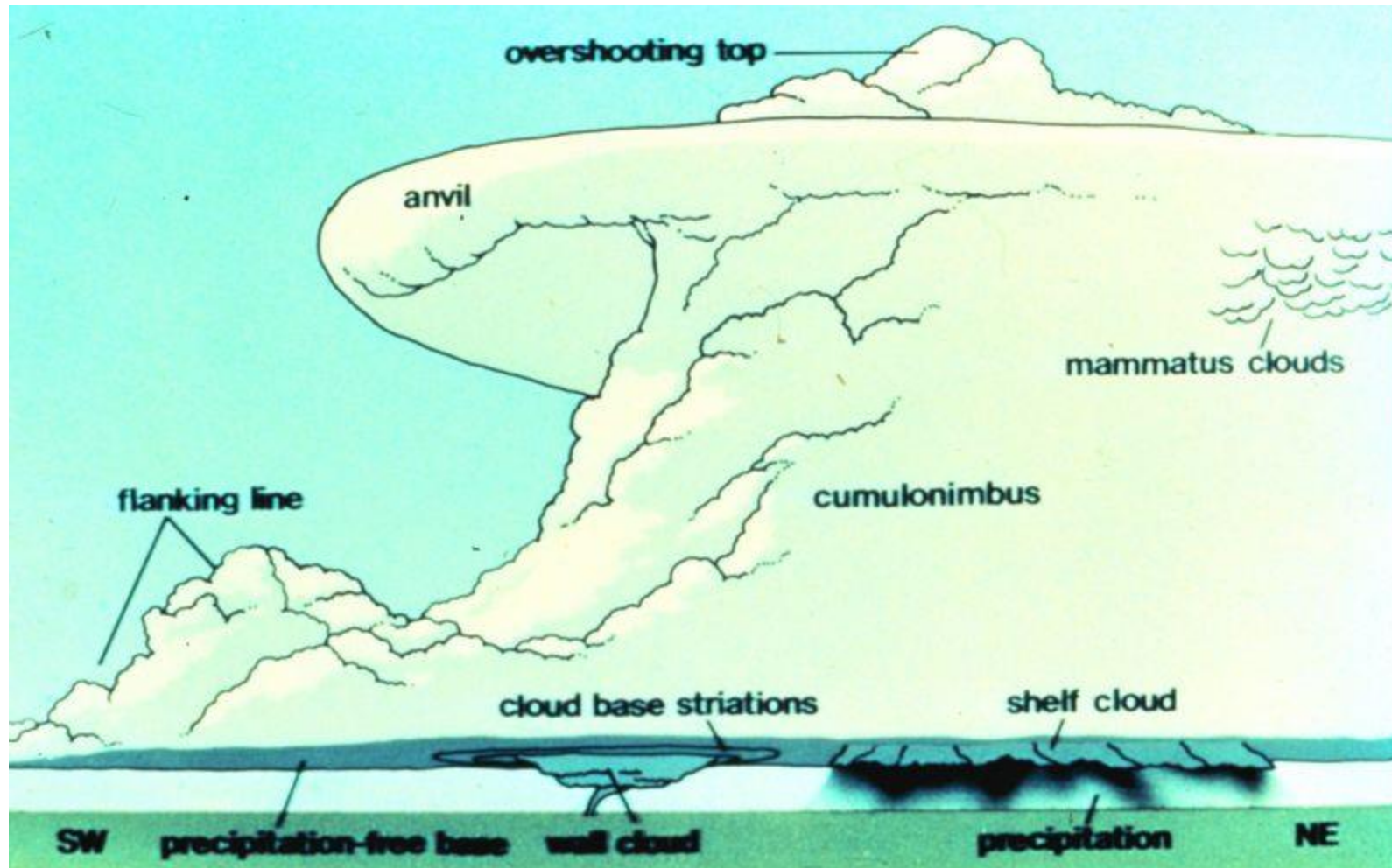


Tornado outbreak Dec 10, 2021

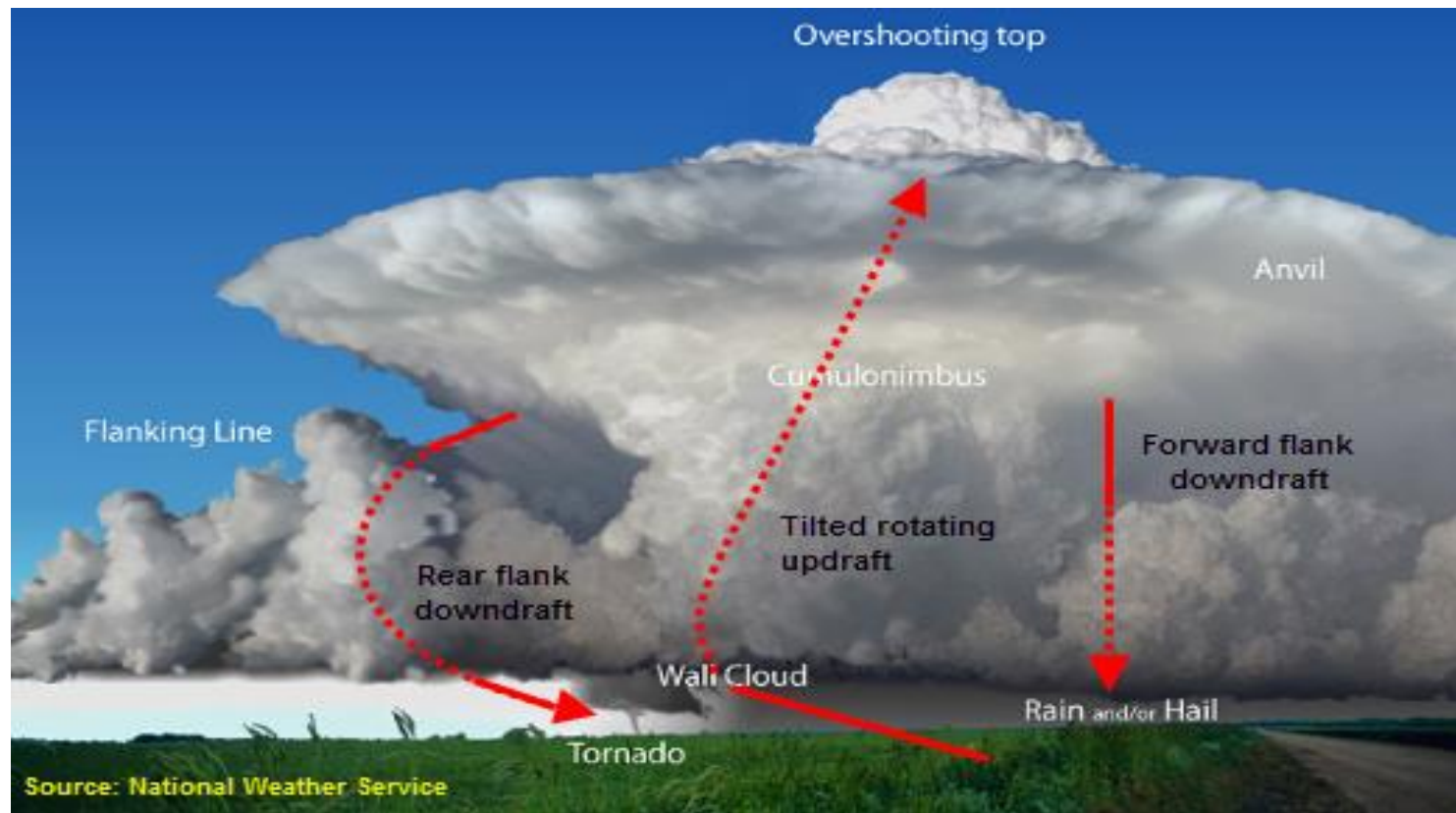
Jeffrey E. Passner

Basic Review of tornado structure

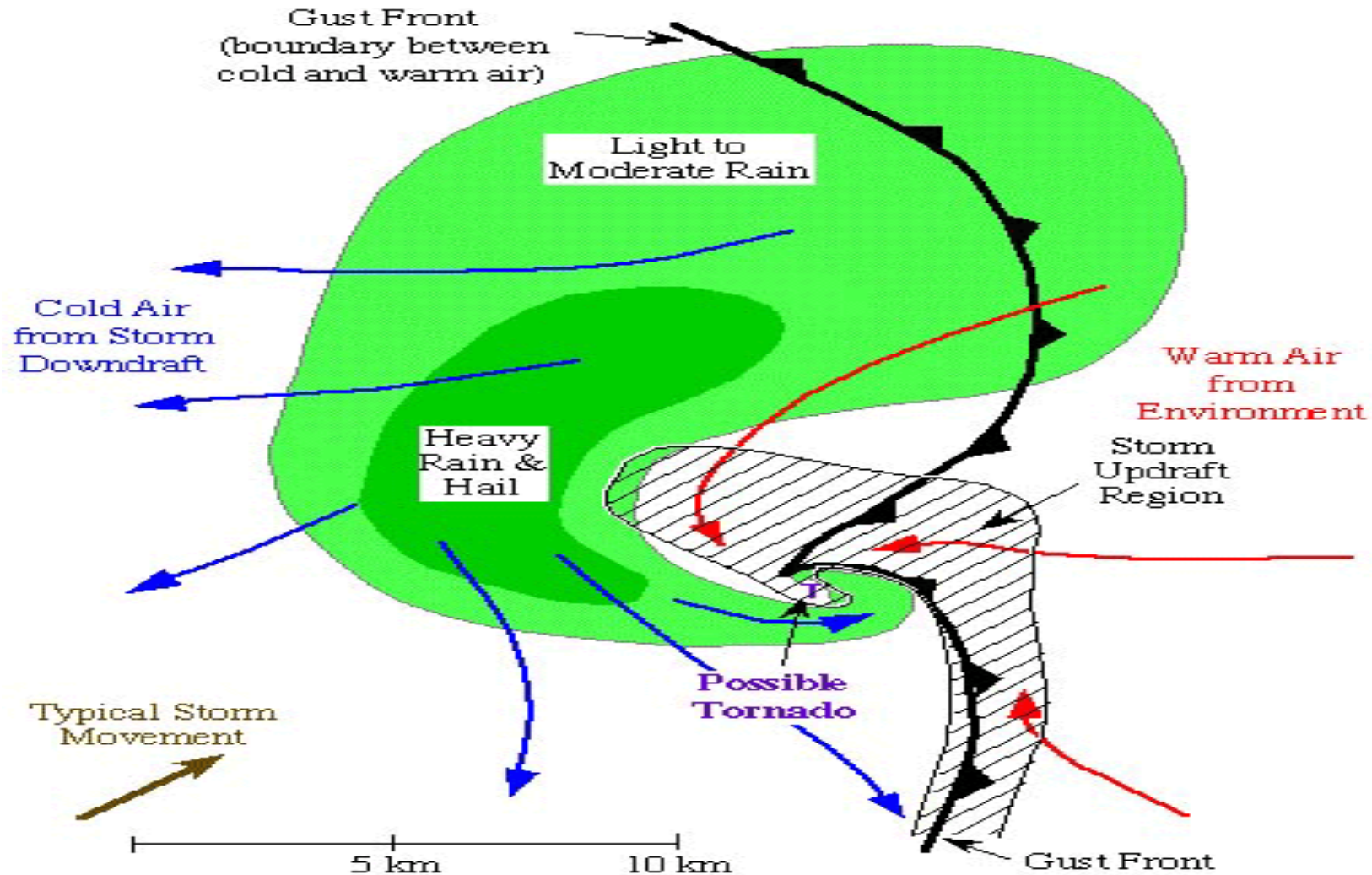
SUPERCELLS



