All Hazards Decision Chart

Tornado

Mesocyclonic

Near Storm Environment: Effective Bulk Wind Difference (EBWD) > 40 kt, effective SRH >150 m^2s^{-2}, MLLCL < 1000 m, MLCAPE > 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 MLCAPE > 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, MUCAPE ≥ 2000 J/kg, 700-500 mb lapse rate > 8.5°C/km, Depth of hail growth zone (-10° to -30C°) (THK_{HGZ}) ≤ 2700 m, Sfc to Equilibrium Level (EL) Bulk Shear ($Shear_{EL}$) ≥ 58 kt, Direction diff between winds at the EL & in 3-6 km layer (GRW_{dirEL}) ≥ 15°, Direction diff between storm-relative wind in 3-6 km and 0-1 km layers (SRW_{dirMID}) ≥ 90°

Storm Characteristics:

≥ 1": Strong updraft, WER, 50 dBZ thickness above the melting level ≥ 16 kft, Z ≥ 60 dBZ, CC = 0.93-0.97, storm-top divergence (STD) ΔV > 70-102 kt, TBSS, 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 Downbursts

Near Storm Environment: Wet Microburst: 0-3 km max $\Delta\theta_e$ > 25°C, DCAPE > 1250 J/kg, SBCAPE > 1000 J/kg, 0-3 km lapse rate > 7°C/km, MLLCL > 1000 Dry Microburst: Inverted-V sounding (midlevel based), MUCAPE > 0 J/kg, MLLCL 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, MARC (0°C to LCL) ΔV > 15 kt, wet hail signature (TBSS, CC ~ 0.93-0.96, KDP > 3°C/km), low-level V > 30 kt within 20 nm of radar, fast storm motion *Note: Beware of low Z cells w/high LCLs at 0°C and/or strong wind in mixing layer.*

Rear Flank Downdraft (RFD)

Near Storm Environment: 0-6 km shear ≥ 30 kt, low LCL, large CAPE, steep sub-cloud adiabatic lapse rate

Storm Characteristics: Meso w/MDA rank 5+ (Vr > 30 kt), developing large hook echo (>50 dBZ), DCZ > 10 kft (> 15-20 kft optimal), fast motion

MCSs/Horizontally-Driven Wind

Near Storm Environment: Widespread lift, DCAPE > 980 J/kg, 0-6 km mean wind > 16 kt, MUCAPE > 2000 J/kg, 0-6 km bulk wind difference > 20 kt

Storm Characteristics: Strong leading Z gradient, bow echo, Rear Inflow Jet (RIJ), MARC ΔV > 50 kts at 3-5 km AGL, Deep Convergence Zone (DCZ) > 10 kft (> 15-20 kft is optimal), gust front speed matches system speed, linear WER along leading edge, fast storm motion

Note: A mesovortex w/RIJ produces strongest wind.

Flash Flood

Individual Cell

Near Storm Environment: High PW & RH (>70%) in convective layer, warm cloud layer > 10 kft, 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 > 0.96, 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 / backward propagation < 15 kt; leading, parallel, or adjoining stratiform MCS

Antecedent Ground Conditions

Poor permeability (urban land use, clay soil, rock, ice, desert pavement, burn scars, 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 biases
   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
3. Is additional rainfall occurring or imminent?