Severe Weather Parameters

June 2023

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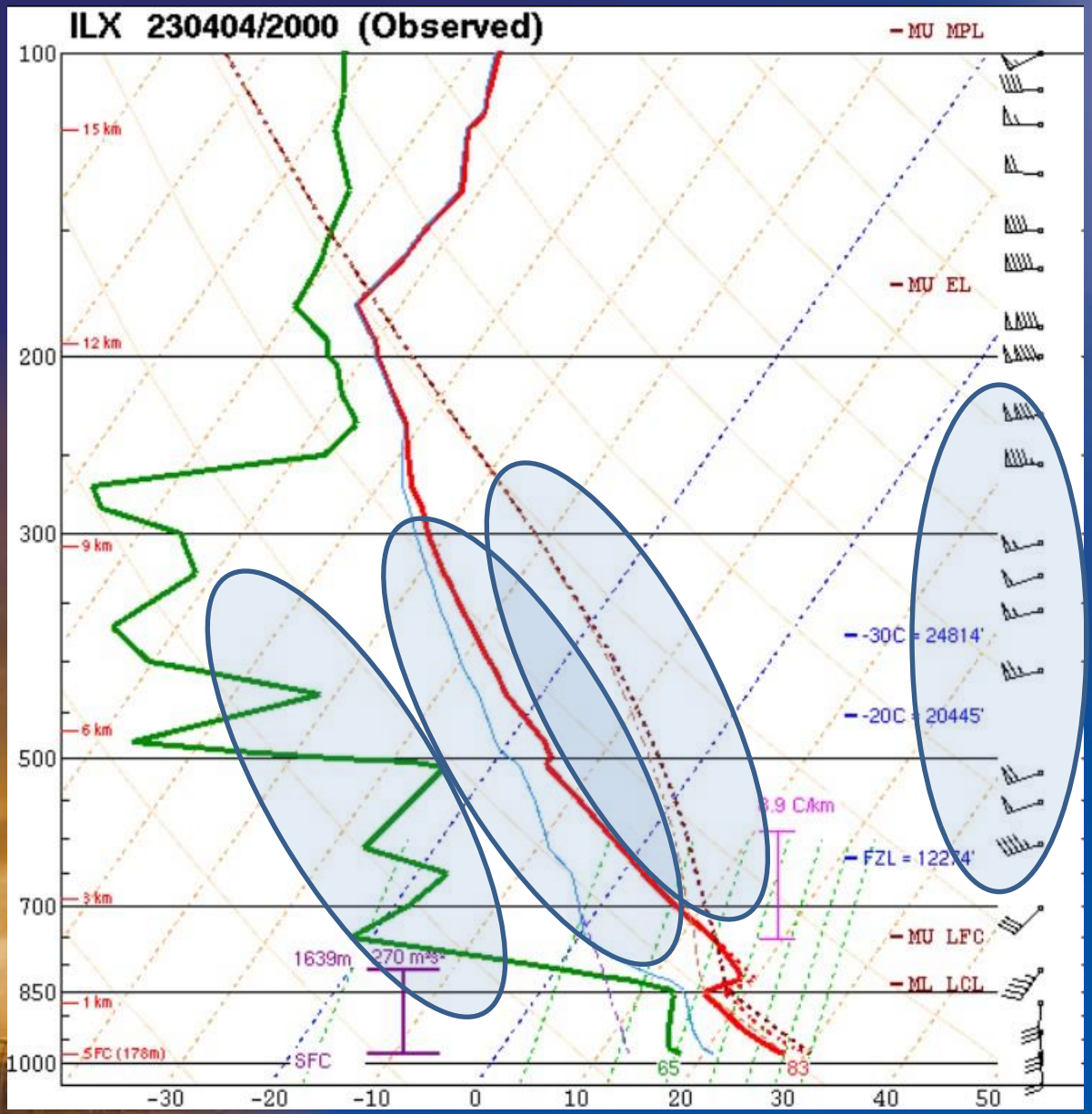
Severe Weather Parameters

- CAPE (Convective Available Potential Energy)
- CIN (Convective Inhibition)
- Wind shear
- SRH (Storm Relative Helicity)

Before we dive into these terms, we need to review atmospheric soundings.

