

## Overview of the October 13, 2004 NWS MHX Severe Weather Event

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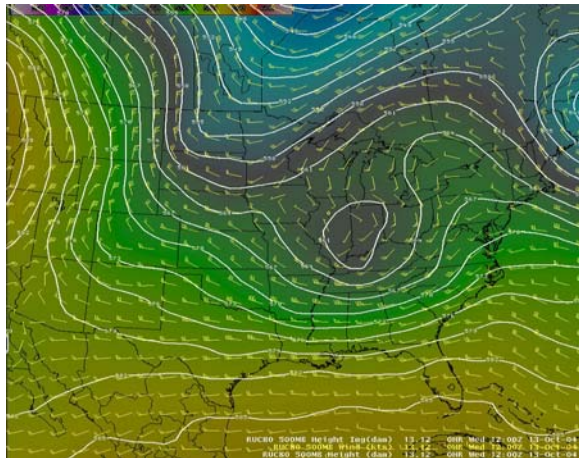
National Weather Service Forecast Office  
Newport/Morehead City, NC

### 1. INTRODUCTION

On October 13, 2004, the National Weather Service in Newport/Morehead City, NC issued nine tornado warnings, two severe thunderstorm warnings and three special marine warnings for several thunderstorms that affected the county warning area primarily between 12:30 pm EDT and 5:00 pm EDT. Preliminary storm reports suggest that at least three tornadoes touched down in Jones, Craven and Pamlico counties. Although there were several reports of tornadoes on the ground, no damage was associated with any of the tornadoes. Most of the minor damage during the event occurred near the towns of Merritt and Stonewall in Pamlico County, and primarily consisted of downed trees and tree limbs. A storm survey completed on October 14, 2004 concluded that this damage was the result of a downburst.

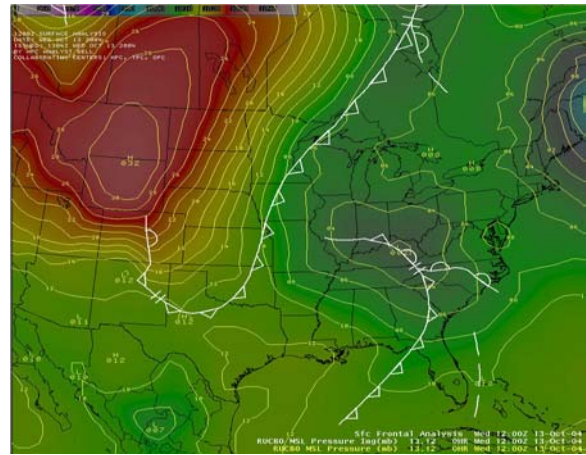
### 2. SYNOPTIC OVERVIEW

The upper-air pattern over the eastern United States early on October 13, 2004 was characterized by a deep, neutral or slightly negatively tilted 500 mb closed upper-low over Indiana, Tennessee, Kentucky and the Ohio valley (**Figure 1**).



**Figure 1.** 12Z 10/13/04 500 mb Heights and Wind.

Downstream of the trough in North Carolina, the 500 mb flow at GSO and MHX was from the west southwest at 40-50 knots. Surface observations and analyses early on October 13<sup>th</sup> showed an occluded 1001 mb surface low located over Indiana, Kentucky and Ohio, with an associated warm front beginning to lift northward over North Carolina by 12Z (**Figure 2**).



**Figure 2.** 12Z 10/13/2004 MSLP and Frontal Analysis

During the day, mesoscale surface analyses indicated a surface trough was located south of the warm front stretching west to east across central and eastern North Carolina (**Figure 3**). The cold front associated with the occluded surface low remained to the west and did not enter the NWS MHX county warning area (CWA) until roughly 00Z October 14.

During the afternoon, the warm front stalled out and remained over north central and eastern North Carolina. As the 500 mb trough over Tennessee, Kentucky and Ohio lifted into western North Carolina and Virginia, a weak 999 mb surface low developed along the stalled warm front in central North Carolina by 21Z October 13, and subsequently began to move northeast into southeast Virginia (**Figure 4**).

