NSSL Briefings

A newsletter about the employees and activities of the National Severe Storms Laboratory

Welcome from the director:

Bob Maddox

This is the first issue of a newsletter which we hope to produce periodically at intervals yet to be determined. The purpose of ***NSSL Briefings*** will be to share information about activities and staff at the National Severe Storms Laboratory (NSSL). ***NSSL Briefings*** will not be used for technical or scientific communications. Rather, it will be slanted toward a diverse audience of federal managers and staff and other colleagues associated with the meteorological community, whom we would like to be aware of our activities.

The most important and visible activity this spring has been the second phase of the collaborative VORTEX field program. Additionally, we have begun collaborations with the National Weather Service (NWS) to prepare for the 1996 Olympics in Atlanta, Georgia. We also provided upper-air sounding support to an Arizona field study coordinated by the National Oceanic and Atmospheric Administration (NOAA) Atmospheric Modification Program. Dave Jorgensen worked on a detail to Environmental Research Laboratory (ERL) Headquarters for a number of weeks this spring. Dave helped to coordinate and develop FY-97 budget requests that support our weather research programs.

Finally, please feel free to comment on this newsletter. You can reach me at (405) 366-0472 (FAX) or maddox@nssl.uoknor.edu. ◆

Summer 1995

In Brief.....

Tornadoes targeted in VORTEX

by Erik Rasmussen

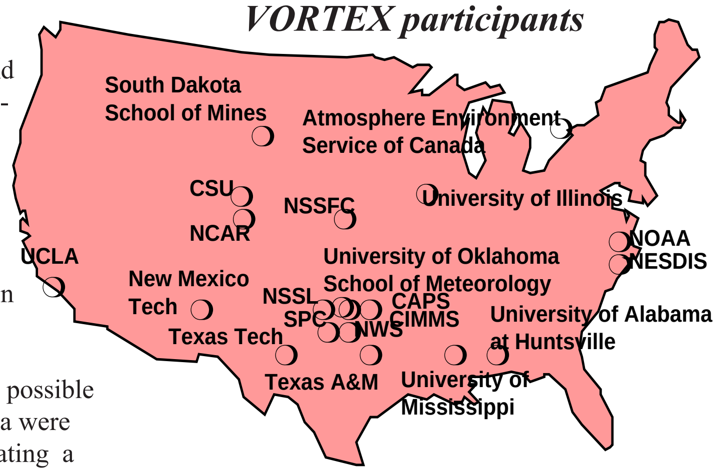
Unprecedented data sets were collected by the **V**erification of the **O**rigins of **R**otation in **T**ornadoes **EX**periment (**VORTEX**) on June 2, 1995. The VORTEX team was able to document the entire life cycle of a tornado from its development through its rope-tornado demise. VORTEX is a carefully planned, narrowly focused experiment designed to answer a number of ongoing questions regarding the causes of tornado formation.

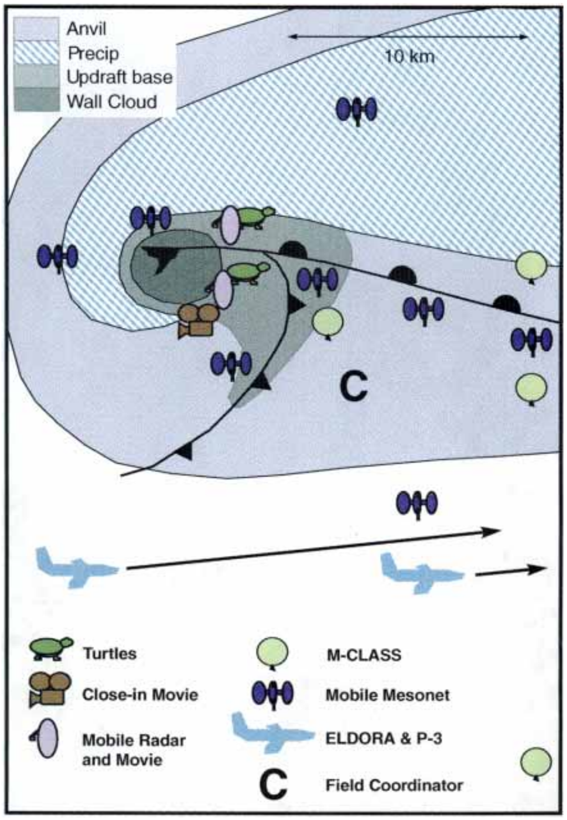
The 2-year experiment began in 1994 and ended this June, hosted by NSSL, along with the Center for the Analysis and Prediction of Storms (CAPS). Collaborators from around the United States and Canada were involved in the experiment. VORTEX was funded through a joint NOAA/National Science Foundation (NSF) program.

VORTEX field operations took place in parts of Texas, Oklahoma, and Kansas. The field program focused on one target storm each day to gather as much data as possible over a complete supercell life cycle. Data were collected by a team of investigators operating a dozen instrumented vehicles, a mobile Doppler-radar, and two Doppler-radar equipped aircraft. Experimental detailed forecasts of supercell and tornado occurrences were done at NSSL and the new Storm Prediction Center (SPC), which is presently housed in the NSSL building.