Atmospheric Sounding



Red line: temperature

Green line: dewpoint

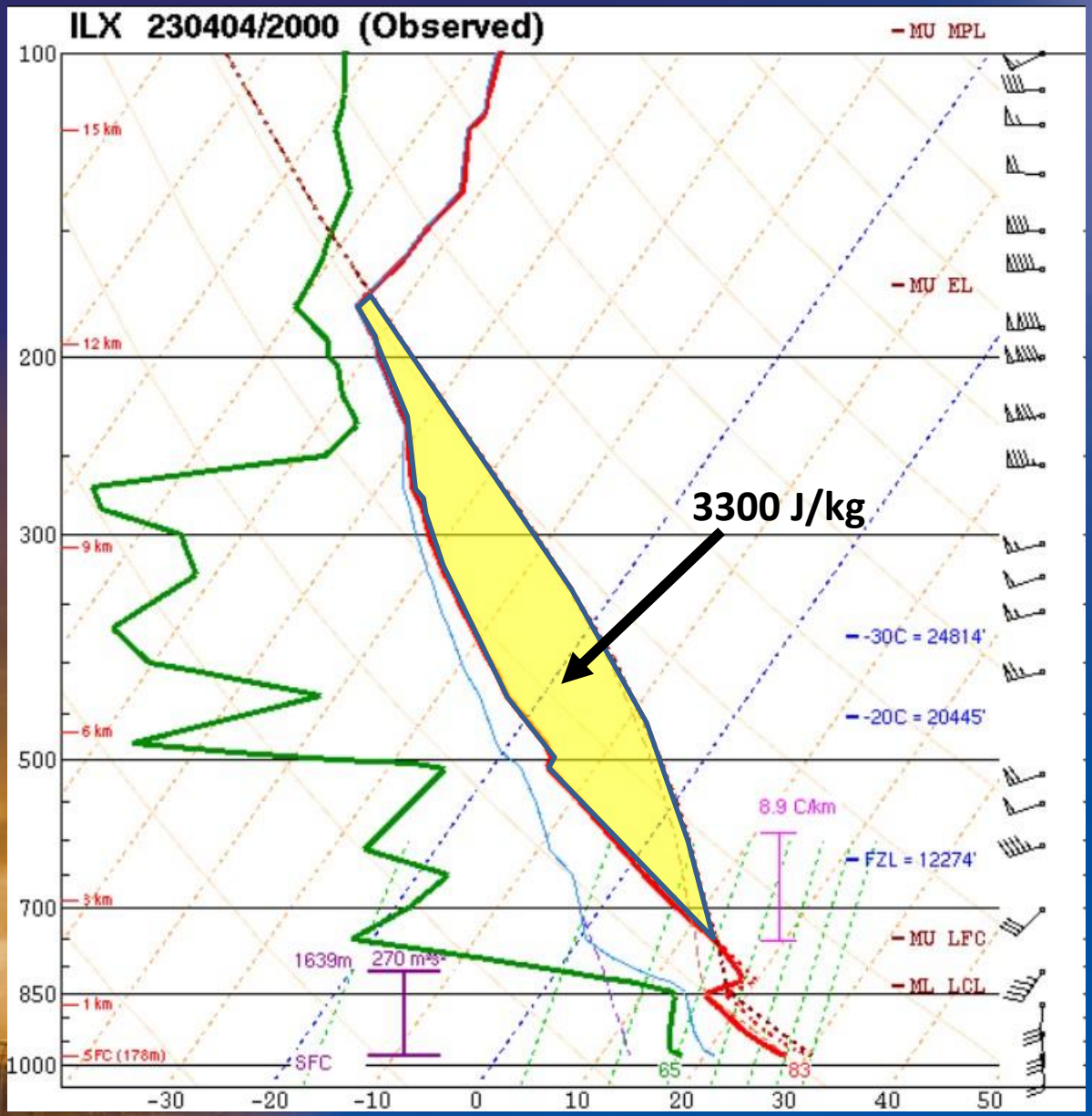
Wind barbs on the right show wind direction/speed

Dashed brown line: shows the trajectory of an air parcel forced upward from the surface

Convective Available Potential Energy

- One of the most commonly referenced severe parameters
- The amount of fuel available to a developing thunderstorm
- Describes atmospheric instability and provides an approximation of updraft strength
- Calculated by determining the area between the environmental temperature trace and the trajectory an air parcel forced upward from the surface would take

