National Weather Service
Raleigh, North Carolina

Changing Skies

Over Central North Carolina

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Play It Safe When Severe Weather Strikes

You are driving down the highway when you notice a dark cloud ahead of you. Traveling further, you now see that the cloud ahead is lowering, and a funnel is starting to extend from the cloud toward the ground. WHAT SHOULD YOU DO?

You are planning an afternoon of golfing, however you hear that there is a high risk of severe storms today in the area. WHAT SHOULD YOU DO?

You are sitting with your family in your home when you see on TV that a tornado warning has been issued for your county. A radar loop shows a bright red hook-shaped feature approaching your neighborhood. WHAT SHOULD YOU DO?

You are shopping in a department store with your cousin when you pass by a TV showing that a severe thunderstorm warning has been issued for the area. Your cousin then tells you that severe storms are not as bad as tornadoes, so you shouldn't worry. WHAT SHOULD YOU DO?

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Springin: Into Severe Weather Season

Spring is fast approaching and with the onset of warmer temperatures in March, April and May comes the threat of severe weather in the form of thunderstorms and tornadoes. The weather across North Carolina can be very volatile during the months from February through May. In fact, most of tornado activity across the region occurs in the spring months. For this reason Governor Michael F. Easley will declare March 14-20, 2004 as Severe Weather Awareness Week.

Going back into the weather records shows in the last 10 years, over 350 tornadoes have touched down in the state

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Inside this issue:

Looking Back: The 1984 Carolina Tornado Outbreak

Twenty years ago, on March 28, 1984, one of the largest and most deadly outbreaks of violent tornadoes ever to occur in North Carolina history struck the state. Over 40 people were killed and hundreds more were injured as several tornadoes ranging upward to F4 intensity (207-260 mph winds) traveling at speed of up to 60 mph left paths of destruction mainly in the coastal plain from the South Carolina border near Laurinburg, Maxton, and Red Springs, to near Greenville in Pitt County and northward into Virginia.

A forecaster recalled "that was the meanest red blob I'd ever seen on radar."

In 1984, there was no Doppler radar network. Aging conventional radar systems operated by the National Weather Service could only detect the heavy rain and hail surrounding the storm cores and none of the detail that might have identified tornadoes. A senior forecaster on duty that night (now retired) recalled, "that was the meanest red blob I'd ever seen on radar."

There was no Skywarn program or spotter network in central North Carolina, thus, making it very difficult to know what was happening on the ground. NOAA Weather Radio had only been introduced six years before. Few people had weather radios and reception was poor in the coastal plain. All weather radio broadcasts were manually produced and tape-recorded, a slow process by today's standards. Watch and warning dissemination was further slowed by aging communications technology that featured teletypes and telephone or radio voice relay at most state and local emergency operations centers. And to make matters worse, a key microwave communications tower near Red Springs was hit early by one of the tornadoes, crippling the use of the Emergency Broadcast System for warnings over commercial radio stations in the area.

The entire culture encompassing the severe

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Spotlight On: Steve Harned, Meteorologist-in-charge of the NWS-Raleigh

Mr. Stephen W. Harned, Meteorologist-In-Charge of the National Weather Service Forecast Office in Raleigh, will retire July 2, 2004, after a 36-year federal service career. Mr. Harned received his B.S. in Meteorology from Florida State University in 1970. Except for a three year tour of duty as a Navy meteorological officer in Spain, his entire career has been with the NWS. Before coming to Raleigh in 1990, some of his duty assignments included: Student Trainee, Bristol, TN; Meteorologist Intern, Lubbock, TX; Fire Weather Forecaster, Raleigh, NC; Aviation and Marine Forecaster, Anchorage, AK; Meteorologist-In-Charge, Houston, TX; and Hurricane and Winter Storm Program manager, NWS Headquarters, Silver Spring, MD.

Several questions were posed to him concerning his career.

