

# Changing Skies Over Central North Carolina

VOLUME 13, ISSUE 2

SPRING 2016

NOAA'S NATIONAL WEATHER SERVICE RALEIGH, NC

## INSIDE THIS ISSUE:

**VORTEX-SE** 2  
Field Project

**Watch vs.** 3  
**Warning**

**Danger Signs of** 4  
**Severe Wx**

**Hydro Outlook** 6

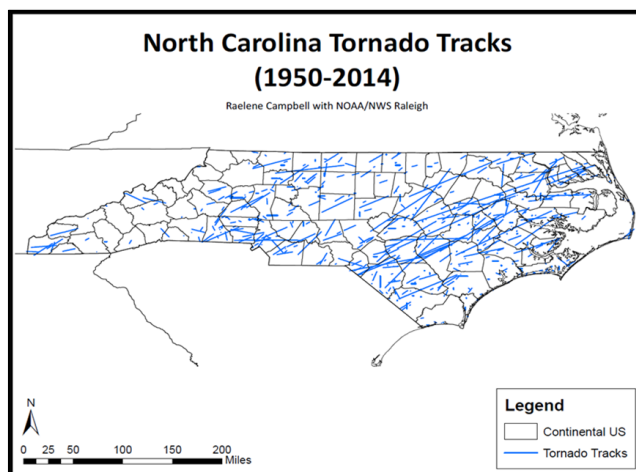
**Reporting** 8  
**Severe Wx**

## Seven Interesting Facts from a Climatology of NC Tornadoes

In an effort to obtain a better understanding of the occurrence, distribution, and impact of tornadoes across North Carolina, a climatology of tornadoes was created by

to observed tornadoes, is greatest across the Coastal Plain and Sandhills near and just east of the Interstate 95 corridor, with a second-

2) The number of tornadoes observed increased significantly from 71 to 81 tornadoes in the 1950s and 1960s, respectively, to an average of 164 tornadoes in the 1970s and 1980s. By the 1990s and 2000s, the number of tornadoes increased to 305 and 318. The number of strong (EF2+) tornadoes has remained steady over the 6 decades while the number of weak tornadoes has tripled. The increase in reported tornadoes, known as tornado inflation, is not a result of changes in climate, but rather improved observations and reporting.



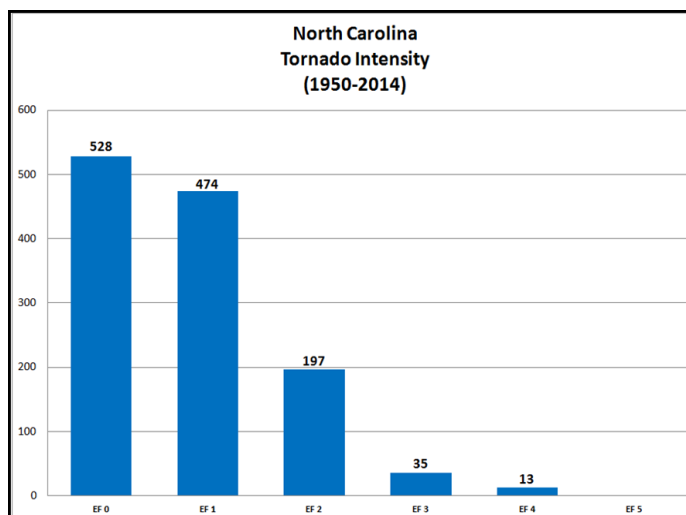
Raelene Campbell, a NOAA Holling's Scholar from Valparaiso University and NWS Raleigh staff members. The climatology was constructed using data from the National Centers for Environmental Information and the Storm Prediction Center.

ary maximum across the western Piedmont. A minimum was located across the mountains and along the immediate coast.

