The Quasi-Linear Convective System

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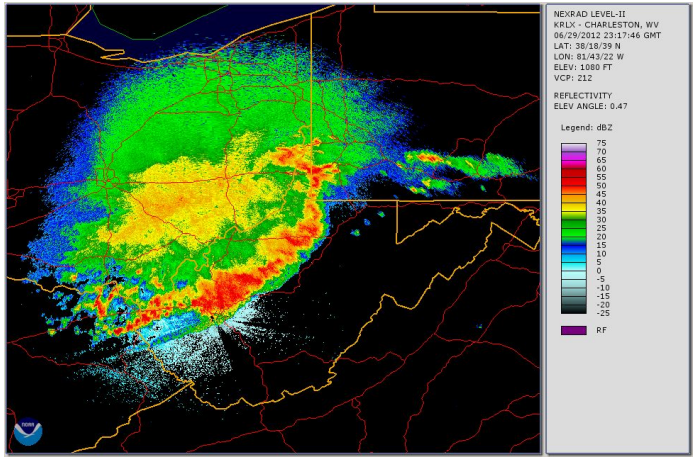
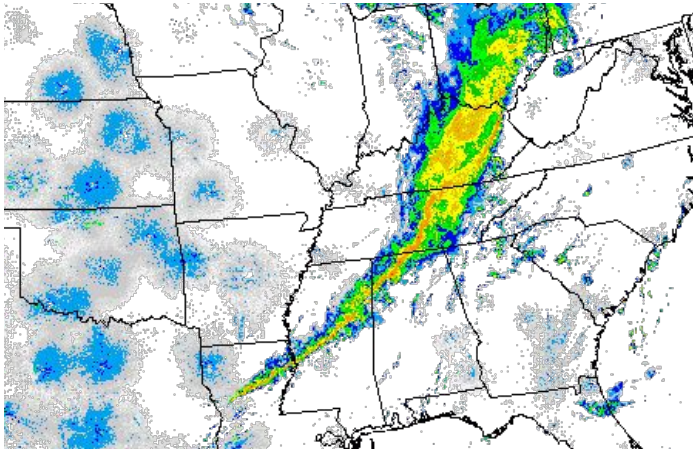
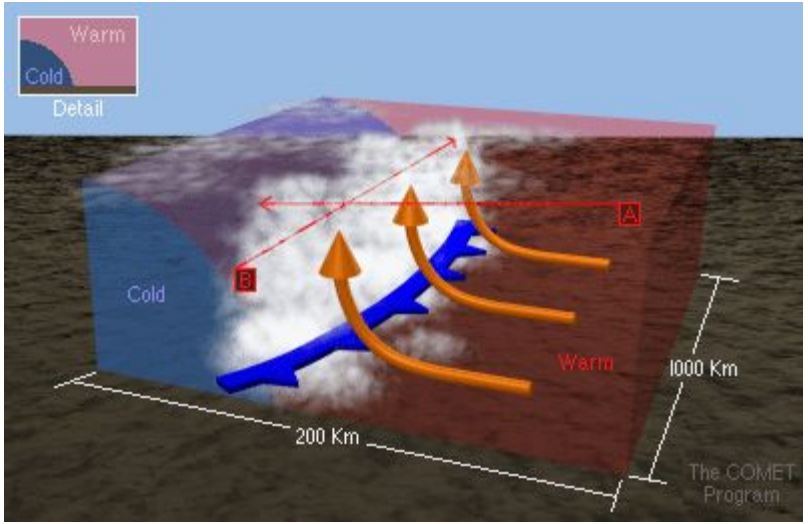
What is a QLCS?

- A subclassification of mesoscale convective systems
  - Mesoscale indicating that the system is on the order of 2000 km or less.
- A “family” of storms moving together as one line.
- Also known as a squall line, which is what we’ll call them for the rest of this presentation.
- Can form a bowing segment, known as a bow echo.
- Happen anytime of year, but by different processes.



