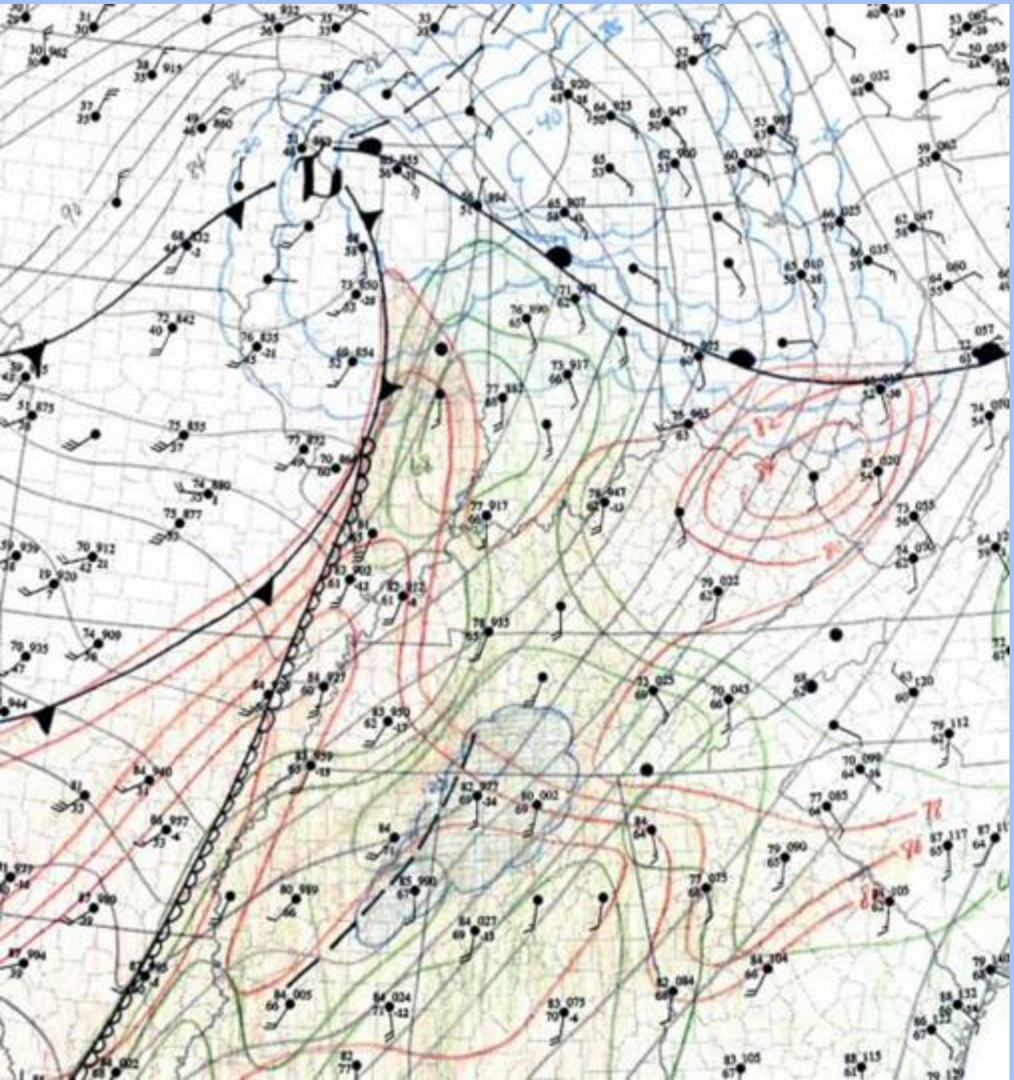
Subjective Analysis: History and Uses in modern forecasting



"Despite the powerful computers, there is no substitute for drawing weather maps by hand for making a forecaster take the time to thoroughly understand the ongoing weather situation. And without knowing the intricate details of what's happening now, a forecast can suffer. So SPC forecasters routinely draw -- by hand -- surface and upper air features on printed maps, many times per day. This is a piece of a surface map containing lows and warm fronts (bright red), highs and cold fronts (blue), outflow boundaries (purple dash-dot), pressure troughs and isobars (dark gray), isotherms and warm spots for temperature (dark red), isodrosotherms and moist spots for dew point (green), a dryline (dark brown), and finally, snapshots of wind flow called streamlines (tan). It may look like a jumbled mess, bad food or abstract art; but to a severe storms meteorologist, it is stuffed with useful information"