VORTEX collected data on 15 storms during 1994 field operations, and encountered three tornadic supercells, eight non-tornadic supercells, and four storms that were not supercells on days

VORTEX participants





Example of the deployment of the VORTEX observing systems around a supercell storm. The precipitation region is the hook-shaped blue region, with cloud bases shown in gray, and the tornado in black. Anemometer-shaped icons are for "mobile mesonet" teams, balloons for mobile sounding teams, movie cameras for photography teams, turtles and radar dishes for those respective teams, and a "C" for the Field Coordinator.

when supercells were expected. VORTEX collected data on 16 storms this spring. Preliminary results from 1995 operations indicate that several valuable data sets were collected.

Using data gathered during the field program, VORTEX will evaluate very specific hypotheses that focus on:

- the connection between rotation in the middle-levels of the storm, and the development of a tornado at the surface,
- airflow patterns and windspeeds in the surrounding storm environment, and
- airflow inside the tornadoes to understand resulting damage.

VORTEX has several areas of emphasis that will lead to significant benefits to operational meteorologists

Drawing from these hypotheses, VORTEX has several areas of emphasis that will lead to significant benefits to operational meteorologists.

One area of emphasis deals with tornado formation. The Weather Surveillance Radar-88 Doppler (WSR-88D) can readily detect rotation in the middle and upper altitudes of a supercell thunderstorm, and theories currently exist to explain this rotation (called a mesocyclone). However, we still do not understand the connection between rotation in the middle altitudes of a storm and the development of a tornado at the surface. By understanding this connection, we may be able to detect the precursors of tornado formation in regions well above the ground. This information will greatly benefit operational meteorologists and reduce false alarms, since many mesocyclones potentially detected by Doppler radar do not have tornadoes associated with them.

A second area of emphasis of VORTEX is to advance our knowledge of airflow patterns and windspeeds in the surrounding storm environment. At times when the atmosphere will support the development of supercell thunderstorms, no storms form at all. And, on days when conditions are marginally favorable for supercells, one or two storms become tornadic while most storms remain below severe limits. VORTEX should provide new knowledge of how supercell storms are initiated and what environmental factors cause those certain few storms to become tornadic. Operational meteorologists will benefit from this information when they attempt to predict the occurrence, or absence of the development, of supercell thunderstorms.

Advancing our knowledge of the environment within tornadoes is a third emphasis of VORTEX. We currently know very little about the airflow in tornadoes, how it varies over time, maximum wind speeds, and temperature, pressure, and humidity tendencies. This information will be helpful in understanding damage produced by tornadoes.

June 2, 1995 intercept

The storm intercept in west Texas on June 2 was a classic example of how VORTEX data collection was designed to be executed. A mobile X-band scanning Doppler radar collected numerous volume scans of data at a range of 3 km from a tornado near Dimmitt, TX. The tornado debris cloud was obvious in the reflectivity data. Preliminary examination of the Doppler velocity data suggests average winds within the radar beam near the tornado to be near 60 m/s. Using the VORTEX-designed "mobile mesonets," nearly 1000 automated surface weather observations were collected within a few kilometers of the tornado. Roughly 1000 other observations were obtained in other parts of the tornadic storm, combined with data gathered during several balloon launches. Airborne Doppler radars on the NOAA P-3 and NCAR Electra aircraft thoroughly documented the airflow throughout the parent storm. (An informal description of June 2 VORTEX operations can be found on page 10).

These data sets obtained by VORTEX this year are several orders of magnitude richer than any collected before on a tornadic storm. They will probably be the 'reference' data sets for tornado and supercell studies for years to come. This information will provide invaluable knowledge to help reduce false alarms, improve predictions of supercell storms, and determine what causes storms to become tornadic. ◆

For more information on VORTEX contact Erik Rasmussen at: rasmussen@nssl.uoknor.edu

Employee of the Year awards include two NSSL employees

Two NSSL employees have been named among 5 recipients of the Oceanic and Atmospheric Research (OAR) Employee of the Year Award. This award recognizes OAR employees for "significant contributions to OAR programs and exceptional and sustained effort towards accomplishment of the OAR mission."

Joy Walton was honored for her high quality executive support as Secretary to the Director. Joy supports both the Director and Assistant Director, and has taken on the support for the new Storm Prediction Center. Joy continues to add to her responsibilities, allowing NSSL to reduce the total number of secretaries from six to three. Her dedication, competence, and desire for excellence have kept NSSL an outstanding organization.

Jerry M. Schmidt (Mike), lead Electronics Technician at NSSL, was recognized for his many outstanding contributions leading to the improvement of NSSL operations and programs. Mike has been instrumental in improving NSSL's Doppler radar capabilities. Among other improvements, dual-polarization capabilities were added to the radar leading to important new discoveries in the area of rain-fall estimation. Mike has also provided maintenance support for our computer systems; saving NSSL thousands of dollars each year. His positive attitude and ability to work with others has resulted in many improvements and cost savings for NSSL.

Our congratulations go out to our two winners! ◆

Joy Walton and Mike Schmidt: OAR Employees of the Year!

NSSL joins the World-Wide Web

By Dave Stensrud and Harold Brooks

The World-Wide Web (WWW) is the most advanced information system currently deployed on the Internet. NSSL joined this information system on November 4, 1994 with the installation of a WWW server on a laboratory workstation.

The WWW has a very interesting history. It was originally developed to allow for the easy sharing of information among an internationally diverse group of high energy physicists working at CERN, the European Laboratory for Particle Physics located near Geneva, Switzerland. However, the physics community quickly realized the power that this information system provides the user, and the WWW expanded rapidly. There are tens of thousands of WWW servers and millions of users. It is the fastest growing segment of the Internet community and, despite only being widely available for two years, it is already the most widely used protocol for data transfer on the Internet. The Web is the first true incarnation of the "information superhighway" about which politicians love to rave.