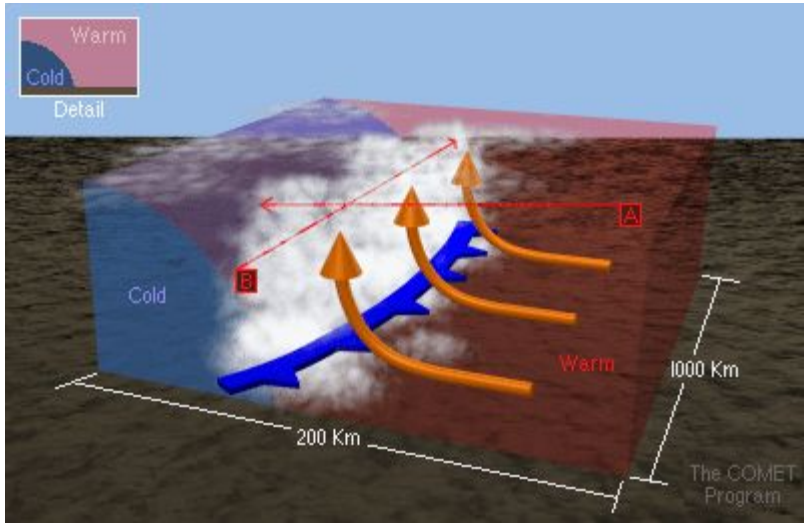


How Do They Form? - Poll Question 1



- What ingredients are needed for any thunderstorm to form?
    1. Moisture
    2. Lift
    3. Instability

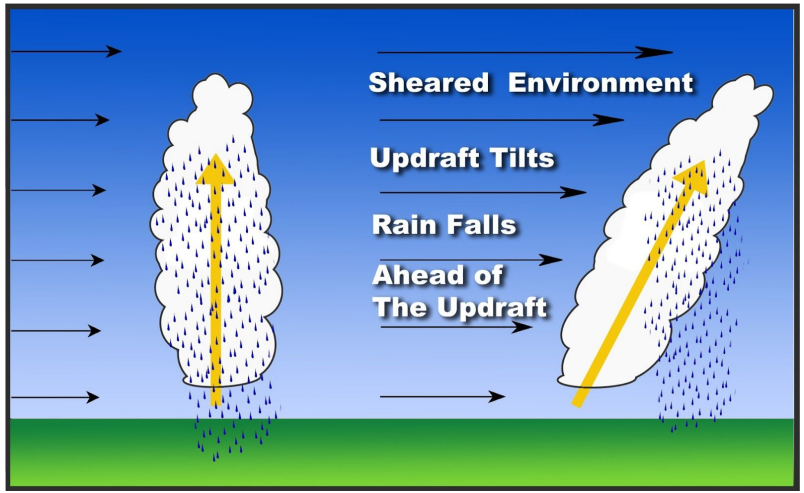
How Do They Form?



- What ingredients are needed for any thunderstorm to form?
  - Moisture
  - Lift
  - Instability

- Squall lines will often develop as individual storms along a boundary and then merge into one line, but this can happen relatively quickly.

How Do They Form? - Poll Question 2

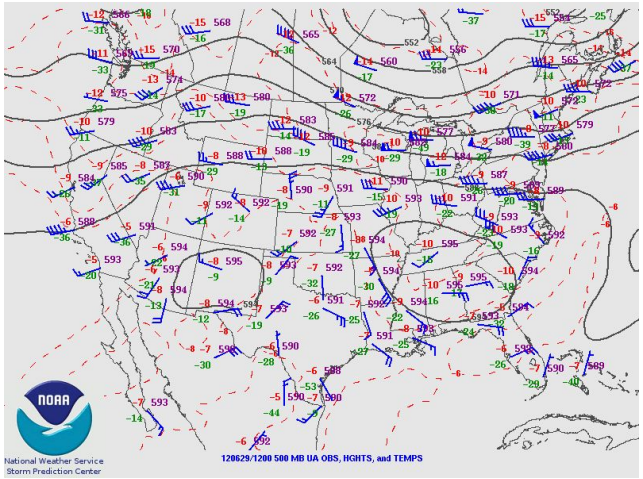


- What about the severity of the storms? Is there something else that is needed?
  - YES! Wind shear or the change in wind speed/direction as you move up in the atmosphere.