Convective Available Potential Energy

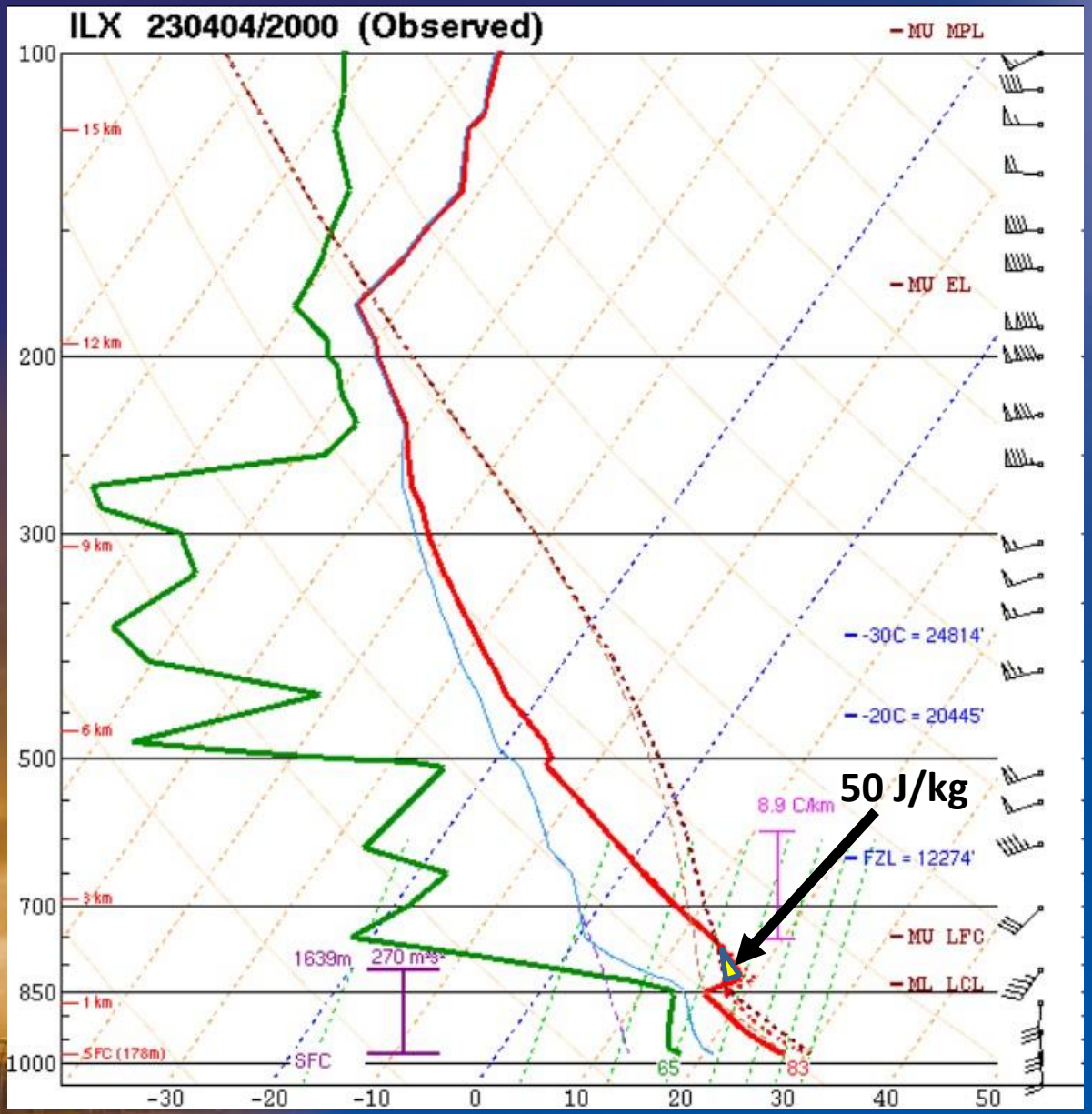


Warm air is less dense (lighter) than cold air. So…if a parcel of air rising from the surface remains warmer than the environment, it will keep rising on its own (hot air balloon)

On the sounding…if the brown dashed line is to the right of the red line, that means the parcel is warmer than the environment (unstable)

The area between the red line and the brown dashed line is the **CAPE**

Convective Inhibition



On the flip side…if the brown dashed line is to the left of the red line, that means the parcel is cooler than the environment (stable)

