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An Overview of ULM Participation in the VORTEX-SE Field Program

Todd A. Murphy, Taylor Aydell, Isaiah Bordelon, Stephen Kreller, Holly Mallinson, Alex Melancon, and Elisa Murillo

Department of Atmospheric Science, University of Louisiana at Monroe, Monroe, LA

Questions or Comments? *Email murphy@ulm.edu | Twitter @ULMweather*

Acknowledgements

ULM participated in VORTEX-SE as part of a collaborative sounding team that included NC State (co-I: Matt Parker) and Mississippi State (co-I: Mike Brown). Other VORTEX-SE PI's are gratefully acknowledged for their data collection efforts. This project is supported by the U.S. Weather Research Program within NOAA/OAR/OWAQ under Grant No. NA15OAR4590236. Base funding for the ULM sounding team is provided by the ULM School of Science.

VORTEX-SE Background

The Verification of the Origins of Rotation in Tornadoes EXperiment-Southeast (VORTEX-SE) is the first funded experiment that focuses on *ALL* processes related to the tornado "problem":

- Improve understanding of severe storms, tornadoes, and their environments, *especially those characteristic of the southeastern U.S.*
- Understand how NWS forecasters anticipate, detect, and warn for tornadoes
- Understand how the public receives and responds to that information

Primary physical science topics for year 1 included:

- CAPE/shear buildup in the SE environment
- Airmass recovery/evolution
- Land surface impacts
- Boundary layer heterogeneity
- Improving model forecasts of the SE environment

ULM participated in all but the first IOP as one of several mobile rawinsonde teams. Six ULM undergraduate students were afforded the opportunity to participate in the project.

IOP #	Date (2016)	IOP Summary	Total Balloons (ULM)
1	13-14 March	Weakening QLCS approached the VORTEX-SE domain, but no severe weather was observed within the domain	19 (0)
2	24 March	High wind shear, but absence of SBCAPE prevented the genesis of severe weather	28 (4)
3	31 March	An EF2 tornado was observed near Priceville, AL, approximately 30 km southwest of Huntsville, in the heart of the domain	47 (7)
4a	27 April	Discrete cells developed over the western part of the domain, but CAPE and shear were marginal, preventing severe weather in the domain	31 (4)
4b	29 April	A QLCS with several tornado-warned storms in Mississippi approached northern and central Alabama, but weakened as it encountered cooler and drier air in the domain	15 (4)
4c	30 April	The removal of an elevated capping inversion resulted in region-wide CI and several discrete cells in the domain briefly acquired rotation	38 (7)
4d	1 May	Local boundary layer destabilization led to CI about 20 km southwest of Huntsville	30 (5)

ULM HAWCS: High Altitude Weather Collection with Soundings

Chevy Suburban outfitted with 4 tank helium rack and 2+3 seating, mobile hotspot, GPS

iMet-3150 & iMet-3050A sounding systems, iMet-1 radiosondes with pressure sensor, 403 MHz

Student Feedback

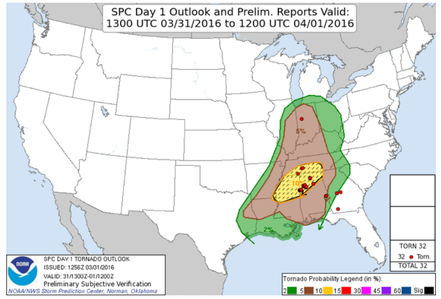
"Participating in this project allowed for me to gain insight into the planning, preparation, and execution of a large-scale field project. This project solidified my desire to pursue a research career." – Holly Mallinson

"I gained experience working as part of a team and learned a number of new skills. It was an honor to be involved with schools and organizations from across the country." – Alex Melancon

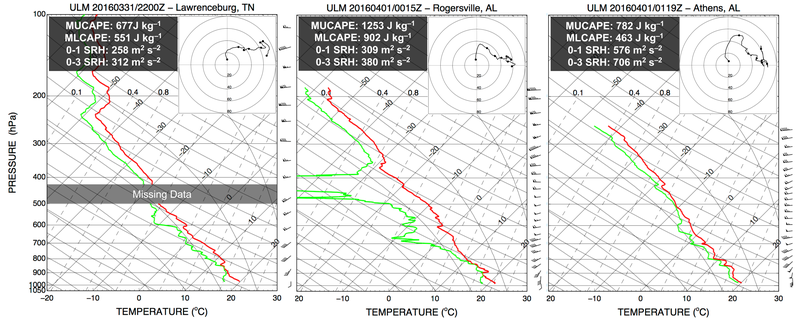
"I gained a better understanding of the rigors of field work and importance in working with others for the good of completing a massive group project." – Stephen Kreller

"One of my favorite parts of the project was getting to know the other participants. I had the opportunity to work with NOAA affiliates, learning more about their positions." – Elisa Murillo