Mid Level Pattern

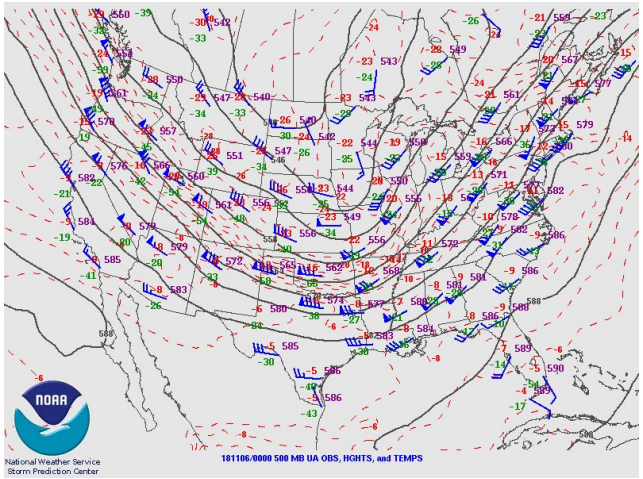
Summer

- Generally characterized by high pressure over the southeastern CONUS and weak shortwave troughs over the northern Great Lakes.
- Flow aloft is very weak.



Cool Season and Spring

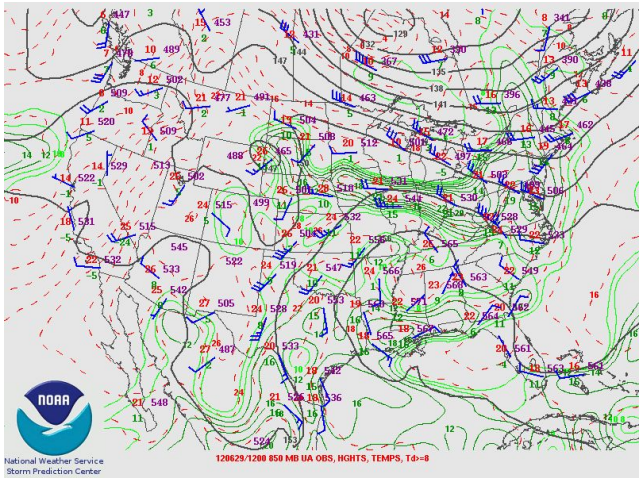
- Dynamic systems, with strong troughs and ridges.
- Winds can be on the order of 100 kts or more.
- Negative tilt vs positive tilt vs neutral.



Low Level Pattern

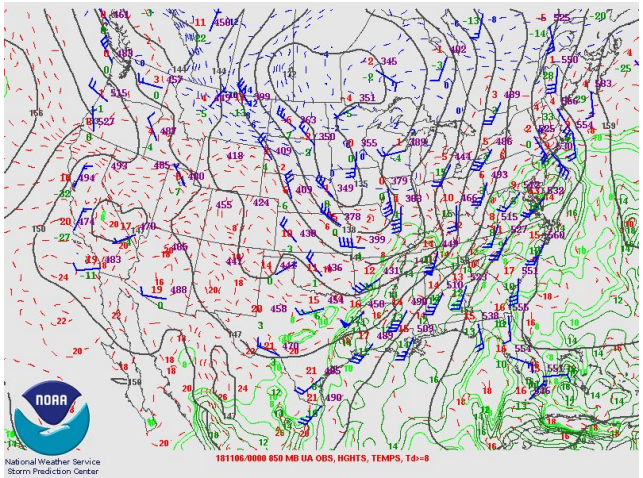
Summer

- Weak flow continues through the vertical column.
- Presence of convergence in the lower levels can enhance the squall line potential.



