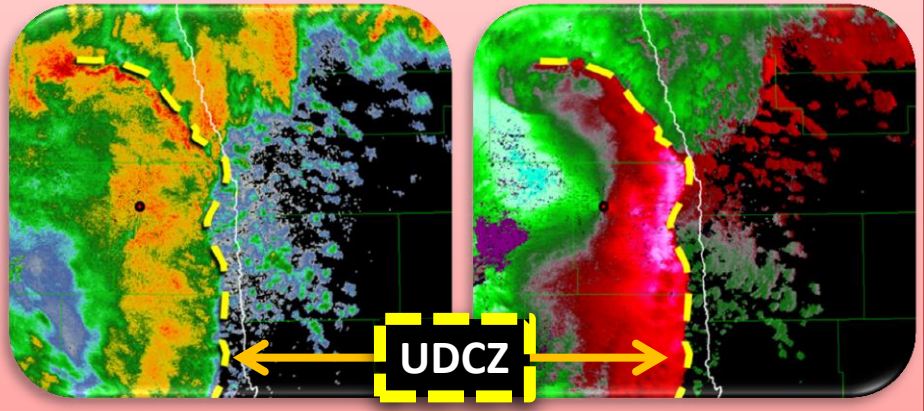
Three Ingredients Method for Meso Genesis, Intensification, and Tornadogenesis in a QLCS

A – Find Balanced or Slightly Shear Dominant Regimes of the QLCS

1. Define the Updraft Downdraft Convergence Zone (UDCZ)
   - Convergence zone coincident with gust front

2. Along UDCZ, look for:
   - Deep nearly vertical updraft
   - Tight reflectivity gradient
   - Trailing stratiform, also possibly thin leading stratiform
   - Inflection point



NOTE: Examine 0.5° Z/SRM plots, then all tilts and cross sections.

C – Look for Surges or Bows in the Line

- A rear inflow jet or enhanced outflow are likely candidates to cause a surge or bowing

NOTE: SRM is the best way to observe line surges and RIJs.

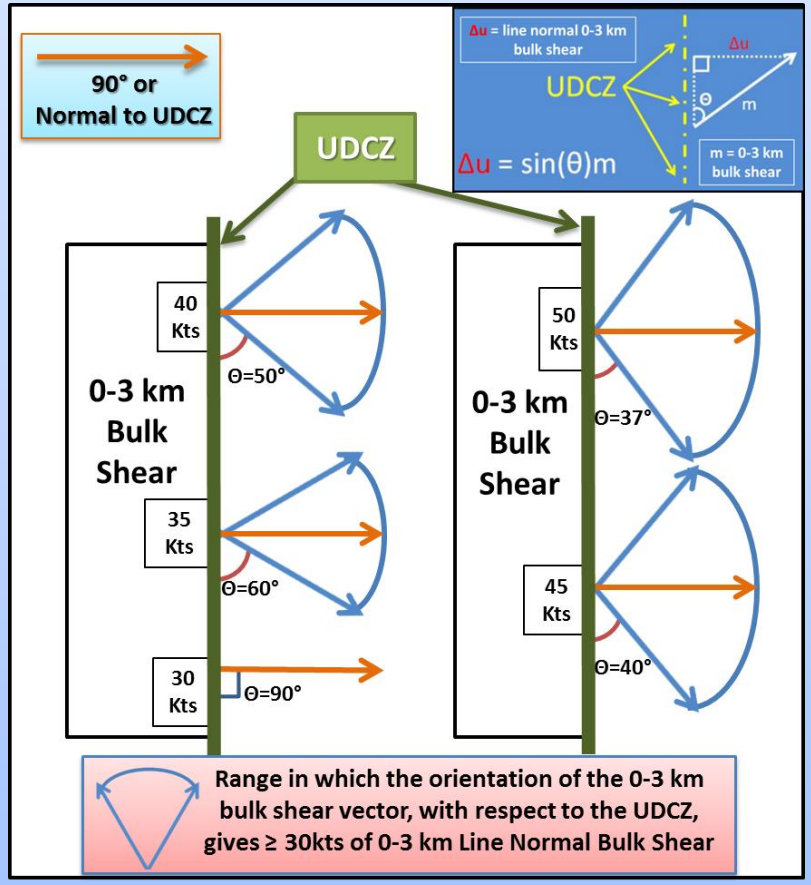
When all three (A, B, and C) ingredients are co-located in a QLCS, there is an increased likelihood for mesovortex genesis and intensification, along with increased tornado potential.

B – Find Line Normal 0-3 km Bulk Shear ≥ 30 Knots

1. Find 0-3 km bulk shear just ahead of the QLCS (must be ≥ 30 knots for ingredient to be fulfilled)

2. Use equation below to determine line normal bulk shear values ≥ 30 knots with respect to the orientation of the shear vector to the UDCZ

TIP: Watch bowing segments of the line…as the bow becomes more pronounced it often changes the orientation of the UDCZ. This is especially the case for the northern portion of the bowing segment.



Send feedback to michael.mathews@noaa.gov

1. Enhanced Surge

- Tip of local surge is displaced more than 5 nm from rest of line OR larger bow is accelerating.