The WWW is accessed by running a program called a browser on your local computer. Browsers are available for PC's, Macintoshes, and just about any UNIX workstation. Browsers read documents from the WWW hypertext servers and then display the contents of these documents on your computer. All of the protocol handling is negotiated between the browser and the server, so the user does not have to worry about formats, fonts, or any of the other problems that can arise when accessing documents not created on their own system. And the WWW is a true multimedia information system with the ability to display text, graphics, pictures, and movies, and to replay sounds.

The NSSL is well on its way to taking full advantage of the information explosion provided by the WWW. The NSSL Home Page can be reached using the following Uniform Resource Locator:

http://www.nssl.uoknor.edu/

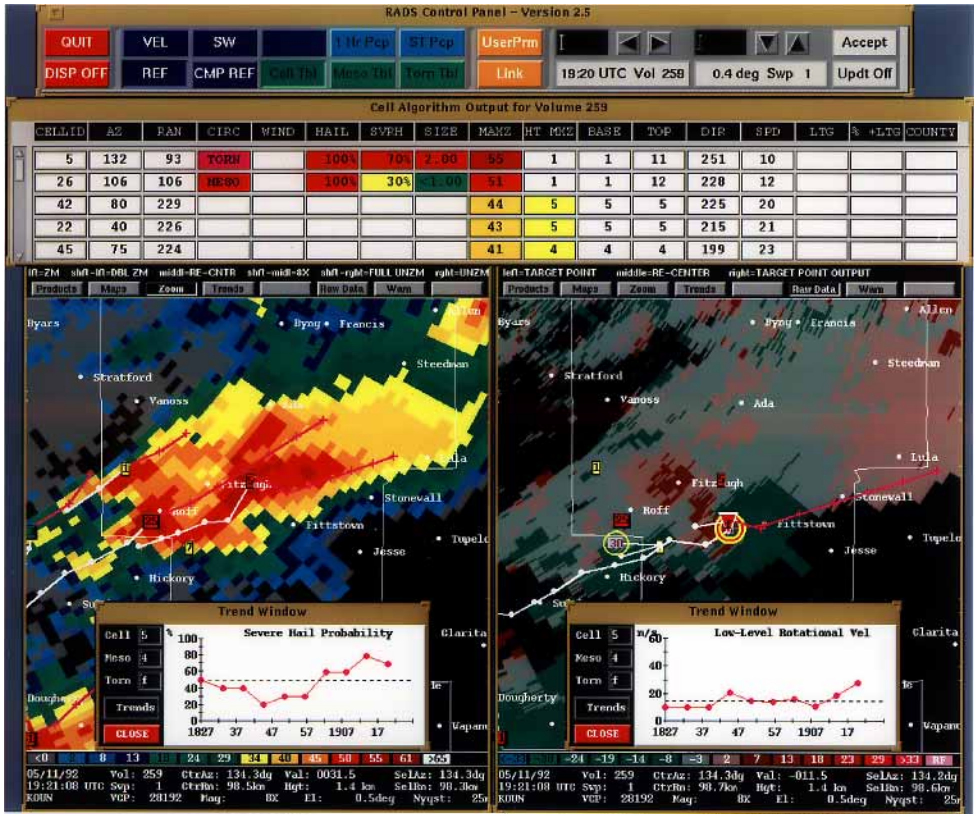
It contains information on the NSSL mission, laboratory administrative structure, special projects (including VORTEX and Short-range Ensemble Forecasting), new developments, employment opportunities, publications, and links to other WWW servers that we find interesting and useful. This incredibly powerful tool for providing up-to-date information to our user community is easy to maintain and use. Please take a look and enjoy! ◆

The URL for the NSSL Home Page is:

http://www.nssl.uoknor.edu/

For more information contact Dave Stensrud at: stensrud@nssl.uoknor.edu or Harold Brooks at: brooks@nssl.uoknor.edu

FEATURE STORY



The meteorologist can examine the Doppler velocity and reflectivity data in great detail and can use the mouse to click on the storm to bring up "trend windows" , as is shown in this example.

Warning process aided by experimental Warning Decision Support System

By J.T. Johnson

The algorithms currently included in the WDSS identify and track storms, and detect hail, mesocyclones, tornadoes, and predict damaging downbursts.

Most of the weather-related losses of human life in the U.S. are caused by small-scale phenomena such as severe thunderstorms, tornadoes, lightning, and flash floods. Accurate forecasting and warning of these phenomena is crucial. NSSL has developed an experimental severe weather Warning Decision Support System (WDSS). The WDSS is a combination of sophisticated severe weather detection algorithms and an innovative, user-friendly display. The concept of the WDSS is to provide important information to warning meteorologists more effectively than previously possible.

NSSL has a full suite of algorithms that have been developed with support of the NWS/OSF and the FAA. The algorithms use Doppler radar data and other meteorological data to analyze severe weather phenomena and provide information to forecasters on storm structure, rates of growth and decay, and the probability of severe weather associated with a given storm. The algorithms currently included in NSSL's WDSS identify and track storms, and detect hail, mesocyclones, tornadoes, and predict damaging downbursts.