If you had to do it all over again, would you seek federal employment? *Probably. When I was entering the workforce, the federal government (military) was about the only game in town, so the decision was easy. Now, with so many new opportunities in the private sector, I would be exploring them also, but would more than likely lean towards the NWS. Another reason to seek federal employment is that federal employment benefits are still among the best of any employer in the country.*

Would you work for the Weather Service? *Most likely (if I could get in!). Universities today are graduating very strong meteorologists, so the competition is much greater than it was in the late 1960s. I would strive to get into the NWS because I have always enjoyed preparing the warning and forecast services for the public, which is the mainstay of the agency.*

What are some of the accomplishments or moments in your career that make you most proud? *There are three that standout the most: 1. Watching the growth of the relationship between WFO Raleigh and NCSU which has become perhaps the best and most effective applied collaborative research program in the country. 2. The national awards the Raleigh office has received over the past 8 years – DOC Gold Medal (2000), 2 Bronze Medals (1996 and 2003), and a NOAA Unit Citation (1997). 3. The most memorable and exciting assignment – serving as one of the meteorologists for the 1980 Winter Olympics in Lake Placid, NY. (Had a better seat for the finals of the ski jump than the judges!)*

What are your future plans? *To open a meteorological consulting firm (Atlantic States Weather, Inc.) specializing in forensic services (for lawyers, insurance companies, etc.), training for weather dependent business, event forecasting, and the provision of any other weather related needs. However, I will not assume any long term forecasting responsibilities. I have done that long enough.*

To round out his career, Steve is a charter member of the National Weather Association. Mr. Harned was a member of the Houston Executive Board and was the NOAA/NWS representative on the Interagency Coordinating Committee on Hurricanes. He has also served on several Disaster Survey Teams. Last but by no means least, Steve retired from the U.S. Navy Reserve in 1995, holding the rank of Captain.

Best of luck Mr. Harned in your new endeavor and much success as you anticipate retirement from federal service.

By Richard Jones

Forecasting a Storm's First Lightning Strike

NWS and NCSU partner to predict lightning strikes

Lightning is the second leading cause of weather-related fatalities nationwide, ranking ahead of tornadoes, severe thunderstorms, and hurricanes (only flooding causes more fatalities). Yet very little has been done to try to warn the public of an impending lightning strike. But local research is attempting to change that. Researchers at North Carolina State University have partnered with NWS-Raleigh forecasters to develop a technique to forecast a storm's first lightning strike. By using radar reflectivity data, a cloud-to-ground lightning strike can be predicted 10 to 20 minutes in advance.

In order for lightning to occur, charge separation must first take place in a thunderstorm. Charge separation occurs during collisions between small ice crystals and hail that remain suspended by the updraft of a thunderstorm. The upper levels of a thunderstorm obtain a positive charge, while the lower levels obtain a negative charge. Radar reflectivity can be used to identify this electrification process within a thunderstorm because hail returns large reflectivity echoes. When the reflectivity reaches a certain level of intensity at a particular height in the storm, then it can be inferred that charge separation has taken place. A cloud-to-ground lightning strike is likely to follow within the next 10 to 20 minutes.

An illustration of charge separation in a thunderstorm. The charge difference between the top and bottom of a thunderstorm can lead to a lightning strike.

Forecasters at NWS-Raleigh hope to apply this technique during the spring and summer months. By issuing statements that warn specific areas of a potential lightning strike, forecasters hope to save lives and property – which is the core mission of the National Weather Service.

By Doug Schneider

Career Exploration Offered to NCSU Meteorology Students

While most would agree there are tremendous insights to be gained by aspiring students through an early look at their chosen career paths, few are given the opportunities to do so. As collaborative partners, the National Weather Service Office in Raleigh and the Department of Marine Earth and Atmospheric Sciences at North Carolina State University are providing meteorology majors with an early exposure to the profession of weather forecasting. Five graduate students and five seniors in meteorology were selected as student interns earning college credits by working along side NWS forecasters. At the NWS forecast office, co-located on the Centennial Campus at North Carolina State, student interns rotate through routine duties associated with day to day weather operations. Routine duties they are trained to do include preparing daily climatological summaries, composing a state wide North Carolina weather summary, and analyzing meteorological data. Performing these duties during the weekend and occasionally during the late night shifts ensures that the interns experience the lifestyle demanded by a 24 hour, 7 day a week operation. The interns also participate in special sessions covering a full array of career related activities such as attending meetings with county Emergency Managers, training sessions for Skywarn weather spotters, and on site tours of NWS weather equipment such as the Doppler weather radar and automated weather stations.

