

QLCS Mesovortex Warning System Reference Sheets

NWS Central Region Tornado Warning Improvement Project

QLCS Mesovortex Warning System

1. Use Three Ingredients Method to anticipate areas where mesovortex genesis is likely over next 30-45 minutes
2. Identify presence of Confidence Builders and Nudgers which indicate an increased likelihood for tornadoes
3. Determine the number and quality of Confidence Builders and Nudgers to issue heightened warning products
4. Draw an effective polygon to capture motion and evolution of key features over next 30-45 minutes

Three Ingredients Method

1. System cold pool and ambient low-level shear nearly balanced or slightly shear dominant **and**
2. 0-3 km line-normal bulk shear magnitude ≥ 30 kts **and**
3. Rear-inflow jet (RIJ) or enhanced outflow causes surge or bow within a QLCS

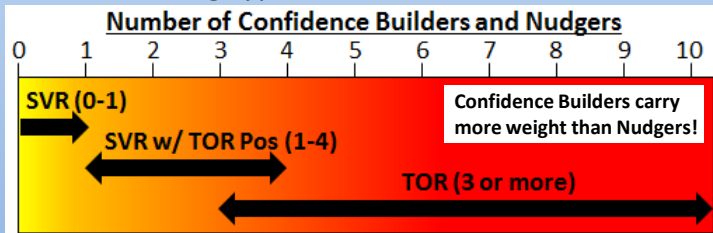
10 Confidence Builders and 4 Nudgers

| |
|---|
| Descending RIJ/reflectivity drop |
| Enhancing surge/bow |
| Line break |
| Paired front/rear inflow notch |
| UDCZ entry point |
| Front reflectivity nub |
| Boundary ingestion |
| Contracting bookend vortex with $V_r \geq 25$ kt |
| Tight/strong mesovortex with $V_r \geq 25$ kt |
| Confirmed tornado/tornadic debris signature (TDS) |
| Reflectivity tag intersecting a surge/bow |
| 0 to 3 km MLCAPE ≥ 40 J/kg |
| Cell merger/reflectivity spike near surge/bow |
| History of tornadoes (includes prior TDSs) |

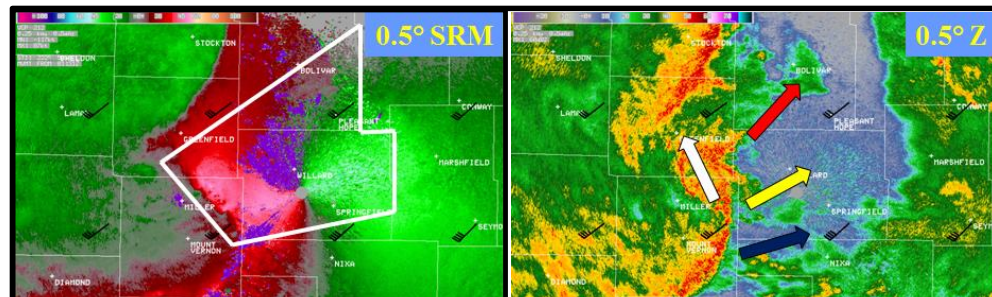
Note: Confidence Builders carry more weight than Nudgers!

General Rules of Thumb for Warning Types

Once the three Ingredients are met, sum up number of Confidence Builders and Nudgers and use chart below to determine warning type:



Note: Use quality and persistence of Confidence Builders and Nudgers to tweak confidence up or down in overlap regions.



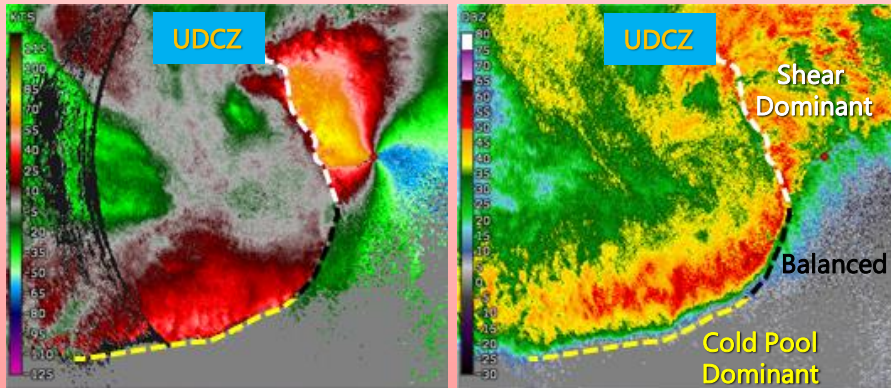
Motions and Evolutions to Consider for Effective Polygon