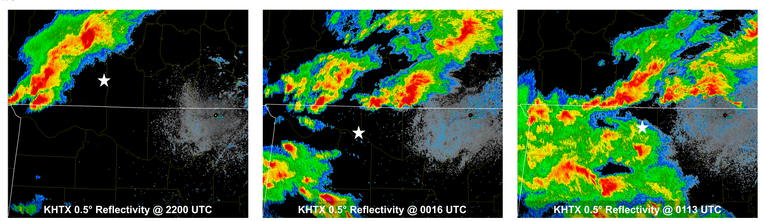
IOP 3: 31 March 2016



Left: SPC Tornado Outlook Verification for IOP 3. An EF2 tornado occurred within the VORTEX-SE domain beginning 0157 UTC 4/1/16. An EF1 and EF0 tornado occurred just outside the domain in central TN near 2200 UTC.
Right: ULM balloon launch at 2200 UTC in Lawrenceburg, TN within the inflow of tornadic supercells to the northwest (below sounding on the left).



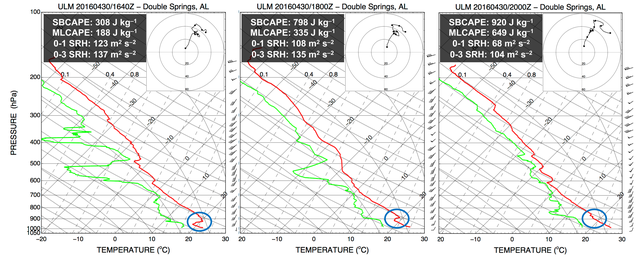
Above: ULM sounding series near the end of IOP 3. CAPE was slow to build during the afternoon, but increased to near 900 J kg^{-1} by 00 UTC. Shear was in place for much of the IOP, however, it increased substantially near and after sunset. This appears to be related to the afternoon-to-evening transition (AET) period and subsequent development of a > 50 kt jet near 1.0 km AGL.
Below: Reflectivity from KHTX valid at the time of each above sounding. Launch locations noted by the star.



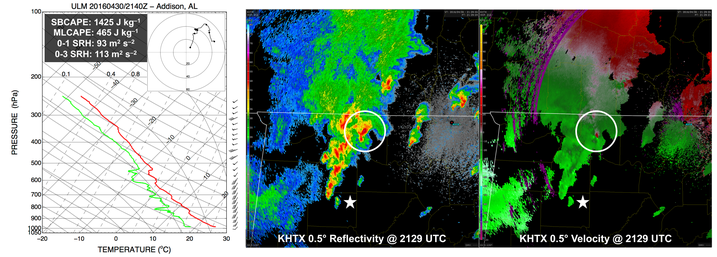
Time (UTC)	Location	MLCAPE (CIN) (J kg^{-1})	0-1 km SRH (m^2 s^{-2})	0-3 km SRH (m^2 s^{-2})
1800	Lawrenceburg, TN	32 (–237)	264	264
1900	Lawrenceburg, TN	98 (–91)	224	224
2000	Lawrenceburg, TN	405 (–28)	275	285
2100	Lawrenceburg, TN	553 (–14)	226	289
2200	Lawrenceburg, TN	551 (–16)	258	312
0000	Rogersville, AL	902 (–12)	309	380
0100	Athens, AL	463 (–16)	576	706

IOP 4c: 30 April 2016

Time (UTC)	Location	SBCAPE (CIN) (J kg^{-1})	MLCAPE (CIN) (J kg^{-1})	0-1 km SRH (m^2 s^{-2})	0-3 km SRH (m^2 s^{-2})	0-6 km Shear (kt)
1640	Double Springs, AL	308 (–154)	188 (–154)	123	137	38
1800	Double Springs, AL	798 (–42)	335 (–83)	108	135	38
2000	Double Springs, AL	920 (–20)	649 (–25)	68	104	41
2100	Double Springs, AL	911 (–8)	620 (–6)	58	106	45
2140	Addison, AL	1425 (0)	465 (–18)	93	113	38
2220	Addison, AL	1301 (–3)	483 (–15)	133	139	41



ULM soundings indicate rapid destabilization and shear profiles that generally support rotating updrafts. However, low-level shear was far too low for sustained low-level mesocyclones and tornadogenesis.



Reflectivity (center) and velocity (right) from KHTX near the time of the sounding (left). The launch location is noted by the star. A supercell (circled) developed strong low-level rotation but did not produce a tornado. A wall cloud was observed by other VORTEX-SE PI's in close proximity to the storm. Weak low-level shear was noted by the ULM sounding.

Year 1 Reflections

- Southeastern severe events tend to be complex (multiple storm modes) and extremely fast-evolving…storm initiation was difficult to anticipate.
- Year 1 demonstrated a tornado field project CAN be accomplished in the southeast, but we're not "chasing" specific storms, but establishing a dense, moveable observation network.
- Science questions I think we can advance from year 1 & 2 measurements:
  1. How are the thermodynamic and kinematic profiles evolving in the lowest 1-km? Accurately representing the PBL is an area where models continue to struggle.
  2. What does the near-ground vorticity distribution really look like under varying stability, land use, and terrain conditions?
- ULM was again funded to participate in the Spring 2017 field campaign, providing two sounding teams to assist the other observational platforms.