Storm Cell Identification and Tracking Algorithm

Knowing the present location of thunderstorms and their movement is crucial to the NWS meteorologist. The Storm Cell Identification and Tracking (SCIT) algorithm is designed to identify the location of storms, track them over time, and forecast their movement over the next 30 minutes. The SCIT algorithm also analyzes the identified storm cells and provides the meteorologist with information in the form of a table about the cell's potential to produce severe weather.

Hail Detection Algorithm

Hail greater than 3/4 inch diameter is considered severe by the NWS. Doppler radar data are examined in real-time by the NSSL-developed Hail

Detection Algorithm (HDA) to determine the probability that the storm is producing hail >3/4 inch diameter. It also estimates the maximum hailstone size associated with a storm.

Mesocyclone Detection Algorithm

Statistics show that storms with mesocyclones (very strong circulations within a thunderstorm) produce severe weather approximately 95% of the time, and tornadoes approximately 20% of the time. The Mesocyclone Detection Algorithm (MDA) detects these strong circulations in thunderstorms and forecasts their movements for up to 30 minutes. The algorithm also analyzes the mesocyclone and produces information about the strength of rotation, depth, and diameter. All of these parameters are useful to meteorologists as they try to determine whether or not to issue severe thunderstorm or tornado warnings.

Tornado Detection Algorithm

Tornadic winds are the strongest produced by nature. The Tornado Detection Algorithm (TDA) examines Doppler radar velocity data to detect signatures that indicate a tornado or signal its development.

Damaging Downburst Prediction Algorithm

The Damaging Downburst Prediction Algorithm (DDPA) is designed to short-term predict and detect the divergent outflow patterns often associated with downbursts. The DDPA uses radar-detectable precursors that have been found to occur 10-15 minutes before a downburst. Some known precursors are: convergence above the cloud base within a storm, a descending reflectivity core, and in some cases, rotation above the cloud base. The output from the algorithm indicates either a prediction or detection of a downburst event and an estimate of its strength.

Radar and Algorithm Display System

All the information produced by these algorithms is extremely valuable to operational meteorologists. Unfortunately, it has the potential to overwhelm them in a chaotic warning situation. NSSL has developed a display system that is designed to provide meteorologists with easy access to algorithm information and radar data images. We also use this display system to support development and assessment of the algorithms. It is called Radar and Algorithm Display System (RADS). RADS combines the radar data, algorithm tables, maps, trends and overlays of algorithm output to supply pertinent warning information. Some attributes of this display system have been evaluated favorably by NWS forecasters and will be transitioned to operational systems.

The deployment of the nationwide network of Doppler Weather Radars is giving warning meteorologists a valuable new tool to enhance their capability to warn of severe weather events. To further capitalize on this investment in radars, it is important that computer software and other tools be developed to help meteorologists synthesize all of the data coming from radars into information that can help them make warning decisions.

Research and development of the Warning Decision Support System meets this need and, when implemented in the WSR-88D and AWIPS (Advanced Weather Interactive Processing) systems, will enhance the weather warning capability of the National Weather Service, ultimately saving lives and reducing damage to public and private property. ◆

The WDSS will enhance the weather warning capability of the National Weather Service

For more information on the WDSS contact J.T. Johnson at: johnson@nssl.uoknor.edu

Outstanding Scientific Paper Awards include three NSSL scientists

by Susan Oakland-Cobb

Three NSSL scientists have been awarded the Environmental Research Laboratories (ERL) 1993 Outstanding Scientific Paper Awards. Bob Davies-Jones received the award for his paper "The Frontogenetical Forcing of Secondary Circulations. Part I: The Duality and Generalization of the Q Vector," which was published in the Journal of Atmospheric Sciences. Brad Smull and J. Augustine won the award for "Multiscale Analysis of a Mature Mesoscale Convective Complex," published in Monthly Weather Review. Congratulations! ◆

Employee spotlight

Arthur Witt

By Susan Oakland-Cobb

Most meteorologists enjoy going out to intercept storms in nature. Arthur Witt, however, would rather stay behind and examine Doppler radar displays during storm events. Arthur spent many spring-times in the 1980's watching Doppler radar and vectoring storm intercept teams. He is rooted in Doppler radar as a result. This sort of "real-time" operation is what Arthur enjoys the most, and he maintains an operational application focus on his work at NSSL.

Arthur is part of the "SWAT" team, or "Severe Weather Warning Applications and Technology Transfer" team at NSSL. He is involved with algorithm design, development, and testing for the FAA and NEXRAD. Arthur has had a direct impact on each of the new severe storm detection algorithms developed by NSSL, and considers it to be one of his greatest successes. Arthur says, “With the NEXRAD deployment already over half completed, I would expect an expanding commitment on NSSL’s part in the continuing process of algorithm development and testing.” Lately his work has focused on the Hail Detection Algorithm.

Working with hail isn’t something new to Arthur; his master’s thesis was on determining hailstorm intensities using Doppler radar data. An intense interest in severe storms brought Arthur to Oklahoma for his master’s degree, after completing his undergraduate degree at the University of Wisconsin-Milwaukee. NSSL employed Arthur as a research assistant while he was a graduate student and later hired him as a research meteorologist. He chose to stay in Oklahoma because he was already familiar with NSSL, and wanted to continue studying severe storms.

Away from the lab, Arthur plays in amateur US Volleyball Association tournaments around the state. Any other spare time is spent reading and developing his interest in electronic music. Arthur describes himself by saying, “There are two types of people, talkers and listeners, and I am definitely in the listener group.”