3) There has never been an EF5 strength tornado observed in NC. Out of a total of 1,247 (continued on page 7)

It included all tornadoes that occurred across the state from 1950 to 2014, totaling 1,247 tornadoes. While the project assembled a wealth of data, we wanted to highlight seven results that are both interesting and should lead to a deeper understanding of the impact of tornadoes in NC.

1) Tornado track density, indicative of areas closest

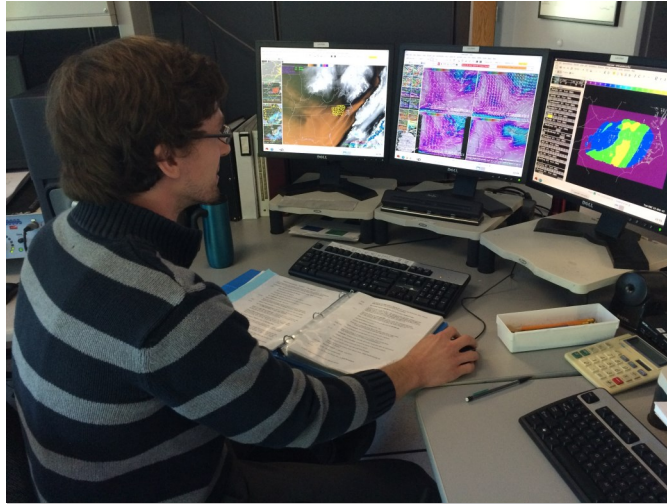




*“Tornadoes across the Southeast have several unique features that make them especially difficult to forecast and impactful to the public.”*



## NWS Raleigh Pathways Student to Participate in VORTEX-Southeast Field Project



**NWS Raleigh Pathways Student Keith Sherburn**

This April, researchers from several universities and national laboratories will descend upon the southeastern U.S. to study the environmental conditions and societal impacts associated with regional tornadoes as part of the Verification of the Origins of Rotation in Tornadoes Experiment-Southeast [VORTEX-SE]. The project, which began March 1st, is aimed toward improving the understanding and forecasting of tornadoes in the Southeast and follows in the footsteps of the original VORTEX project of 1994-1995 and VORTEX2 project of 2009-2010, both of which focused on severe thunderstorms and tornadoes in the Plains.

Tornadoes across the Southeast have several unique features that make them especially difficult to forecast and impactful to the public. In particular, the

climatology of Southeast tornadoes is unconventional, with a relatively large fraction of tornadoes occurring during the cool season and overnight when compared to tornadoes in the Plains and Midwest. This climatology overlaps with time periods associated with poor tornado watch and warning statistics and a relatively high percentage of tornado-related fatalities, the latter likely associated with lower public awareness of the tornado threat during these times. Additionally, compared to the Plains, terrain and vegetation are considerably different across the Southeast. The impacts of terrain and vegetation on tornadoes are not well-understood meteorologically; however, hills and trees across the Southeast make visual confirmation of tornadoes difficult in this region, further contributing to the lowered public

awareness of their imminent threat.

A wide range of research techniques will be utilized during VORTEX-SE. Direct measurements of the environment's vertical profile will be available via wind profilers and several mobile and fixed radiosonde systems, while high-resolution near-surface observations will be available through a movable sticknet array. Mobile and fixed radars will attempt to evaluate the structure of tornadoes' parent thunderstorms; meanwhile, lightning mapping arrays and disdrometers will attempt to analyze their electrification and hydrometeor distribution, respectively. Researchers hope that these data will paint a four-dimensional picture of tornadic and non-tornadic thunderstorms across the region, allowing for a better understanding of why some thunderstorms produce tornadoes and others do not. Ideally, this would ultimately lead to a reduction in false alarms and increase in probability of detection of tornado warnings across the region.

A second aim of VORTEX-SE is to improve the dissemination of and response to tornado warnings across the region. To do this, social scientists will assess the flow of information from forecasters within the National Weather Service to emer-

gency managers, broadcast meteorologists, and the public. Goals are to determine any reasons for complacency associated with tornado warning response among the public and to improve the method of tornado warning dissemination during climatologically unusual time periods, such as during the overnight or winter.