The area between the red line and the brown dashed line is the **CIN**

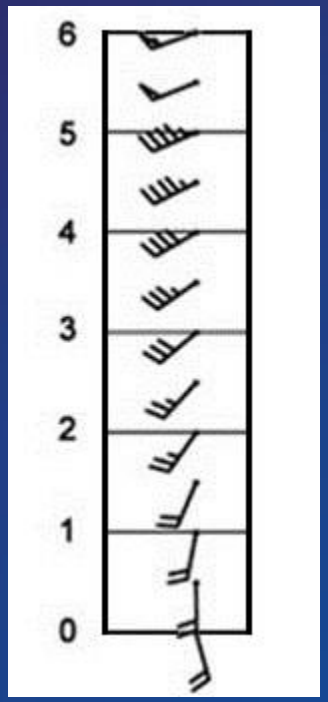
CIN acts as a “cap” to prevent thunderstorm updrafts

CAPE Values

0-1000: Marginally unstable
1000-2500: Moderately unstable
2500-4000: Very unstable
4000: Extremely unstable

Varies depending on time of year.
For example, a CAPE of 200 J/kg
would be considered inconsequential
in June, but could be very significant
in January

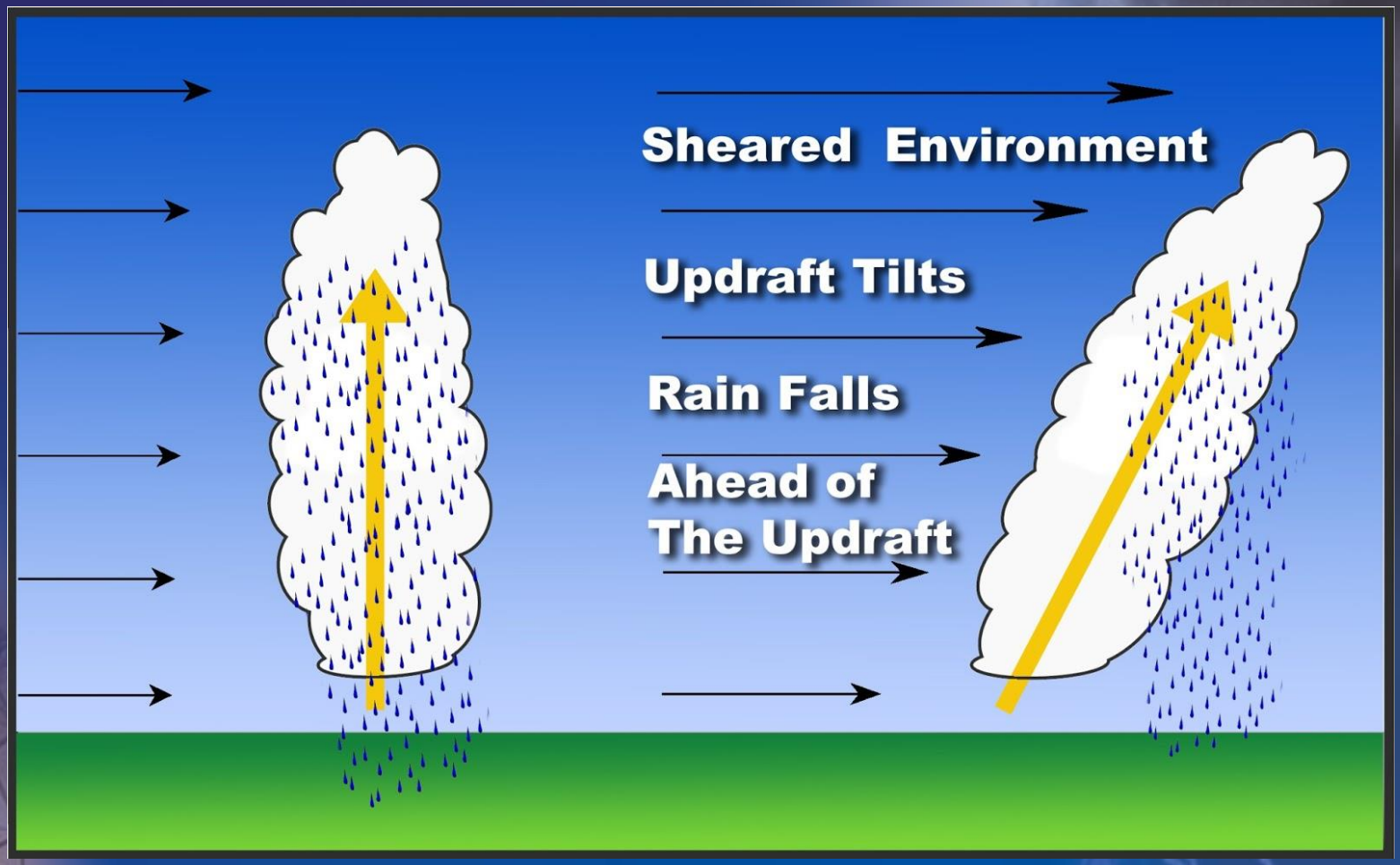
Wind Shear



Describes how the wind changes speed and/or direction with height