The 12Z October 13 upper-air sounding from NWS MHX indicated relatively low wet-bulb zero heights (~10 kft) along with modest speed and

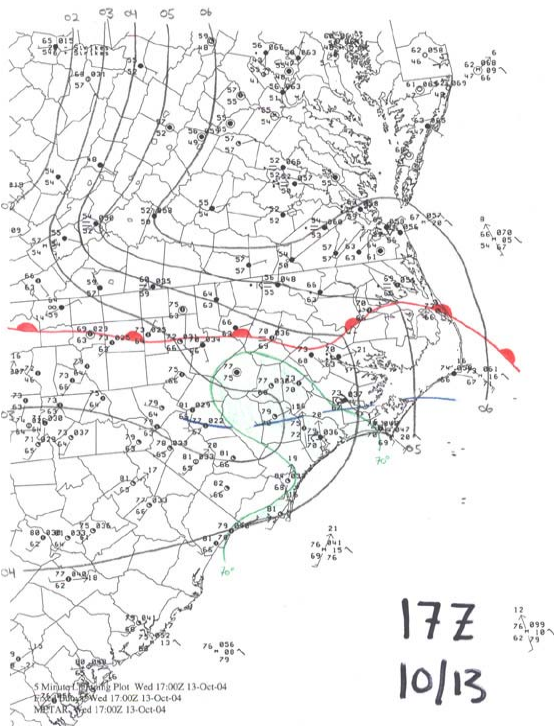


Figure 3. 17Z 10/13/2004 Manual Surface Analysis.

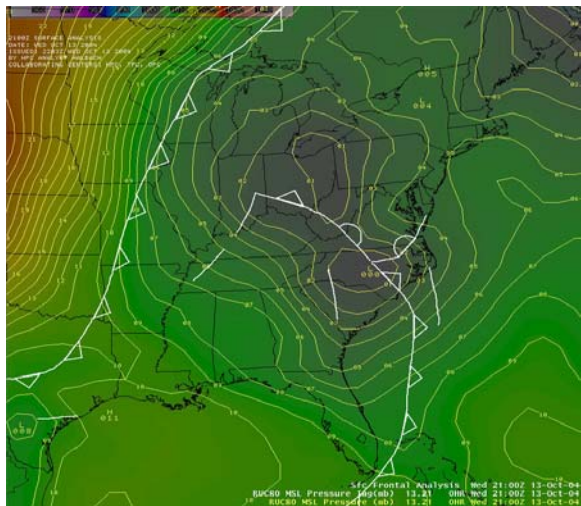


Figure 4. 21Z 10/13/2004 MSLP and Frontal Analysis.

directional shear through 500 mb (Figure 5). The 500 mb flow was from the west southwest at near 40 knots. Although the morning thermodynamic profile supported only near 500 J/kg of CAPE, diurnal heating and dry air aloft (above 700 mb) would allow enough instability to fuel storms as the day progressed.

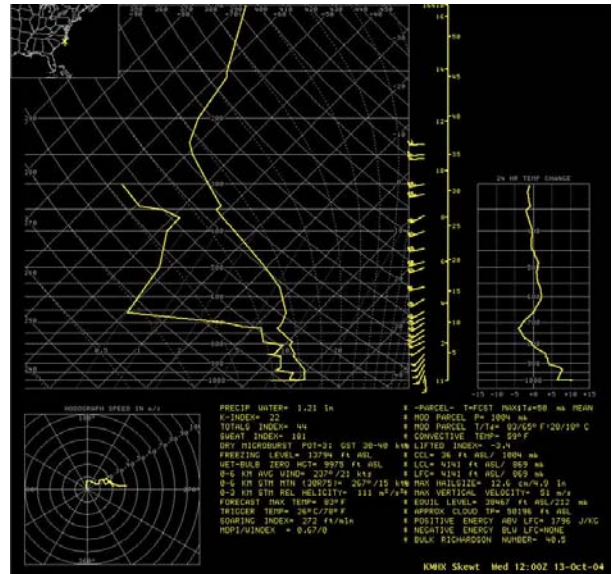


Figure 5. 12Z 10/13/04 MXH Upper-Air Sounding.

### 3. WARNING CHRONOLOGY

The threat of severe weather on Wednesday, October 13 was noted in Storm Prediction Center (SPC) convective outlooks and in NWS MXH area forecast discussions prior to the event. The SPC day 1 outlook outlined a SLGT risk of severe thunderstorms across central and eastern North Carolina (Figure 6).