WFO Raleigh Pathways Intern Keith Sherburn will be partici-

pating in the VORTEX-SE field program as a member of the mobile soundings group led by Dr. Matthew Parker from NC State University. During the first VORTEX-SE intensive observation period (IOP) on March 13-14, Keith released three soundings with a group from Texas Tech University as a dissipating convective system approached the VORTEX-SE domain. In future IOPs, Keith will either be in the field

launching balloons or in the operations center assisting with the coordination of mobile sounding teams.

This year's VORTEX-SE project runs through April 30th with plans for 4-6 total IOPs. A second iteration of VORTEX-SE is tentatively planned for next spring.

**-Keith Sherburn**

## Watch vs. Warning: Do You Know the Difference?

As we continue further into the spring season and temperatures climb, severe weather events will likely increase.

One of the most important messages the National Weather Service wants to portray is "Be Prepared"! The first step in being prepared is understanding weather jargon, most specifically the difference between a watch and a warning and then knowing what to do with that knowledge. If a watch is issued, you must be prepared for possible severe weather, and when a warning is issued, you must act.

**Watches** mean severe weather is possible in and near the watch area. Review and discuss your emergency plans and check supplies and your safe room. Be ready to

act quickly if a warning is issued. Acting early helps to save lives!

Watches are issued by the Storm Prediction Center for counties where severe weather may occur. The watch area is typically large, covering numerous counties or even states.

**Warnings** mean severe weather is occurring and has been reported by spotters and/or indicated by radar. Warnings indicate imminent danger to life and property. Take shelter in a substantial building. Get out of mobile

know the difference between a severe thunderstorm

# Watch and Warning

**Be Prepared...**  
severe weather possible

- Check for forecast updates
- Monitor sky conditions
- Know where to take shelter

**Take Action!**  
severe weather imminent

- Take shelter immediately
- Seek further information
- Check for forecast updates

Be Weather Ready

**Weather-Ready Nation**  
National Oceanic and Atmospheric Administration

National Weather Service  
weather.gov/tornado

homes that can blow over in high winds. Warnings are issued by your local forecast office. Warnings typically encompass a much smaller area (around the size of a city or county).

**-Katie Dedeaux**







*“North Carolina’s springs bring renewal but are also the most active months for severe thunderstorms and tornadoes”*



## Know the Danger Signs if Tumultuous Weather Hits



**Storm debris from Feb. 24 severe weather system that impacted much of North Carolina**

A late winter with bitter temperatures, rain, snow, sleet and ice has most people screaming for spring – warmer temperatures, blooming flowers, budding trees and carefree days. Those seemingly far off days of bliss can be marred by tumultuous, unpredictable storms that strike quickly, leave devastation and cost residents thousands in repairs.

“North Carolina’s springs bring renewal but are also the most active months for severe thunderstorms and tornadoes,” said Mike Sprayberry, North Carolina Emergency Management director. “Weather conditions during spring in this state are unpredictable and can change very fast. A calm, balmy day can quickly deteriorate into a severe thunderstorm with lightning, flash floods and tornadoes. It’s critical for residents to know the warning signs, what to do and where to go when severe weather threatens. Take the time to plan ahead so that you won’t be caught off-guard.”

In 2015, the National Weather Service issued 25 tornado warnings and recorded nine tornadoes in North Carolina. –significantly less than in previous years. Due to El Nino weather conditions, there were significantly higher incidents of flash flooding reported in North Carolina. The National Weather Service issued 98 flash flood warnings for the same period and recorded 133 incidents across the state. Combined, tornadoes and flash flooding caused nearly \$500,000 in damages.

In addition, the NWS issued more than 528 severe thunderstorm warnings, and recorded more than 542 incidents of severe thunderstorms with damaging winds and/or large hail. The severe storms caused nearly \$12 million in damages.