The National Weather Service and North Carolina State University value their role in assisting students toward making the right career choice. No doubt after the end of this spring semester course, our student interns will know far more about operational forecasting. Perhaps they will also come to know whether they have the "right stuff" for a career in operational forecasting with NWS - where the protection of life and property from weather hazards is our principal mission.

By Kermit Keeter

NWS Raleigh is located on the Centennial Campus of NC State University.

The "Right Stuff": What It Takes To Be A Forecaster

Most of us who have made weather forecasting our life's work knew at an early age that our level of excitement and curiosity about the weather went far beyond the norm. As a child venturing outside to get a better look at lightning, I was on the receiving end of more than just a few spankings. Then later as a teen I drove the family car some one hundred miles northward to find snow. Contrary to my plans, the deed was not successfully concealed when I returned a snow covered car into the driveway only to see my Dad standing on the porch as I pulled into the garage. Parents of aspiring meteorologists often do not know what to think of their offspring's obsession with weather. They can not help but wonder if their child's apparent joy about the approach of a hurricane or a winter storm is an early sign of a lack of common sense or even worse, insanity. Later in life, they are relieved as their college bound youngster announces an intent to discover more about what makes storms tick and a goal to serve others by making more accurate forecasts.

While a passion for weather is typical for those seeking a life's work dedicated to matching wits with the forces of nature, it is not the sole consideration for making forecasting a career choice.

Forecasting for the National Weather Service, whose principal mission is the protection of life and property, is more than a job; more than a career. Indeed, it is a way of life. Weather forecasting is a 24 hour and 7 day a week operation that never shuts down. Working rotating shifts, weekends, and holidays and all too often traveling to and from work during hazardous weather conditions is a way of life for forecasters as well as their families.

While a passion for weather is typical for those seeking a life's work dedicated to matching wits with the forces of nature, it is not the sole consideration for making forecasting a career choice.

Obviously, NWS forecasters must be able to adapt to the demands of an ever changing schedule. But adaptability is just one key personal attribute comprising the "right stuff" for being a NWS forecaster. While an aptitude for science and math applies to all meteorologists, the operational forecaster is a special breed. Most choose forecasting seeking the challenge and the excitement found in predicting storms. When and where to issue warnings for flash flooding, winter storms, severe thunderstorms, and tornadoes is a demanding process. It requires well coordinated actions between a team of individuals. Over the past twenty eight years, I have worked with many talented forecasters who had the "right stuff" to get the job done. Their commonly shared attributes included an ability to work well under pressure, to meet short-fused deadlines, to quickly differentiate distractions and "red herrings" from critical data and information, and to make critical decisions even in the face of considerable uncertainty.

By Kermit Keeter

‘Bearly’ Making the Grade

NWS-Raleigh Reaches Out to Classrooms

Grade school science curriculums cover many elements of meteorology throughout the year. The students study topics such as basic weather elements, cloud identification, and weather safety. In addition to the core materials they are supplied, Wake county teachers have an opportunity to request a visit from a meteorologist through a local program, the Research Triangle Science and Math Partnership. The National Weather Service meteorologists here at Raleigh fill these requests often throughout the year, visiting elementary schools to talk to students and offer ‘hands-on’ experiments as well as attempting to answer the tough questions, such as “Will we get to miss school next month when it snows?” We also offer support and expertise for other weather-related activities, such as science fairs, Boy Scout weather merit badge training, and school career days.

Forecaster Michael Moneypenny gives a student an “electrifying” experience with a Van de Graaff generator.

Seeking to blend science and career exploration, a sixth grade teacher from Leesville Elementary School in North Raleigh introduced a novel project for her students this year. The class purchased a number of stuffed bears, which they mailed to volunteers in the scientific community around the Triangle. The bears were accompanied by a diary and a disposable camera, for use in documenting the bear’s experiences while job-shadowing the scientists for a few weeks.

Diego helps measure snow outside the NWS-Raleigh office.

Our bear’s name was Diego, and the staff enjoyed posing him performing various tasks, such as measuring snow and making NOAA weather radio broadcasts. He was also taken out of the office and photographed visiting river and rain gauges. His diary was used to record the meteorologists’ activities and thoughts during the forecast process as well as answer some questions the students had included, such as how much math a meteorologist needs and how hail forms. We sent him home in early February, and the students who chose meteorology for their project will use the data to produce a ‘documentary’ to present to the class.