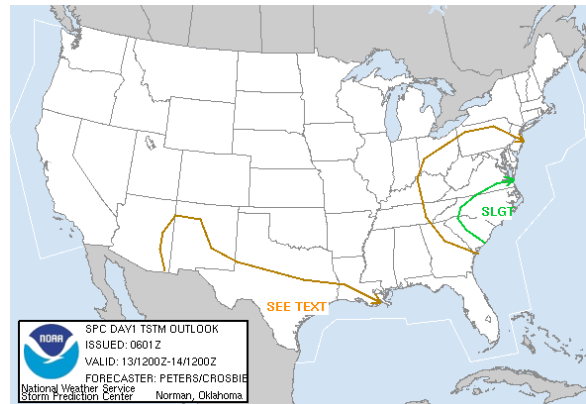


Figure 6. 06Z 10/13/04 SPC Day 1 Convective Outlook.

Specifically, the SPC mentioned a 5% probability of tornadoes in eastern North Carolina (Figure 7). The early morning area forecast discussion from NWS MXH also mentioned the threat for locally strong to severe storms, including the threat for tornadoes. A special weather statement from NWS MXH was issued at 4:15 am EDT on October 13 outlining the threat of severe thunderstorms and isolated



tornadoes across eastern North Carolina during the late morning and early afternoon hours.

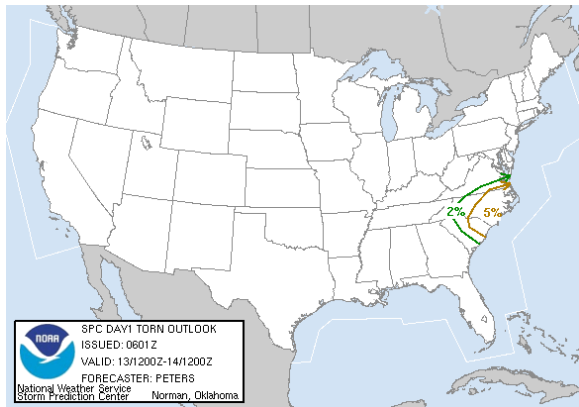


Figure 7. 06Z 10/13/04 SPC Day 1 Tornado Outlook.

As the day shift arrived at NWS MHX, it was decided that the best radar scanning strategy would be VCP-121. VCP-121 was selected because this scanning strategy eliminated much of the range folding present in VCP-12. As the morning progressed, the day shift at NWS MHX closely monitored the radar and noticed convection gradually becoming better organized as several cells developed in Duplin, Onslow and Jones counties.

At 12:28 pm EDT, a special weather statement was issued for a strong thunderstorm in Jones County. It was this thunderstorm in Jones County that would develop into a supercell and persist for several hours, tracking across portions of four counties and prompting many of the warnings issued during the event. Less than 10 minutes after the special weather statement was issued, the Jones County storm developed a velocity couplet with ~50 knots of shear (Figure 8) and a pronounced inflow notch and hook in the 0.5 degree reflectivity (Figure 9). Also, at this time (and throughout

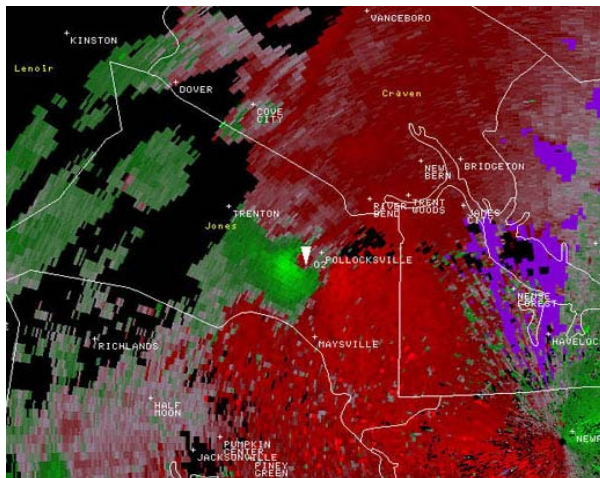


Figure 8. 1636Z 10/13/04 KMHX 0.5 Degree SRM with TVS Overlaid.