### Warning Signs

Not all storms are emergencies, but every storm has the potential to become one. Seemingly mundane, average ‘spring showers’ can change

quickly with little notice. Dangers linked with severe storms include lightning, tornadoes, strong winds, hail and flash flooding. “Knowing the warning signs of when an ordinary storm takes a dangerous turn is key to protecting yourself and your loved ones,” said Sprayberry. “You don’t usually have much time when a storm is bearing down on your community. If you see lightning, and cannot count up to 30 before hearing thunder, then you need to go indoors.”

Lightning can strike as far as 10 miles away from the rain area in a thunderstorm. That’s about the distance you can hear thunder. If the sky looks threatening, people should take shelter even before they hear thunder. “Lightning strikes are one of the top three storm-related killers in the United States,” said Nicholas Petro, warning coordination meteorologist for the National Weather Service’s Raleigh Office. “Most lightning victims survive, but those who have been struck by lightning often report a variety of long-term symptoms.”

Tornadoes, nature’s most violent storms, are formed from powerful thunderstorms. They appear as spinning, funnel-shaped clouds that reach from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Sprayberry reminds people to know what the warning signs are for dangerous

weather conditions, especially in the case of tornadoes. “Tornadoes may be identified by a large, dark, low-lying cloud, most likely rotating, greenish skies and a loud roar, much like a freight train,” said Sprayberry. “If you see or hear any of these warning signs, you should implement your emergency plan immediately.”

**Safety Tips**

North Carolina Emergency Management officials recommend having a weather radio that broadcasts NWS alerts when severe weather threatens. While tornadoes can touch down at any time during the day or night, many North Carolina tornado fatalities have occurred at night when people are asleep and less likely to receive a warning without a weather radio. Emergency officials recommend people use the following safety tips:

- Know the terms: WATCH means a tornado is possible. WARNING means a tornado has been spotted; take shelter immediately.
- Know where the nearest safe room is, such as a basement or interior room and away from windows, and go there immediately if you hear or see a tornado.
- If driving, you should leave your vehicle immediately to seek safety in an adequate structure. Do not try to outrun a tornado in your vehicle, and do not stop under an overpass or a bridge.
- If you are outdoors, and there is no shelter available, take cover in a low-lying flat area. Watch out for flying debris.

- Following a storm, wear sturdy shoes, long sleeves and gloves when walking on or near debris, and be aware of exposed nails and broken glass.
- Be aware of damaged power or gas lines and electrical systems that may cause fires, electrocution or explosions.

“A plan is only as good as how often it is practiced,” said Sprayberry. “After you write down your emergency plan, talk to others in your home about it and practice it at least once a year. Make sure your loved ones know where to go when severe weather strikes. It can save their lives.”

There are different places that you need to go to depending on the weather emergency and your location.

- At Home – Go to the basement. Under the stairs or in a bathroom or closet also are good spots.
- At Work – Go to the basement if there is one. Stairwells, bathrooms and closets are good spots. As a last resort, crawl under your desk.
- At School – Seek shelter in inside hallways, small closets and bathrooms. Get out of mobile classrooms, gymnasiums, auditoriums and other rooms with a large expanse of roof. Bus drivers should be alert for bad weather on their routes.
- In Stores – Seek shelter against an inside wall. An enclosed hallway or fire exit leading away from the main mall concourse is a good spot. Stay away from sky-

lights and large open areas.

- Outside – Find the nearest sturdy shelter or seek shelter in a ditch or low-lying area, and cover your head with your hands. DO NOT get under an overpass or bridge. You are safer in a low, flat location. Watch out for flying debris.

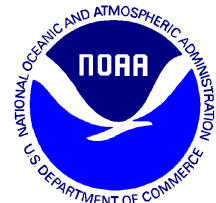


**NCEM Area Coordinators Yancy King and Tim Byers survey damage in Granville County from the Feb 24 tornadoes**

- In a car – Never try to outrun a tornado in a car. Pull over, and seek shelter in a building.

