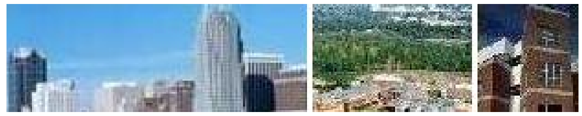
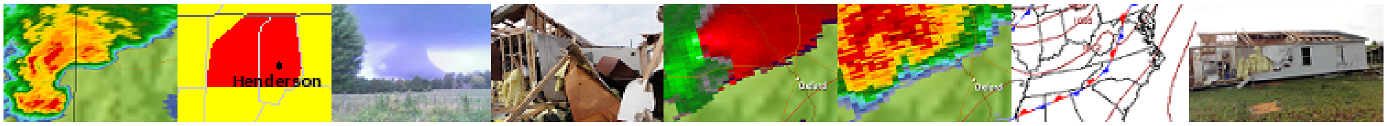
Event Summary
National Weather Service, Raleigh NC



October 27, 2010 North Carolina Tornado Outbreak

Note that this is a PDF version of the event summary and that some links, media or resources may not be avaiable in this format.



Event Headlines -
...Five Tornadoes of EF-0 to EF-1 strength touched down from 2 parent supercells in Orange, Person, Granville and Vance Counties...
...There were no fatalities or injuries associated with any of the Tornadoes...
...This event is a good example of a severe weather event that occurred in the secondary severe weather season during the fall...
...The severe weather event was associated with a low pressure system over the Midwest that set a record for the lowest pressure ever recorded in a non-tropical system over the continental United States..

Event Overview -

A high shear, moderate instability environment produced two supercells and 5 tornadoes across the northern Piedmont of North Carolina during the late afternoon and evening hours of 27 October 2010. This was actually the second day of severe weather to impact North Carolina. Severe weather struck locations across western North Carolina along a pre-frontal trough on 26 October. Several of these storms prompted Tornado and Flash Flood warnings for Forsyth County during the late evening hours of 26 October. There was wind damage in Forsyth County and considerable tornado damage in the Hickory area during this event. The strongest activity moved into southern Virginia during the overnight hours with convection across much of North Carolina weakening overnight.

Additional convection developed during the early afternoon hours on 27 October with a few thunderstorms growing into supercell thunderstorms ahead of a slow moving cold front located across the eastern slopes of the Southern Appalachians. North Carolina and Virginia were located along the southeastern edge of a region of strong deep cyclonic flow associated with the deep vortex over the Great Lakes region. North Carolina was in a region of fairly deep moisture and moderate surface based instability.

The tornadoes were weak, either EF-0 or EF-1 intensity and produced no confirmed reports of injuries or deaths. The region was outlooked in the slight risk category by the SPC with the 06 UTC day 1 outlook which included a 5% chance of tornadoes from northern North Carolina northeast into Virginia. This area was upgraded to a 10% chance of tornadoes with the 12 UTC outlook.

Event Details -
An intense vertically stacked low pressure system was located over southwestern Ontario at 12 UTC 27 October 2010. A strong polar jet of up to 150 kts extended across the Missouri Valley into the eastern Great Lakes. Central North Carolina was in region of deep cyclonic flow with a strong southwesterly flow of around 50 kts at 500 hPa. The southwesterly flow aloft extended into the lower levels with the 12 UTC 850 hPa analysis and the 925 hPa analysis showing a 35 to 40 kt southwesterly flow transporting warm moist air into the Carolinas.

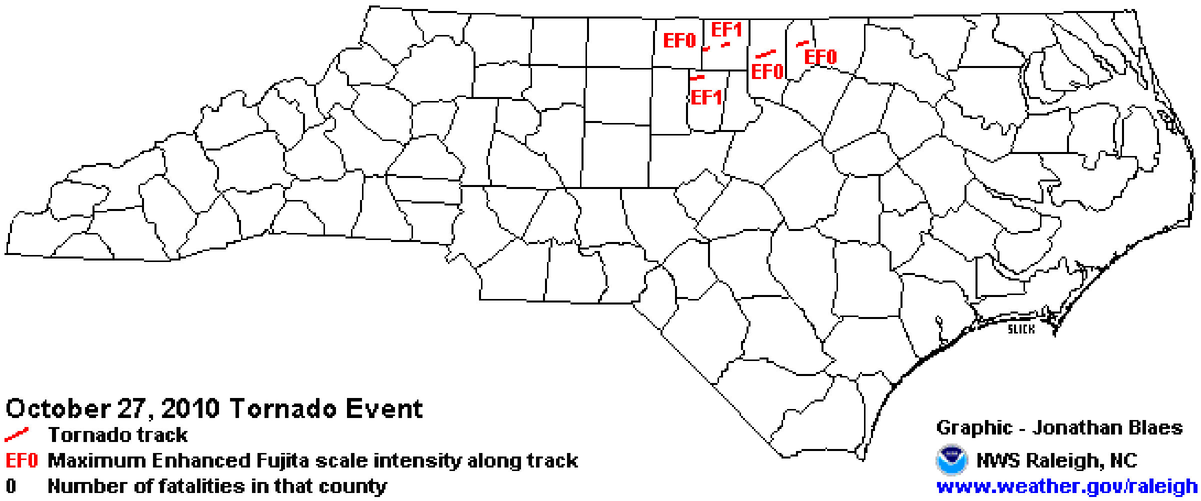
The surface analysis from 12 UTC 27 October depicted a remarkably deep surface low pressure system centered over southwestern Ontario. A surface cold front extended from New York south-southwest along the eastern slopes of the Appalachians. The front was nearly stationary across western North Carolina and Virginia during the late morning and early afternoon hours. During the afternoon, a southwesterly surface flow resulted in warm advection and moisture advection that allowed surface dew points to reach the upper 60s to lower 70s across central North Carolina. Surface temperatures climbed into the mid 80s across much of central North Carolina, which was well above normal for that time of the year. A Java loop shows the evolution of the surface features during the event. Note that the front remains well west of central North Carolina during the event and that no obvious surface wave is present on the front.

By 21 UTC, the vortex over southwestern Ontario drifted north slightly with the main jet core shifted slightly south and east. The strong southwesterly flow at 850 hPa persisted with a notable increase in moisture. The analysis of precipitable water (PW) at 21 UTC indicated a very moist air mass with PW values approaching 2.0 inches across the western and northern Piedmont of NC.

Scattered showers and thunderstorms were ongoing across western North Carolina just after midday on 27 October. The convection was resulting from localized forcing near a stalled surface front along with the heating of a rather moist boundary layer. Moderate instability with MLCAPE values ranging between 1000 J/kg and 1500 J/kg across the western and northern Piedmont and limited inhibition resulted in the development of additional convection and especially stronger updrafts during the mid afternoon hours. The strong deep layer southwesterly flow resulted in bulk shear values of 50 and 60 knots and 0-1 km Storm Relative Helicity values of around 250 m2/s2 to 350 m2/s2 which supported the development of organized convection with bow or rotating structures and tornadoes.

Severe Weather Reports

Text of severe weather reports across central North Carolina



What is a Mini-Supercell?

This event included two mini-supercells that moved across the western and northern Piedmont of North Carolina. Mini-supercells are members of the supercell spectrum of thunderstorms that include 1) classic, 2) high precipitation (HP), and 3) low precipitation (LP). Classic supercells are often large horizontally, tall vertically, contain deep mesocyclones (rotating updrafts), and frequently produce large hail, damaging winds, and occasionally tornadoes.

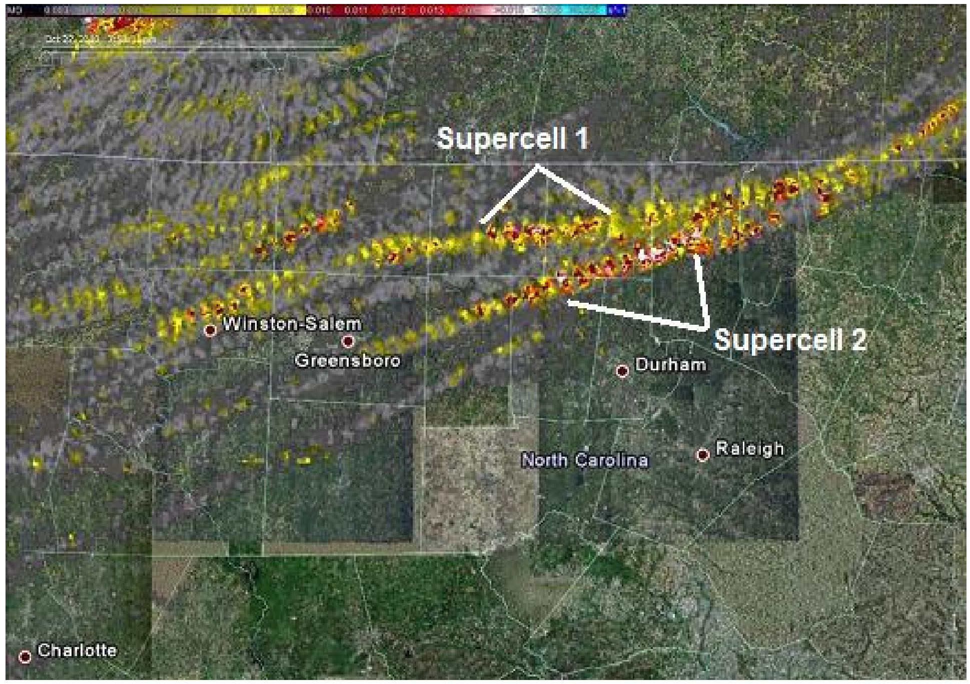
In addition, there are a number of supercells that occur which are more diminutive both horizontally and vertically than the classic supercell. These smaller storms often possess the same radar attributes, albeit sometimes more subtle, as their larger counterparts, including hook echoes, weak echo regions (WERs), bounded weak echo regions (BWERs) aloft, and mesocyclones. In essence, these storms are miniature versions of large, classic supercells and contain lower echo tops. Because of this, they have been called "mini supercells" or "low-topped supercells."

