Anthony W. Lyza¹, Todd A. Murphy², Kevin R. Knupp¹ ²University of Louisiana at Monroe, Monroe, LA

Overview of the 28-29 April 2014 Tennessee Valley Tornado Outbreak ¹Severe Weather Institute and Radar & Lightning Laboratories, University of Alabama in Huntsville, Huntsville, AL

Overview

- Long-lived tornado outbreak occurred across a large area from the eastern Great Plains to the Carolina coastal plain from the afternoon of 27 April through the afternoon of 29 April 2014, with approximately 75 confirmed tornadoes
- Epicenter of the outbreak was across Mississippi, Alabama, and southern Middle Tennessee on 28-early 29 April, where over 50 tornadoes were documented, many of which were significant (EF2-EF4 intensity)
- Thirteen tornadoes occurred within a high-density observational domain across the Tennessee Valley region of northern Alabama and southern Middle Tennessee

Active Tornado Interception with a Mobile Radar in the Tennessee Valley

- First attempt to active pursue a tornado intercept using the Mobile Alabama X-band (MAX) in Northern Alabama during a significant tornado outbreak
- Captured most of the lifespan of the first Alabama tornado of the day near Russellville in Franklin County
- Though extensive beam blocking was encountered below 3.0° with partial blocking above that, radar observations of the tornado are encouraging for the viability of mobile radar operations in portions of the Tennessee Valley during severe weather episodes



Figure 2: Picture of the wall cloud producing the Russellville EF1 tornado taken by Brian Freitag (UAH) of the MAX crew (top) and 6.4° plan position indicator plot of equivalent reflectivity factor (Z_e, middle-left), dealiased base velocity (V_r, middle-right), spectrum width (lower-left), and cross-polar correlation coefficient (ρ_{hv} , lower-right) at 20:49:56 UTC 28 April 2014.



Welti-Berlin EF

Figure 1: Overview of tornado tracks from 28-29 April 2014 focused on the Tennessee Valley of northern Alabama and southern Middle Tennessee. Tornadoes discussed on this poster are labeled.

dissipated quickly upon descending the edge of Sand Mountain



Figure 3: Aerial survey image of the end of the Aroney EF3 tornado track showing the dissipation of the tornado as it descends Sand Mountain. Photo provided by Paula Tucker (UAH). The white arrow depicts the tornado track. Picture is looking southwest.

• The Dawson EF2 tornado (DeKalb County) formed through a regeneration of the Aroney circulation and traveled along the edge of the Sand Mountain



Figure 4: Hytop WSR-88D (KHTX) two-panel 0.5° PPI plots of Z_e (left) and V_r (right) from KHTX at 05:45:11 UTC (top) and 05:54:35 UTC (bottom) 29 April 2014, showing the evolution of the Aroney and Dawson circulations.

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Effects of a Mid-Tropospheric Wave on Tornado Motion

- The Welti-Berlin EF3 tornado featured an extremely deviant motion to the left of the other tornadoes, with a mean bearing of 188°, vs. 210-250° bearings for most of the other tornadoes
- KHTX featured a large band of enhanced Z propagating through the parent supercell
- This band passed directly over the Mobile Integrated Profiling System (MIPS) at the University of Alabama in Huntsville (UAH), where an apparent wave was noted above the melting layer at 4-7 km AGL
- Tornado motion appeared to mirror motion of this wave feature more so than the motion of the parent supercell



Wave signature was concentrated aloft, with little-no surface reflection

Possible Terrain Influences on Tornado Behavior in NE Alabama

The Aroney EF3 tornado (Etowah and DeKalb Counties) • The Pine Ridge EF2 tornado (DeKalb County) followed the Wills Valley just NW of Fort Payne, including small-scale ridges within the valley, such as Shinbone Ridge

> smaller-scale valley within the Wills Valley along Shinbone Ridge. Path synthesized from NWS survey data as well as aerial imagery provided by Paula Tucker (UAH). Note the path paralleling the Shinbone Ridge.

• The Mentone EF1 tornado initially turned to the north, but then curved back to the northeast and moved along the peak ridge line on Lookout Mountain without moving off the mountain



Figure 6: Google Earth map of the Mentone EF1 tornado track, with an elevation profile along the red line transecting the track. The location of the tornado along the highest ridge line of Lookout Mountain is evident.

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indicates the position of the University of Alabama in Huntsville's (UAH's) Mobile Integrated Profiling System (MIPS).

Figure 8: KHTX four-panel 0.5° PPI of Z_e (upper-left), V_r (upper-right), Z_{DR} (lower-left), and ρ_{hv} (lower-right) at 02:43:49 UTC 29 April 2014. The Welti-Berlin tornado was producing EF3 damage around this time.

Figure 9: MIPS X-band Doppler profiling radar (XPR) profiles of Z_e (top) and vertical particle velocity (W, middle) from o3:12:00 UTC to 03:21:19 UTC 29 April 2014, showing the passage of the midtropospheric wave feature.