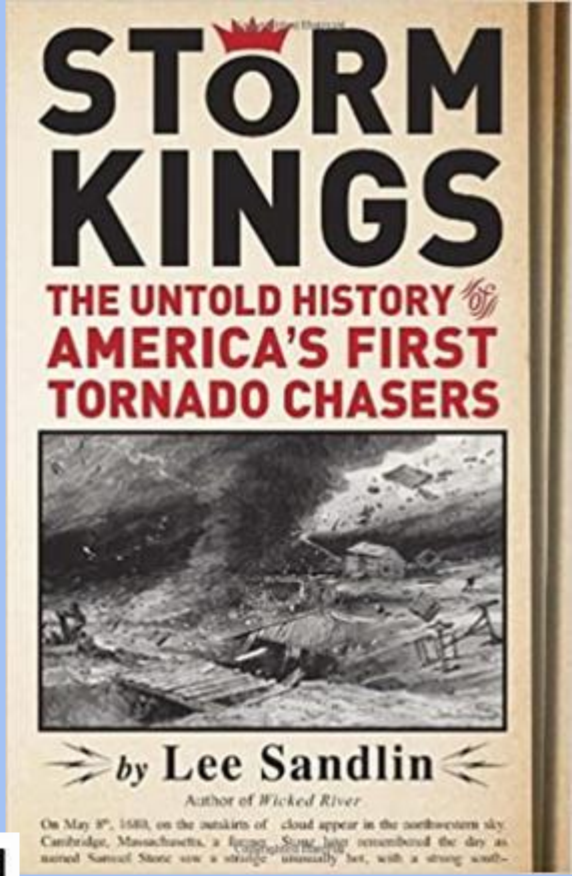
-SPC Tornado FAQ

A brief History

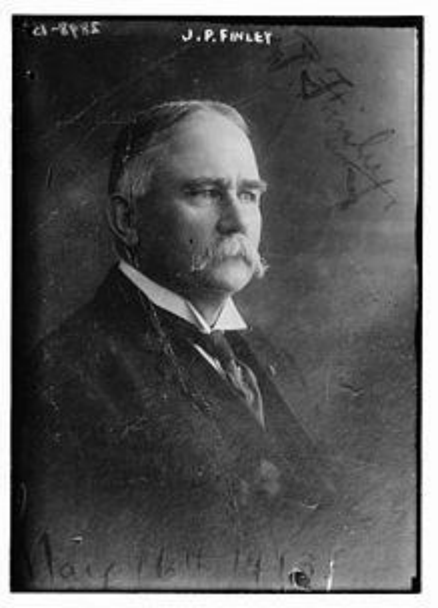
- 1870 US Congress establishes a weather unit within the US Army Signal Corps. Precursor to today's NWS

- 1872 Signal Corps weather unit begins collecting country wide observations via telegraph for use in forecasts for **agriculture and commerce**. *(NOAA is under the Department of Commerce today)*

- John Finley, a Signal Corps forcaster, began the first systematic study of tornadoes through the use of surface observations, tornado reporters (spotters) and climatology in 1884. Recognized the need for more observations and data.



I highly recommend Storm Kings by Lee Sandlin for the history of tornado forecasting and the National Weather Service.



<-John Park Finley Us Army Signal Corp

Surface maps and next Steps; Fawbush and Miller Tornado Forecasting

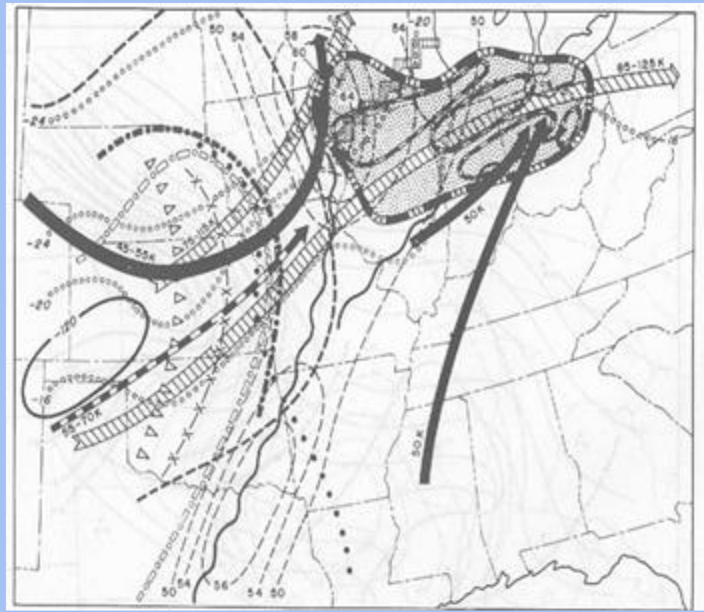
- **Standardized surface maps became the norm for weather and forecasting for decades. Still remain essentially the same today.**

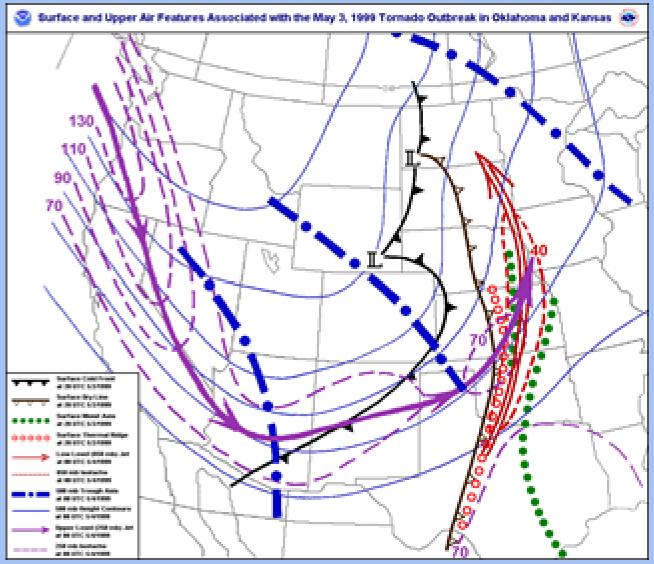
- **Captain Robert C. Miller and Major Ernest J. Fawbush USAF became the first successful tornado forecasters on March 25th 1948 Tinker AFB OKC after recognizing a similar pattern from a tornado just 5 days before.**