The Two Tornadoes Viewed with NSSL's Rotational Track Product

NOAA's National Severe Storms Laboratory (NSSL) has developed a gridded dataset that contains rotational shear from single and multiple radars that is accumulated over time providing tracks of radar detected rotation. The basic process for creating these products is initiated when velocity data from each radar is run through a Linear Least Squares Derivative (LLSD) filter creating an azimuthal shear field. The azimuthal shear fields in a 0-3 km layer from each radar across the CONUS are then combined and the maximum value at each 250 m^2 grid point is plotted over the time period providing the graphic.

The process was further improved when the WDSS-II (Warning Decision Support System - Integrated Information) group at NSSL made the "Rotational Tracks" data available for display in Google Earth. Using Google Earth with an overlay of near real-time "rotational tracks" allows forecasters to estimate where a storm's low-altitude circulation was most intense and to determine locations of possible damage. The satellite images and high density maps in Google Earth often make it possible to determine the location down to the neighborhood scale. This simplifies the verification process by reducing the amount of time that is spent searching for reports. This data has been used for numerous events across central North Carolina during the past few years including the April 25, 2010 Tornado Event, the March 27, 2009 Tornado Event, and the November 15, 2008 Outbreak.

The rotational track product for this event from 18 UTC 27 October through 00 UTC 28 October is shown above (click on it to enlarge). The product shows two primary corridors of enhanced rotation across northern North Carolina which are associated with two tornadic supercells. The first supercell (Supercell 1) developed west of Winston-Salem and then moved northeast and intensified. The supercell turned right across Rockingham and Caswell Counties before producing two tornadoes in Person County. The second supercell (Supercell 2) actually first developed north of Charlotte and then matured into a supercell southeast of Greensboro in Guilford County and then moved northeast into Alamance County. The thunderstorm intensified across northern Orange County and would eventually produce three separate tornadoes across Orange, Granville, and Vance Counties.



Details on the 5 Tornadoes based on Parent Supercell

The tornadoes that tracked across northern North Carolina on 27 October were produced by two supercell thunderstorms. The initial supercell moved along a more northern track and produced two tornadoes. The second supercell developed a short time later and took a more southern track as it produced three tornadoes.

Northern Tornadic Supercell (Supercell #1)

Roxboro Lake Tornado

The National Weather Service in Raleigh, NC confirmed a tornado near Roxboro Lake in western Person County, North Carolina on 27 October, 2010.

Numerous trees were snapped off and uprooted in a small area along Gordonton Road south of U.S. Highway 158 near Roxboro Lake. There was little if any property damage in this very rural location.

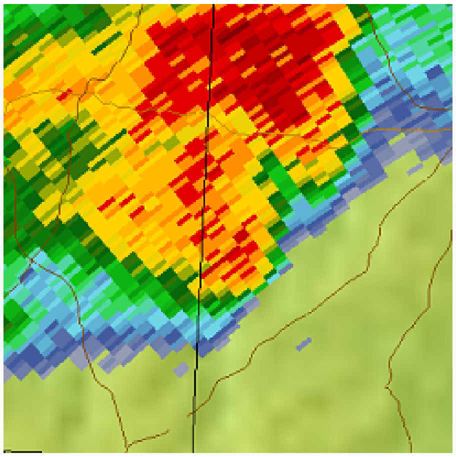
Special thanks to Person County Emergency Management and local residents for assisting with the tornado survey.

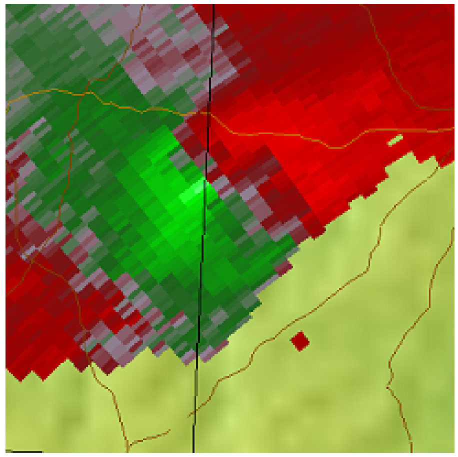
Time/Date: 358 PM EDT, Wednesday, October 27, 2010
Tornado: EF-0
Peak Wind: 75 to 80 MPH
Path Length: 200 yards
Path Width: 50 yards
Beginning Lat/Lon...36.37N / -79.15W
Ending Lat/Lon...36.37N / -79.14W
Injuries: none
Fatalities: none

Roxboro Lake Tornado Radar Imagery -

The first mini-supercell moved across Caswell County North Carolina and quickly took on tornadic characteristics as it approached Person County. At 1943 UTC KRAX reflectivity images show a weak echo region on the 0.5 degree scan. Beyond that, the storm did not have the look of a classic tornado producing supercell. There was no well-defined hook or appendage, although looking closer at reflectivities greater than 50 dBz, a hook structure can be inferred, embedded within the storm. Further aloft, the 0.9 degree scan, a BWER is visible on the southeastern side of the storm. This is well displaced from where the eventual center of circulation would be, which was further to the northwest. Looking at storm relative velocity, a broad but strengthening rotational signature can be seen at 1943

UTC with 50-60 knot inbound velocities adjacent to 10-20 knot outbounds. A shallow mesocyclone is visible on the 0.9 and 1.4 degree scans. On the 0.9 degree scan of the storm relative velocity, one pixel of 74 knot inbounds gate to gate with 8 knot outbounds can be seen above the center of circulation. At this time, echo tops ranged around 30 kft and never climb much above 40 kft during the life of the supercell. It appears that this cell reaches its full maturity at or near 1947 UTC. At this time, the reflectivity data shows the weak echo region penetrating into the core of the storm. A very strong rotational signal is seen on the storm relative velocity with 61 knots inbound adjacent to 40 knots outbound, resulting in 50 knots of rotational velocity. A very clear signal can be seen on the 1947 UTC 0.9 degree spectrum width product as well. What is usually a noisy and hard to use product makes it evidently clear in this case where the center of rotation is located. After 1952 UTC, radar imagery indicated a weakening storm. The 0.5 degree storm relative velocity image from 1957 UTC shows a broader circulation with 45 knots inbound and 30 knots outbound, resulting in 38 knots of broad rotational velocity. The cell was able to hold together long enough to produce a weak EF-0 tornado just east of the Caswell/Person County line.





Roxboro Lake Tornado Photos -

Photos courtesy of the National Weather Service.
(click on the image to enlarge)

Roxboro Tornado

The National Weather Service in Raleigh, NC confirmed a tornado near Roxboro in Person County, North Carolina on 27 October, 2010.

A mini-supercell thunderstorm produced a short lived EF-1 tornado which produced significant damage to a double wide modular home along Apple Tree Lane near Allensville Road. The modular home was shifted up to 40 feet off of its foundation and sustained significant structural damage, with 50 percent of the roof destroyed. One individual was inside of the modular home at the time of the tornado and was not injured. Several nearby modular homes sustained minor roof and siding damage. Numerous trees were either snapped off or uprooted at this location. Winds were estimated to be between 86 to 90 MPH.

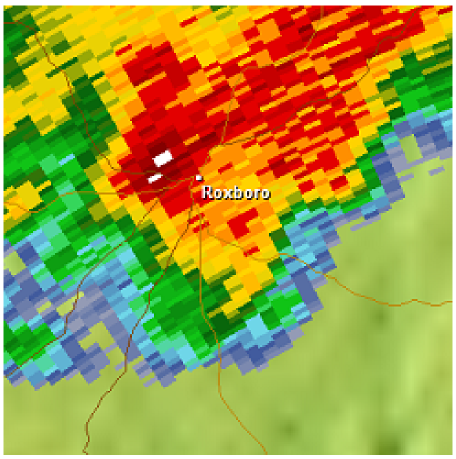
The tornado tracked eastward and across a wooded area before crossing Ruff Davis Road, where several trees were snapped off and downed in different directions. The tornado lifted as it moved into another wooded area east of Ruff Davis Road.

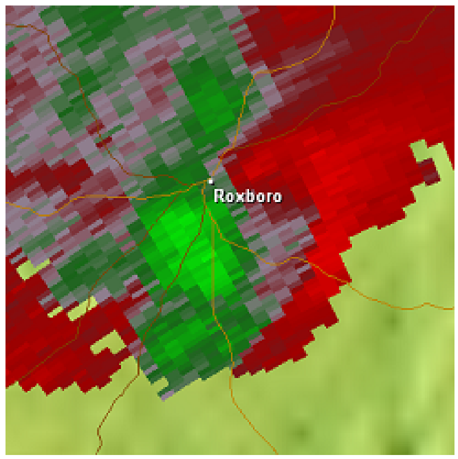
Special thanks to Person County Emergency Management and local residents for assisting with the tornado survey.