Segment + **Balanced/Shear Dominant Regions** + **Confidence Builders/ Nudgers** + **Possible Mesovortex Migration**

Three Ingredients Method for Mesovortex Genesis and Intensification

1 Locate Balanced and Slightly Shear Dominant Regimes

- Locate the Updraft Downdraft Convergence Zone (UDCZ) using 0.5° SRM, V, and SW products
- Compare location of UDCZ to updraft region in 0.5° Z product:
 - Shear Dominant – UDCZ within or behind updraft towers
 - Balanced – UDCZ on immediate front edge of updraft towers
 - Cold Pool Dominant – UDCZ out ahead of updraft towers



3 Locate Bows and Local Surges

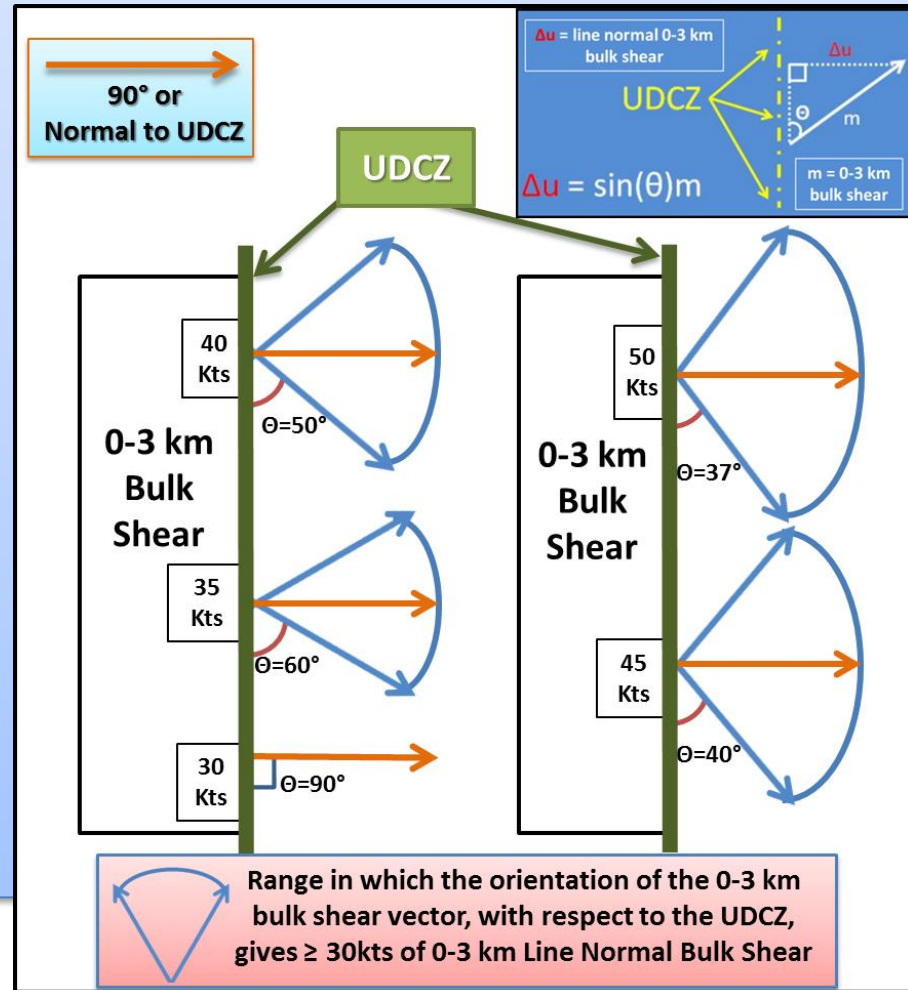
- A rear inflow jet or enhanced outflow are likely candidates to cause a local surge or bow
 - Look for MARC signatures in the 8-16 kft layer as a precursor to bows
 - Low level V, SRM, and SW products often reveal developing local surges quicker than Z product

When all three ingredients are co-located within a QLCS, there is an increased likelihood for mesovortex genesis and intensification, along with increased tornado potential.