- **Fawbush and Miller spent the rest of their careers pioneering tornado research and forecasting methods for the USAF. This included creating composite charts of surface and upper-atmospheric features. (Look Familiar?)**

- **In 1952-3 the Weather Bureau created the Severe Local Storms unit SELS (precursor to SPC) based on the work of Fawbush and Miller.**
    - https://www.spc.noaa.gov/history/early.html


Planes destroyed at Tinker AFB; March 20, 1948





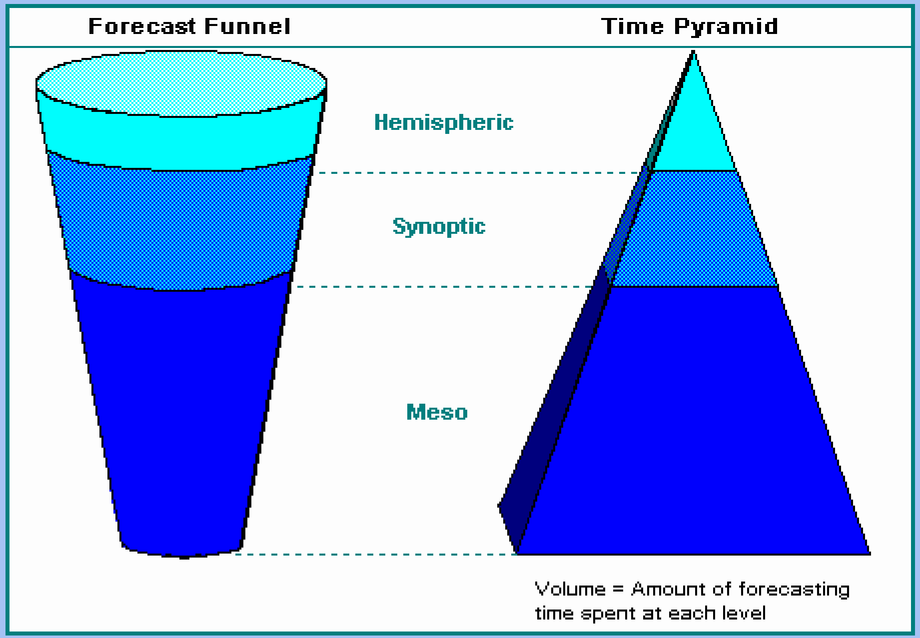
Cool, why do we care?

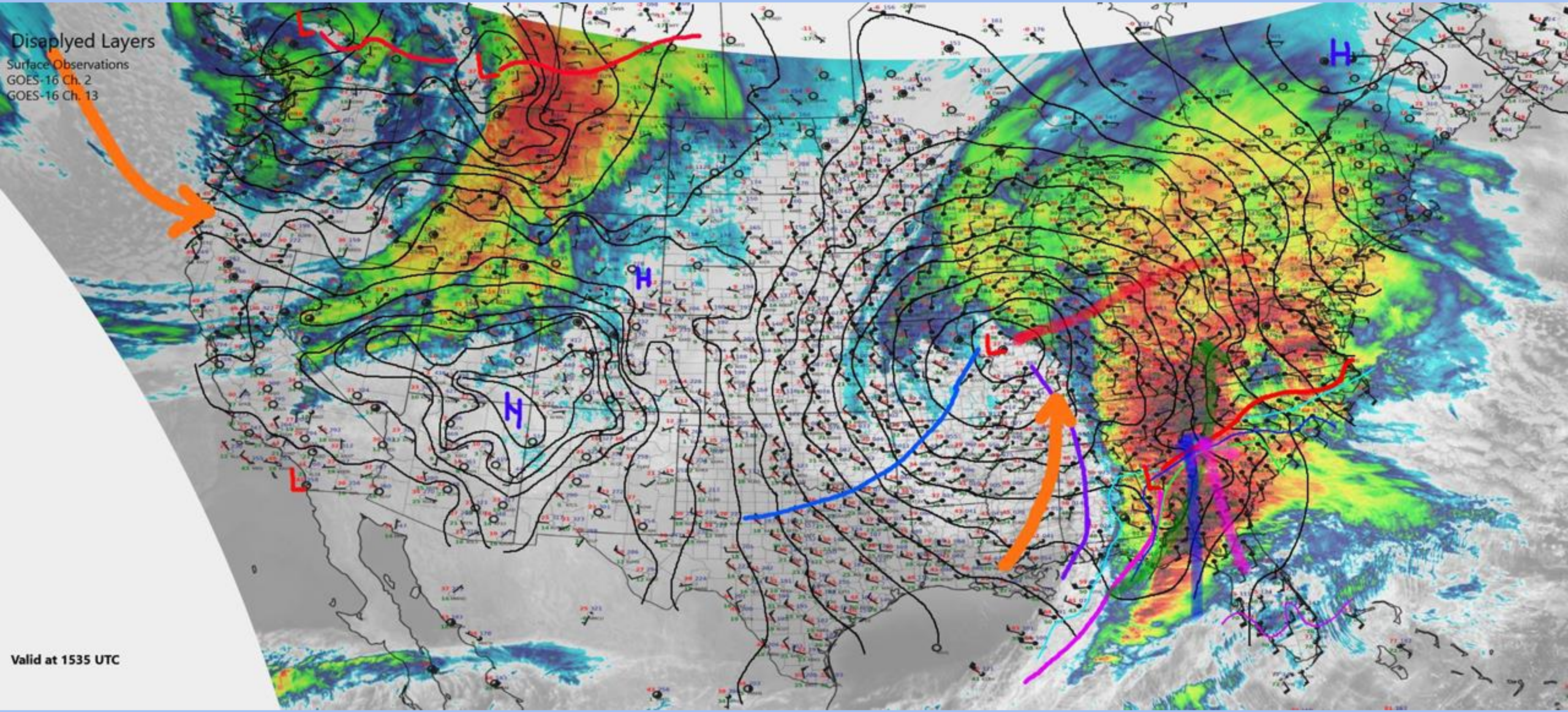
- **Serves as a solid basis for building a successful forecasting routine.**
  - **“Even Michael Jordan starts his warm-up with chest passes.” - Unknown**