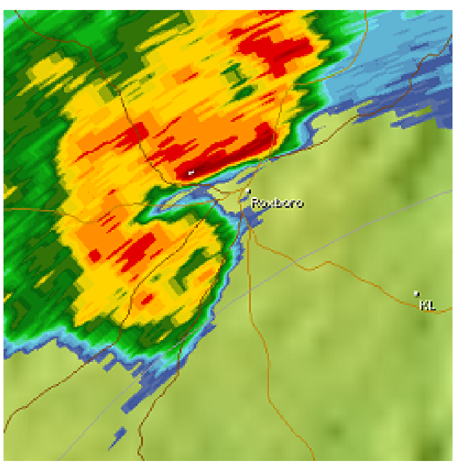
Time/Date: 413 PM EDT, Wednesday, October 27, 2010
Tornado: EF-1
Peak Wind: 86 to 90 MPH
Path Length: 0.5 miles
Path Width: 50 yards
Beginning Lat/Lon...36.39N / -78.95W
Ending Lat/Lon...36.39N / -78.94W
Injuries: none
Fatalities: none

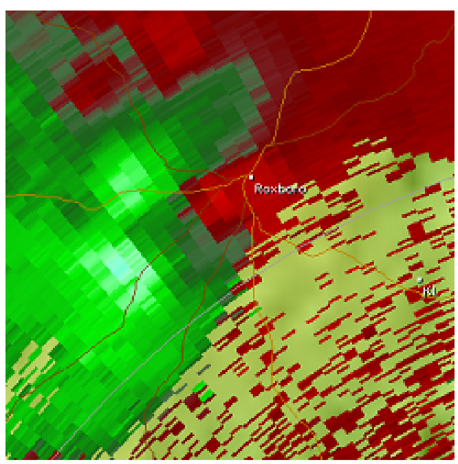
Roxboro Tornado Radar Imagery -

The mini-supercell that produced the Roxboro Lake Tornado weakened for a short time as the storm approached central Person County and then reorganized as it approached Roxboro. Radar signatures for this second tornado were less impressive than with the first tornado, it but produced more significant damage than the first tornado touchdown. As with the first tornado, the only hook signature that could be inferred was with the strongest reflectivities, which produced a very broad weak echo region on the south side of the storm. The greatest reflectivity values were northwest of the center of eventual circulation with the greatest velocities to the southwest. The rotation on the lowest levels of the storm at 2011 UTC is rather broad and was located just to the east of the town of Roxboro. One can infer an ill-defined BWER on the 0.9 degree reflectivity but this would be hard to spot in real time, not knowing the exact location of the storm center. Higher elevation angles of storm relative velocity do not show a very well defined mesocyclone either. One product that indicates the potential of a tornado is the spectrum width which shows one pixel of 29.1 knots of velocity differences along with a larger area of more than 20 knots. This is one instance where the spectrum width product provided helpful information to forecasters and it was arguably the strongest piece of evidence that a tornado could have been on the ground in the location in which damage was found. From a warning perspective, although the storm weakened as it tracked across Person County, there was continuity in the storm relative velocity signatures that certainly warranted tornado warnings across the county. This was the last tornado produced by this supercell in North Carolina that would eventually exit the Raleigh and move into Virginia.









Roxboro Tornado Photos -

Photos courtesy of the National Weather Service.
(click on the image to enlarge)

Southern Tornadic Supercell (Supercell #2)

Carr Tornado

The National Weather Service in Raleigh, NC confirmed a tornado near Carr in Orange County, North Carolina on 27 October, 2010.

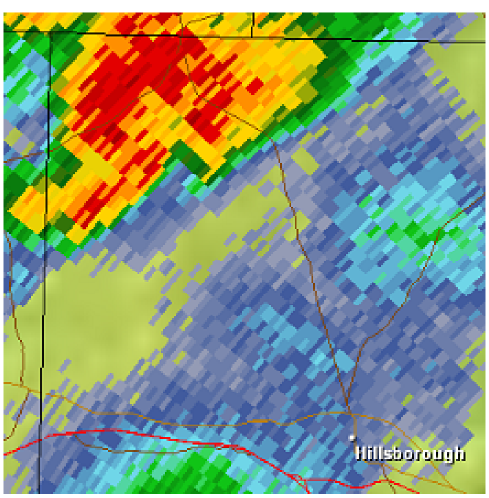
A mini-supercell thunderstorm produced a series of tornadoes across portions of Orange, Granville, and Vance counties in central North Carolina on 27 October, 2010. The first tornado associated with this supercell produced a tornado with EF-1 damage from winds between 90 to 95 MPH along Carr Store Road near Allie Mae Road in northern Orange County. At this location, a church sustained significant damage, with two walls made of cinder blocks blown down. Numerous hard and soft wood trees were also snapped off and uprooted at this location. The tornado continued to track east northeast and damaged two homes along Pentecost Road. Both homes sustained roof damage, including a partially collapsed chimney. Two individuals were home at the time of the tornado and were not injured. Numerous trees were snapped off and uprooted at this location as well. The tornado weakened as it continued to track east north-east across McDade Store Road and Efland-Cedar Grove Road before lifting of the ground. Numerous trees were either damaged or downed in this area.

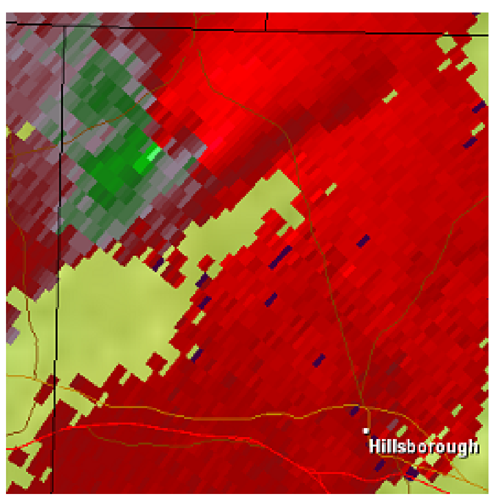
Special thanks to Orange County Emergency Management and local residents for assisting with the tornado survey.

Time/Date: 530 PM EDT, Wednesday, October 27, 2010
Tornado: EF-1
Peak Wind: 95 MPH
Path Length: 2.5 miles
Path Width: 50 yards
Beginning Lat/Lon...36.19 / -79.22W
Ending Lat/Lon...36.20 / -79.17W
Injuries: none
Fatalities: none

Carr Tornado Radar Imagery -

This second mini-supercell, which eventually spawned three tornadoes across Orange, Granville, and Vance counties developed well before it ever crossed into Orange County. While the storm can be traced back to the southwestern Piedmont of North Carolina and it was responsible for some Severe Thunderstorm and Tornado Warnings in the WFO Greenville-Spartanburg CWA, it was of modest intensity as it moved into the WFO Raleigh CWA. The storm intensified as it moved south and east of Greensboro as it moved across Guilford and Alamance Counties. A weak echo region forms on the south side of the storm at 2117 UTC at 0.5 degrees and quickly forms into a BWER five minutes later as the storm passes to the north of Green Level in eastern Alamance County. A very broad circulation can be seen at 2117 on both the 0.5 and 0.9 storm relative velocity images. A tightening mesocyclone can be seen at 1.4 degrees. After several minutes of development, the tornado cyclone is visible on radar by 2131 UTC. At 2131 UTC a gate to gate signature of 42 knots inbound adjacent to 33 knots outbound can be seen on the 0.5 degree storm relative velocity product with results in a rotational velocity of 38 knots. The spectrum width imagery shows a core of 32 knot velocity differences. The highest echo tops observed during the tornado were only in the 20 kft range.





Carr Tornado Photos -

Photos courtesy of the National Weather Service.
(click on the image to enlarge)

Berea Tornado

The National Weather Service in Raleigh, NC confirmed an EF-0 tornado just east of Berea in Granville County, North Carolina on 27 October, 2010.

The mini-supercell thunderstorm that moved northeast across Orange County previously produced a tornado near Carr in northern Orange County and then moved northeast into Person County and Granville County. This same mini-supercell produced a second tornado which touched down just east of Berea in Granville County. This EF-0 tornado tracked over 5 miles with a path width near 100 yards and winds of 80 to 85 MPH. The tornado touched down north of Highway 158 near the intersection of Bob Daniel Road and Hebron Road. Numerous trees were uprooted and shingles were blown off houses in this area. The tornado continued moving east-northeast while partially removing the roof from a house on Hebron Road and destroying 2 sheds at 1657 Elam Currin Road. A neighbor on Elam Currin Road stated he heard the warning on NOAA Weather Radio before the tornado struck and took cover with his wife in an interior hallway.

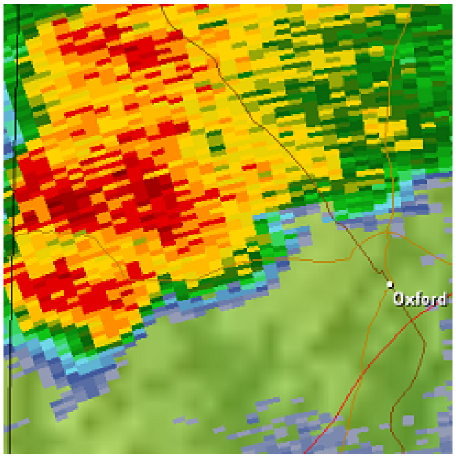
The tornado then crossed Pine Town Road where more minor damage to tin roofing and shingles was noted before crossing Graham-Hobgood Road. Numerous outbuildings were severely damaged along Joe Pruitt Road near its intersection with Graham-Hobgood Road. At least 2 outbuildings were destroyed and as many as 4 others suffered substantial damage. A single wide mobile home was shifted about 2 feet off of its foundation, however, the tie downs and anchors held, which kept the trailer from overturning. Winds in this area were rated around 80 to 85 MPH based on the noted damage. The tornado then turned a little more to the northeast, crossing Bodie Currin Road causing minor roof damage to a residence at 2543 Bodie Currin Road. Numerous trees were blown down in this area and other homes suffered shingle and siding damage. The tornado then crossed Highway 96 lifting off the ground near the intersection of Cornwall Road and Sterl Carrington Road.

