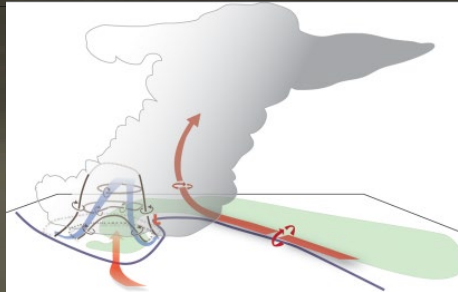


Tornado

Near Storm Environment

- Significant tornado parameter (Effective Layer) (STP_{eff}) > 1
- Effective bulk wind difference ($EBWD$) ≥ 39 kt
- Effective storm-relative helicity ($ESRH$) > 150 m²s⁻²
- 100-mb mean parcel LCL (MLLCL) < 1000 m
- 100-mb mean parcel CAPE ($MLCAPE$) > 1500 J/kg
- 100-mb mean parcel CIN ($MLCIN$) < 50 J/kg within last hour

Mesocyclonic

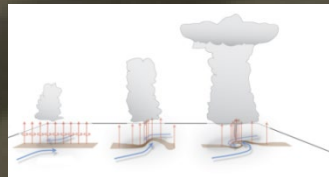


Storm Characteristics

- Discrete classic or High Precipitation (HP) supercell
- Strengthening updraft
- Acceleration & convergence into a strong low-level mesocyclone
- Tornado vortex signature (TVS)
- Tornado debris signature (TDS)

Non-Mesocyclonic (Landspout/Waterspout)

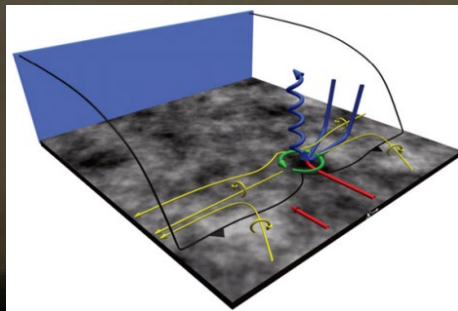
- Non-supercell tornado parameter (NST) > 1
- 0-1 km lapse rate (LR_{0-1}) > 9°C/km
- 0-3 km MLCAPE ($MLCAPE_3$) > 100 J/kg
- 100-mb mean parcel CIN ($MLCIN$) < 25 J/kg
- Stationary boundary with sfc relative vorticity (ζ_r) > 8×10^{-5} s⁻¹



- Strong, rapidly growing updraft (best seen via Z at -10°C)
- Tornado vortex signature (TVS)
- Tornado debris signature (TDS)

Quasi-Linear Convective System (QLCS)

- 0-3 km line normal bulk shear ≥ 30 kt
- Rear Inflow Jet (RIJ) or enhanced outflow causing surge or bow in line
- 0-3 km MLCAPE ($MLCAPE_3$) ≥ 40 J/kg



- Balanced or slightly shear dominant
- Confidence Builders (3 Ingredients Method):
- Descending rear inflow jet (RIJ)/reflectivity drop
- Enhanced surge • Line break
- Updraft deep cnvg zone (UDCZ) entry/inflection point
- Paired front/rear inflow notch • Boundary ingestions
- Front reflectivity nub
- Contracting bookend vortex with $V_r \geq 25$ kt
- Tight/strong mesovortex with $V_r \geq 25$ kt
- Confirmed tornado/Tornado Debris Signature (TDS)

Nudgers:

- Reflectivity tag intersecting a surge
- Cell merger/reflectivity spike near surge
- History of tornadoes