Arthur has always wondered what it would have been like to be a full-time operational meteorologist. But through spring field programs like VORTEX, he gets an adequate taste of the operational life-style. The complexity of the weather has always been intriguing to Arthur, which makes it easy for him to be content in his job. Looking ahead, he hopes to continue his heavy involvement with field programs as well as developing operational applications that will help NWS meteorologists provide better warnings to the public. ◆

Bio-Box

Current position: *Research Scientist, NSSL*

Current project: *NEXRAD algorithm testing and design*

Education:

B.S. Meteorology - University of Wisconsin-Milwaukee

M.S. Meteorology - University of Oklahoma

SRAD achieves significant milestone

by Mike Eilts

The Stormscale Research and Applications Division (SRAD) achieved a significant milestone in the past year by delivering four second-generation algorithms to the WSR-88D Operational Support Facility. The algorithms will be included in the WSR-88D soon. The algorithms that were delivered are the NSSL-developed Storm Cell Identification and Tracking, Mesocyclone Detection, Hail Detection, and Tornado Detection Algorithms. ◆

Phoenix and Fort Worth NWS/WSFO's evaluate Warning Decision Support System during severe weather events

by J.T. Johnson and Greg Stumpf

The Stormscale Research and Applications Division (SRAD) has just completed a real-time demonstration of their experimental Warning Decision Support System (WDSS) in front of NWS meteorologists in Fort Worth, TX. This was the second opportunity for SRAD to demonstrate their new tool to enhance warning capabilities. The first WDSS test took place in Phoenix, AZ during the summer of 1994, and the next test will be held this summer in Atlanta, GA.

Part of SRAD's mission is to develop severe weather warning applications and transfer them to users to enhance their capability to warn of severe weather. SRAD has been developing enhanced Doppler radar-based algorithms and algorithm product display concepts for the WSR-88D system for the last 5 years. The algorithms and associated display techniques have been tested significantly off-line, and are scheduled to replace the current baseline algorithms in the WSR-88D system in the next 1-3 years. One goal of the WDSS tests is to identify any special areas of enhancement for the algorithms prior to their inclusion in the WSR-88D system.

The WDSS was tested in Phoenix, AZ during the 1994 summer-monsoon season. The primary severe weather events in the Southwest during the summer are damaging winds associated with downbursts and gust fronts, and flash flooding situations. Three additional algorithms were added to the NSSL suite for the first time to handle these phenomena: the Damaging Downburst Prediction Algorithm (DDPA), the Gust Front Detection Algorithm (GFDA), and a ported version of the WSR-88D Precipitation Package. Doug Green, Phoenix NWS Scientific Operations Officer (SOO), said of the DDPA and the GFDA, "these are two important algorithms that should be implemented into the WSR-88D system."

Although the Mesocyclone, Tornado, and Hail Detection Algorithms (MDA, TDA, and HDA) were running in Phoenix, the 1994 summer-monsoon season was not associated with many large hail and/or tornado reports. As a result, these particular algorithms were not rigorously tested. These types of severe weather are more common in the Southern Plains springtime environment, and are frequently associated with supercell thunderstorms.

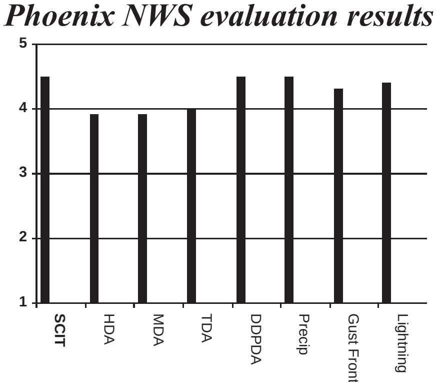
The most recent test was conducted this spring in Fort Worth, TX. The test had several objectives:

- To test NSSL's enhanced Doppler radar-based algorithms in the Southern Plains springtime environment in actual NWS operational warning situations. Specific emphasis was placed on the Mesocyclone, Tornado, and Hail Detection Algorithms.
- To gain feedback from NWS warning meteorologists on the concept of a Warning Decision Support System as well as the display concepts represented by NSSL's Radar and Algorithm Display Software (RADS) and its enhanced algorithm product display capabilities.

Post-shift questionnaires and NSSL staff observations were used to obtain feedback on the usability of the products available in the WDSS, and needed additions and enhancements.

Although we are continuing to enhance all components of the WDSS, and these tests provide us great feedback for that enhancement, the overall impression of the WDSS as a concept has been positive. The Phoenix NWS staff were most pleased with the availability of time trend information and the ranking of storms by severity. The evaluations of the Fort Worth, TX test have not been compiled yet, but Mike Foster, Fort Worth NWS Scientific Operations Officer (SOO), had some informal comments, "As to the performance of WDSS, I am sold. I have developed a great deal of confidence in the algorithms." ◆

Phoenix NWS evaluation results



Meteorologists rate the algorithms included in NSSL's WDSS (5 is the highest rating).

"These are two important algorithms that should be implemented into the WSR-88D system."

-Doug Green
Phoenix SOO

"As to the performance of the WDSS, I am sold. I have developed a great deal of confidence in the algorithms."

- Mike Foster
Fort Worth SOO

For more information contact J.T. Johnson at: johnson@nssl.uoknor.edu or Greg Stumpf at: stumpf@nssl.uoknor.edu

Storm Prediction Center has meteorologists from NSSL and NWS working together

by John Cortinas Jr.