Cool Season and Spring

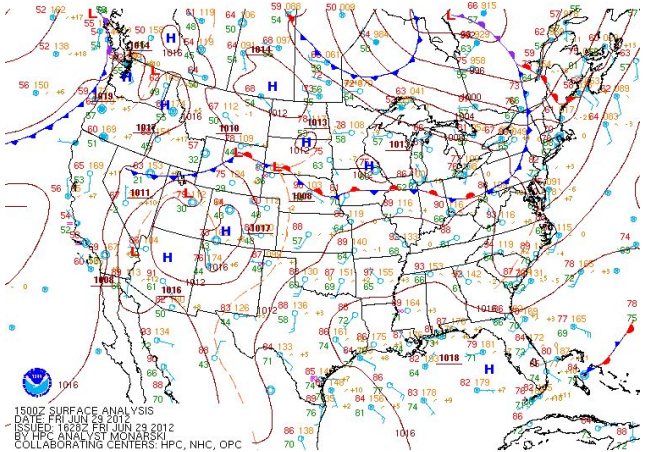
- Strong southerly winds present, which helps with shear.
- The higher winds aloft present a greater chance for those to be transferred to the surface.



Surface Pattern

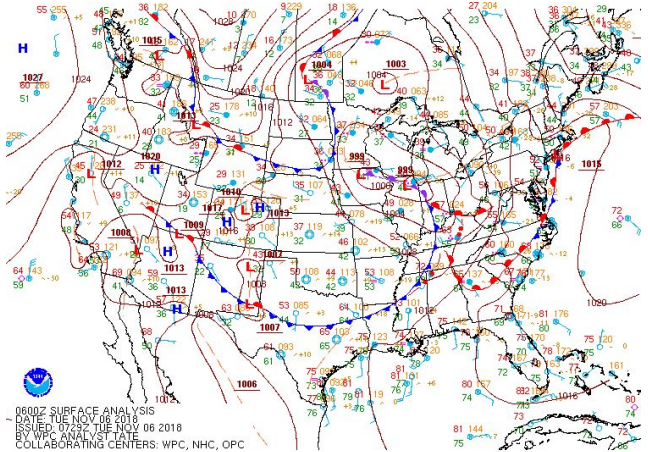
Summer

- Stalled frontal boundary, usually oriented west-east.
- Warm, moist air helps with increased instability.



Cool Season and Spring

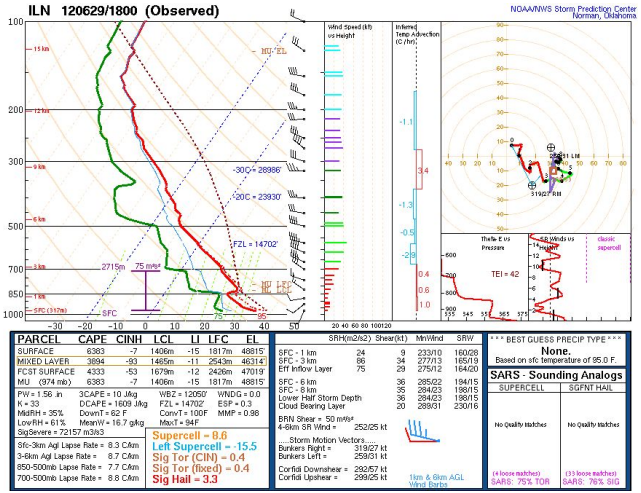
- Strong cold front separates cooler air mass from warm, moist air mass.
- The presence of a warm front can increase tornado potential.