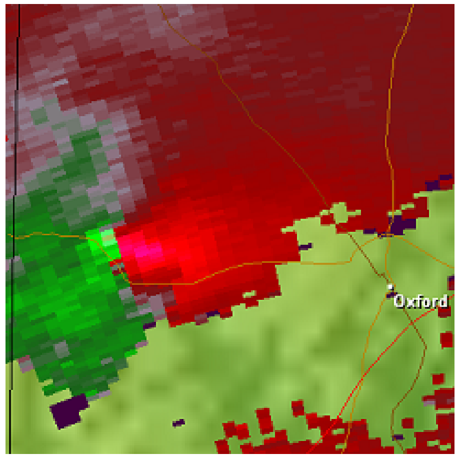
All residents interviewed were aware of the tornado warnings via television and radio. Special thanks to Granville County Emergency Management and local residents for assisting with the tornado survey.

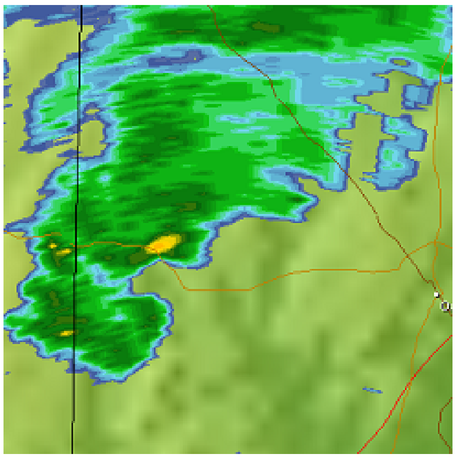
Time/Date: 615 PM EDT, Wednesday, October 27, 2010
Tornado: EF-0
Peak Wind: 80 to 85 MPH
Path Length: 5.25 miles
Path Width: 100 yards
Beginning Lat/Lon...36.33N / -78.71W
Ending Lat/Lon...36.35N / -78.63
Injuries: none
Fatalities: none

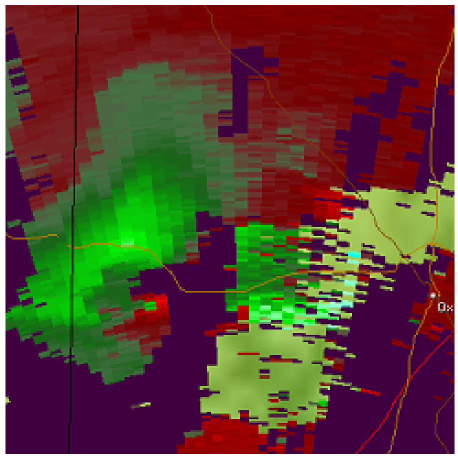
Berea Tornado Radar Imagery -

After spawning the tornado in Orange county, the storm weakened slightly as it moved into Person County. As the storm travelled across Person County it began to reorganize. Another weak echo region formed, this one was well defined, indicative of stronger inflow than previously. Another strong BWER formed at 2159 UTC as the storm approached Granville County. Velocity signatures across Person County showed that the storm maintained a broad circulation at low levels which started to lose definition above eight thousand feet. Storm relative velocities began to tighten and increase in magnitude as the storm moved into Granville County. At 2213 UTC, two minutes before the estimated tornado touchdown, several bins of 66 knot outbounds were located adjacent to 15 knot inbounds, which resulted in a rotational velocity of 41 knots. This tornado was the most impressive in the sense that it was the longest lived of the five, creating a damage path of more than 5 miles. In this case, the spectrum width data did not peak until 5 minutes after touchdown. Despite the impressive radar velocity signatures, this storm was only estimated to be an EF-0.









Berea Tornado Photos -

Photos courtesy of the National Weather Service.
(click on the image to enlarge)

Middleburg Tornado

The National Weather Service in Raleigh, NC confirmed an EF-0 tornado just west of Middleburg in Vance County, North Carolina on 27 October, 2010.

A mini-supercell thunderstorm that moved across Orange, Person and Granville counties previously produced a tornado near Carr in Orange County and a second tornado near Berea in Granville County. The same supercell produced a third tornado north of Henderson and just west of Middleburg in Granville County. This EF-0 tornado, which was the weakest of the three, tracked nearly 3 miles with a path width of 50 yards and winds of 75 to 80 MPH.

The tornado initially touched down on Coopers Grove Road blowing limbs out of trees and causing minor damage to a couple of sheds and outbuildings. The tornado tracked east-northeast crossing Satterwhite Point Road while blowing down and snapping numerous trees. Some minor damage to 2 homes occurred along with some damage to an above ground pool. The tornado then crossed Mabry

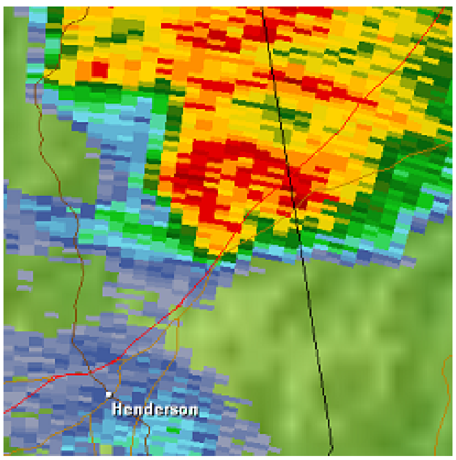
Mill Road causing extensive damage to trees which blocked Mabry Mill Road and damaged some guardrails. As the tornado continued east, it crossed Interstate 85 and produced some minor awning and roof damage to the Snackers BP gas station at exit 220. The tornado then lifted off the ground after striking the gas station.

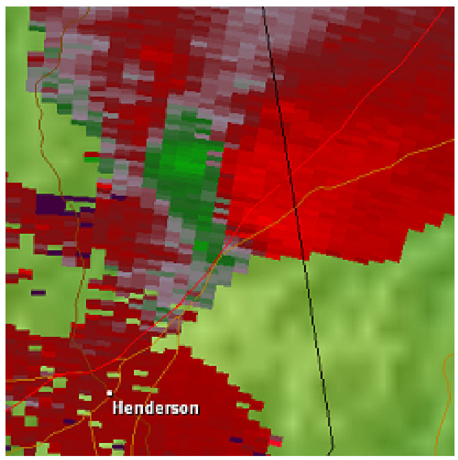
Nearly all residents interviewed were aware of the tornado warnings via television, radio and scanners. Special thanks to Vance County Emergency Management and local residents for assisting with the tornado survey.

Time/Date: 650 PM EDT, Wednesday, October 27, 2010
Tornado: EF-0
Peak Wind: 75 to 80 MPH
Path Length: 2.75 miles
Path Width: 50 yards
Beginning Lat/Lon...36.38N / -78.38W
Ending Lat/Lon...336.39N / -78.33
Injuries: none
Fatalities: none

Middleburg Tornado Radar Imagery -

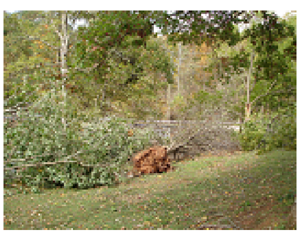
The mini-supercell that produced a tornado near Berea and Middleburg tracked northeastward into Vance County eventually spawning the final tornado of the event. This final tornado was not as well defined as the prior two tornadoes produced by this cell, which showed more and more signs of decay as it moved northeastward towards the Virginia border. A weak echo region evolves from 2236 UTC through 2245 UTC prior to touchdown. Storm relative velocities showed a circulation that was rather broad and the spectrum width data was not useful in this case. Based on the radar data, this was a storm that was slow to produce a tornado, possibly exhibiting elevated rotation and a funnel cloud for a more extended period of time before touchdown. The storm survey team eventually determined a touchdown time of 2250 UTC for the final EF-0 tornado in Vance County.





Middleburg Tornado Photos -

Photos courtesy of the National Weather Service.
(click on the image to enlarge)



November Tornadoes and the Secondary Fall Severe Weather Season

Locklear (2008) in a study of severe weather and tornadoes across WFO Raleigh's (RAH) County Warning Area (CWA) during the period of 1950 to 2005 found that 284 tornadoes were reported in the 55 year period. All 31 counties in the RAH CWA have had at least 2 confirmed tornadoes during that time frame. On average, five tornadoes occur within the RAH CWA each year. In addition, the RAH

CWA has experienced tornadoes throughout the calendar year. However, tornadoes are most likely to occur during the spring (March through May) when 43% or 122 of the total 284 tornadoes have occurred. The most active month is May when 59 of the total 284 tornadoes or 21% have been reported. Spring is the peak tornado season in the RAH CWA because of the increasing instability while the region is still vulnerable to strong and shearing winds through the depth of the atmosphere. The number of tornadoes decreases dramatically during the summer months (June through August), as the jet stream migrates north and the upper wind flow weakens over the Carolinas. There is a pronounced, secondary peak of tornadoes in the fall (September through November). This secondary tornado season can be explained by two processes, 1) land-falling tropical systems or their remnants and 2) the interaction of a strengthening wind field as the jet stream migrates south with occasional periods of instability.

Some of the notable November tornado events across central and eastern North Carolina since 1985 include...

