

Impact-Based Tornado Warning Guidance

30 kt V_{rot}

If STP > 0 – Tornado
Warning Likely Needed

40* kt V_{rot}

Considerable Tag
With TDS, STP > 1

50* kt V_{rot}

Considerable Tag
Without TDS, STP > 1

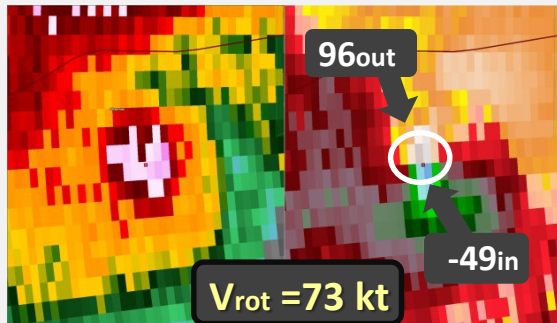
70* kt V_{rot}

Catastrophic Tag With
TDS, STP > 6

Put this into context with other available information and your professional judgement/experience

Measuring V_{rot}

$$V_{rot} = \frac{V_{r[max]} - V_{r[min]}}{2}$$



Important To Remember...

- V_{rot} relationships weaken at ranges > 70 nmi
- Is the velocity in area of > 20 dBZ?

Tornado Debris Signature (TDS) Identification

Criteria for a "Radar Confirmed Tornado"

Nowcasting Significant Tornadoes

* Median EF-2 cases begin at this V_{rot} and STP > 3. STP 1-3 cases have a slightly higher FAR but may still be sufficient for considerable tag. QLCS cases may require slightly lower thresholds and examination of shear variables rather than STP.

TDS Height Threshold

EF2+: 8,000-10,000 ft.

Upgrade to Catastrophic Tag

"Tornado Emergency" if:

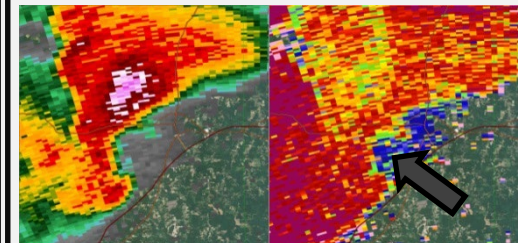
(Must meet BOTH)

1. Tornado 100% confirmed via TDS or credible source
2. Destructive tornado/catastrophic damage potential

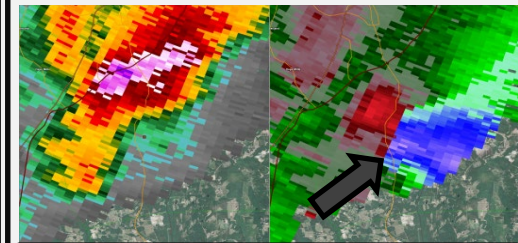
$V_{rot} \geq 70$ kt, STP ≥ 6.0

Evaluate/update with SVS frequently!

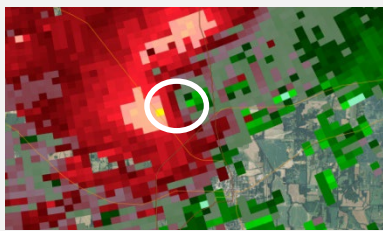
Potential Pitfalls



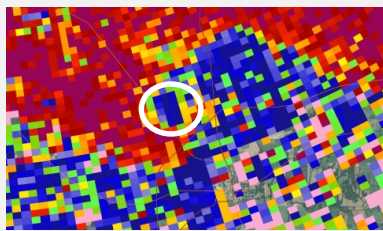
CAUTION: Low CC in inflow area can APPEAR to be TDS
Make sure the dBZ is ≥ 20



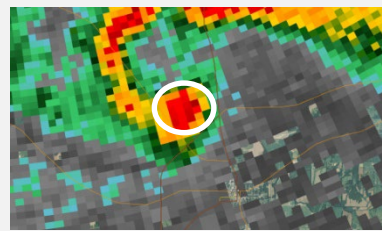
Vertical Side Lobe Contamination
Strong velocity in Weak Z below strong meso aloft,
may not be valid signal



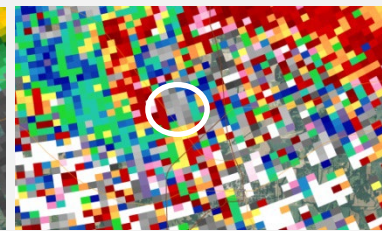
First, Identify a valid velocity circulation
at the lowest elevation tilt



Is the CC below 0.90?



Collocated with Z above 30 dBZ?



ZDR near zero? – Not necessary
but adds confidence



Time
continuity



Height
continuity

ADDS
CONFIDENCE!!

Tornado Warning Points of Emphasis*

* To be used in the full context and after completion of all NWS Warning Ops Training

Supercell Warning Confidence Thresholds

Significant Tornado Parameter (STP)

Includes these ingredients:

- Surface-based CAPE
- Surface-based LCL height
- SRH
- 0-6 km BWD

When using STP, be sure to also examine these ingredients individually during any severe weather mesoanalysis!