Instability and Wind Shear

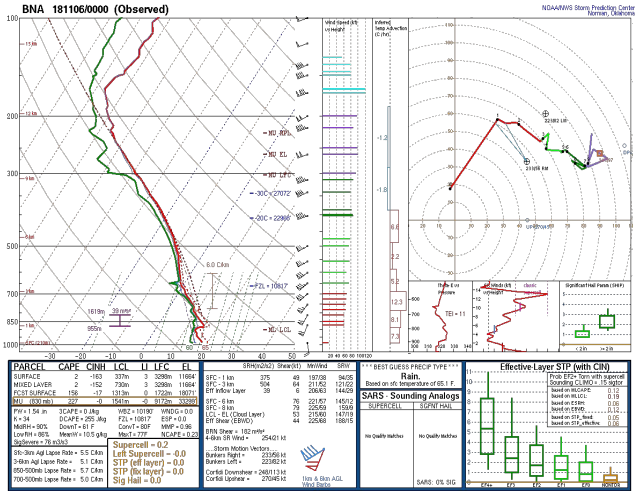
Summer

- Ample heating during the day and higher dewpoints lead to greater instability.
- The weaker flow aloft and lack of a jet reduces the amount of shear.



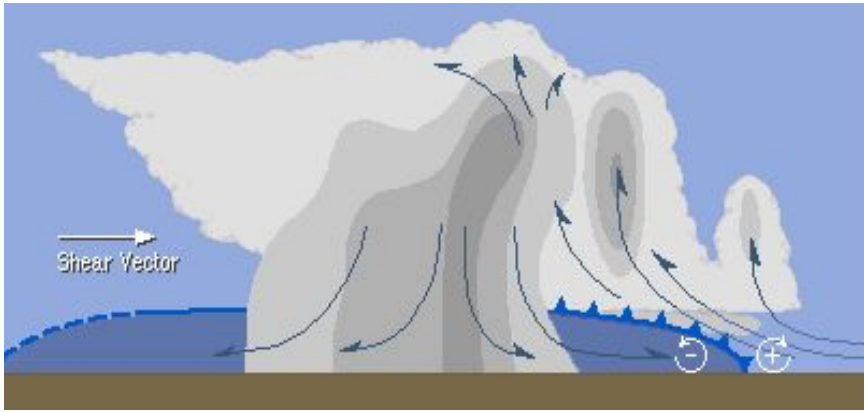
Cool Season and Spring

- Strong low level jet, on the order of 45+ kts leads to high shear.
- Shear is typically unidirectional.
- Less heating and lower dewpoints leads to less instability.

