Quasi Linear Convective System (QLCS) tornado event for Shreveport/Bossier City, Louisiana and ARKLATEX region April 13-14 2018

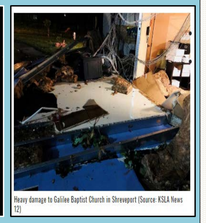
Ray L. Christensen II USAF, 26th Operational Weather Squadron, Barksdale AFB, Louisiana

Introduction/Abstract

The United States Air Force's (USAF) 26th Operational Weather Squadron (26 OWS) has hazardous weather warning responsibility for approximately 150 Department of Defense locations stretching across the southern United States. USAF weather forecasters face a daunting challenge in that most customers require a 10-30 minute lead time for warnings of tornadoes and/or funnel clouds. Improving the detection and forecast accuracy of these storms, while maintaining sufficient lead time, will increase the confidence of military decision makers to take the necessary actions in order to save lives and protect millions of dollars in aircraft and other high value assets. This poster will focus on means to improve USAF tornado warning lead times by offering enhanced detection techniques for QLCS tornado signatures via a case study of this recent event and past research of QLCS tornadoes.

Impacts

- 17 Tornadoes
- Property damage to homes and businesses
- Tree damage and power outages
- One fatality (2 year old child)



Heavy damage to Galilee Baptist Church in Shreveport (Source: KSLA News 12)

Past Research

QLCS Common in Spring (NWS Louisville KY)

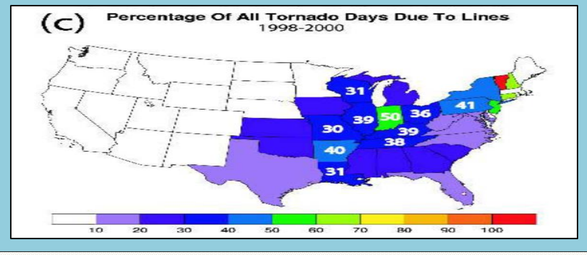
- Usually form in warm sector ahead of cold front or along or just north of the warm front
- 30-60 knots at 850mb
- CAPE 500-2000 J/kg
- Layer of dry or cool air in mid levels
- Strong speed shear 40-60 knots in lowest 2.5 - 5km (SFC-850 or 700 mb)

Mesovortex Genesis (Alliss & Hoffman 2010)

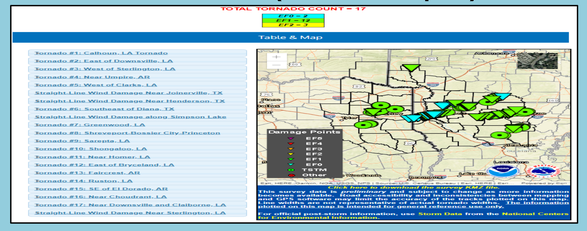
- Strong vertical wind shear
- Coriolis forcing
- Moderate instability and CAPE

QLCS Tornado Percentage (Alliss & Hoffman 2010)

- Typically spawn weaker tornadoes F0-F2

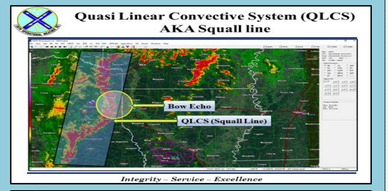


Tornado Count (NWS Shreveport)



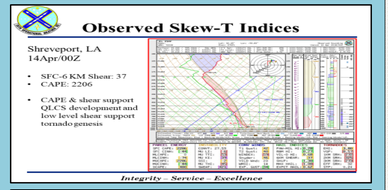
- 17 Tornadoes

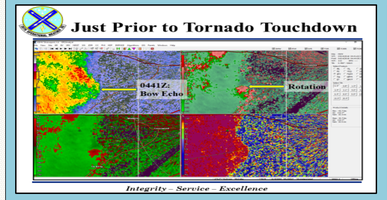
Case Study

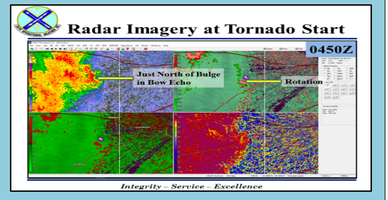


Observed Skew-T Parameters

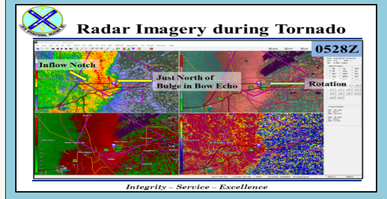
- CAPE: 2206 J/Kg
- SFC-6KM Shear: 37 knots
- 850mb wind: 45 knots
- All favorable parameters for QLCS

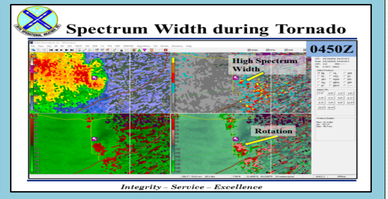






- Rotation near apex and just north of bow echo





- Inflow notch evident just west of bow echo
- High spectrum width values near rotation and tornado report

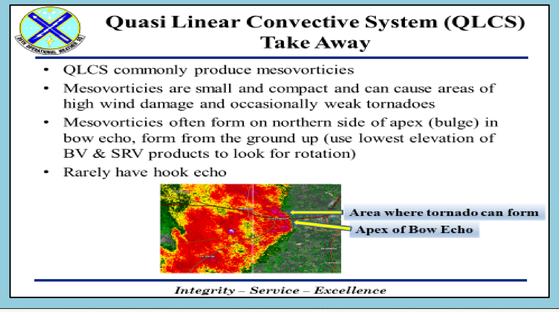
Other facts

- Mesovorticies are low level storm features within 1 km from the surface and build upward
- Occurred in April and at night during this event (near and after midnight)
- QLCS tornadoes are more likely to occur during the late night or early morning hours (Trapp et al., 2005)
- QLCS tornadoes are most frequent during the months of April through June (Trapp et al., 2005).

Take Away

- QLCS commonly produce mesovorticies
- Common in spring
- Common at night or early morning hours
- Moderate CAPE >1500 and strong vertical shear >40kts favorable parameters for QLCS
- Use SRV and BV to identify rotation – it was clearly evident on both products in this case study
- Use BR to identify bow echoes and inflow notches – both evident in this case, but inflow notches are not always seen
- Use SW after other products may show high values in turbulent area near rotation, but not always

Barksdale AFB 14 Apr 2018 Tornado Review (Christensen 2018)



References

Ryan Alliss & Matt Hoffman, 2010: Quasi-Linear Convective System Mesovorticies and Tornadoes; https://www.meteor.iastate.edu/~ralliss/qlcsmesovorticies.pdf

Trapp, R.J., S. A. Tessendorf, E.S. Godfrey, and H.E. Brooks, 2005: Tornadoes from Squall Lines and Bow Echoes. Part I: Climatological Distributions. Wea Forecasting, 131, 2779-2803.

Christensen R.L., 2018: Barksdale AFB Louisiana 14 April 2018 Tornado Review

Contact Information

Ray L Christensen II
Ray.christensen.3@us.af.mil