In the example to the left, winds are from the SE at 20kt at the surface, then veer to W/SW and increase to 55kt at 6km aloft

Wind Shear



Wind shear acts to tilt thunderstorm updrafts. This prevents rain from falling directly into the updraft…helping it last longer and potentially become stronger

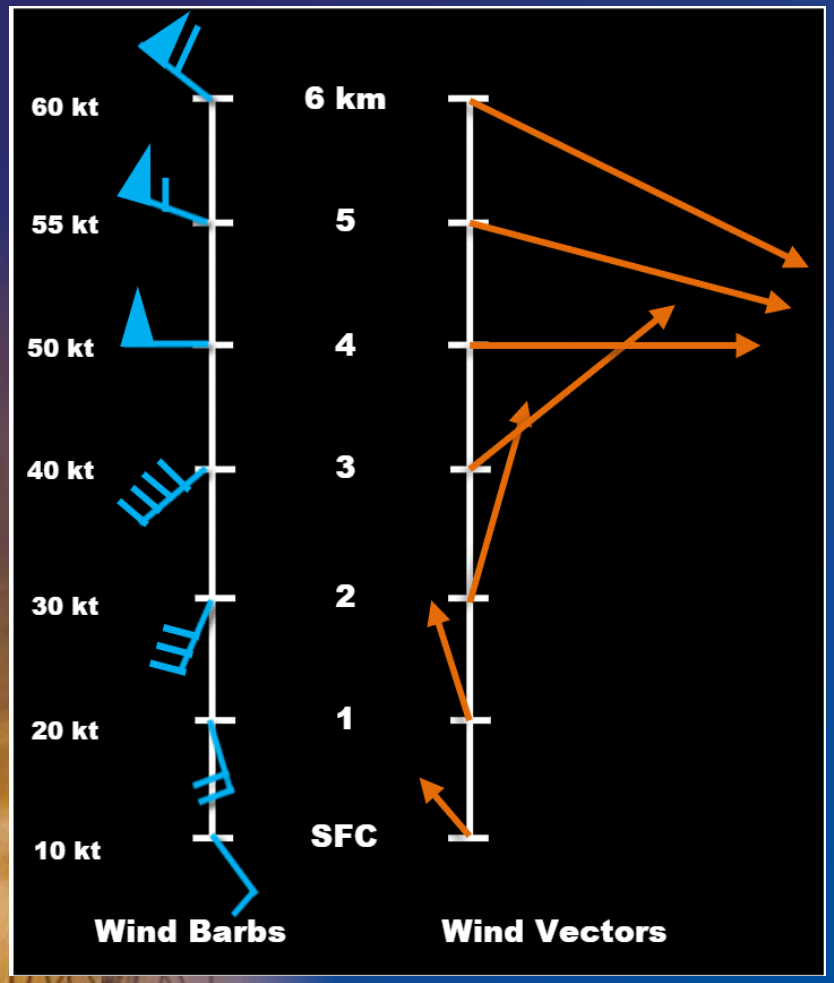
Wind Shear

- There are a number of different ways to measure wind shear
- One of the most common parameters is 0-6km bulk shear (wind vector difference between the the surface and 6km aloft)