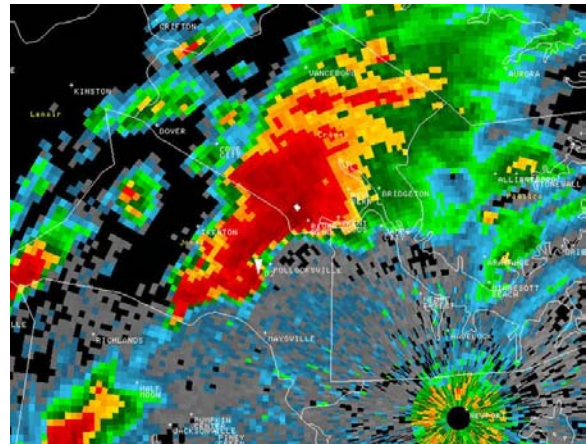


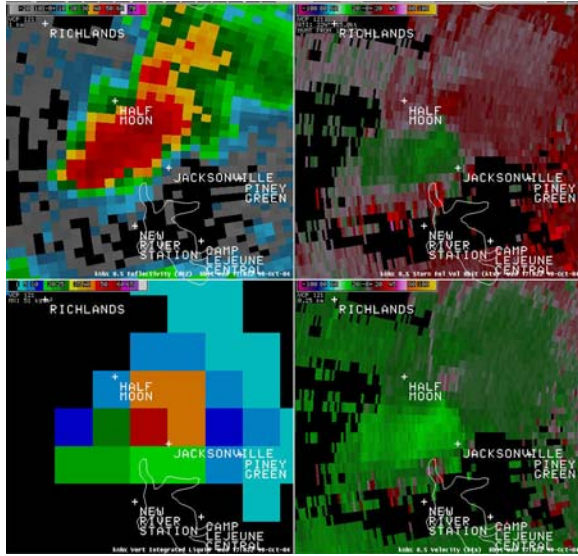
Figure 9. 1636Z 10/13/04 KMHX 0.5 Degree Reflectivity with TVS Overlaid.

the next two hours) the storm intermittently set off the MESO and TVS algorithms. A tornado warning was promptly issued for Jones County valid from 12:37 pm to 1:15 pm EDT. As the storm continued to head towards the Craven County border, a tornado warning was issued for Craven County valid from 12:47 pm to 1:30 pm EDT. At 12:50 pm EDT, a report was received from Craven County 911 that a motorist on Highway 17 just northeast of Pollocksville in Jones County had sighted a tornado on the ground.

At 1:00 pm EDT (12:00 pm CDT), a mesoscale discussion was issued by the SPC outlining the threat for an isolated tornado or two across coastal North Carolina. In the mesoscale discussion, the SPC noted that the threat was too limited temporally and spatially to warrant a watch box. As the supercell in question continued moving through Craven County, reports of a tornado were received from the James City area around 1:20 pm EDT.

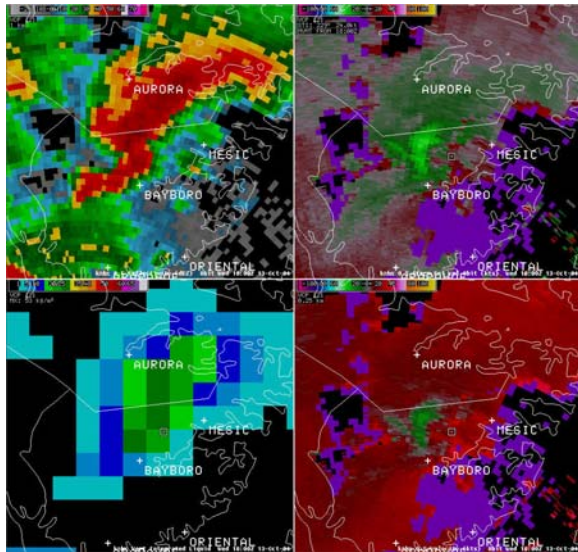
At 1:08 pm EDT, a separate storm that quickly developed in Onslow County showed signs of rotation and contained a VIL of  $55 \text{ kg/m}^3$  (Figure 10), prompting a tornado warning for that county valid from 1:08 pm to 1:45 pm EDT. At 1:10 pm EDT, 3/4" hail was reported near Jacksonville in Onslow County.

At 1:24 pm EDT, the supercell thunderstorm that had tracked through Jones and Craven counties was approaching Pamlico County. Based on the radar signatures and storm history, a tornado warning was issued for Pamlico County, valid from 1:24 pm to 2:00 pm EDT. At 1:48 pm EDT, a tornado warning was also issued for far southeast Beaufort County, effective from 1:48 pm to 2:30 pm EDT. The Beaufort County warning was issued because of the projected motion of the Pamlico County supercell along the Beaufort/Pamlico County line. At 1:50 pm EDT, reports of 3/4" hail were received from the Silver Hill area in northern Pamlico County. At 1:57 pm EDT a tornado warning was re-issued for Pamlico County, effective from 1:57 pm to 2:30 pm EDT. The Pamlico County warning was re-issued because the storm



**Figure 10.** 1702Z 10/13/2004 KMHX 4-Panel of 0.5 Degree Reflectivity (upper left), 0.5 Storm Relative Velocity (upper right), VIL (lower left), and 0.5 velocity (lower right).

motion slowed and the track continued along the Beaufort/Pamlico County border (**Figure 11**). At 2:00 pm EDT, the public reported a tornado on the ground near the intersection of Highway 306 North and Paul Farm Road in north central Pamlico County.