- **Observations should serve as the basis for all forecasts with numerical models and other tools “filling in the gaps”.**

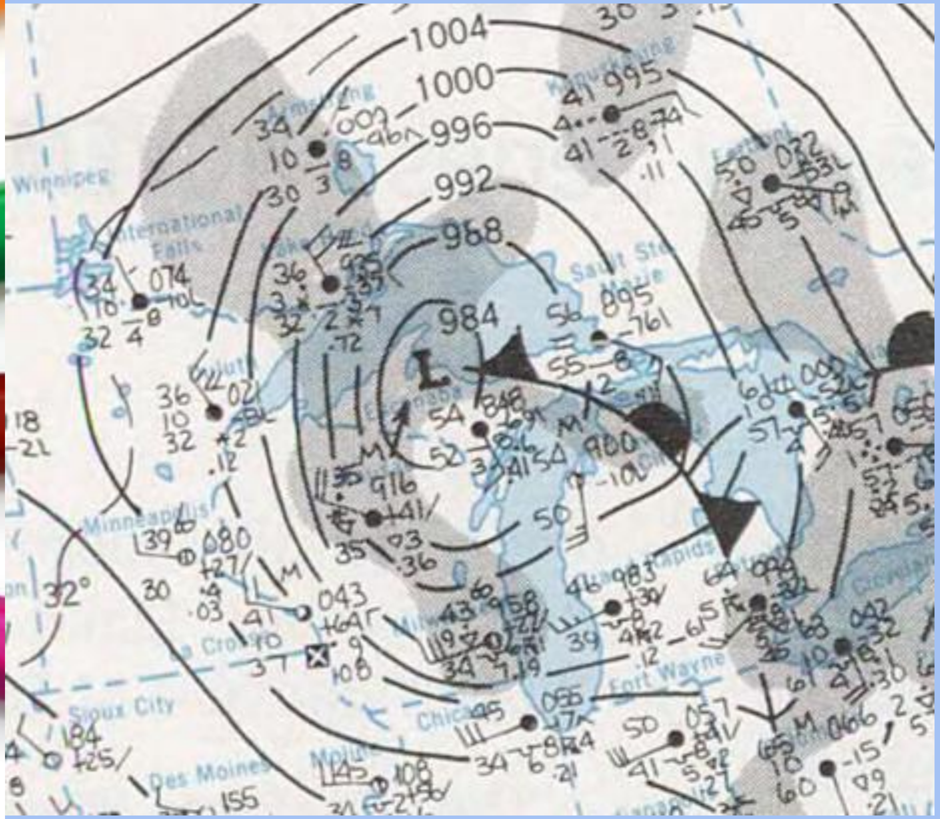
- **Model guidance and objective analysis can, *and will*, lead you astray!**
  - **Hand analysis allows you to identify when guidance/objective analysis has initialized poorly.**

- **Hand analyses don’t have to be pretty so long as they give you the information you need.**




Disaplyed Layers
Surface Observations
GOES-16 Ch. 2
GOES-16 Ch. 13
Valid at 1535 UTC

Break out the Pencils!



Upper Air Analysis

300 mb

Notes:
300 mb is typically near 9000 meters. Heights on chart typically omit the ending "0"
(so 9120 meters is 912 on the chart).

Use:
Jet stream and upper-wave identification

What to draw:

1. Isotachs (wind speed) every 25 knots
2. Isohypses (heights) every 120 meters

500 mb

Notes:
500 mb is typically near 6000 meters. Heights on chart typically omit the ending "0"
(so 5640 meters is 564 on the chart).

Use:
Upper-wave identification

What to draw:

1. Isohypses (heights) every 60 m
2. Isotherms every 4 C

700 mb

Notes:
700 mb is typically near 3100 meters. Heights on chart typically omit the leading digit
(so 3050 meters is 050 on the chart).