By Michael Moneypenny

Cooperative observer network to receive an upgrade

An upgrade of the nation’s oldest and largest weather observation network is in the works for later this year. The National Weather Service’s Cooperative Observer Program was established in 1890 to collect temperature, precipitation and other meteorological data for climate applications related to agriculture and water resources. Data collection and submission has mostly been manual for more than a century, and quality control and data verification can take up to six months. So there is a real need to speed up and automate much of this process.

Cooperative Observer Program-Modernization, or COOP-M, will improve the network’s spatial density, distribution, communications, and processing capabilities. Ultimately the network will have new automated temperature, precipitation, soil moisture and river level sensors; near real time data collection, quality control and dissemination; automated flash flood reporting, and interactive data terminals to collect both automated and manual observations.

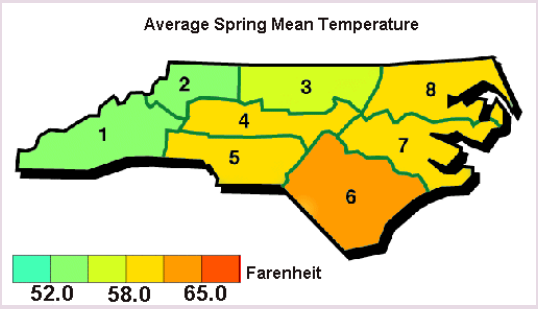
A new COOP-M station

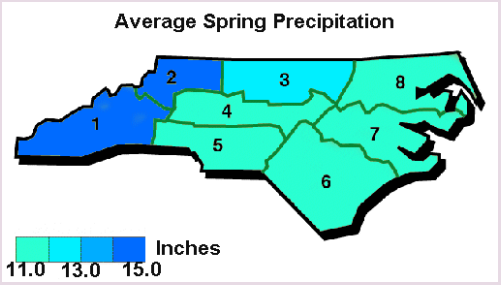
The Aerospace Corporation is taking part in early planning for COOP-M. Aerospace is getting the acquisition portion of the program off the ground, developing program requirements, a program plan, and an acquisition strategy. Concept definition and prototype production will take place over the next year-and-a-half. Aerospace will spend $160 million to completely upgrade and automate the network from October 2004 through 2010.

By Robert Ussery

Climate Watch: A look at the spring ahead

Currently near neutral ENSO (El Nino Southern Oscillation) conditions exist over the equatorial Pacific Ocean. While sea surface temperatures are slightly warmer than normal over this region, they remain below the threshold required to produce substantial impacts on the United States climate. Climate model output continues to forecast near neutral ENSO conditions over the equatorial Pacific Ocean through the spring. Thus, with a lack of sufficient atmospheric signals or predictors, the outlook for March-April-May (MAM) calls for equal chances of below, near, or above normal temperatures and precipitation over North Carolina. Typically in the MAM period, the storm systems bring cold weather southward, reach North Carolina less often and with less force. However, it is not uncommon to have strong storms and cold temperatures that result in snowfall well into March and as late as early April. In fact, the latest occurrence of measurable snowfall in Raleigh occurred on April 18, 1983.





In contrast, the rise in average temperature is greater in May than in any other month. These sharp temperature swings make spring in North Carolina the peak time for tornado occurrence. March marks the 20th Anniversary of the 1984 Carolina tornado outbreak (see story on page 1 for more details on the Carolina Outbreak).

By Brandon Locklear

Springin: Into Severe Weather Season (continued)

(Continued from page 1)

resulting in 6 deaths, around 300 reported injuries, and over $200 million in damage. Since tornadoes pose a significant threat to North Carolina residents, a statewide tornado drill will be conducted Wednesday, March 17, 2004. The Emergency Alert System along with all NOAA Weather Radios will be alerted at 9:15 a.m., initiating the statewide tornado drill. It is our hope that schools, businesses, and other public facilities will enact their severe weather safety plans, testing procedures and safety response. A key part to surviving disasters is knowing what to do when severe weather strikes. Taking a moment to develop and practice a safety plan can one day save your life as well as those around you.