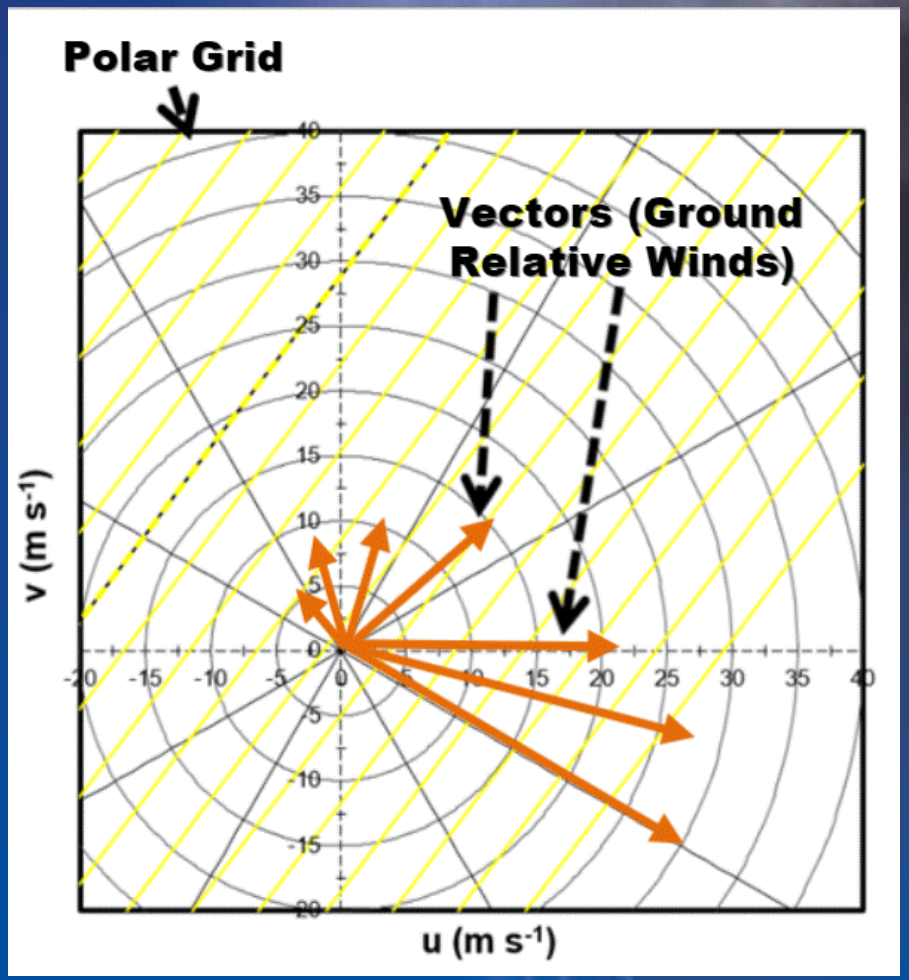
- Values greater than 35kt support supercell thunderstorms