2 Locate Regions where Line-Normal 0-3 km Bulk Shear is ≥ 30 Knots

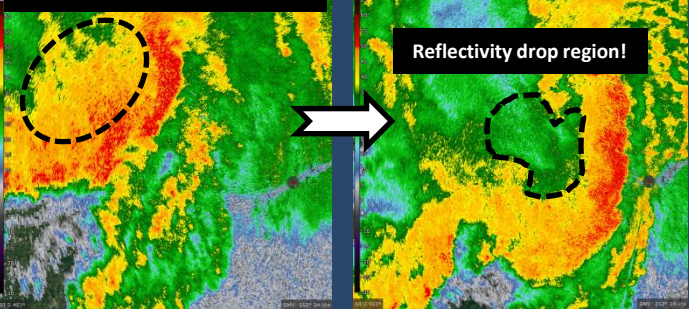
- Determine 0-3 km bulk shear just ahead of the QLCS (must be ≥ 30 knots for ingredient to be fulfilled)
- Use equation below to determine line-normal bulk shear values as they relate to the UDCZ

Tip: Local surges and bows often change the orientation of the UDCZ. This is especially true for the northern portion of a bowing segment.

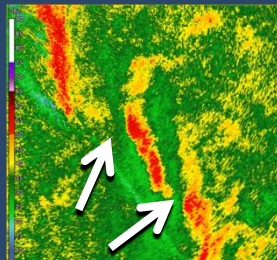


Descending Rear Inflow Jet/Reflectivity Drop

Watch trailing stratiform region behind main updrafts

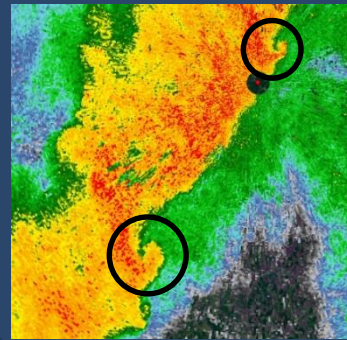


Line Break

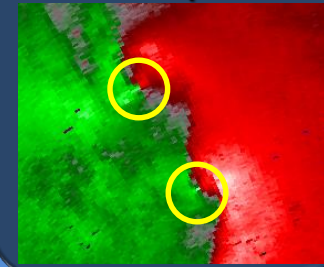


Watch southern tip of reflectivity pendant behind line break for tornado threat!

Front Reflectivity Nub



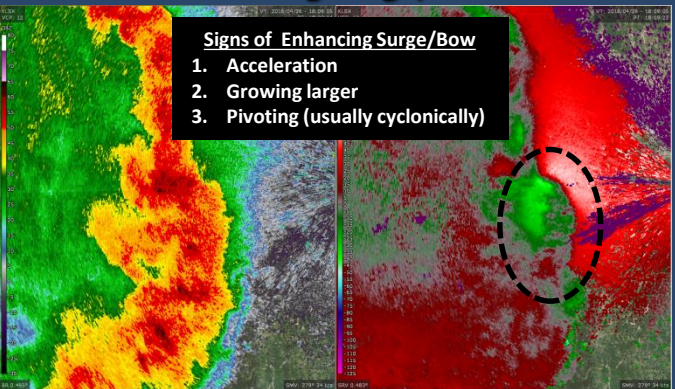
Tight/Strong Mesovortex ($V_r \geq 25$ kt)