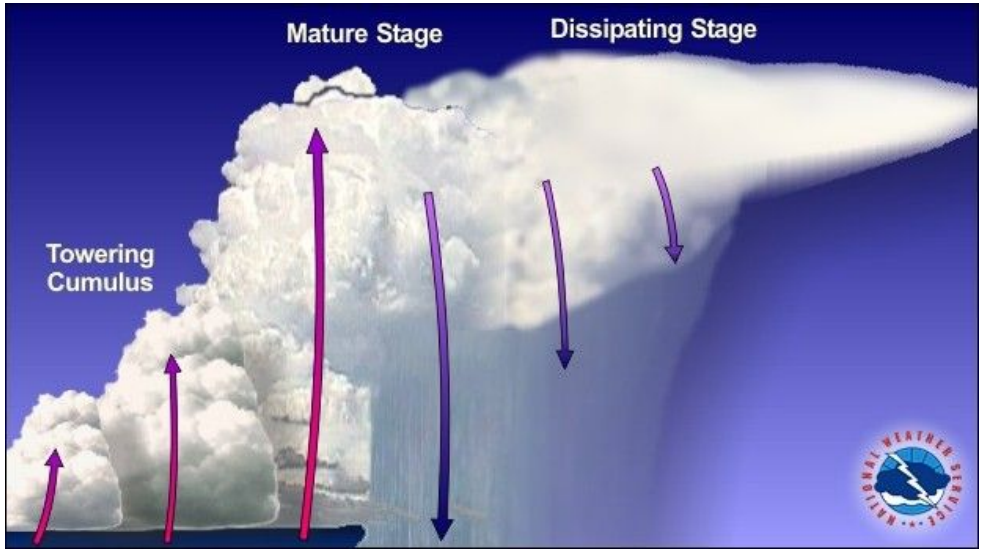


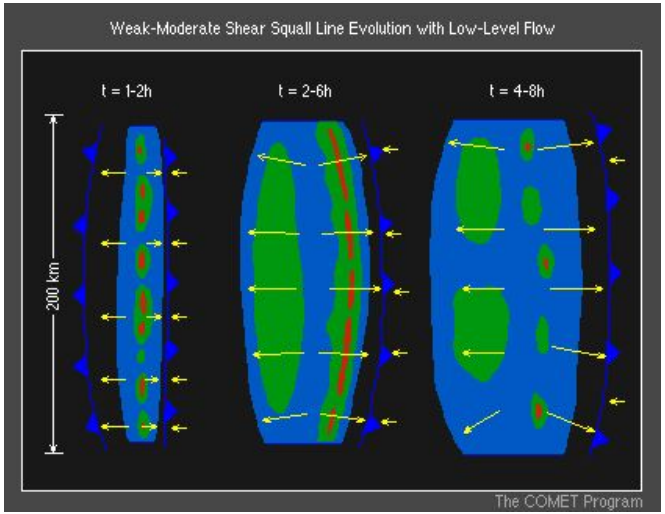
The Cold Pool - Why is it Important?

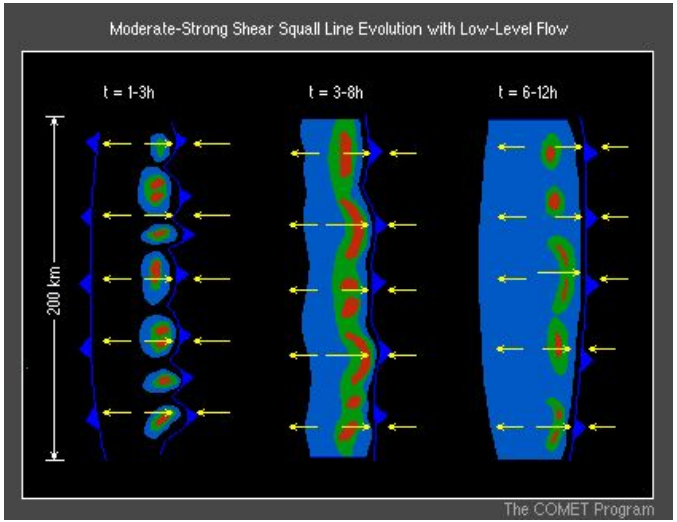
- A cold pool is simply the cooler air that descends from the downdraft, like a mini cold front on the leading edge of the squall line.
- Think of a squall line as an intricate machine that has to remain balanced in order for it to continue.
- The cold pool is essential for this balance and provides lift for the squall line to maintain its organization and strength.