Flying debris tossed around by a tornado are the most deadly. Pieces of glass and wood flying through the air at more than 100 mph can easily smash through the windows of your house or automobile. Debris can even smash through the outside wall of your home. For this reason anytime the National Weather Service issues a Tornado Warning or if you see a tornado, seek shelter in a sturdy substantial structure and go to an interior bathroom or closet. Put as many walls between you and the outside as possible and stay away windows. Most tornado deaths occur when people are caught outdoors, in automobiles, or in mobile homes. Never try to outrun a tornado in your car. Even weak tornadoes can easily push your car off the road and roll it along the ground. If threatened by a tornado you should abandon your car and seek shelter indoors. If no building is nearby, seek shelter in a ditch or culvert. This should allow for most of the high wind and debris to pass over your head.

So, what causes a tornado? Before thunderstorms develop changes in wind direction and an increase in wind speed with increasing height creates an invisible, horizontal spinning effect in the lower atmosphere. Rising air within the thunderstorm's updraft tilts the rotating air from horizontal to vertical. Most strong and violent tornadoes form within an area of rotation that develops inside the thunderstorm. This area of rotation is called a mesocyclone. The mesocyclone is the parent to strong to violent tornadoes. Tornadoes are classified by the NWS by three different ways: weak, strong and violent.

Weak tornadoes account for over 70 percent of all tornadoes in North Carolina and are defined as having winds less than 110 mph. Weak tornadoes last an average of 5 to 10 minutes and account for only about 3 percent of all tornado deaths. Strong tornadoes account for a little less 29 percent of all tornadoes, but create more damage and cause more fatalities. About 27 percent of all tornado deaths occur in strong tornadoes. Wind speeds range from 110 to 205 mph, and these tornadoes may last 20 minutes or longer. Violent tornadoes account for less than 1 percent of all tornadoes but are responsible for result in 70 percent of all tornado deaths. Wind speeds in violent tornadoes exceed 205 mph, and they can be on the ground for over an hour.

Severe and tornadic thunderstorms can be very scary and even life threatening, but knowing how to protect you and your family is paramount if the day comes when you must hide from the wind.

By Jeff Orrock

The Fujita Scale (F-Scale) of Tornado Intensity

	Wind speed	Damage		Wind Speed	Damage
F0	40-72 mph	light	F3	158-206 mph	severe
F1	73-112 mph	moderate	F4	207-260 mph	devastating
F2	113-157 mph	considerable	F5	261-318 mph	incredible

Play It Safe When Severe Weather Strikes (continued)

BEFORE severe weather threatens:

- Learn about severe thunderstorms and tornadoes, and what kinds of damage they can produce and the dangers they present.
- Have an emergency action plan for both your home and your workplace. Know where you will go if a severe thunderstorm or tornado warning is issued.
- Know what county you live and work in, and where within the county you are located. Severe weather warnings are issued by county or a section of a county (northern Wake county, for example).
- Before heading outdoors for an extended time, check the latest forecasts. If the risk of threatening weather is high, you may wish to postpone your plans.
- Make sure you always have access to a reliable source of weather information. A battery-powered NOAA weather radio will always provide you with the very latest weather information, including watches and warnings, and radios with an alarm feature will automatically alert you of any watches or warnings issued.

(Continued from page 1)

Twenty-four hours a day, seven days a week, the National Weather Service continually monitors Doppler radar, weather observations, satellite imagery, computer models, and other data to determine the threat for severe weather over central North Carolina. Severe Weather Outlooks, Severe Thunderstorm Watches, and Tornado Watches are issued to alert the public to a potential threat for severe weather. As soon as a severe or tornadic storm appears imminent, the Weather Service will immediately issue a Severe Thunderstorm or Tornado Warning, and this alert is quickly sent to the public via NOAA Weather Radio, other local media outlets, and the Internet. However, despite this structured alert system, many people are injured or killed by severe thunderstorms and tornadoes every year. Why is this? People may not hear the alerts, may not fully understand the threat, or may not believe it can happen to them. Being prepared for severe weather of all kinds, including knowing where to get reliable information, understanding what severe storms and tornadoes can do, and being ready to take the proper action if they occur, could save your life.

A thunderstorm is classified as severe if it produces:

- Hail 3/4" or greater (about the size of a penny)
- Winds gusting in excess of 50 knots (about 58 mph)
- A tornado

Now, let's look at each of the above scenarios.

