FLOW CHART TO EVALUATE WET MICROBURST AND LARGE HAIL POTENTIAL FROM PULSE OR MULTICELLULAR THUNDERSTORMS

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Consider these parameters to make informed warning decisions for wet microburst/hail producing pulse or multicell storms. Understand the pre–storm and near–storm environment, and its effects on convection, then enter the flow chart at any point to assess pertinent variables. Given values are approximate and may vary geographically and from case to case. SPS = Severe Pulse Storm. UNK = Unknown.

ENVIRONMENTAL PARAMETERS

Instability
- Is surface-based LI ≤ -4 & CAPE ≥ 2000?
- Does θe decrease with height ≥ 12-15 K?
- Are low-level (0-2 km) lapse rates steep, i.e., nearly dry adiabatic (≥ 6 K per km)?

YES ►►► **Low-Level Moisture**
- Are high values of low-level moisture present (e.g., PW > 1.4; 850 T_d ≥ 12 ºC; approx)?

YES ►►► **Evaporative Cooling and DCAPE**
- Is unsaturated/dry/low θe air present aloft (~750-500 mb)? Is downward CAPE (DCAPE) > 900 J/kg? If so, then evaporative cooling could significantly enhance downdraft and wind damage & hail potential.

NO ►► *Limits updraft strength & hail potnl; weak low-level lapse rates limit downward momentum transfer to surface; gusty winds still possible.*

NO ►► *Lower SPS potnl but still possible.* ◄◄ **NO**

►**YES** ▼ Higher SPS potnl. ▼ ◄◄◄

Vertical Wind Shear
- Does vertical wind shear exist in the environment? If so, then updraft rotation, S-R flow aloft, and deviant storm motion are more likely to enhance large hail potential. Stronger/deeper shear is best.

YES ◄◄◄ **Height of Freezing Level / Wet Bulb Zero**
- Is freezing level (0 ºC line) < 12500 ft?
- Is 7000 < WBZ < 12000 ft (approx)? If so, then hail more likely due to a shallower warm cloud layer than outside this range.

YES ◄◄◄ *All* **YES** *answers: Environment very conducive to severe pulse or multicell storms with wet microbursts and/or large hail.*

NO ►► *Large hail less likely unless significant dry air aloft; wet microburst still possible, especially if YES answers to environmental parameters.* ◄◄ **NO**

REFLECTIVITY DATA

Boundary Intersections/Cell Mergers
- Is the storm the result of a boundary intersection or cell merger from earlier storms? If so, this will enhance updraft strength and microburst potential.

NO ▼ *SPS still possible; consider other variables.*

YES ►►► ▼ *High SPS potnl.*

Reflectivity Data
- Did the storm's high reflectivity core initially form at a higher altitude than neighboring storms (indicates a strong updraft)?

NO ▼ *SPS still possible; consider other variables.*

UNK YES ►►► ▼ *Higher SPS potnl; monitor closely for possible wrng.*

Reflectivity Distribution
- Does composite reflectivity or All Tilts show dBZ values > 60 aloft while low-level (0.5 deg) values are lower (max core is suspended aloft)? Is suspended 50 dBZ core vertically deep (extends well above 0 ºC line)?

NO ▼ *Lower SPS potnl or pulse occurring or already occurred.*

►**YES** ▼ *High SPS potnl if envir. favorable; strongly consider wrng.* ▼ ◄◄◄

Reflectivity Data
- Are any reflectivity values ≥ 65 dBZ present aloft in the storm near or above the freezing level (0 ºC line)?

NO ▼ *SPS still possible; consider other variables.*

YES ◄◄◄ ▼ *High SPS potnl given favorable envir; issue wrng!*

Reflectivity vs. Height of Freezing Level
- Does the top of the 50 dBZ core approach or exceed 20000 ft above 0 ºC line and > 5000 ft above –20 ºC line? If so, then precip loading and melting of ice should enhance downdraft.

NO ▼ *Slightly lower SPS potnl but still possible; consider other variables.*

YES ◄◄◄ ▼ *High SPS potnl given favorable envir; issue wrng!*

Reflectivity Data
- Assuming other parameters suggest a SPS, choose character of storm's max reflectivity core: **a)** already descended, **b)** still aloft, **c)** descending rapidly.

ANSWER:
a) Descended: SVR threat past.
b) Aloft: issue wrng now for lead time.
c) Descending rapidly: SVR threat imminent; issue wrng at once!

STORM-RELATIVE VELOCITY (SRM)

Mid-Altitude Radial Convergence
- Is strong, deep MARC present in SRM data (V_{in}+V_{out}) ≥ 50 kts from ~8-20 kft (depends on storm height)? Viewing angle may prevent proper assessment of MARC.

NO ▼ *SPS still possible, especially if bad viewing angle; consider other variables.*

YES ►►► ▼ *High SPS potnl given main core aloft, drier envir air aloft, & steep LL lapse rates; issue wrng!!*

Updraft Rotation
- Is any mid-altitude rotation present in storm (indicates strong updraft and possible deviant motion to promote better large hail production at surface)?

NO ▼ *SPS still possible; consider other variables.*

YES ►►► ▼ *High SPS potnl given main core aloft, drier envir air aloft, & steep LL lapse rates; issue wrng!!*

Storm-Top Divergence
- Is strong storm-top divergence present in SRM data? Values (V_{out} + V_{in}) ≥ 75 kts associated with hail ≥ 1 inch in diameter.

NO ▼ *SPS still possible; consider other variables.*

►**YES** ▼ *Higher SPS potnl but need to consider reflectivity variables.* ▼ ◄◄◄

OTHER PARAMETERS ►►

Digital VIL / Lightning Trends
- Is DVIL near 80 or increasing rapidly (intense updraft) and higher than neighbor storms? (Note: decreasing DVIL may indicate wet microburst is imminent or occurring.)
- Is CG lightning count higher than neighbor storms and increasing (indicates intense storm and possibly descending core)?

NO ▼ *Lower SPS potnl than neighbor storms, but still possible.*

YES ◄◄◄ ▼ *High SPS potnl given favorable envir and refl parameters; issue wrng!*

SCAN Algorithms
- Storm Cells: **a)** is POSH increasing and ≥ 80% AND hail size (hSize) ≥ 1.5, OR **b)** were POSH/hSize very high but are decreasing rapidly indicating psbl descending hail core below freezing level?
- Hail Diagnostic Grids: Is Digital VIL Density values ≥ 4.7?

NO ▼ *Lower SPS potnl for hail, but still wet microburst psbl; monitor storm.*

YES ◄◄◄◄◄◄◄◄ ▼

High SPS potnl if envir is favorable:
a) Issue wrng for minimal lead time.
b) Issue wrng at once as SVR threat is imminent or occurring; otherwise, too late.