What it looks like in real life



From above, classic tornado formation

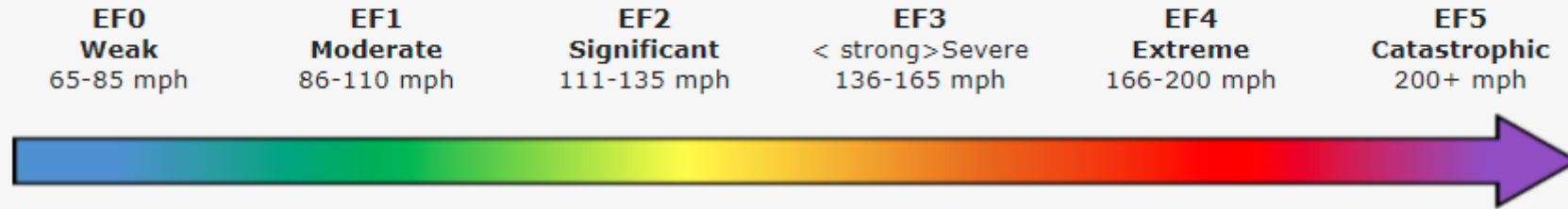


To form tornadoes -- A balance of these

- Lifting mechanism for thunderstorm formation
- Low-level moisture
- Warm surface temperatures (most of the time)
- Atmospheric instability
- Wind shear --- Directional shear and speed shear (increasing with height)

The EF scale

The Enhanced Fujita (EF) Scale classifies tornadoes into the following categories:



*Media use of NWS Web News Stories is encouraged!
Please acknowledge the NWS as the source of any news information accessed from this site.*



Large winter tornado outbreaks

Largest Winter Tornado Outbreaks in the United States (1950-2012)

Date(s)	Outbreak	Sequence	Deaths	Injuries	Strongest	Max Track (mi)
1/21-22/1999	129	131	9	162	4	39.0
2/5-6/2008	86	86	57	425	4	121.8
1/7-8/2008	56	56	4	35	3	50.4
1/1-3/1999	46	47	1	35	3	10.0
2/27-28/2011	45	45	1	7	3	23.3
12/23-25/1982	43	43	3	82	4	63.0
1/9-10/1975	41	41	11	331	4	56.0
12/14-15/1971	40	40	2	119	3	48.0
12/30/2010-1/1/2011	37	37	9	32	3	26.2
12/2-3/1982	34	41	4	99	3	34.0

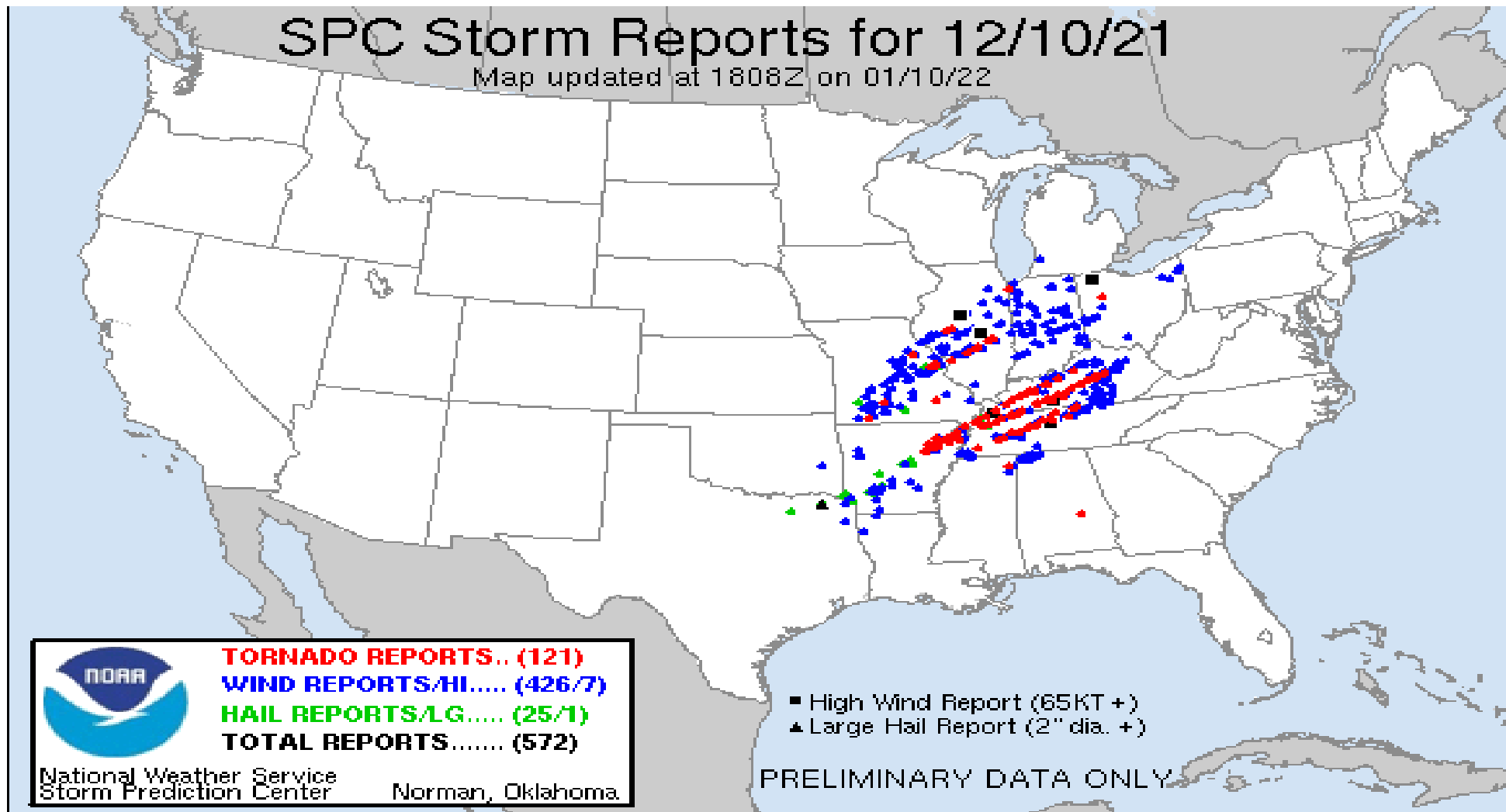
Jan 21-22, 1999 Arkansas and other states
(129 tornadoes). Strongest F4