The Storm Prediction Center will be responsible for providing hazardous weather guidance to NWS field forecasters.

NSSL and SPC meteorologists are working together to improve hazardous weather forecasting.

The National Weather Service (NWS) and NSSL have created a unique environment where research and operational meteorologists can interact and improve hazardous weather forecasting. NWS meteorologists have been working at the new Storm Prediction Center (SPC) with NSSL Mesoscale Research and Applications Division (MRAD) scientists since September, 1994.

SPC is one of the National Centers for Environmental Prediction, created under the reorganization plan of the NWS. SPC will be responsible for providing hazardous weather guidance to NWS field forecasters. The types of hazardous weather of concern to SPC are: large rain amounts, large snow accumulations, freezing precipitation, blizzards, 3/4 inch diameter hail, convective winds in excess of 50 knots, and tornadoes. SPC will first issue winter weather guidance near the end of 1996. Eventually, SPC duties will replace those of the National Severe Storms Forecast Center.

The initial phase of SPC has emphasized the definition of operational logistics. Part of current operations includes daily weather discussions identifying hazardous weather areas of interest to SPC. Both NSSL and NWS meteorologists contribute to these discussions and benefit from this mutual participation. The interaction between NSSL and SPC allows NSSL meteorologists a means to transfer and test the results of their research immediately in an operational environment. In this way, they can quickly address any problems with their research that may require further study. Operational meteorologists benefit by having access to important research results that may improve their guidance products. Already, this interaction has identified new gaps in the scientific knowledge of hazardous weather.

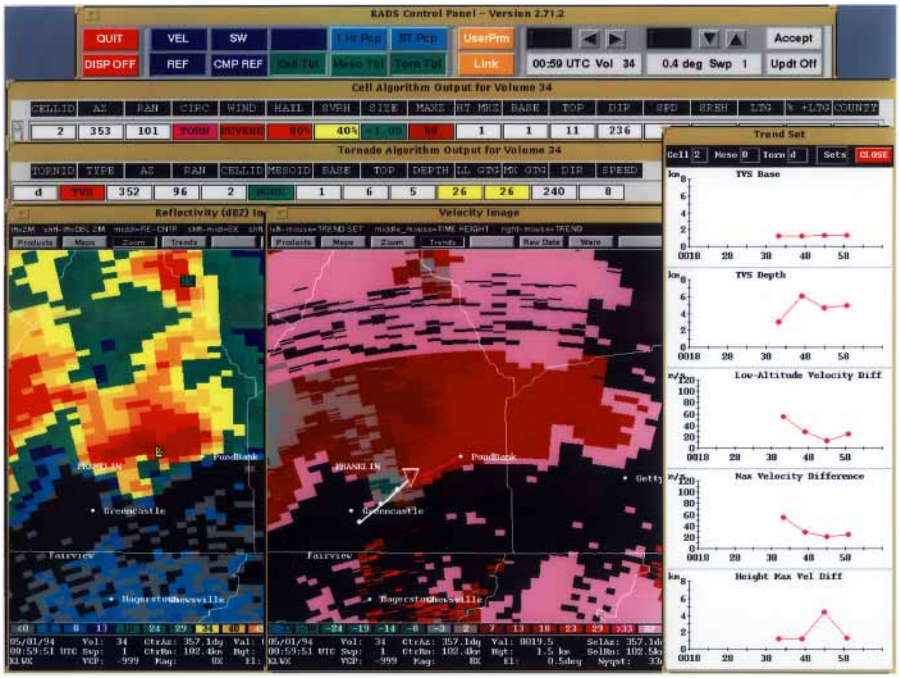
NSSL meteorologists in the MRAD meteorological and applications group are already involved with scientific research in all types of hazardous weather. Currently, they are pursuing studies in areas including:

- forecasting heavy precipitation and flash flooding
- the use of lightning to forecast the movement of convective systems
- new severe weather forecast techniques
- the use of mesoscale models in forecasting
- the evaluation of forecasting techniques for freezing precipitation and heavy snow.

STORM PREDICTION CENTER

The NSSL/SPC collaboration continues to evolve. NSSL and SPC meteorologists are working together to address issues they have already identified to increase their understanding of hazardous weather. This interaction will ultimately lead to a better product for our primary customer -- the public. ◆

For more information contact John Cortinas Jr. at: cortinas@nssl.uoknor.edu



NSSL Tornado Detection Algorithm Output. The inverted triangle identifies a detected tornado and assigns it a number that corresponds with the number in the table.

Tornadoes identified by algorithm

By E. DeWayne Mitchell

In a move to spur progress toward better tornado warnings, NSSL is developing a Tornado Detection Algorithm (TDA) to be used on the WSR-88D. With the installation of WSR-88D radars around the country, operational meteorologists now have the capability to examine circulations associated with tornadoes. Warning events are hectic for the meteorologists. The TDA saves them time by automatically detecting, analyzing, and tracking the movement of tight circulations often associated with tornadoes. When a suspect circulation is detected, the warning meteorologist is alerted.

The ability to automatically detect tornadoes is a very important function that will improve future warnings produced by the National Weather Service. Our goal for the TDA is that it would eventually provide a probabilistic statement such as "there is a 40% chance that the circulation detected will produce a tornado in the next 10 minutes." To provide such a statement requires that numerous cases and parameters be analyzed.