Use:
Mid-level wave identification.
Thermal advection regimes
Mid-level moisture

What to draw:

1. Isohypses (heights) every 30 meters
2. Isotherms (temperature) every 4 C
3. Isodrosotherms (dewpoint) every 4 C above -4 C

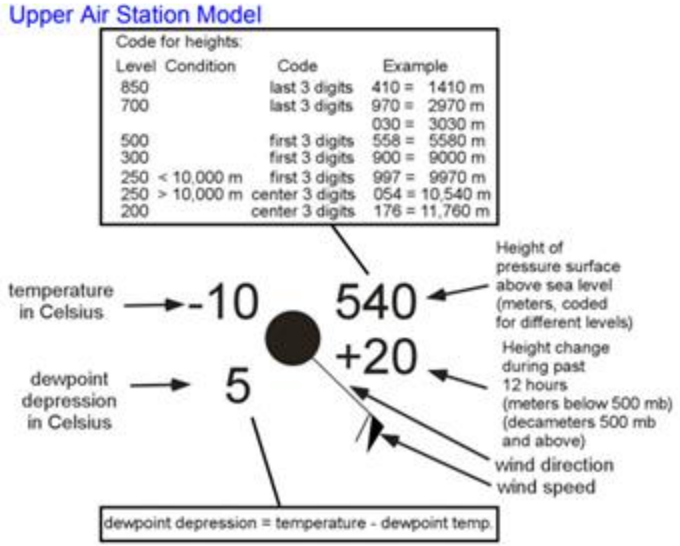
850 mb

Notes:
850 mb is typically near 1170 meters. Heights on chart typically omit the leading digit
(so 1320 meters is 320 on the chart).

Use:
Low-level wave identification.
Thermal advection regimes
Low-level moisture
Low-level jets

What to draw:

1. Isohypses (heights) every 30 meters
2. Isotherms (temperature) every 4 C
3. Isodrosotherms (dewpoint) every 4 C above 8 C



Surface Analysis

Main goal: Identify air masses and boundaries!

Isobars (pressure): Every 2 or 4 mb (Depends on CONUS vs. Regional scale. For this exercise, do 4 mb)

Isodrosotherms (dewpoint): Every 4 C (Allows you to scale down to 2 C as needed)

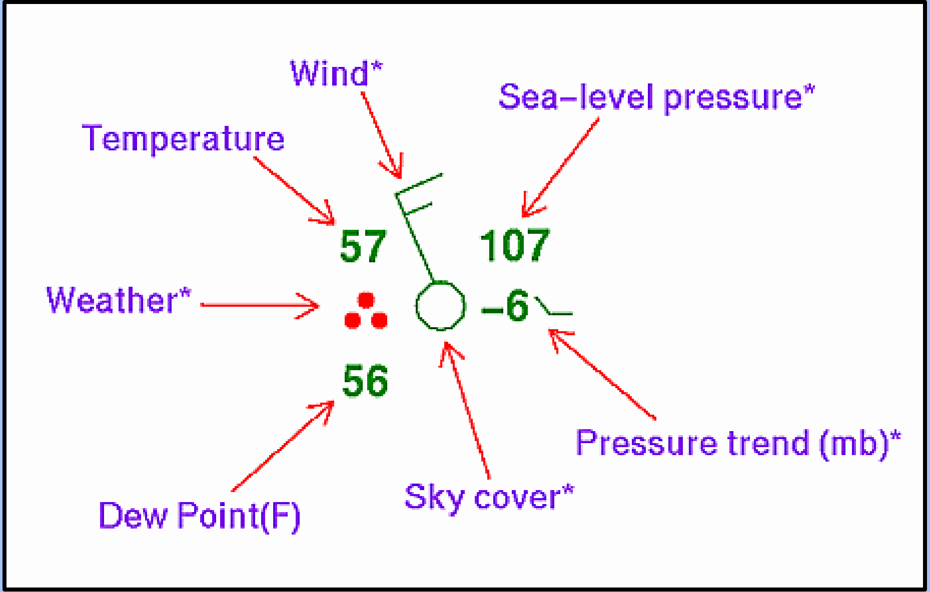
Isotherms (temperature): Every 4 C (Allows you scale down to 2 C as needed)

Boundaries:

- **Cold Fronts**
- **Warm Fronts**
- **Stationary Fronts**
- **Occluded Fronts**
- **Drylines**
- **Surface troughs**
- **Surface Ridges**
- **Confluence axes**
- **Outflow boundaries**

For this exercise, prioritize:

1. **Surface Pressure**
2. **Dewpoint**
3. **Boundaries**
4. **Temperature**

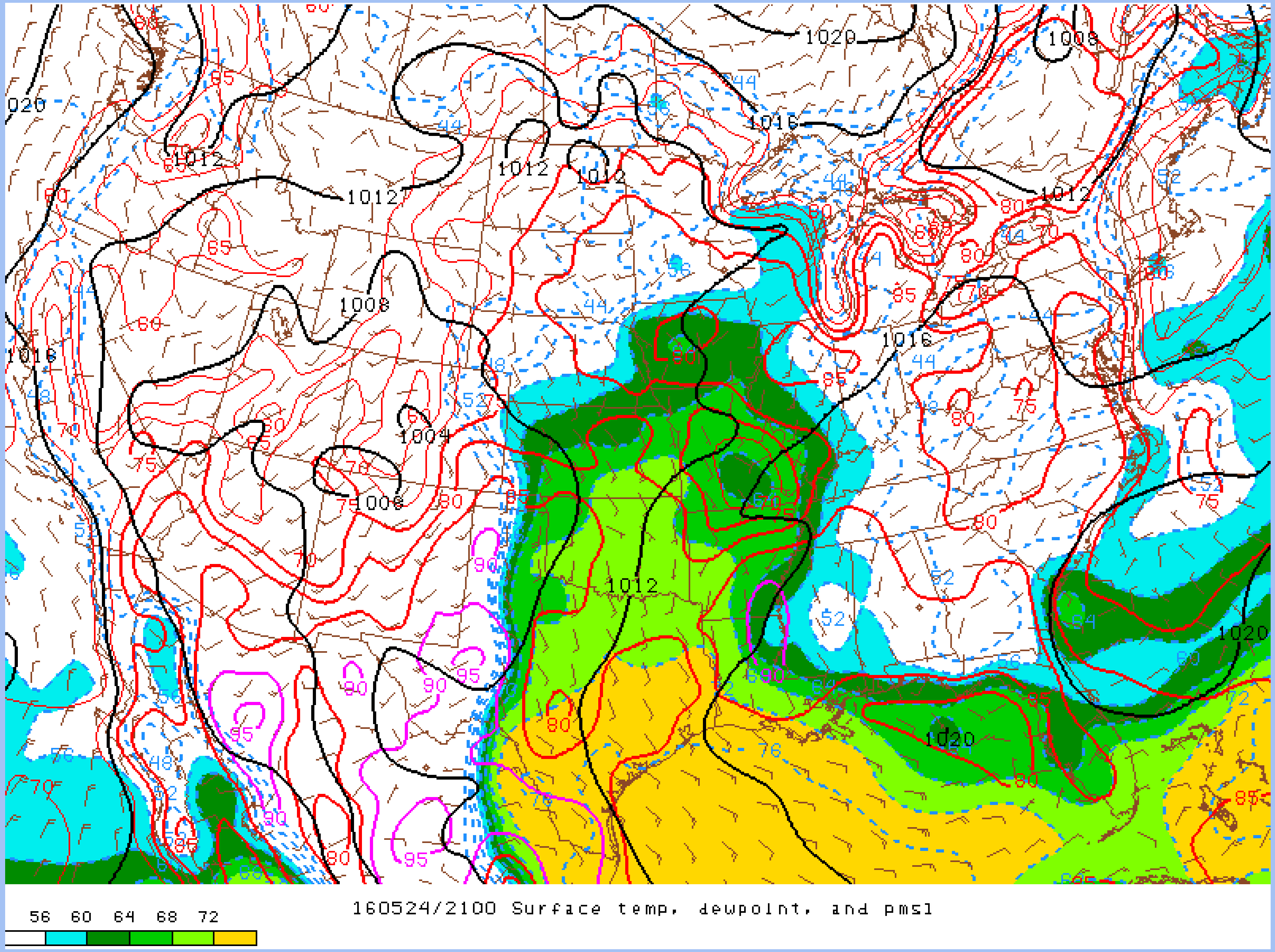


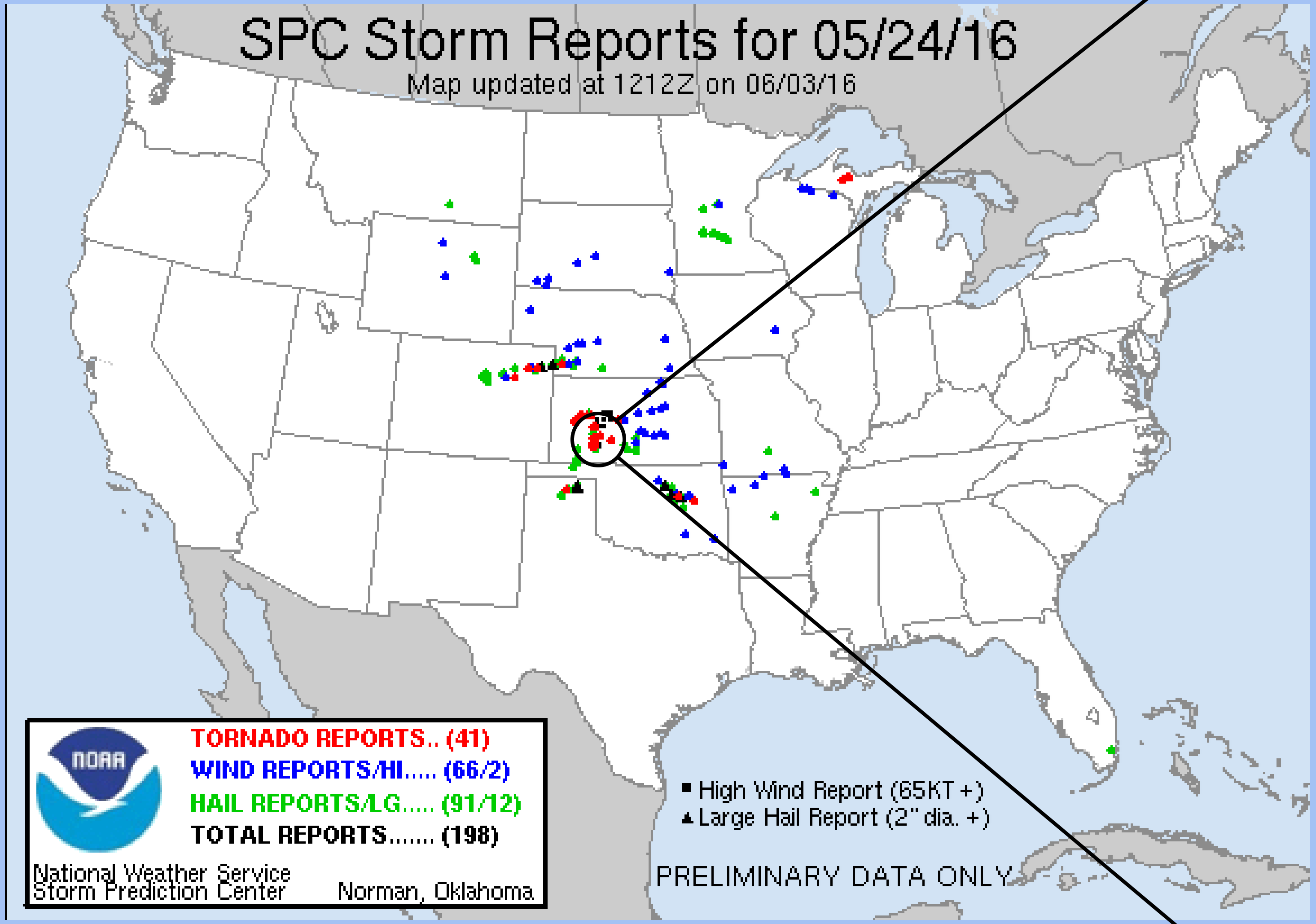
Let’s put it all together

- Quick and dirty maps can give you insight on small details mesoanalysis may miss.
- They don't have to be pretty, only functional!
- Think in 4D (XYZ <u>**&T**</u>). The atmosphere changes in space <u>**and Time**</u>! Composite charts are a great way to do this on the fly.
- Do multiple charts to see the progression of features(OFBs fronts ect…)