Squall Line Characteristics







Hazards

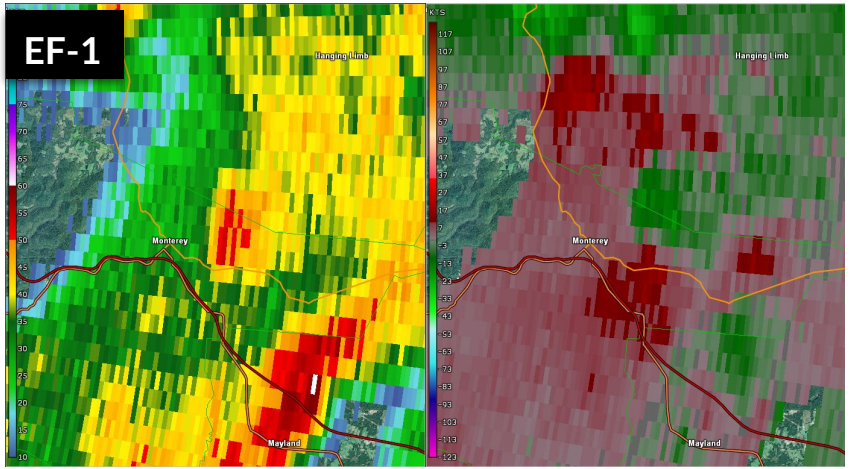
Straight-line Winds

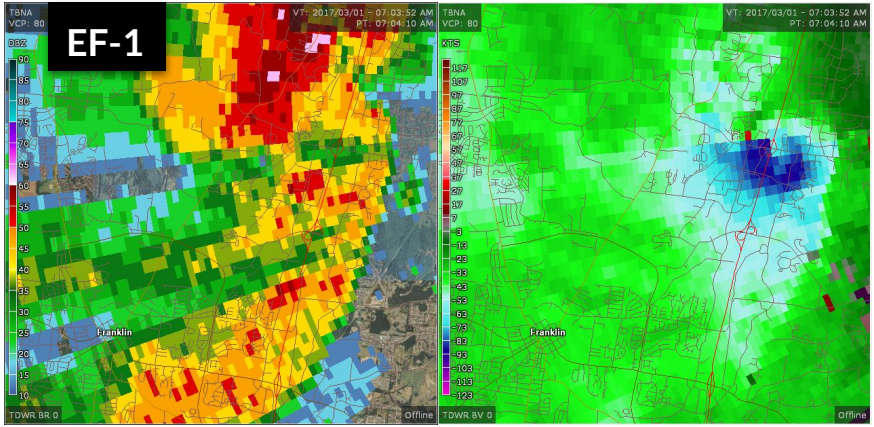
Tornadoes

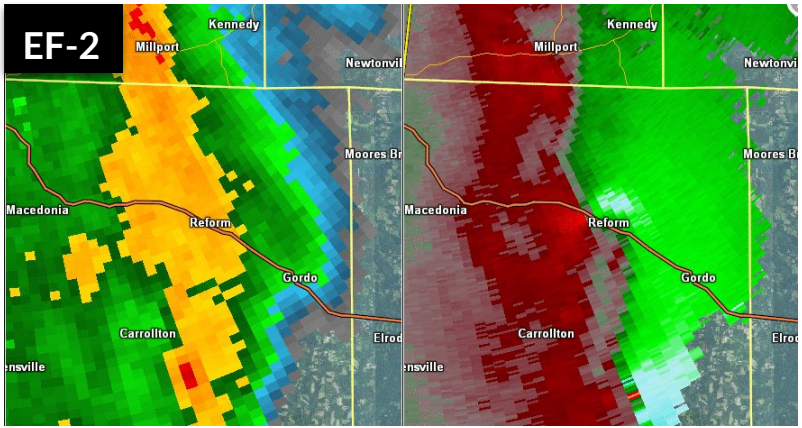
Hazards - Winds

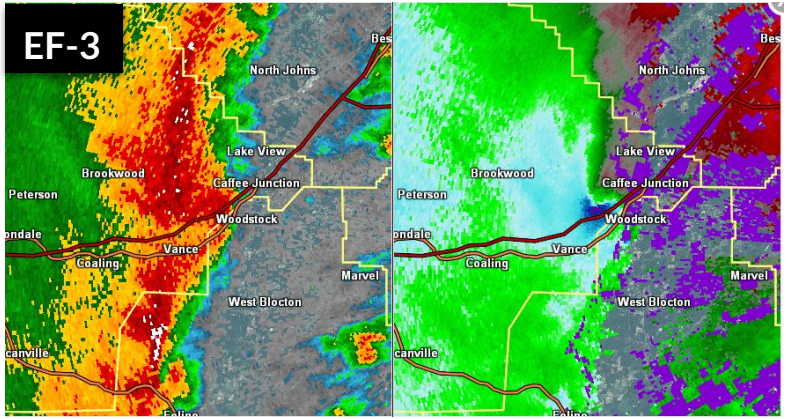
Hazards - Tornadoes

Squall Lines on Radar