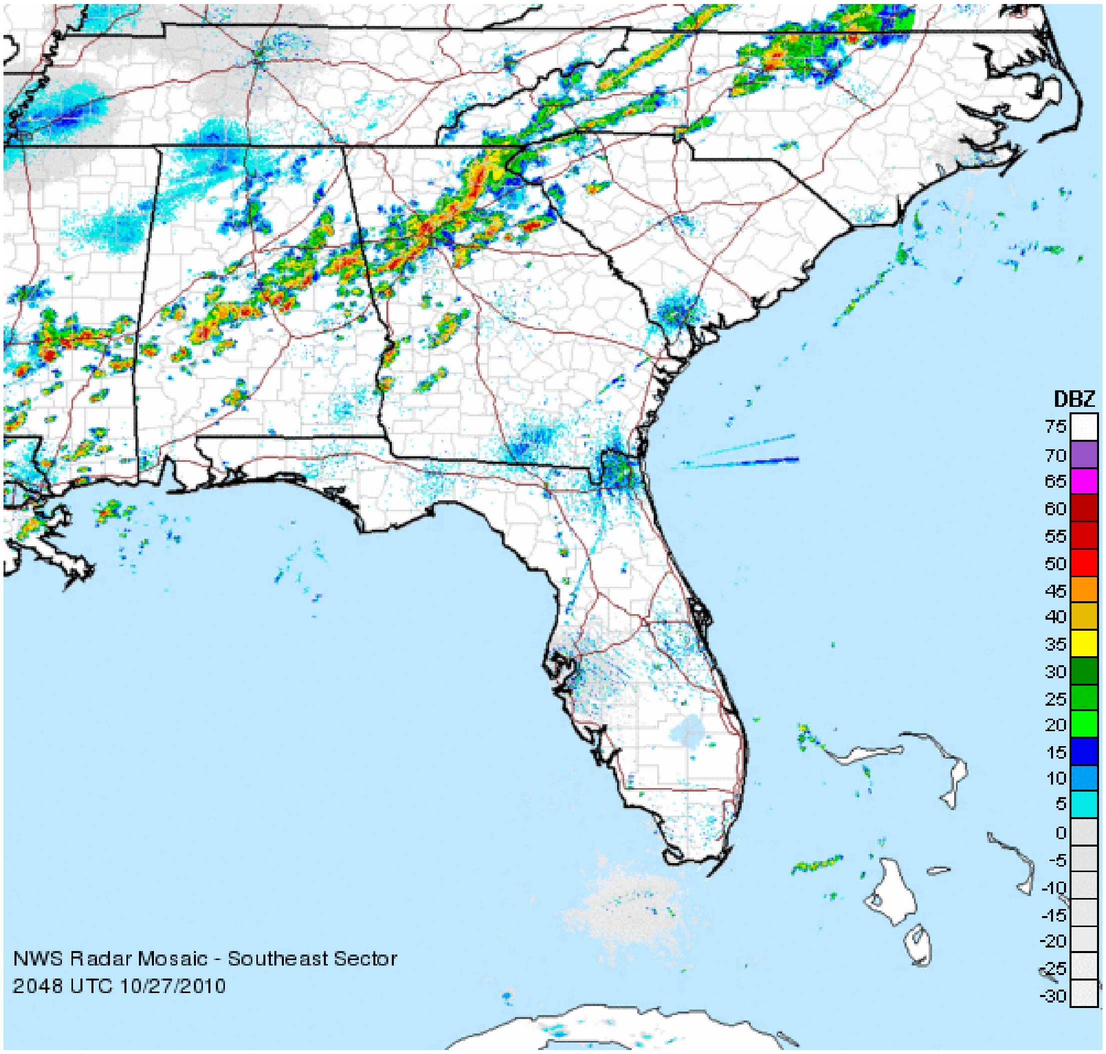
- November 15, 2008 North Carolina Tornado Outbreak
- November 15-16, 2006 Tornado Event (Riegelwood, NC)
- North Carolina Tornado Outbreak, November 22, 1992
- November 4, 1992 Tornado Event (southeastern NC)
- Raleigh Tornado, November 28, 1988 (F4 tornado strikes Raleigh, NC)
- November 17, 1988 Tornado Event (central Coastal Plain of NC)
- November 5, 1988 Tornado Event (northeastern NC)

Regional Radar Loop

A loop of regional reflectivity imagery from 1658 UTC through 2348 UTC on 27 October 2010 is available here.

A regional radar loop of the southeastern United States shows the convection associated with the nearly stationary cold front that extended across the eastern slopes of the southern Appalachians from western Virginia southwest into northern Georgia. The precipitation is initially setup in two bands, the eastern most band is associated with a prefrontal trough and the western band is associated with the actual cold front. The linear mode of the convection in the eastern band breaks down during the early afternoon with the two convective clusters that would later organize into the two mini-supercells discernible by 1828 UTC. The cells track northeast in the broad southwesterly flow associated with the deep cyclonic circulation across the eastern CONUS.

The regional reflectivity image below is from 2048 UTC on 27 October and shows the two supercells across the northern and northwestern Piedmont of North Carolina.



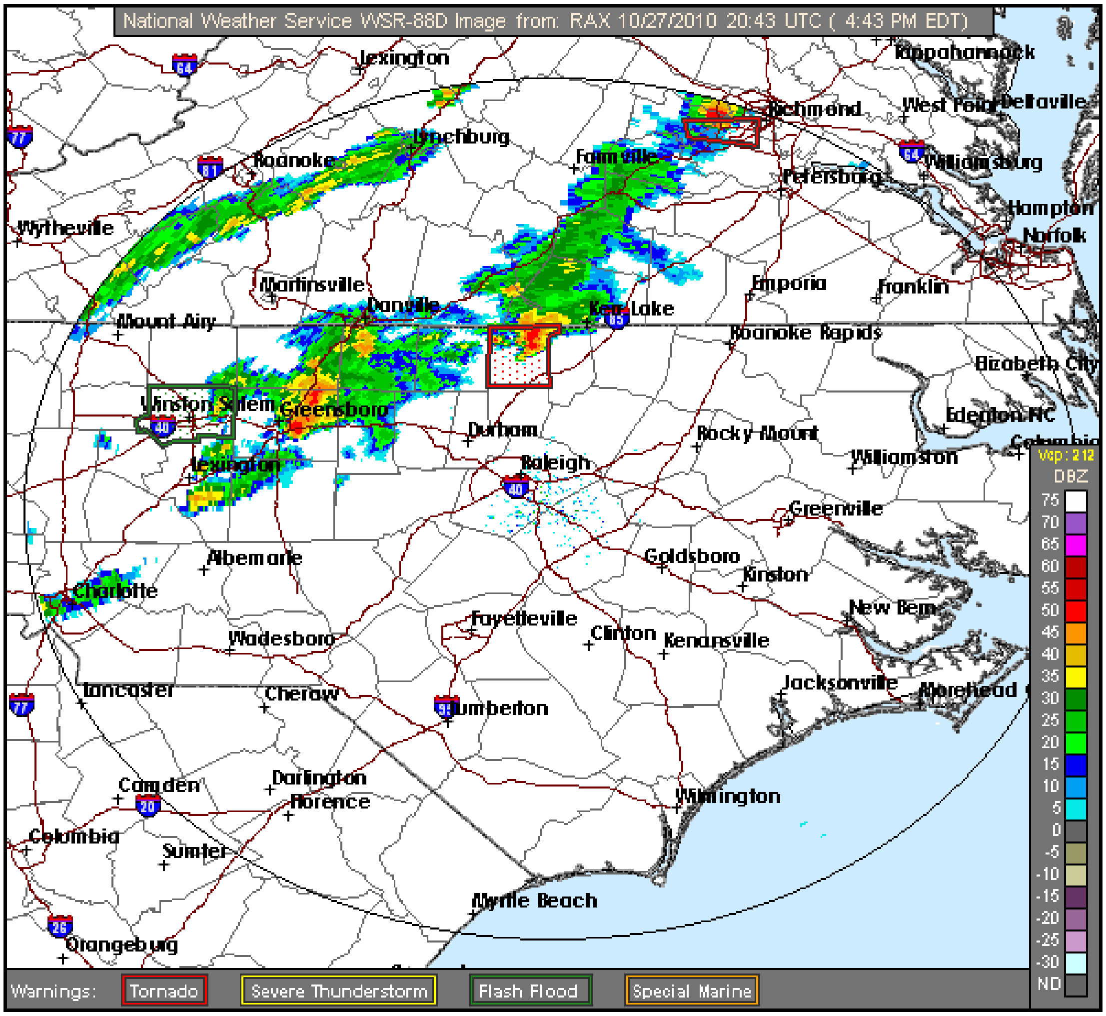
KRAX Radar Loops

Overview of the entire event with images from every 15 minutes between 1732 UTC through 2355 UTC on 27 October 2010.
Java loop of KRAX reflectivity imagery every 15 minutes from 1732 UTC through 2355 UTC on 10/27.
Note - this loop includes 33 frames

Overview of the first part of the event with images from every volume scan between 1732 UTC through 1956 UTC on 27 October 2010.
Java loop of KRAX reflectivity imagery from 1732 UTC through 1956 UTC on 10/27.
Note - this loop includes 32 frames

Overview of the second part of the event with images from every volume scan between 2001 UTC through 2355 UTC on 27 October 2010.
Java loop of KRAX reflectivity imagery from 2001 UTC through 2355 UTC on 10/27.
Note - this loop includes 48 frames

The KRAX reflectivity image below is from 2039 UTC or 439 PM EDT on 27 October 2010, as the first mini-supercell moved across northern Granville County and the second mini-supercell was intensifying across Guilford County.