Is the Environment Favorable?

Given a 30 kt Vrot Signature:

Warning may be unnecessary

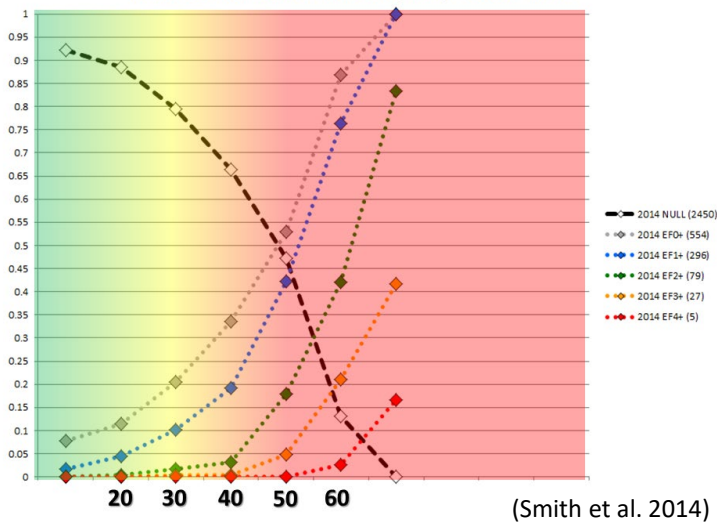
Environment favorable enough to be cautious

TOR WARN



RM+QLCS Tornadoes and NULLs (2014): 0-5900 ft ARL

Probability of Tornado



Keep in Mind...

Presence of a hook indicates a supercell, not NECESSARILY a tornado, evaluate velocity data

Evaluate the storm/velocity at all elevation angles!

Warn downstream with sufficient lead time



Vrot methods/Pitfalls/TDS Identification (see reverse side)

Attempt to limit false alarm area

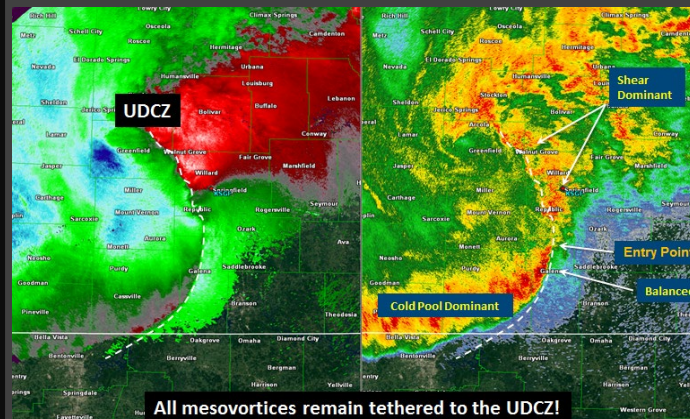
Collaborate on the CWA borders as much as possible

Avoid "blanket" warnings in QLCS when possible

QLCS Three Ingredients Method

Key features to look for when assessing QLCS tornado potential:

1. Slightly shear dominant portion of line
2. 0-3km shear >30 kts
3. Surges/Bows in line

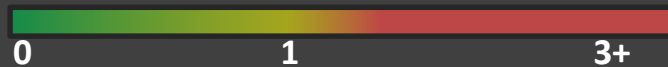


Other features to watch for:

- UDCZ entry/inflection point
- Descending RIJ or reflectivity drop
- Line break
- Paired front/rear inflow notch
- Front reflectivity nub
- Contracting bookend vortex ($V_r > 25$ kts)
- Tightening mesovortex ($V_r > 25$ kts)

Remember: Rotational Velocity will assess CURRENT intensity, but likely not provide much lead time on QLCS tornadoes. Stronger environments may require more proactive warnings.

Significant Tornado Parameter



Chances for significant tornadoes with higher V_{rot} increase as STP increases

But BE AWARE of how STP is put together and calculated

$$STP = \frac{MLCAPE}{1500} * \frac{2000 - ML LCL}{1000} * \frac{ESRH}{150} * \frac{EBWD}{20} * \frac{200 + MLCIN}{150}$$

The mLCL term is set to 1.0 when mLCL < 1000 m, and set to 0.0 when mLCL > 2000 m;

the mLCIN term is set to 1.0 when mLCIN > -50 J kg⁻¹, and set to 0.0 when mLCIN < -200;

the EBWD term is capped at a value of 1.5 for EBWD > 30 m s⁻¹,
and set to 0.0 when EBWD < 12.5 m s⁻¹.

Lastly, the entire index is set to 0.0 when the effective inflow base is above the ground.

If the boundary layer is mis-analyzed (too stable) the STP can go to zero erroneously

SPC Mesoanalysis is a 40km resolution analysis - finer scale details can and will impact overall tornado potential