**Figure 11.** 1800Z 10/13/2004 KMHX 4-Panel of 0.5 Degree Reflectivity (upper left), 0.5 Storm Relative Velocity (upper right), VIL (lower left), and 0.5 velocity (lower right) at time of reported tornado touchdown in northern Pamlico County.

At 2:04 pm EDT, a thunderstorm that developed in eastern Jones County prompted

simultaneous severe thunderstorm warnings for Jones and Craven counties, effective from 2:04 pm to 3:00 pm EDT. At 2:10 pm EDT, a report of trees blown over on Highway 17 near Ten Mile Fort Road was received from Jones County 911. Additionally, the damage survey the following day noted a fresh tree down along Highway 17 near River Bend in Craven County, and it is assumed this tree was a casualty of the same storm.

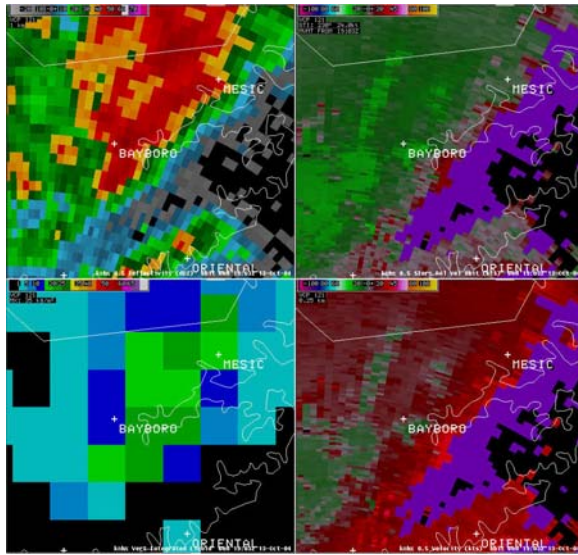
At 2:16 pm EDT, the severe thunderstorm in Craven County showed definitive signs of rotation, and the severe thunderstorm warning was upgraded to a tornado warning, effective from 2:16 pm to 3:00 pm EDT. Meanwhile, the supercell along the Beaufort/Pamlico County line weakened, and damage reports ceased.

At 3:35 pm EDT Pamlico County 911 was called and it was determined that trees were down near the town of Merritt (just southeast of Bayboro) at approximately 3:14 pm EDT. A post-event review of radar data on the warning event simulator (WES) showed that the damage must have occurred in this area at approximately 3:00 pm EDT. A resident (interviewed by the damage survey team) near the town of Merritt reported tree/tree limb damage occurring at his residence around 3:00 pm EDT. In addition to tree damage, a sawhorse and a five gallon bucket of water were blown off the resident's porch. Tree limb debris was noted on the resident's roof, as well. The minor damage was very localized and was determined to be caused by a downburst. The damage that occurred in this area was not associated with the supercell in the northern portion of the county. The damage was the result of a separate storm that formed over central Craven County (just south of the convection that prompted the Jones/Craven severe thunderstorm warnings) that subsequently moved east northeast into Pamlico County.

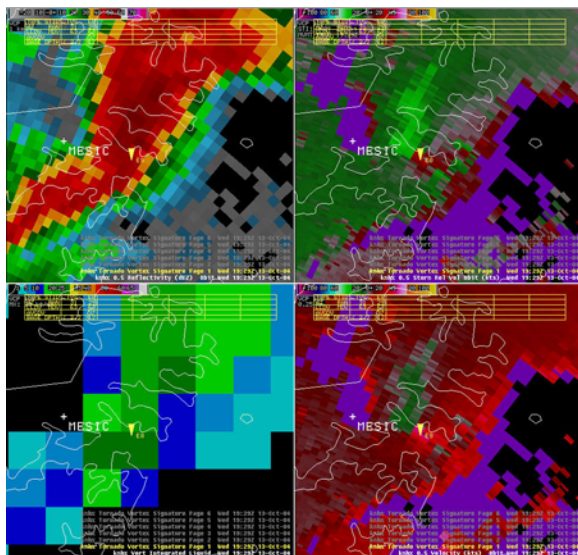
As the convection approached eastern Pamlico County, the velocities were partially obscured by range folding (**Figure 12**). The storm that produced damage near Merritt was not nearly as organized as the supercell in the northern portion of the county. Reports of damage in the Merritt area were not received until 3:35 pm EDT. Thus, no warning was in effect when the damage occurred near Merritt at 3:00 pm, and this must be counted as a missed event.