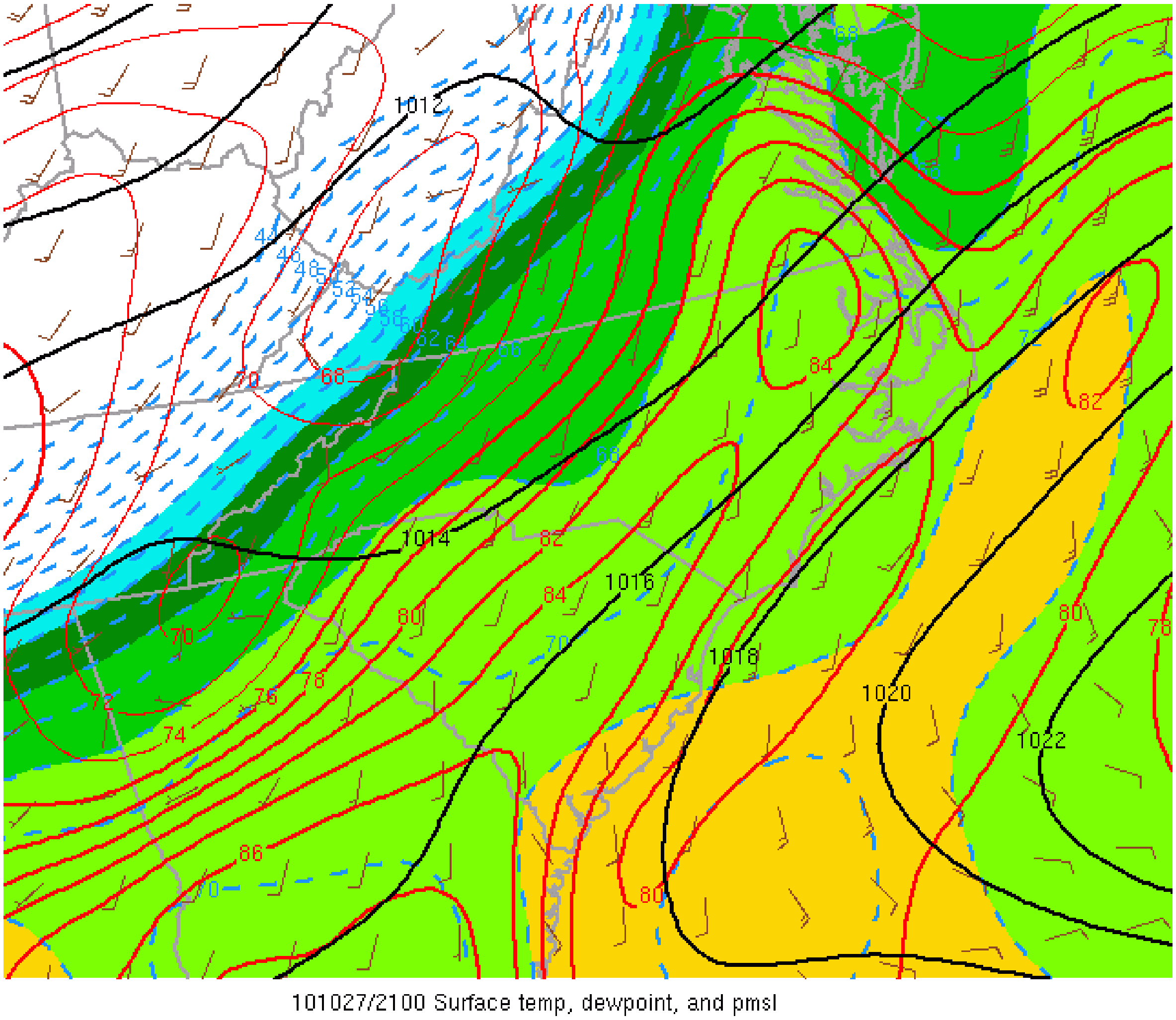
Mesoscale Data

Forecasters at the NWS Raleigh, NC routinely use the SPC meso-analysis products during severe weather operations. During this event, the SPC meso-analysis products were consulted frequently to monitor the evolving environment, identify the location of low level instability, and locate the region of greatest tornado threat. The images and discussion below highlight several of the SPC meso-analysis products that provide insight into the evolution of the severe weather event. Several analysis products shown below provide insight and important details about the mesoscale environment that supported the development of the supercells and tornadoes.

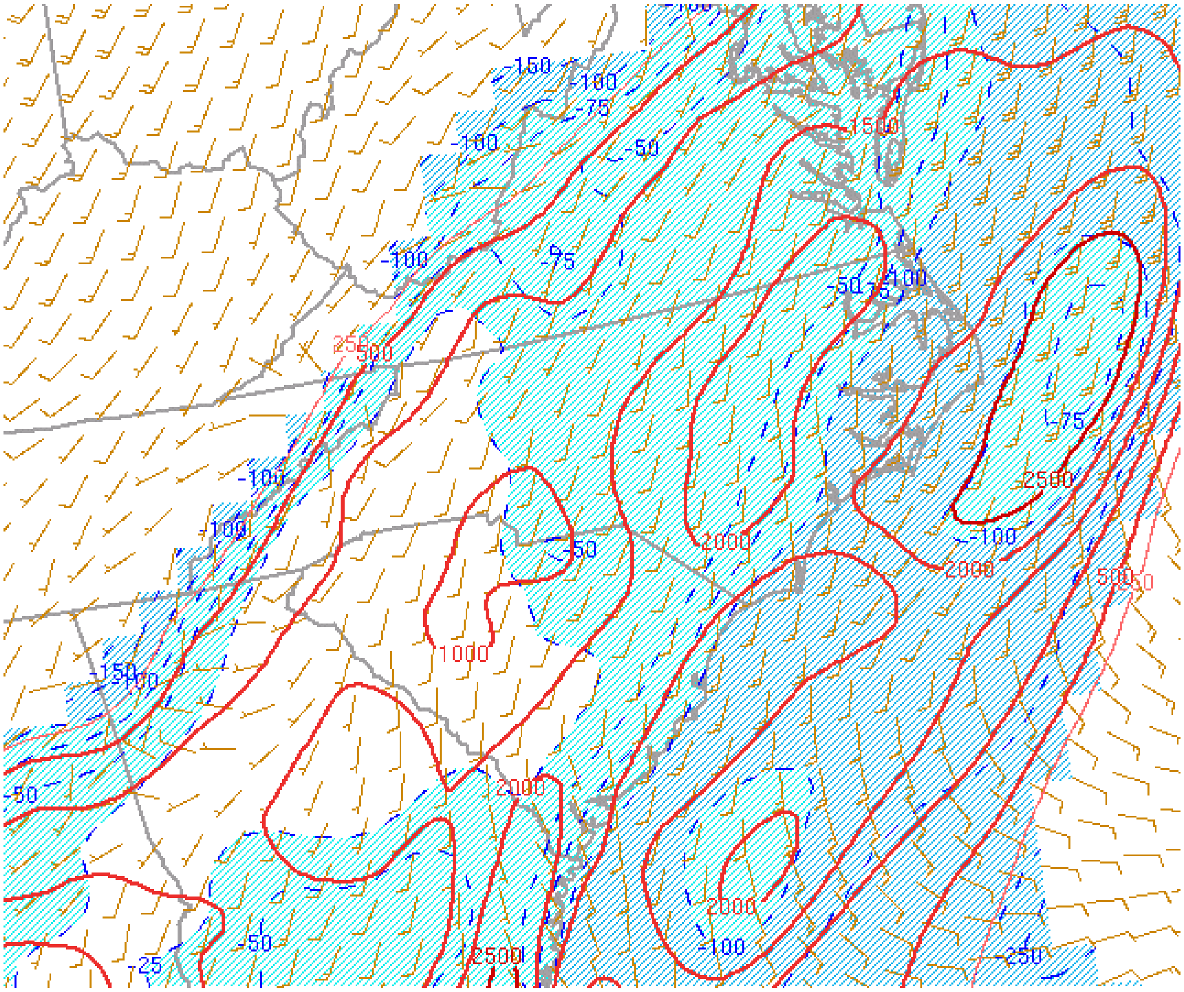
Analyzed MSLP (black) surface temperatures (red), dew points (blue) and shaded, and wind barbs from SPC at 2100 UTC 27 October 2010

The surface analysis showed a high pressure system located off the southeast U.S. coast with a south to southwesterly flow at the surface transporting warm, moist air into central North Carolina. A strong but slow moving surface front was located across western North Carolina and western Virginia. A strong dew point gradient was located behind the front, west of the Appalachians, with dew points in the upper 40s to mid 50s while dew points were in the upper 60s to near 70 across central North Carolina.

(Click on the image below to enlarge)