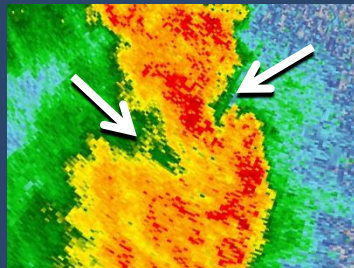
Enhancing Surge/Bow

Signs of Enhancing Surge/Bow

1. Acceleration
2. Growing larger
3. Pivoting (usually cyclonically)



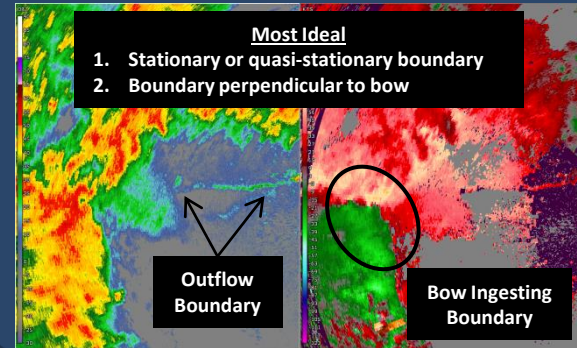
Paired Front/Rear Inflow Notch



Boundary Ingestion

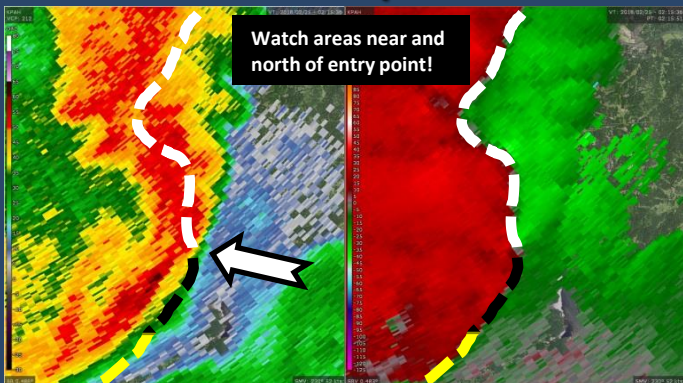
Most Ideal

1. Stationary or quasi-stationary boundary
2. Boundary perpendicular to bow

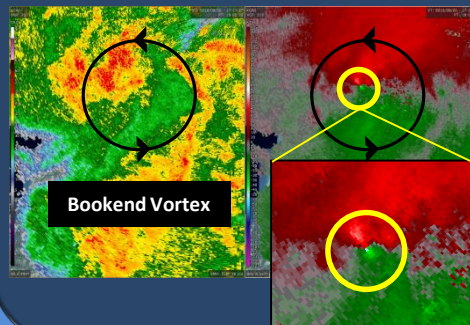


UDCZ Entry Point

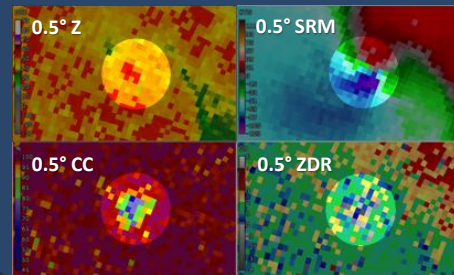
Watch areas near and north of entry point!



Contracting Bookend Vortex with $V_r \geq 25$ kt

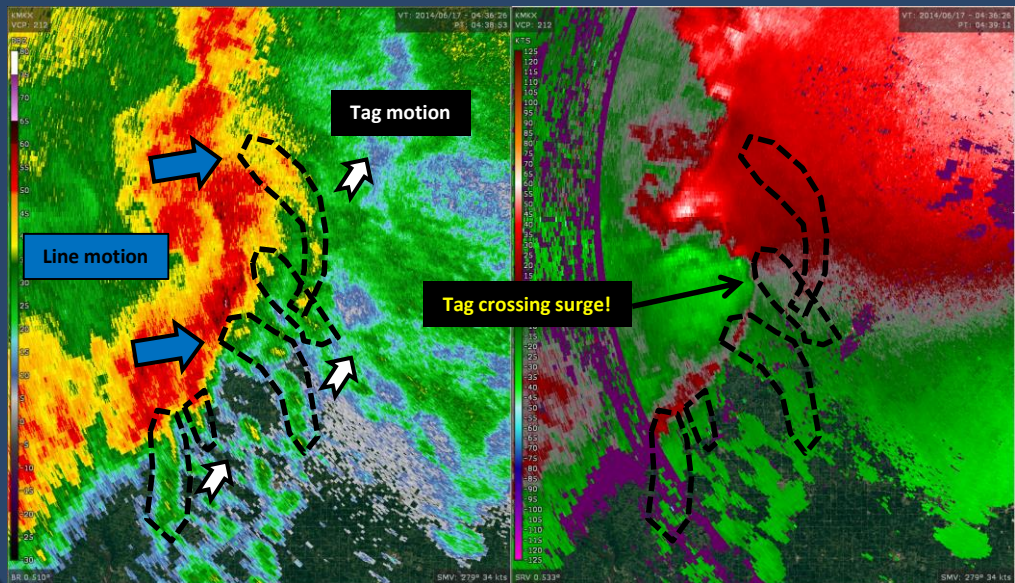


Tornadic Debris Signature (TDS)