2. Inflection Point

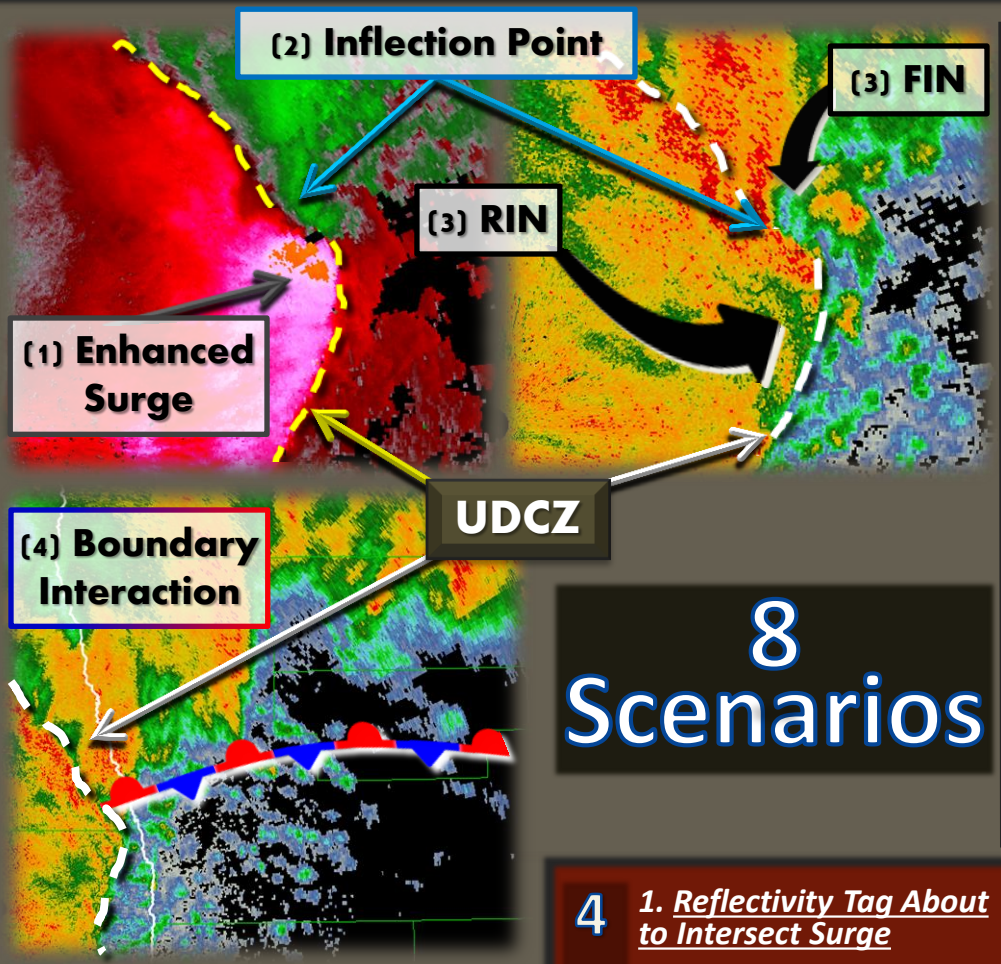
- Located where the UDCZ curls from the leading edge back into the precipitation.

3. Paired Front & Rear Inflow Notch (FIN/RIN)

- FIN on front & often northern side of surge. RIN location is typically directly behind FIN, but depends on trajectory of the RIJ/outflow.

4. Boundary Interaction

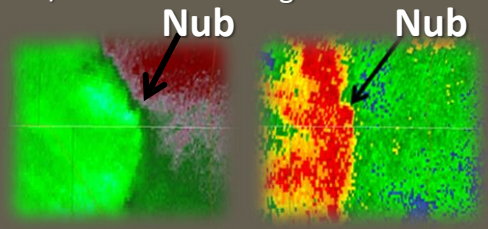
- Synoptic front or convective outflow ingested by surge. Front is typically stationary.



8 Scenarios

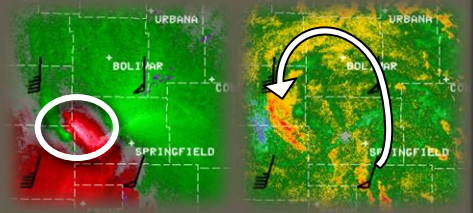
5. Front End Nub

- May be variation of coupled FIN/RIN and local surge.



6. * Contracting Bookend Vortex w/ Increasing Rotational Velocity

- Low level Vr ≥ 25 kts.



7. Tight & Strong Mesovortex (no example)

- Low level Vr ≥ 25 kts.

8. * TDS (no example)

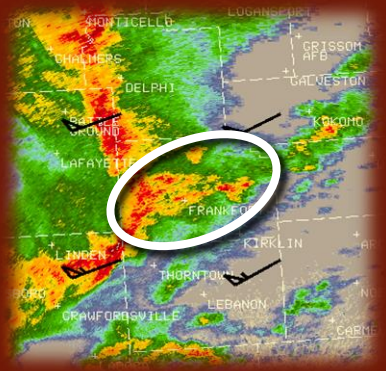
Any one of the 8 scenarios met with the three ingredients is often worthy of a * Tornado Warning. Multiple scenarios present should further increase confidence in a TOR.

Nudgers are secondary, and should add confidence in issuing a TOR when one of the scenarios and the three ingredients are present.

**** Three ingredients not necessary to issue a TOR with a contracting bookend vortex (#6) or TDS (#8).***

4 NUDGERS

1. Reflectivity Tag About to Intersect Surge



2. 0-3 km ML CAPE ≥ 40 J/kg

3. Reflectivity Spiking Up Near Surge

- Often ahead of line & may only be viewable at higher slices.

4. History of TDS's

Send feedback to michael.mathews@noaa.gov