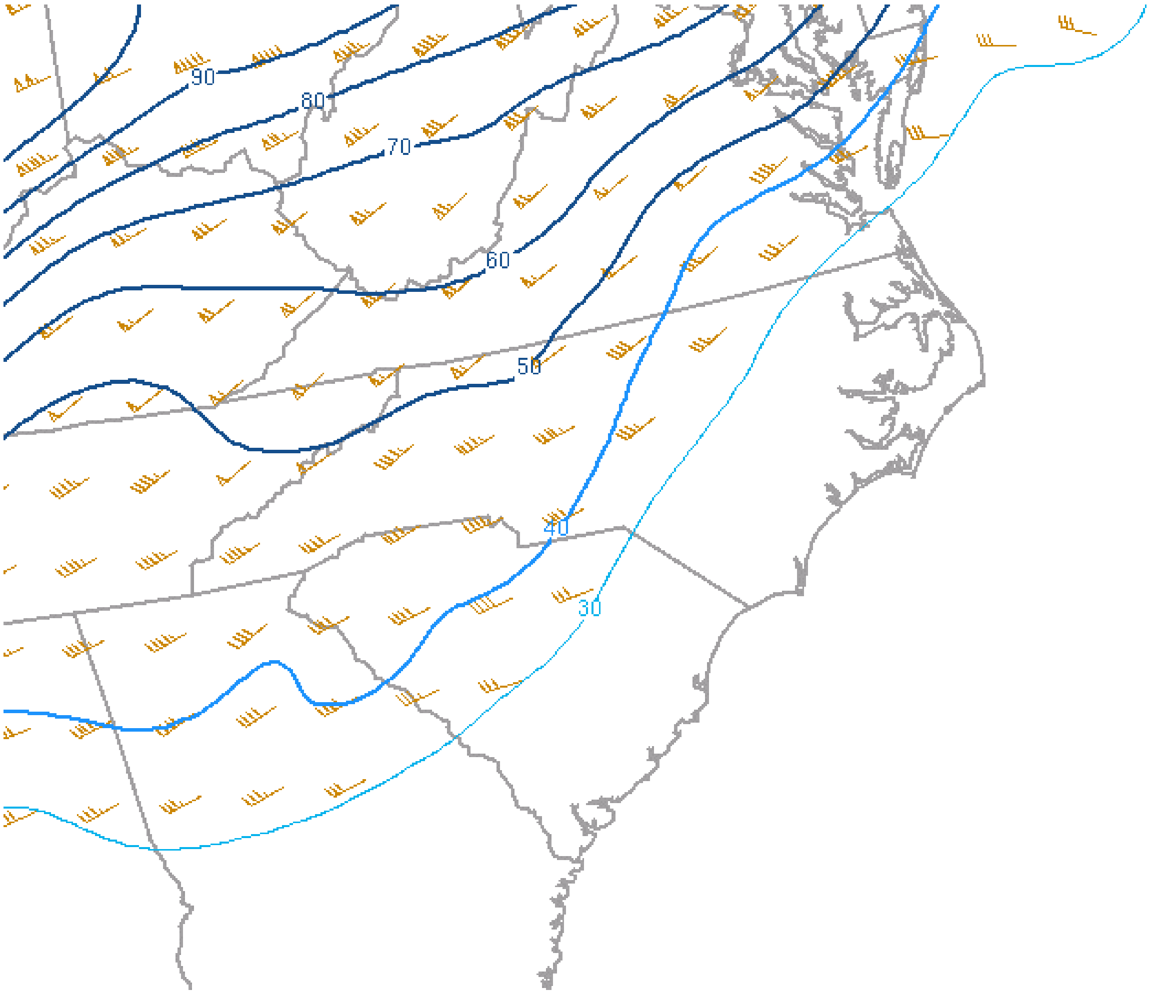


Analyzed Mixed Layer CAPE (red contours), and Mixed Layer CIN (shaded) from SPC at 2100 UTC 27 October 2010
The Mixed Layer CAPE analysis indicated CAPE values ranging between 1000 J/kg and 1500 J/kg across the northern Piedmont with values exceeding 2000 J/kg across the Sandhills and Coastal Plain of North Carolina.
(Click on the image below to enlarge)



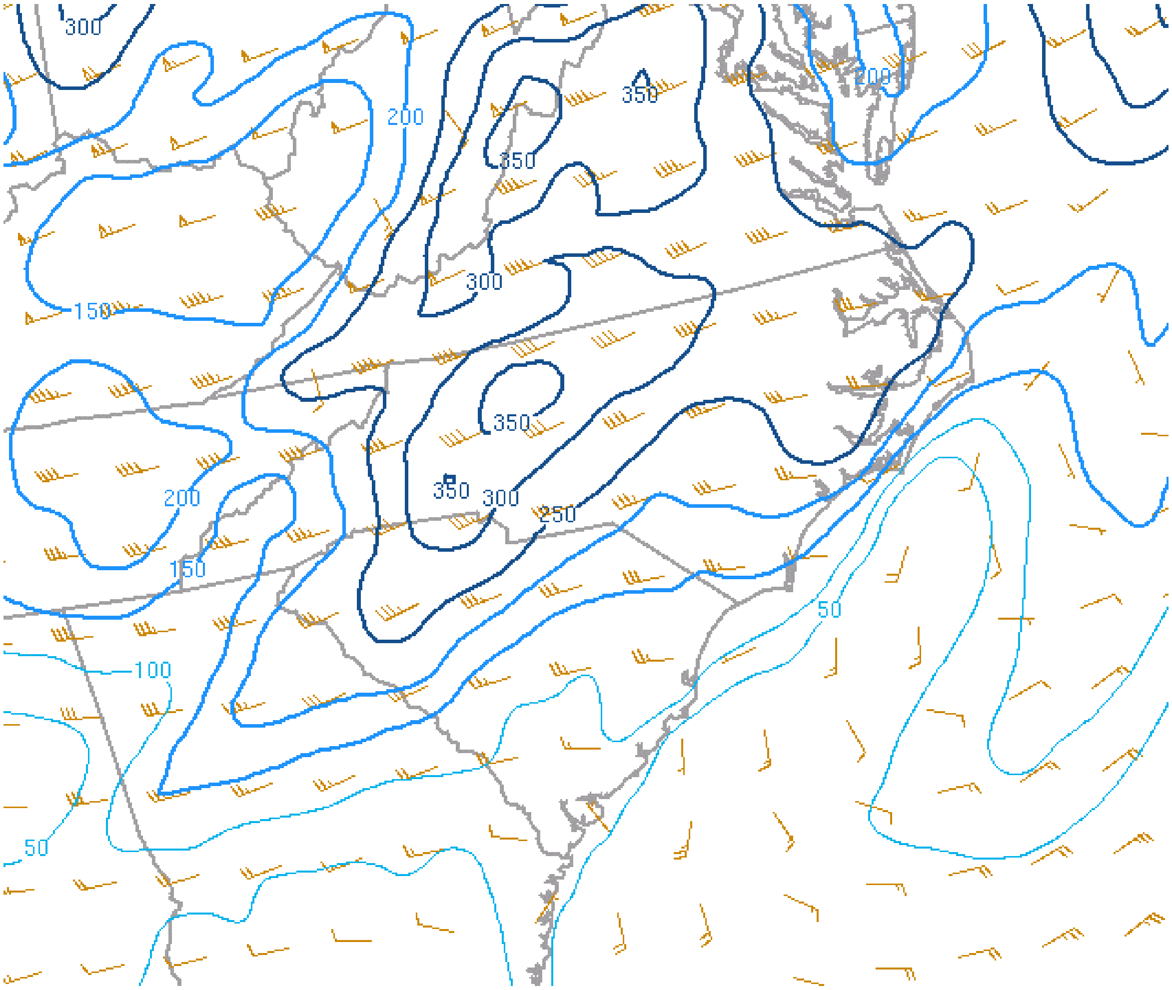
101027/2100 MLCAPE (contour) and MLCIN (J/kg, shaded)

Analyzed surface to 6km Bulk Shear vectors from SPC at 2100 UTC 27 October 2010
The 0-6 km bulk shear values ranged between 50 and 60 knots across the northern and especially the northwestern Piedmont. Given sufficient instability, thunderstorms tend to become more organized and persistent as vertical shear increases. Supercells are commonly associated with vertical shear values of 35 to 40 knots in this depth and the analysis at 21 UTC supports the potential of supercells.
(Click on the image below to enlarge)

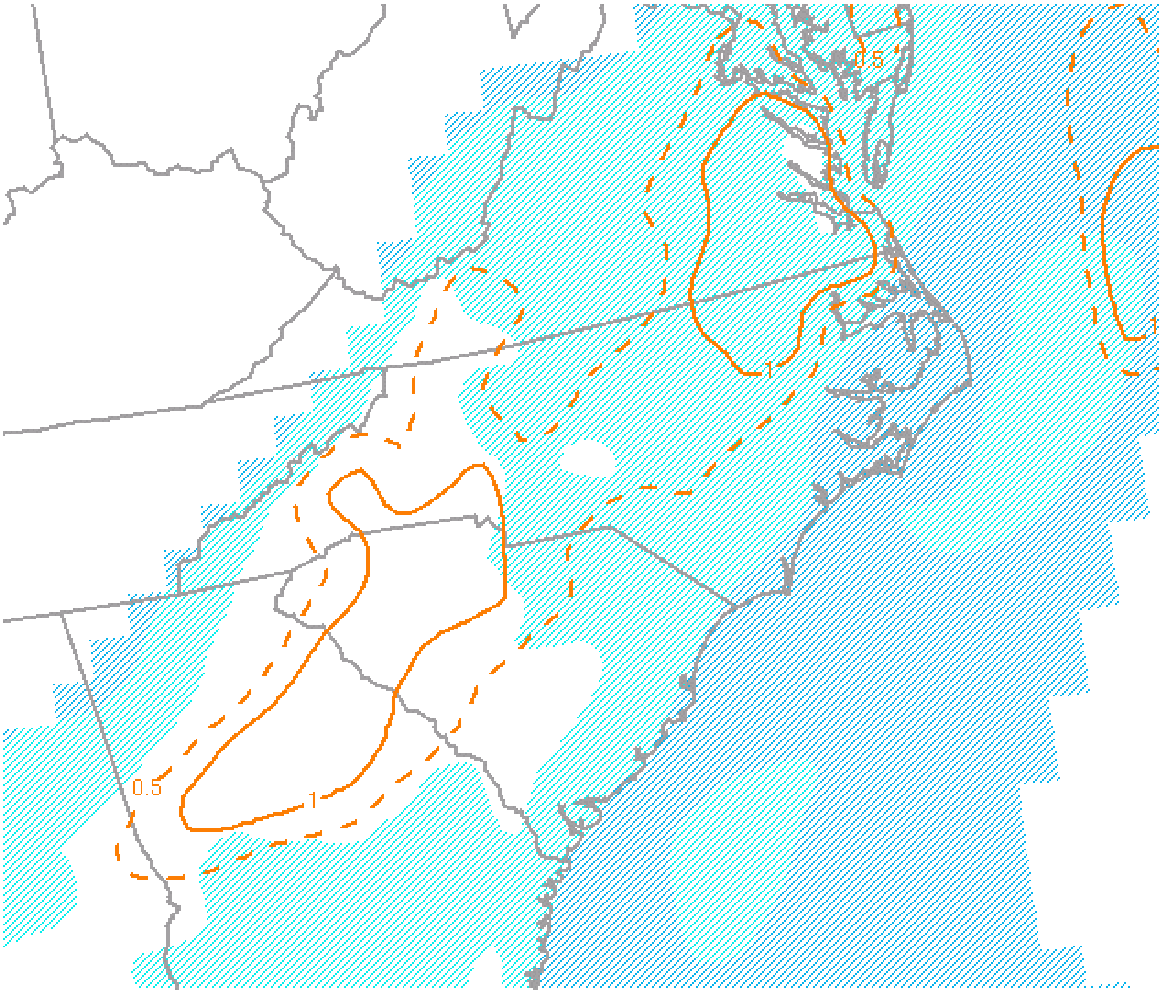


101027/2100 Surface to 6 km shear vector (kt)