Compare/Contrast

- How did your chart compare to the objective analysis?
- What features did you capture (or miss)?
- Did you catch the “boundary of the day”???



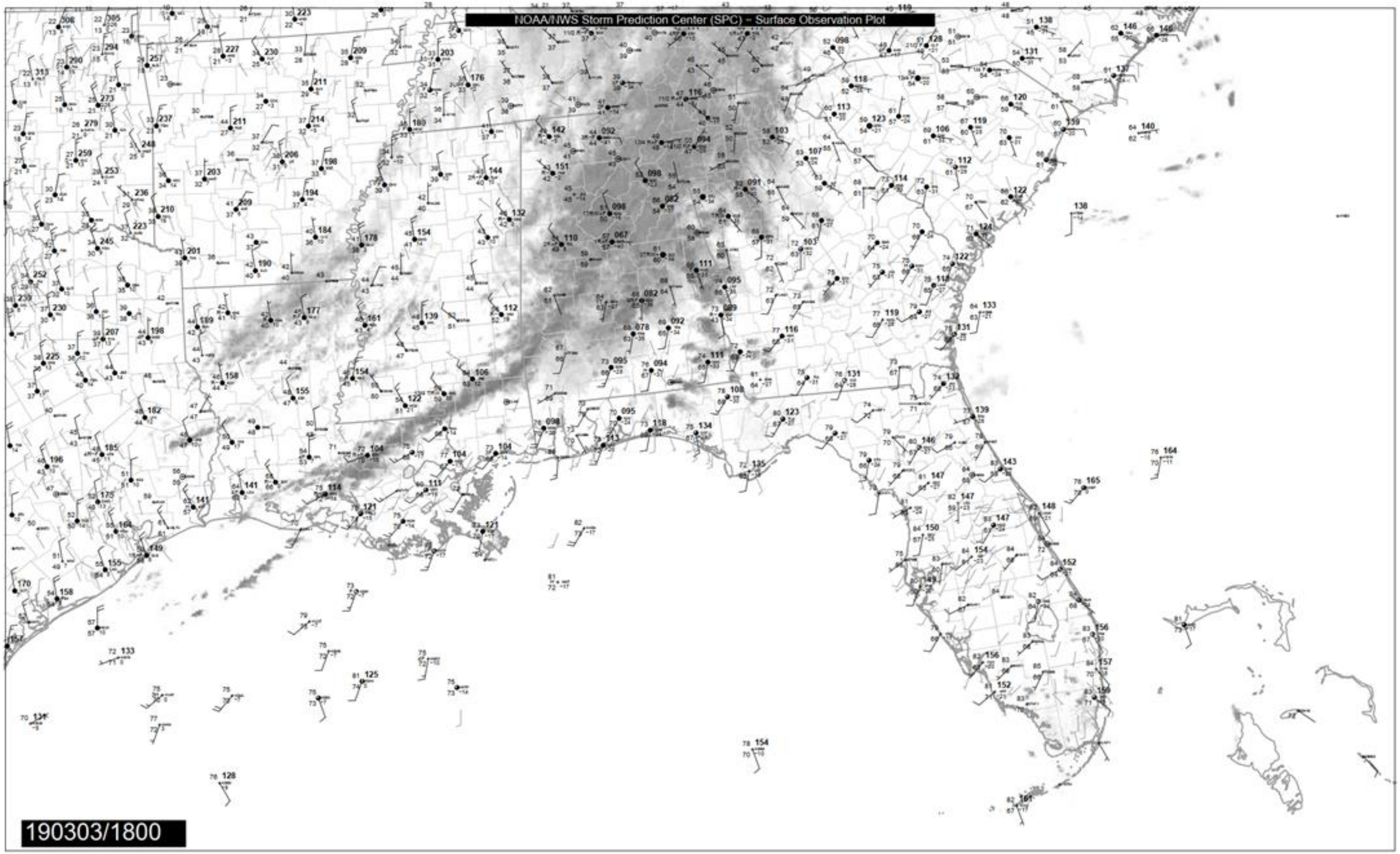

SPC Storm Reports for 05/24/16
Map updated at 1212Z on 06/03/16
TORNADO REPORTS.. (41)
WIND REPORTS/HI..... (66/2)
HAIL REPORTS/LG..... (91/12)
TOTAL REPORTS....... (198)
National Weather Service
Storm Prediction Center
Norman, Oklahoma
High Wind Report (65KT +)
Large Hail Report (2" dia. +)
PRELIMINARY DATA ONLY