Wind Shear

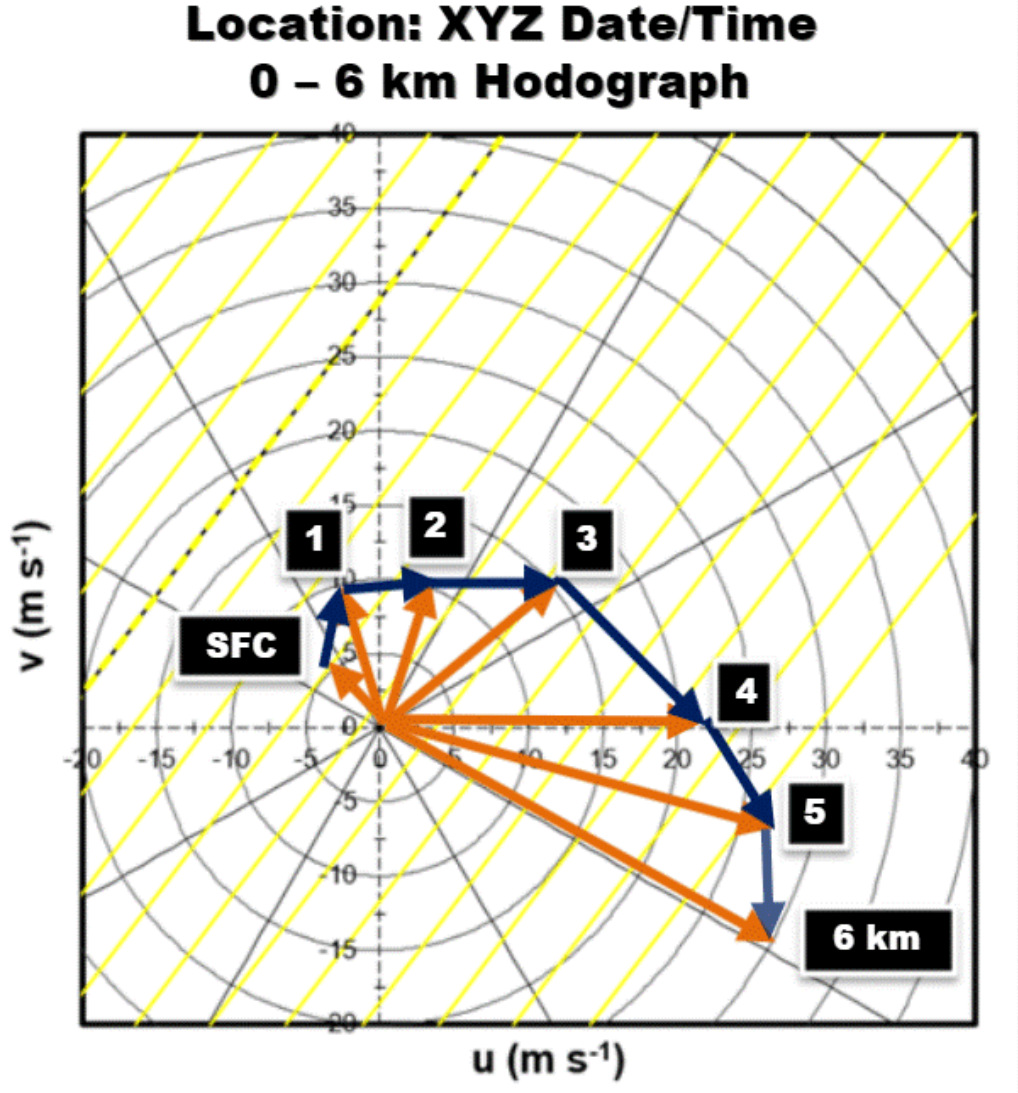
Wind Vectors



Plotted Vectors



Hodograph



Visual display of wind shear

Image shows 0-6km shear

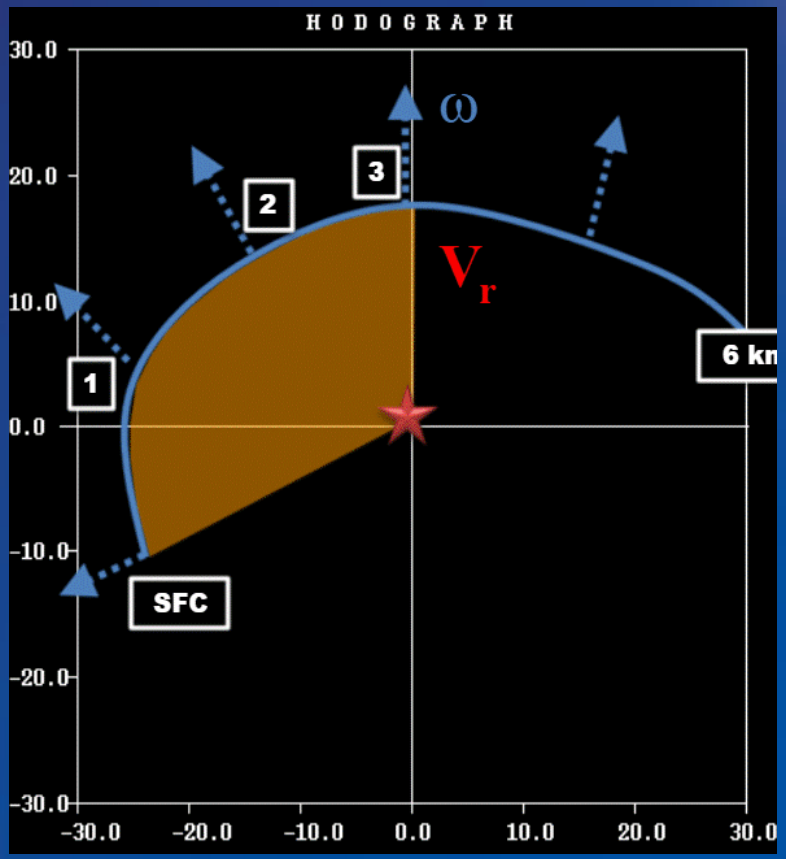
Winds veering and strengthening with height will produce a "curved" hodograph

This is an indication of **supercell potential**

Storm Relative Helicity

A measure of the potential updraft rotation in supercells

Twice the area swept out between the hodograph and storm motion between two levels