North Carolina emergency officials urge residents to get the free ReadyNC mobile app, which provides real-time traffic and weather information plus information about opened shelters, riverine flood levels and basic instructions on how to develop an emergency preparedness plan. The ReadyNC.org website also provides information to help you prepare for severe weather and tornadoes, including how to make an emergency supplies kit and what to do during and after severe storms.

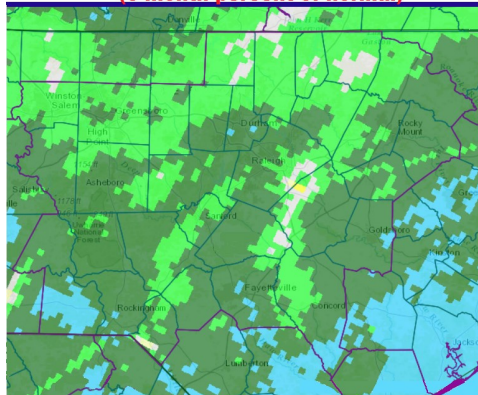
**- NC Department of Emergency Management**



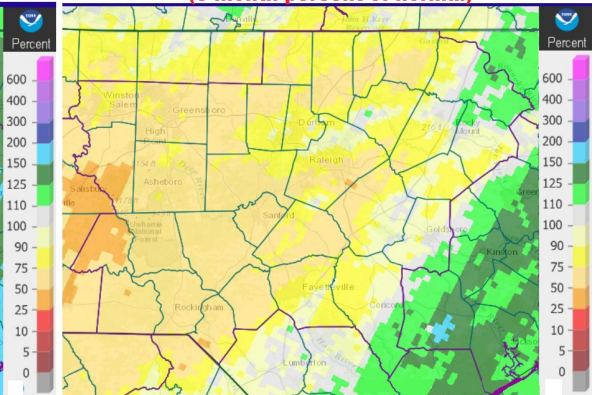


# Effects of El Niño Winter on 2016 Water Outlook

**Oct 1, 2015 - Apr 1, 2016**  
(6 month percent of normal)



**Jan 1, 2016 - Apr 1, 2016**  
(3 month percent of normal)



**Six month (left) and three month (right) percent of normal precipitation**

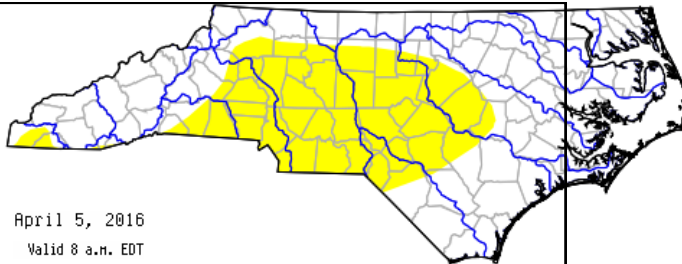
El Niño has a significant impact on winter precipitation patterns across the southeastern United States, generally producing wetter and cooler conditions from December

to reduced runoff. So, due to the overall surplus early this fall and winter, our water supply reservoirs, Falls Lake and Lake Jordan, are above their target elevations, and streamflows are near normal heading towards warmer weather. As of April 5th, we have no drought conditions across NC, but an area of abnormally dry conditions does exist in the southwest piedmont and southern foothills. The effects of El Niño weaken as spring progresses, and we will be more reliant on the day-to-day shower and thunderstorm cycle for the bulk of our rain. Loss of the El Niño signal, however, does suggest a better chance for tropical cyclone formation heading towards fall, as there will be reduced atmospheric shear across the tropics.

ceiving more than 200% of normal. Precipitation tailed off dramatically in Jan-Mar of 2016, however, and only a few areas east of I-95 received normal precipitation for the 3-month period. The overall seasonal picture is mixed as well, with a fairly decent surplus for the 6 month period, but trending dry headed into the spring. The mixed bag also held true for temperatures. We had a warm spell through much of December, a month which ended up 12 to 13 degrees above normal, making it the warmest December on record by 2 to 3 degrees.

