationship between storm rotation and the temperature, humidity, and wind fields in this layer," commented V2 Principal Investigator Lou Wicker, NSSL. Results from the first VORTEX experiment showed scientists that these weather conditions are very important in controlling the formation and strength of tornadoes.

Examining a storm from every angle

V2 will focus operations on the Central Plains. The relatively flat landscape in this region allows mobile radars to collect



VORTEX2 in the field

V2 teams will target potentially tornadic supercell thunderstorms on the Central Plains. Most strong tornadoes (F2–F3) and nearly all violent tornadoes (F4–F5) come from supercell thunderstorms.

The red outline (left) defines the region where research teams will focus their attention. In the enlarged picture (right), the green shading is the precipitation area of a supercell thunderstorm and the gray shading shows the cloud boundary seen by satellite. The drawing shows how instruments and vehicles might be positioned to gather data needed to answer questions about tornado formation and wind fields.

data close to the ground, the region where many important tornado secrets lie, without interference from hills, trees, or buildings. V2 will target this area during May and early June, statistically the most active time of year for severe weather and a time when storms tend to be slower moving, presenting a better opportunity for observation.

Instrumentation

V2 will be a fully mobile experiment, and scientists have chosen a region with favorable terrain, a good road network, and unobstructed visibility. V2 will canvass this target area with an armada of vehicles and an arsenal of instruments. Plans include the use of up to nine mobile radars, deployable instruments (tornado-POD's and sticknets), unmanned instrumented aerial systems, mobile ballooning facilities, mobile mesonets, and camera systems for storm photogrammetry. When storms develop near central Oklahoma, the National Weather Radar Testbed phased array radar, CASA radar array, Oklahoma mesonet, and KOUN dual-polarimetric WSR-88D – all fixed instruments – will be added to the arsenal.

For over 40 years, researchers at NSSL and their colleagues have been working to unravel the mysteries of tornado formation. On a national scale, new clues about how and why tornadoes form will lead to improved forecasts and warnings of severe thunderstorms and tornadoes saving lives and property.

Mobile mesonets with roof-mounted instruments transmit real-time temperature, humidity, pressure, wind speed, wind direction, vehicle orientation and GPS location to a central command vehicle.

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On the web: http://www.vortex2.org, and http://www.nssl.noaa.gov/vortex2/
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