We have been examining Archive II data from WSR-88D's in Phoenix AZ, Amarillo TX, Dodge City KS, Houston TX , St. Louis MO, Sterling VA, Memphis TN, and Norman OK. We examined a number of characteristics of the circulations observed by radar. We found that some small, weak tornadoes have very little signature in the velocity data at ranges greater than 40km. We also discovered that, in general, the signature of a tornadic circulation is a tight azimuthal shear with limited range extent and that all tornadic circulations in our present database were at least 1.5km deep. So far we have found that the best discriminator between tornadic and nontornadic circulations is the maximum gate-to-gate velocity difference at the 0.5^{o} tilt.

Data from geographically diverse regions will be obtained to aid in the isolation of other important parameters for tornado prediction and detection. To be able to analyze WSR-88D data from all parts of the country is an enormous task. However, compared to just a couple of years ago, the job of analyzing large datasets has been simplified. We have now developed the capability to read Archive II tapes, run the data through the algorithm, and display it easily.

We plan to continue to analyze cases and parameters in order to provide a better detection capability. Every case we examine fine tunes the TDA to become an invaluable tool in the warning process. ◆

The TDA saves time by automatically detecting, analyzing, and tracking the movement of tight circulations often associated with tornadoes.

For more information on the TDA contact DeWayne Mitchell at: mitchell@nssla.nssl.uoknor.edu

In the field with VORTEX

Valuable data on two storms that produced violent tornadoes were obtained by VORTEX on June 2, 1995. The following is an informal description of VORTEX operations and observations on that day.

by Erik Rasmussen

The storms formed in a region of strongly backed low-level flow with modest westerly flow aloft, yielding strong deep shear. The target area for VORTEX for storm initiation was Clovis, New Mexico. Storms formed in this area in the late afternoon.

The first storms seemed somewhat disorganized. However, inflow quickly increased to 40-50 knots, so we felt that the storms had a lot of potential for becoming supercells

The first target storm moved NE along US 60 toward Friona, TX. When the storm was near Bovina, TX, inflow became so strong that visibility went to zero in blowing dust, and power lines were torn down at a distance of 15km SE of the storm. Some surface teams were forced to turn away from the storm because of these conditions. The other teams which were closer to the developing mesocyclone reported winds of 30-50kts flowing toward the mesocyclone from all directions. The mobile Doppler radar scanned the storm from a distance of 12km and observed very strong low-level horizontal shear. This information was reported in real-time to the Field Coordinator.

The first violent tornado formed just SW of Friona, moved across the southern fringes of the community, and then across the east side of town. It traveled for several miles further NE to the area north of Black, TX. At Friona, a large grain elevator was destroyed. The airport was completely destroyed, with the most significant damage being to a large steel building. The anchor bolts holding the columns of this building were ripped out of the concrete slab, with part of the slab going with the bolts. The heavy beams were left in a twisted heap. One I-beam became a missile and was thrown about 100 meters.

The cemetery just north of the airport was also heavily damaged with trees missing most of their branches. A several-ton railroad boxcar which served as a storage building bounced through the cemetery, destroying monuments and gouging a 2-foot deep hole through an asphalt drive and into hard-packed soil. The boxcar traveled about 100 meters.

After the Friona tornado became rain-wrapped, attention shifted to a new mesocyclone just SE of Friona. This mesocyclone was due to move into a region with very few roads. Another mesocyclone was developing SW of Dimmitt, TX, so VORTEX targeted that storm (at times, more than half-dozen mesocyclones were in existence over a few-county area, making the intercept very risky in terms of choosing the “best” storm and staying safe).

As the mesocyclone approached Dimmitt, teams quickly converged on their correct storm-relative positions around Dimmitt. The mobile Doppler scanned the near-ground mesocyclone region south of Dimmitt briefly. A tornado developed quickly on the south side of Dimmitt, moving cyclonically about the mesocyclone to just east of Dimmitt, and then curved back towards the northeast. Mobile mesonet data were obtained in all quadrants of this tornado within 3 km. Video was obtained from several sites.

The mobile Doppler obtained tremendous data as the tornado moved in an arc around the Doppler position on the 3km range ring. The tornado debris cloud itself appears in the reflectivity data.