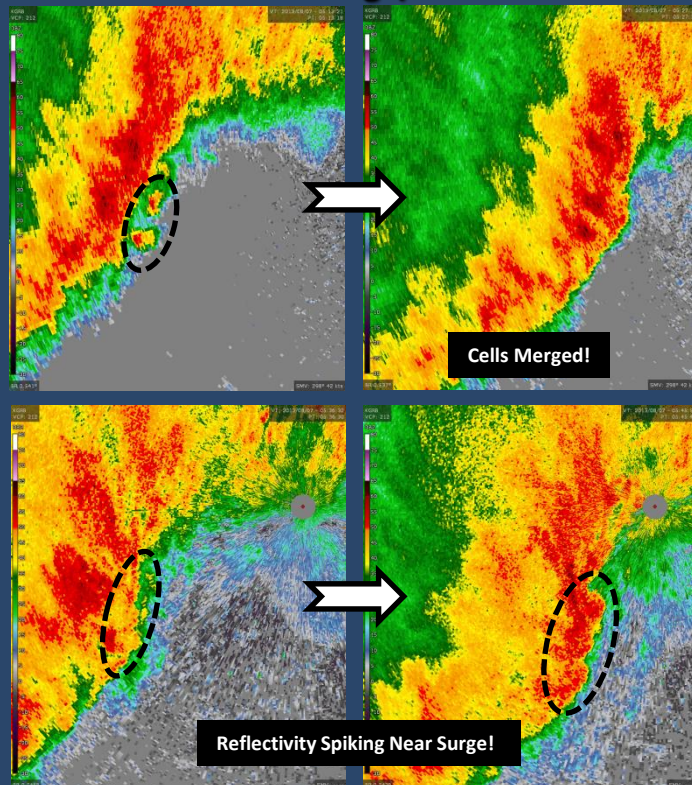


Tornado Warning Confidence Builders

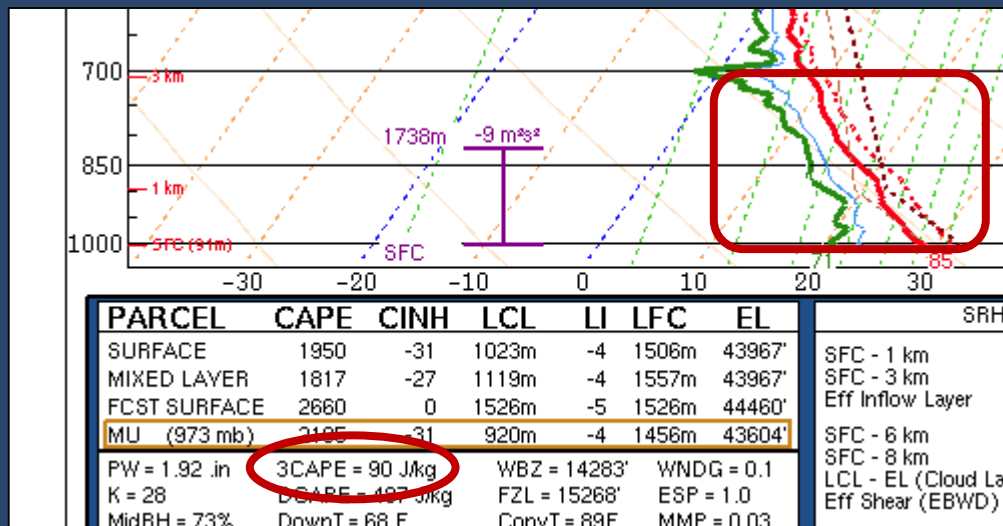
Reflectivity Tag Intersecting a Surge/Bow



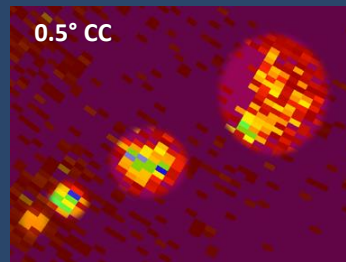
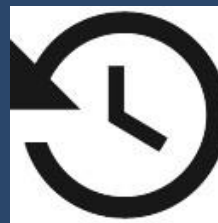
Cell Merger/Reflectivity Spiking Near Surge/Bow



0-3 km MLCAPE ≥ 40 J/kg



History of Tornadoes (Includes prior TDSs)



Tornado Warning Nudgers