0-1km SRH > 100
0-3km SRH > 250

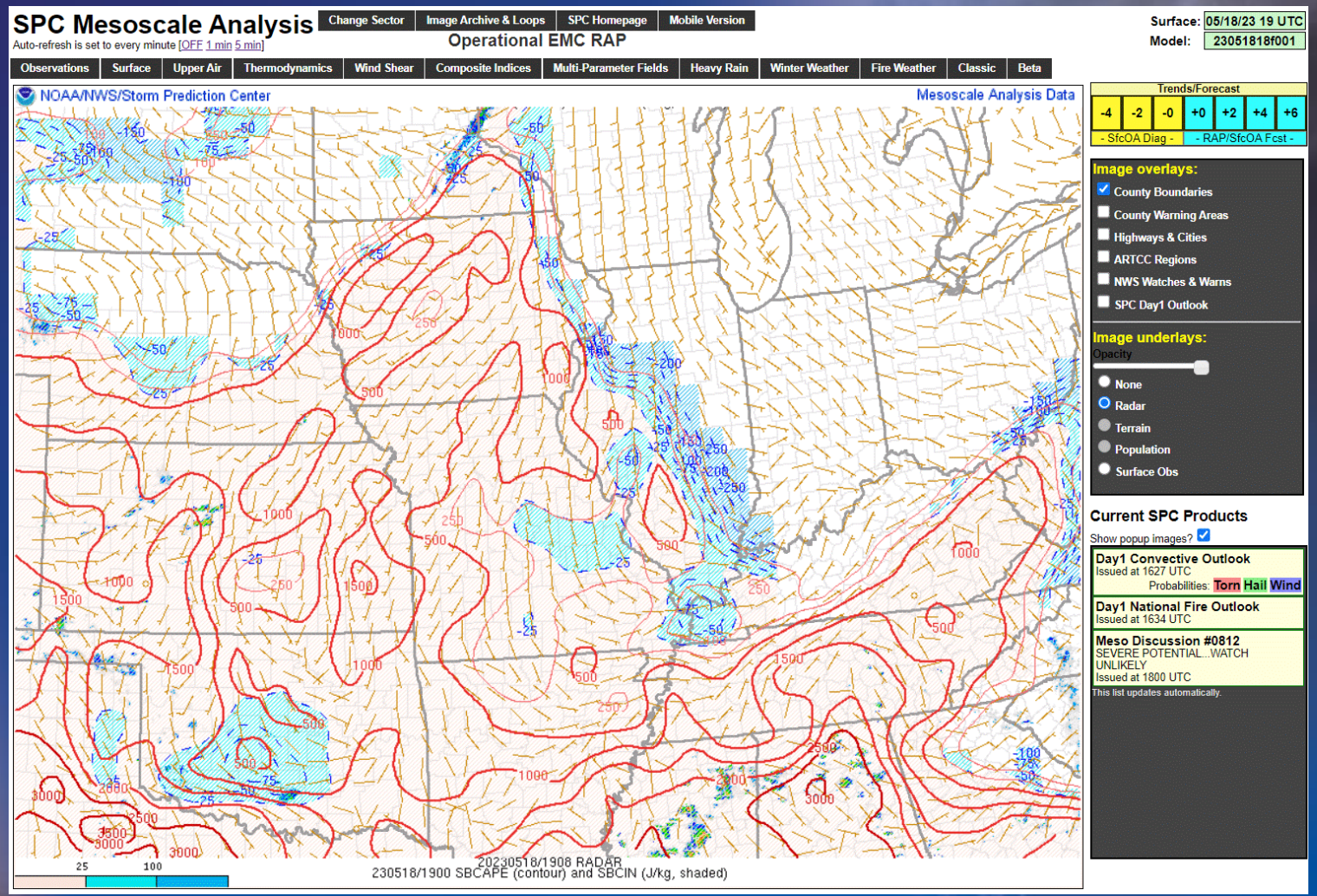
Increased threat of tornadoes with supercells

Severe Weather Parameters

- Forecasting severe thunderstorms is a complex process involving many key ingredients acting in tandem
- There is no one “magic” parameter that works every time
- Meteorologists use the various severe weather parameters as tools…in conjunction with other observational and model data to forecast severe convection

Severe Weather Parameters

For much more, go to www.spc.noaa.gov
Click the “Mesoanalysis” tab, then select a region of interest



Thank You for Attending!