- A dark cloud that is lowering is indicative of a possible tornado developing. If you are caught in a vehicle when a tornado approaches, do NOT try to outrun it. A tornado can move erratically, or can dissipate and re-form closer to you. Pull your vehicle carefully to the side of the road and get out. Go to a sturdy shelter, or if none is available, crouch down in a nearby ditch. Make sure the place you choose is not subject to flash flooding. Stay as low as possible, and cover your head with your hands. Be alert for possible flying debris.
- There is no need to cancel outdoor plans if severe storms are in the forecast, but you must make sure you know what to do in case they occur. If you are planning to be outdoors for an extended time, check the latest forecasts and conditions before leaving. Watch carefully for signs of approaching storms, such as darkening clouds, sudden gusts of wind, and of course any thunder or lightning. Take a NOAA weather radio with you (preferably one with the alert feature) or a portable radio, so you can keep up with the latest conditions and any watches or warnings. If you observe or hear about a storm, go immediately to the nearest sturdy shelter.
- A hook-shaped feature on radar is one signal of a possible tornado. Time is of the essence when a storm is bearing down on your area. Seconds count. If a severe storm or tornado is imminent, move to a basement or other underground shelter immediately. If none is available, move to an interior room on the lowest floor. If possible, cover your head with a pillow, or get under a sturdy piece of furniture, to protect yourself from possible flying debris. Bring a battery-powered NOAA weather radio or other portable radio with you, to keep track of the storm and the weather warning.
- While tornadoes are often thought of as the "ultimate" in severe weather, straight-line or downburst winds from a severe thunderstorm can indeed produce as much or more damage than a tornado. A bow-shaped feature on radar may indicate straight-line winds in excess of 60 mph, which may down trees, power lines, and cause structural damage. If you are caught in a department store, grocery store, or other large building when a warning is issued, go to the designated shelter area if known, or move to a small reinforced area on the lowest floor such as a restroom, office area, or freezer section.

Did you answer correctly? Knowing what to do when severe weather strikes and being able to make critical decisions at a moments notice is crucial to protecting your life and the lives of your loved ones.

By Gail Hartfield

Looking Back: The Carolina Tornado Outbreak (continued)

(Continued from page 1)
weather warnings and preparedness program then was something very different than today. Not long before the 1984 outbreak, there existed a mindset among many people (including some older forecasters) that tornado warnings were useless. The prevailing thought was that warnings could never reach people in the path of the storm in time to take action. And by issuing a tornado warning, more people would be tempted to run out to look at the storm and put themselves in harm's way than would be persuaded to take cover. This was a time before video cams. Tornadoes were a curiosity and a rare event in this part of the country. Except for the artistic rendition in *Wizard of Oz,* most people had never seen a tornado in action. Only grainy photos taken at long range were available, printed in periodicals and books.

The tornadoes hit on a Wednesday evening, entering the state from South Carolina around 6:45 PM and lasting to around 9:30 PM. A tornado watch was in effect for all of eastern North Carolina from about 2 PM until 10 PM. Storm survivors interviewed after the event said even though they had heard the watch, they did not know what to do to protect themselves and their families.

Weather disaster education, awareness and preparedness was needed. Following the '84 outbreak, the National Weather Service added the new position of Weather Preparedness Meteorologist to its staff at the Forecast Office in Raleigh. The National Weather Service collaborated with the state's Division of Emergency Management and the media to conduct a comprehensive severe weather preparedness campaign. Severe Weather Awareness Week with proclamations from the Governor became an annual exercise. Tornado drills became as common as fire drills at schools. Skywarn came alive in North Carolina with several amateur radio clubs coordinating efforts for storm spotter networks. TV meteorologists broadcast tornado safety rules as part of their news and weather shows.

As testament to the success of this campaign, four years later, in the wee hours of November 28, 1988, without warning, a massive F4 tornado swept through North Raleigh and tracked another 88 miles. Although over 1500 homes were destroyed or badly damaged, the number of fatalities were limited to 4. Interviews with storm survivors in the aftermath of the '88 event found that many knew upon hearing the loud train-like noise, to seek shelter in the middle of the lowest floor of their houses, in closets or small bathrooms, under mattresses, and away from windows. Education worked!