The positive news is that cool season precipitation provides a greater recharge deep into the soil and shallow aquifers as not as much is utilized for plant growth or lost to evaporation. In addition, cool season precipitation is usually lighter, which allows better infiltration due

## US Drought Monitor of NORTH CAROLINA



April 5, 2016  
Valid 8 a.m. EDT

### Drought Classifications

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

  County Boundaries   Major River Basins ([View Map](#))  
**S** = Short-Term, typically <6 months (e.g. agriculture, grasslands)  
**L** = Long-Term, typically >6 months (e.g. hydrology, ecology)  
[Hi-Resolution Image](#) | [Print Version](#) |

### Current NC Drought Assessment

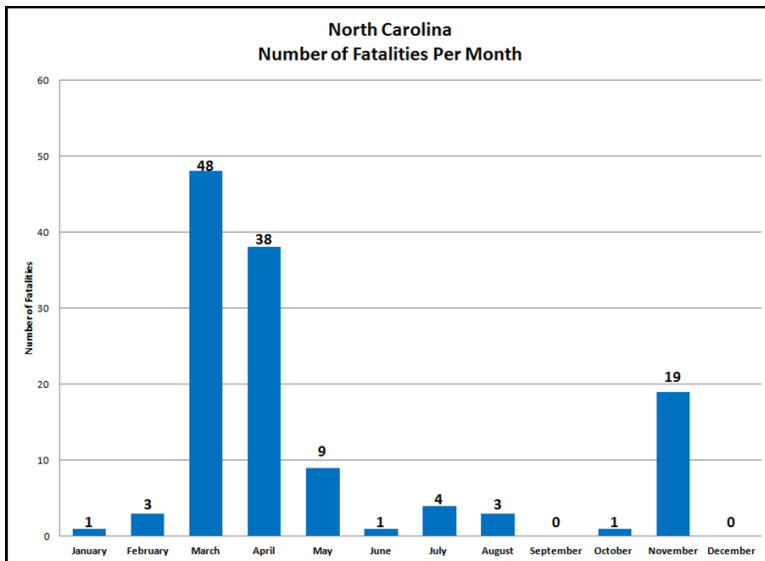
**NEW**



through April. This winter featured a strong El Niño, but the resulting precipitation and temperature trends over central NC from October through March have been a mixed bag. Precipitation for Oct-Dec of 2015 was well above normal over all of central NC, with many areas re-



# Seven Tornado Facts (continued from page 1)



tornadoes, there have only been 13 EF4 tornadoes, 1% of all tornadoes, and just 35 EF3 tornadoes or 3%.