Additional Analysis Types:

Streamline Analysis

Helps identify confluence axes where there may be subtle lift.

Start at a point and follow the observed wind vectors until your streamline intersects another streamline or leaves the analysis area.


NOAA/NWS Storm Prediction Center (SPC) – Surface Observation Plot
190303/1800

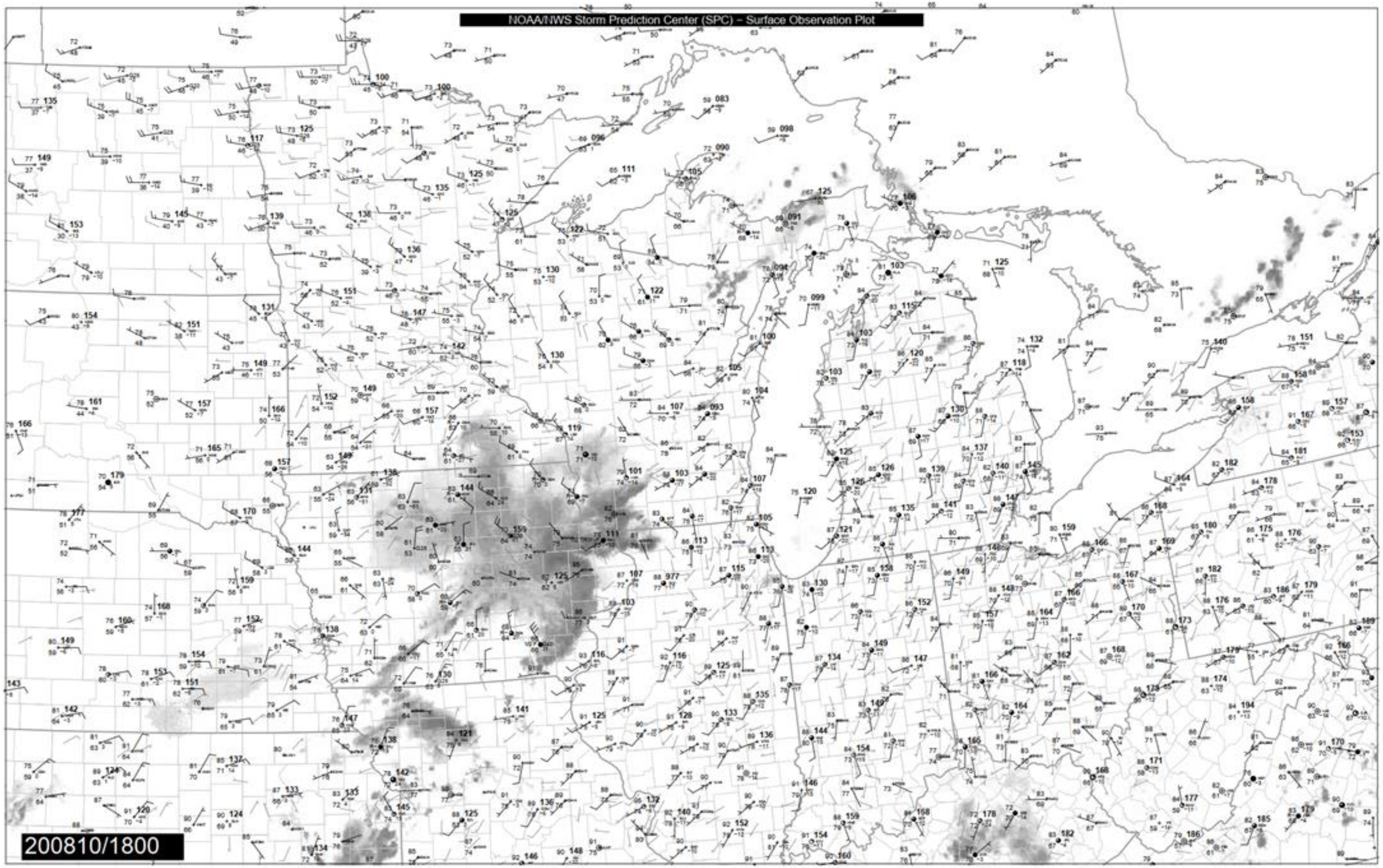
Additional Analysis Types:

Surface Pressure Tendency

Helps identify where lift is likely ongoing (think back to mass conservation).

This may be important for synoptic evolution and T-storm initiation.

Can also help identify pressure rise/fall couplets that can be associated with strong winds.


NOAA/NWS Storm Prediction Center (SPC) – Surface Observation Plot
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