Around 3:30 pm EDT, the storm that produced tree damage near the town of Merritt (although this was not known at the time) intensified and concurrently set off the MESO and TVS algorithms. Based on the MESO and TVS algorithms and the radar velocity/reflectivity representation (**Figure 13**), a tornado warning was issued for northeast Pamlico County, valid from 3:31 pm to 4:00 pm EDT. At 3:50 pm EDT, as the storm entered the far northeast portion of Pamlico County, a special marine warning was issued for the Pamlico Sound, valid from 3:50 pm to 4:15 pm EDT. The supercell





**Figure 12.** 1903Z 10/13/2004 KMHX 4-Panel of 0.5 Degree Reflectivity (upper left), 0.5 Storm Relative Velocity (upper right), VIL (lower left), and 0.5 velocity (lower right) at time of damage in Merritt (just southeast of Bayboro).

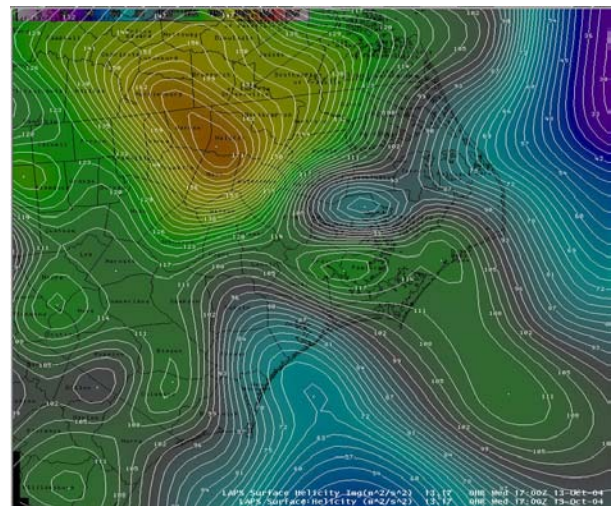


**Figure 13.** 1929Z 10/13/2004 KMHX 4-Panel of 0.5 Degree Reflectivity (upper left), 0.5 Storm Relative Velocity (upper right), VIL (lower left), and 0.5 velocity (lower right) with TVS overlaid.

crossed the Pamlico Sound and maintained its intensity. At 4:16 pm EDT, a tornado warning was issued for eastern Hyde County adjacent to the Pamlico Sound, valid from 4:16 pm to 5:00 pm EDT. As the supercell continued its northeast motion, another special marine warning was issued for the Pamlico Sound, valid from 4:45 pm to 5:30 pm EDT. The last warning to be issued in this event was a special marine warning for the Albemarle Sound, valid from 9:50 pm to 11:00 pm EDT.

#### 4. DISCUSSION

Looking over the before-mentioned synoptic overview, SPC outlooks and NWS MHX area forecast discussions, it is not difficult to understand why eastern North Carolina experienced severe weather. The conditions necessary for severe weather, including isolated tornadoes, were predicted well in advance. It is worth noting that the Onslow County storm may not have become tornadic because it was further removed from the favorable helicity fields (**Figure 14**) in the vicinity of the warm front further north. Based on the observed synoptic pattern, mesoscale boundaries, and thermodynamic and kinematic profiles obtained, it is probable that the thunderstorms in Jones, Craven, and Pamlico counties were occasionally tornadic because of their closer proximity to the warm front. In addition to the favorable helicity fields in the vicinity of the warm front, the developing surface low over central North Carolina during the afternoon on the 13<sup>th</sup> may have contributed to storm severity by slightly backing the surface winds over eastern North Carolina.



**Figure 14.** 17Z 10/13/04 LAPS Helicity Analysis.

Looking at the missed event in Pamlico County at 3:00 pm EDT, it was ascertained that not much could have been done to anticipate the minor tree damage (**Figures 15 and 16**) that occurred at that time. There were no tell-tale reflectivity or velocity signatures in the radar data, no damage history with the cell in question and the Pamlico County 911 report of damage in the Merritt area was not received until 3:35 pm EDT.





**Figure 15.** Tree damage near the town of Merritt in Pamlico County.



**Figure 16.** Tree damage near the town of Merritt in Pamlico County.