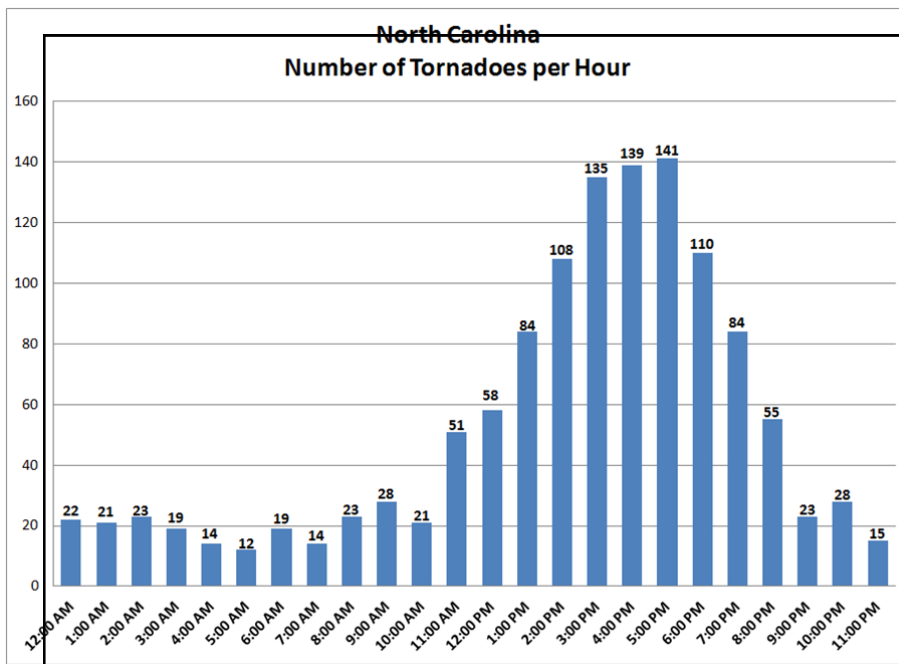
tornadoes in NC since 1950. More than two thirds of all fatalities occur in the spring months of March and April with a combined total of 86 deaths (68% of all tornado deaths). A secondary maximum of fatalities occurs in November with 19 deaths (15% of the total).

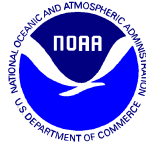
4) Of all the tornadoes that occurred in North Carolina, only 20% are considered strong (EF2 or greater), but those tornadoes account for 97% of all the tornado related deaths and 89% of all tornado related injuries. The vast number of NC tornadoes (80%) are weak (EF1 or EF0) and these tornadoes are responsible for only 3% of fatalities.

5) There have been 127 deaths directly related to

- 6) Tornadoes most frequently occur in the 3, 4, and 5 PM hours, with 135, 139, and 141 tornadoes reported in each hour, respectively. This accounts for 33% of all tornadoes. While the number of tornadoes decreases significantly in the 6, 7, and 8 PM hours, the number of fatalities increases. A third of all deaths (43) occurred in the 7 PM hour alone. This is likely a result of the tendency for the stronger tornadoes to occur later in the evening between 6 and 8 PM.
- 7) While only 39% of all NC tornadoes occur at night, nocturnal tornadoes are responsible for 74% of all tornado fatalities in NC.

**-Jonathan Blaes**





## **NOAA's National Weather Service**

### **Raleigh, NC**

1005 Capability Drive  
Suite 300  
Centennial Campus  
Raleigh, NC 27606

Phone: 919-515-8209

Fax: 919-515-8213

## **Reporting Severe Weather to the National Weather Service**

During severe weather and winter storms, the NWS uses reports from trained spotters to help in decision making. Such reports are often invaluable, as they provide ground truth to supplement tools such as satellite and radar, giving decision makers added confidence as they issue warnings. Reports also help the NWS verify warnings and improve future warning techniques. Below is a list of the types of reports we seek from spotters.

### **Urgent Priority**

Tornado  
Funnel cloud  
Rotating wall cloud  
Flash flooding

#### **Reports can be sent to our social media accounts**



@NWSRaleigh



facebook.com/NWSRaleigh

### **High Priority**

Hail 1-inch diameter or larger  
Wind speed greater than 58 mph  
Rainfall 1 inch or more per hour  
Snow/ice accumulations

### **Lower Priority**

Hail 1/2-inch diameter or larger  
Wind speed greater than 40 mph  
Cloud features suggesting storm organization

The NWS Raleigh frequently works with groups such as amateur radio clubs, emergency services organizations, schools, universities, civic groups, and clubs to host SKYWARN Spotter Training. If you are interested in learning more about severe weather and being a spotter, or if your group or club would like to host a training session in central North Carolina, please visit <http://www.weather.gov/rah/skywarn>. —Barrett Smith