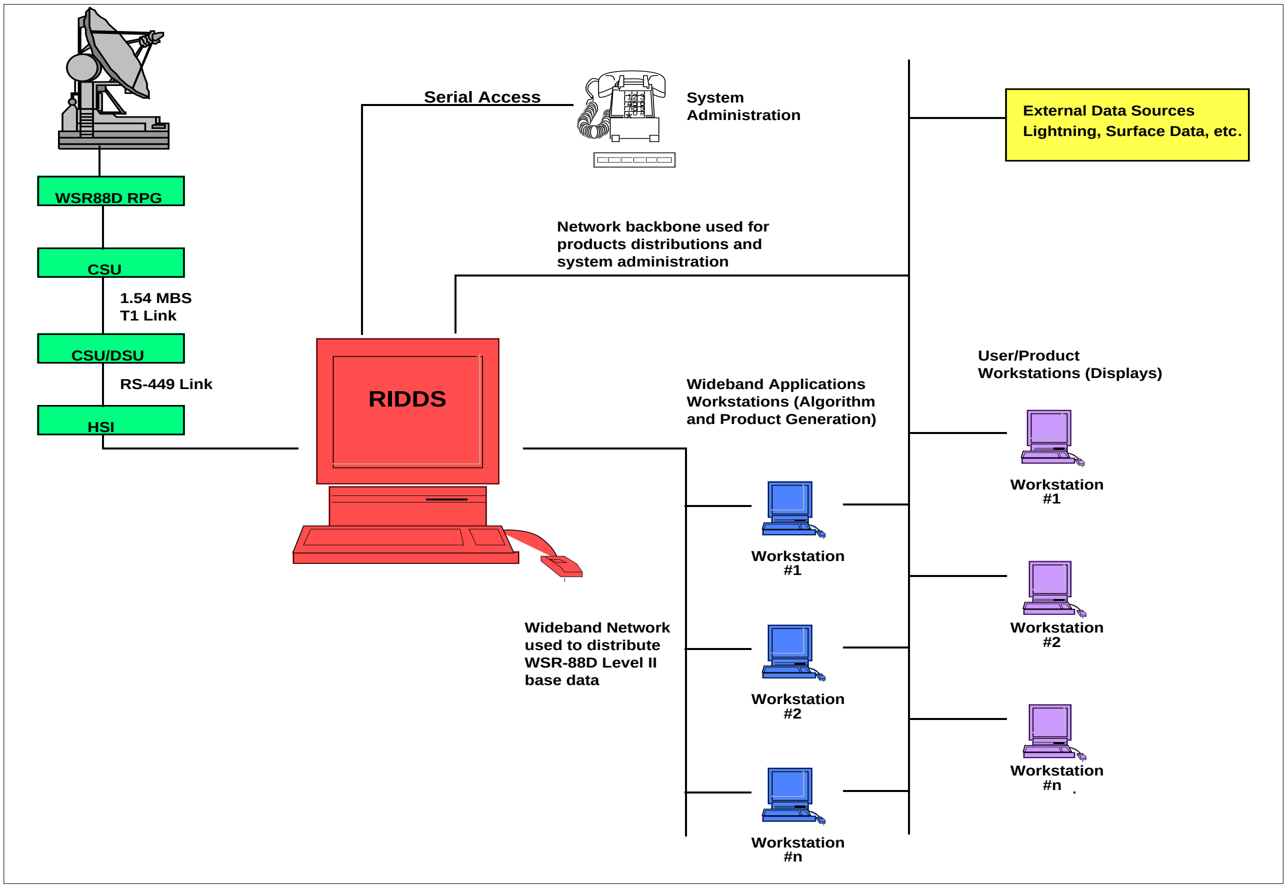
When the tornado crossed TX 86, it removed the pavement in a 10m wide swath over a length of approximately 100m. The asphalt was thrown over 200m into the adjacent field. Power poles were snapped at the ground. Vehicles were totally destroyed, with reports of two truck trailers missing entirely.

As the Dimmitt tornado was in progress, another, less significant tornado was occurring about 10 miles north of Dimmitt associated with the mesocyclone (noted above) which formed southeast of Friona.

The research aircraft were forced to fly on the west sides of these storms because of the wide-spread intense convection. A large number of pseudo-Doppler volume scans were collected by the aircraft at somewhat greater ranges than normal.

In summary, VORTEX has obtained a rich data set on one significant tornado event (Dimmitt tornado). We obtained a good data set at Friona, although that event was sampled somewhat less well than the Dimmitt tornado. ◆

For more information on VORTEX access the VORTEX Home Page on the WWW.



The RIDDS environment

WSR-88D's live data stream now accessible in real-time

By Mike Jain and Doug Rhue

NSSL, with funding support from the FAA (AND-460), and with help from Lincoln Laboratory and the NWS/WSR-88D Operational Support Facility (OSF), has made a major breakthrough in the development of a system called the WSR-88D Radar Interface and Data Distribution System (RIDDS). Using RIDDS, NSSL can now easily test and evaluate new algorithms as well as innovative display and severe weather warning techniques using real-time WSR-88D data.

RIDDS utilizes a Reduced Instruction Set Computer (RISC)-based workstation (Sun SPARC 5 or greater) that accesses the WSR-88D User Port. The benefit of RIDDS is the ability to access the WSR-88D real-time base data stream from a single point and to distribute the base data over an ethernet to any number of workstations without impacting the performance of the WSR-88D. Additional workstations can be added to the network at any time as additional processing requirements are encountered. RIDDS not only establishes and maintains the necessary communications required of the WSR-88D but also receives and stores the base data (reflectivity, velocity, and spectrum width), and passes the data by ethernet or T1 line to other computing platforms to run various applications. The resulting open systems platform is relatively low-cost and portable.

With the development of RIDDS, we now have the ability to easily test and evaluate experimental algorithms, displays, and severe weather warning techniques on a live WSR-88D data stream. We are continuing to enhance RIDDS to ensure that we never impact the operational WSR-88D's, and that we have a stable connection for operational tests. The system has already successfully supported operational experiments with the Memphis, Phoenix, and Fort Worth WSR-88D. ◆

For more information on RIDDS contact Mike Jain at: jain@nssl.uoknor.edu

NSSL's Mission

The mission of the National Severe Storms Laboratory is to enhance the National Oceanic and Atmospheric Administration's (NOAA) capabilities to provide accurate and timely forecasts and warnings of hazardous weather events (e.g., blizzards, ice storms, flash floods, tornadoes, lightning, etc.).

NSSL accomplishes this mission, in partnership with the National Weather Service (NWS), through a balanced program of research to advance the understanding of weather processes; research to improve the forecasting and warning techniques; development of operational applications; and the transfer of understanding, techniques, and applications to the NWS and other private sector agencies.

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