Since the tornadoes of '84 and '88, meteorologists have also learned a great deal about meteorological environments and factors conducive to outbreaks of violent tornadoes in North Carolina and the Southeast. With the introduction of Doppler radar, improved weather satellites, video recordings documenting ground truth observations from spotters, and with supercomputer modeling, the science of severe storms forecasting has advanced dramatically in the past two decades. Locally, collaborative studies by the National Weather Service with researchers at NC State University and other universities in the Southeast revealed several weather factors that forecasters now use to help recognize tornado outbreak situations.

Occurring when it did at the cusp of revolutionary new technology, the 1984 Carolina Tornado Outbreak more than any other severe weather event led to a change in the way we think about tornadoes in the Southeast and to a vastly improved severe weather warnings and preparedness program in North Carolina.

By Rod Gonski

For more details on the 1984 Carolina Tornado Outbreak, go to http://www4.ncsu.edu/~nwsfo/storage/cases/19840328/

Skywarn – The Eyes of the NWS

Skywarn is a network of all hazard weather spotters who help provide real time severe weather information to the National Weather Service and emergency managers. Storm spotters are an integral part of the NWS warning decision-making process; their reports are invaluable in making accurate and timely forecasts and warnings. Doppler radar tells us about hail, wind, and rotation in thunderstorms, but humans can tell us if it is a tornado and precisely where it is. Radar, satellite information, and surface observation equipment help develop forecasts, but spotters are critical for the confirmation of weather warnings, and sometimes filling in information that radar cannot provide.

The NWS has 167,679 trained all hazard weather spotters in the Skywarn program working with 121 individual NWS offices nationwide. Some spotters report from their homes, using telephones; others go to a designated area and report to the Weather Forecast Office and Emergency Managers simultaneously by amateur radio. Amateur radio communication is particularly valuable in cases where communication with counties might be cut off by weather conditions.

Local storm reports received by the local NWS office are sent out to mass media through special text products. These storm reports alert broadcasters to the severity of the situation and help to raise awareness of the severe weather threat. Storm reports play a vital role in forecasting, warning and the overall protection of life and property. The NWS if Raleigh extends many thanks to all of those who volunteer their time and energy taking part in the Skywarn program.

If you are interested in learning more about Skywarn, visit www.erh.noaa.gov/rah/skywarn. You can also contact Jeff Orrock the Warning Coordination meteorologist by email at jeff.orrock@noaa.gov, or by phone at (919) 515-8209 ext. 223.

National Weather Service
Raleigh, North Carolina

1005 Capability Drive
Suite 300
Raleigh, NC 27606

Phone: 919-515-8209
Fax: 919-515-8213
Forecast Line: 919-515-8225
Website: www.erh.noaa.gov/rah

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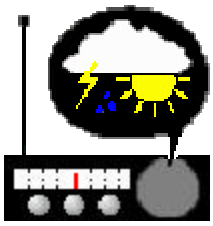
Issue Editor: Doug Schneider (douglas.schneider@noaa.gov)

Mailing Address Line 1
Mailing Address Line 2
Mailing Address Line 3
Mailing Address Line 4
Mailing Address Line 5

NOAA Weather Radio: The Voice of the National Weather Service



NOAA Weather Radio provides a continuous broadcast of the latest weather information for your local area from the National Weather Service. NOAA Weather Radio is an "all hazards" radio network, working in conjunction with the Federal Communication Commission's Emergency Alert System. In addition to weather related watches and warnings, the Weather Radio system can provide information on all types of hazards, including Civil and National Emergency Messages.

North Carolina is served by over 27 NOAA Weather Radio transmitters which are located within North Carolina as well as in 3 neighboring states. These transmitters provide broadcasts to all 100 counties in North Carolina.

NOAA Weather Radio Stations Serving Central NC

Station	Location	Frequency
WWF 60	Buck Mountain	162.500 mhz
WXL 58	Chapel Hill	162.550 mhz
WXL 50	Fayetteville	162.475 mhz
KXI 72	Garner	162.450 mhz
WNG 586	Henderson	162.500 mhz
WXL 59	Tarboro	162.475 mhz
WXL 42	Winston-Salem	162.400 mhz
Coming Soon!	Ellerbe	

For an interactive map of NWR transmitters across North Carolina, go to:

http://www.erh.noaa.gov/rah/ncnwr/