# All Hazards Decision Chart

## Tornado

**Mesocyclonic**

- **Near Storm Environment:**
  - Effective Bulk Wind Difference (EBWD) > 40 kt, effective SRH > 150 m²/s², MLLC < 1000 m, MCAPE > 1500 J/kg, MLCIN < 50 J/kg within last hour
- **Storm Characteristics:**
  - Supercell, strengthening updraft, acceleration & convergence into a strong low-level meso, TVS. TDS means tornado is likely occurring

**Non-mesocyclonic**

- **Near Storm Environment:**
  - 0-1 km lapse rate > 9°C/km, 0-3 km MCAPE > 100 J/kg, MLCIN < 25 J/kg, significant surface vertical vorticity associated with a slow moving wind shear boundary.
- **Storm Characteristics:**
  - Look for strong, rapidly growing updrafts via development of reflectivity core at ~10°C, TVS. TDS means tornado is likely occurring

## Severe Hail

- **Near Storm Environment:**
  - 0-6 km Bulk Wind Difference (BWD) ≥ 27 kt, MCAPE ≥ 2000 J/kg, 700-500 mb lapse rate > 8.5°C/km, Depth of hail growth zone (~10° to ~30°C) (THKmax) ≤ 2700 m, Sfc to Equilibrium Level (EL) Bulk Shear (ShearEL) ≥ 58 kt.
  - Direction diff between winds at the EL & in 3-6 km layer (GRWmax) ≥ 15°. Direction diff between strong-relative wind in 3-6 km and 0-1 km layers (SRWmax) ≥ 90°
  - **Storm Characteristics:**
    - 1°: Strong updraft, WER, 50 dBZ thickness above the melting level > 16 kt, Z > 60 dBZ, CC = 0.03-0.07, storm-top divergence (STD) ΔV = 70-102 kt, TDOS, MESH ≥ 1°
    - 2°: Supercell, BWER, updraft lasts > 10 min, 60 dBZ above ~20°C, 50 dBZ above the EL, CC = 0.7-0.9, ZDR = 0 dB, STD ΔV > 130-162 kt, MESH ≥ 2°
    - 4°: Updraft lasts > 20 min, STD ΔV > 233-267 kt

## Severe Wind

- **Individual Cell Downburst**
  - **Near Storm Environment:**
    - Wet Microburst: 0-3 km max Δθ, > 25°C, DCAPE > 1250 J/kg, SBCAPE > 1000 J/kg, 0-3 km lapse rate > 7°C/km, MLLC > 1000 J/kg
  - Dry Microburst: Inverted-V sounding (midlevel based), MCAPE > 0 J/kg, MLLC height > melting level, weak 0-6 km shear, weak boundary layer winds, 0-3 km lapse rates ~ dry or superadiabatic
  - **Storm Characteristics:**
    - Strong elevated precip core rapidly forms, descending core bottom, MRC (0°C to LCL) ΔV > 15 kt, wet hail signature (TBSS, CC = 0.03-0.06, KDP = 3°C/km), low-level V > 30 kt within 20 mm of radar, fast storm motion
    - Note: Beware of low Z cells w/high LCLs at 0°C and/or strong wind in mixing layer.

## Flash Flood

- **Individual Cell**
  - **Near Storm Environment:**
    - High PW & RH (>70%) in convective layer, warm cloud layer > 10 kt, weak convective-layer wind < 10 kt
  - **Storm Characteristics:**
    - Slow motion < 10 kt, Z > 50-60 dBZ (45-55 dBZ trop. env.), low echo centroid, CC = 0.03, ZDR = -2.5 dB (0.5-3.0 dB trop. env.), KDP > 1°/km
  - **Multicell**
    - **Near Storm Environment:**
      - High PW & RH (>70%) in convective layer, LLJ transporting high moisture, slow MBE motion, slow (<15 kt) motion of forcing mechanism, upwind instability
  - **Storm Characteristics:**
    - Intra-storm seeding; collisions; slow motion; training/forward propagation <15 kt; leading, parallel, or adjoining stratiform MCS
  - **Antecedent Ground Conditions**
    - Poor permeability (urban land use, dry soil, rock, ice, desert pavement, burn scar, etc.), poor drainage, saturated soil (recent rain, snowmelt, etc.), sloping terrain (mtns, canyons, hills, etc.)
  - **Precipitation Accumulation**
    - Does rainfall meet flash flood thresholds?
    - 1. Pick your optimal precip source: Dual-Pol, legacy DHR, HPE, Bias HPE, MRMS
    - a. Assess radar QPE bias
    - b. Compare QPE with observations
    - 2. Use FFMP for decision making
      - a. Ratio > 100%, diff < 0°
      - b. Look at 1-, 3-, and 6-hour durations
      - c. Is additional rainfall occurring or imminent?