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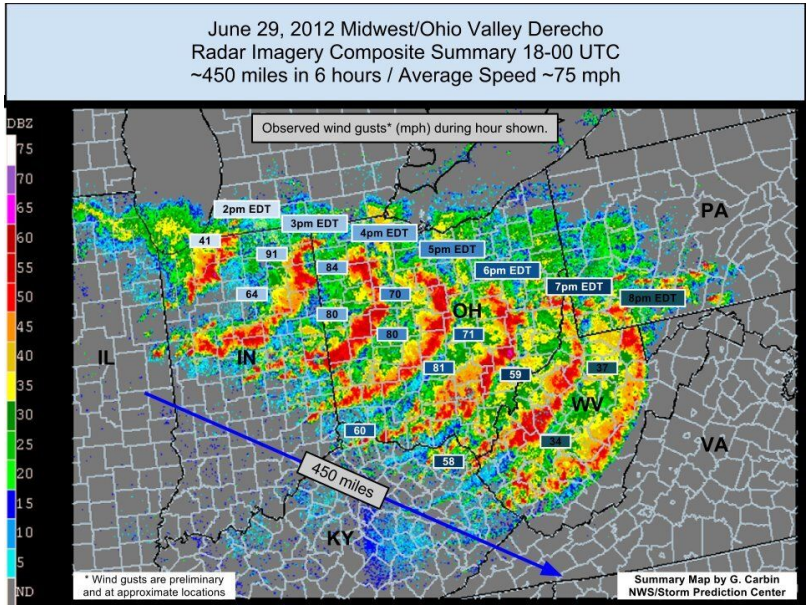

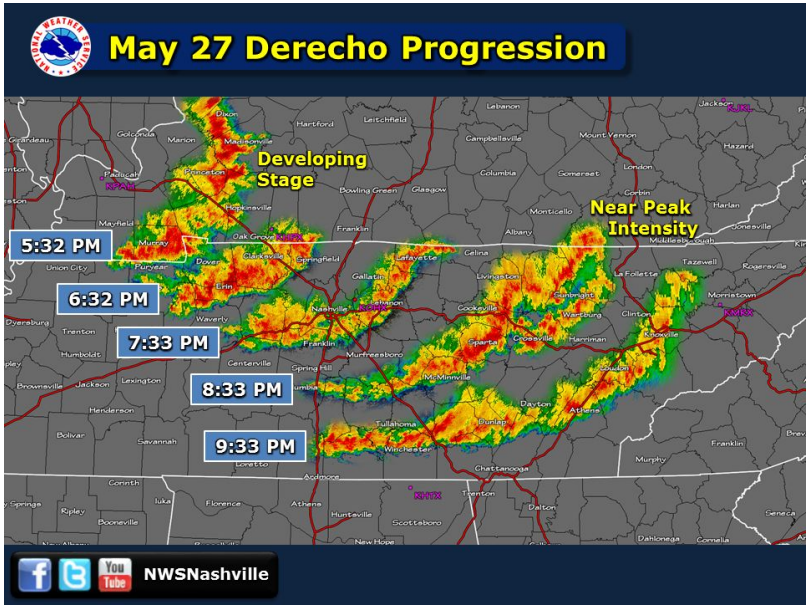

- A widespread, long-lived wind storm
- Damage swath > 250 miles
- Wind gusts at least 58 mph along most of the length, with gusts at least 75 mph within portions of the line.

Questions or Comments?

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