0-1 km Storm Relative Helicity (blue) and storm motion (brown) from SPC at 2100 UTC 27 October 2010
The axis of greatest 0-1 km Storm Relative Helicity extended from west to east across much of the western and northern Piedmont of North Carolina. The 0-1 km SRH values ranged from around 250 m^2/s^2 to 350 m^2/s^2 in this region. The SRH is a measure of the potential for cyclonic updraft rotation in right-moving supercells. Studies have shown that larger values of 0-1 km SRH, greater than 100 m^2/s^2, suggests an increased threat of tornadoes and that very large values of 0-1 km SRH (perhaps greater than 200 to 300 m^2/s^2) are indicative of significant tornado potential.
(Click on the image below to enlarge)

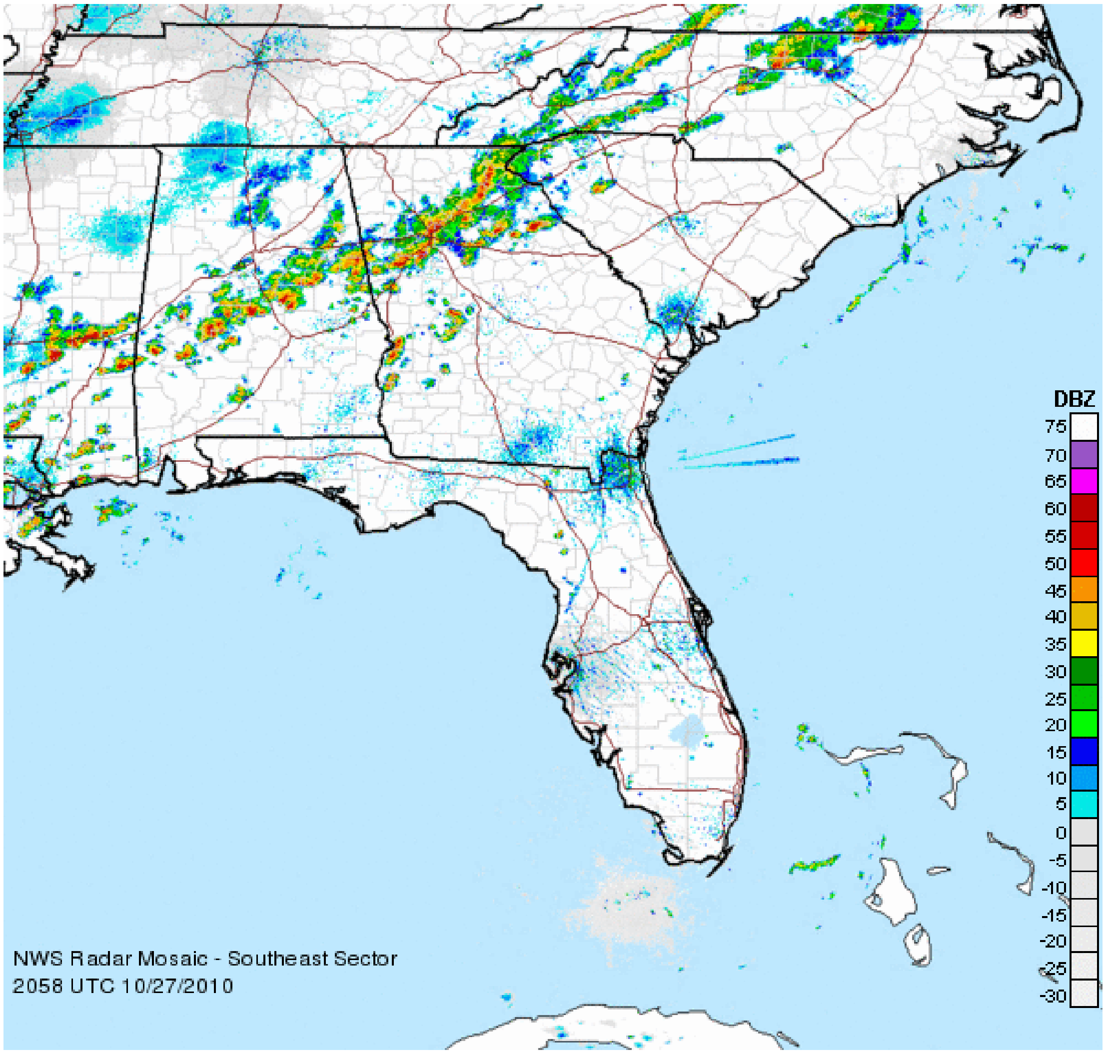


Significant Tornado Parameter (red) with Mixed Layer CIN (shaded) from SPC at 2100 UTC 27 October 2010
The STP is designed to highlight areas favoring right-moving tornadic supercells. The STP is a multiple ingredient, composite index that includes effective bulk wind difference (EBWD), effective storm-relative helicity (ESRH), 100-mb mean parcel CAPE (MLCAPE), 100-mb mean parcel CIN (MLCIN), and 100-mb mean parcel LCL height (MLLCL). Analyzed STP values across the western and northern Piedmont ranged between 0.5 and 1. A majority of significant tornadoes (F2 or greater damage) have been associated with STP values greater than 1, while most non-tornadic supercells have been associated with values less than 1 in a large sample of RUC analysis proximity soundings. Additional details on the Analyzed Significant Tornado Parameter (STP) is available in this reference.
(Click on the image below to enlarge)



101027/2100 Significant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded at 25 and 100)

NWS composite radar reflectivity imagery from 2058 UTC 27 October 2010.
The regional composite reflectivity imagery is from the approximate time in which the analysis imagery above is valid.



Archived Text Data from the Severe Weather Event

Select the desired product along with the date and click "Get Archive Data."
Date and time should be selected based on issuance time in GMT (Greenwich Mean Time which equals EST time + 4 hours).

Product ID information for the most frequently used products...

RDUAFDRAH - Area Forecast Discussion
RDUZFPRAH - Zone Forecast Products
RDUAFMRAH - Area Forecast Matrices
RDUPFMRAH - Point Forecast Matrices
RDUHWORAH - Hazardous Weather Outlook
RDUNOWRAH - Short Term Forecast
RDUSPSRAH - Special Weather Statement
RDULSRRAH - Local Storm Reports (reports of severe weather)
RDUSVRRAH - Severe Thunderstorm Warning
RDUSVSRAH - Severe Weather Statement
RDUTORRAH - Tornado Warning

* Scroll down for list | from | October | 26 | 2010

Get Archive Data

Lessons Learned

As has been the case in several events affecting the northwest Piedmont, use of the KFCX WSR-88D was critical in issuing warnings for the northwest Piedmont and Triad. Initial warnings for Forsyth, Guilford, and Person Counties were strongly driven by radar data from KFCX. A strong rotational couplet just west of Lewisville, just prior to 2 PM, was too far north to be seen well by TCLT.

In situations with long lived supercells, a strategy of each radar operator following a particular supercell for the duration of its life cycle in central North Carolina once again proved to be effective. This strategy has also been employed successfully in previous tornadic events.

As the initial storms started to lose rotational structure in Vance and Warren Counties, Severe Thunderstorms were issued instead of Tornado Warnings. This is a difficult warning decision, as long-lived supercells can spin up quickly and produced additional tornadoes.

The second supercell was followed across parts of the GSP CWA using the TCLT TDWR. WFO GSP was issuing tornado warnings on this cell but none of them verified. The storm was modest in intensity as it moved into Davidson and Randolph Counties but eventually intensified as it moved across Guilford and Alamance Counties. The TDWR was helpful in allowing the radar operator to build some familiarity with the storm.

Relaying information to customers, particularly the media through the use of NWSChat was highly effective in this event. We were able to pass to those on the chat reasons for issuing or continuing warnings, and to pass along severe weather reports. We also received several reports from the media. Monitoring local television stations from both Greensboro and Raleigh during the event revealed that in numerous instances, our information sent via chat was being delivered in some form by the media on-air.

This event is a good example of a severe weather event in the secondary severe weather season. Note there is a pronounced, secondary peak of tornadoes in the fall (September through November). This secondary tornado season can be explained by two processes, 1) land-falling tropical systems or their remnants and 2) the interaction of a strengthening wind field as the jet stream migrates south with occasional periods of instability.

Recent advances in Numerical Weather Prediction (NWP) and in computational efficiency have resulted in an improvement in and the availability of high resolution model forecasts on the convective scale. The convection that moved into the western Piedmont on the evening of 26 October and which produced severe weather, was not well predicted by the operational NAM or GFS. High resolution NWP with convection allowing models did much better and indicated the threat 18 to 30 hours in advance.

References Locklear, C.B., 2008: A Severe Weather Climatology for the Raleigh, NC County Warning Area. NWS ER Technical Memorandum, **101**.

Acknowledgements

Many of the images and graphics used in this review were provided by parties outside of the NWS Raleigh. The surface analysis graphics were obtained from the Hydrometeorological Prediction Center. SPC meso-analysis graphics provided by the Storm Prediction Center. NSSL's Rotational Track product provided by the WDSS-II (Warning Decision Support System - Integrated Information) group at NSSL. Local storm reports and warning polygons KMZ data provided by the National Climatic Data Center.

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