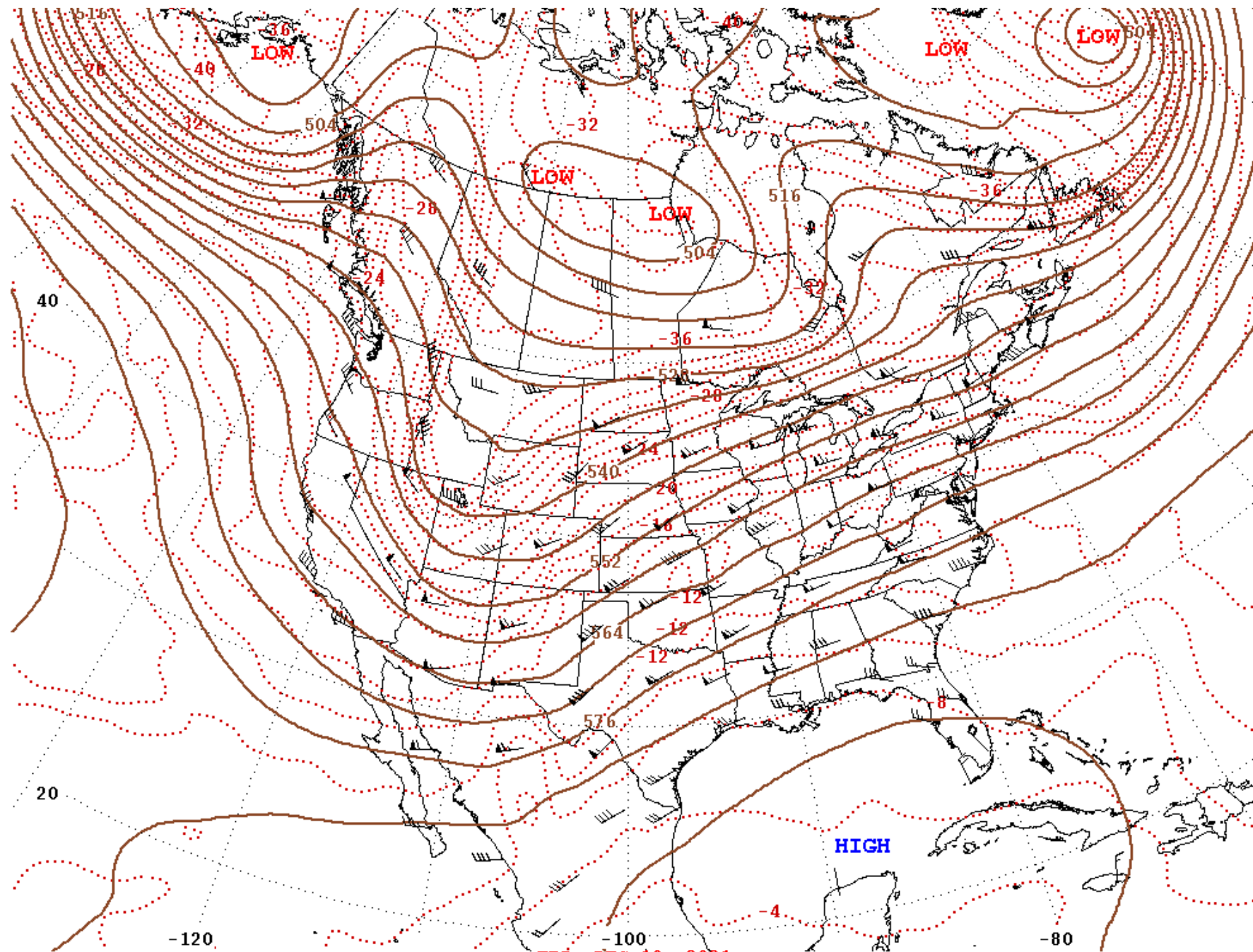


Feb 5-6, 2008 Southern USA --- 86 tornadoes, 57 fatalities, 425 injuries, Strongest EF4.



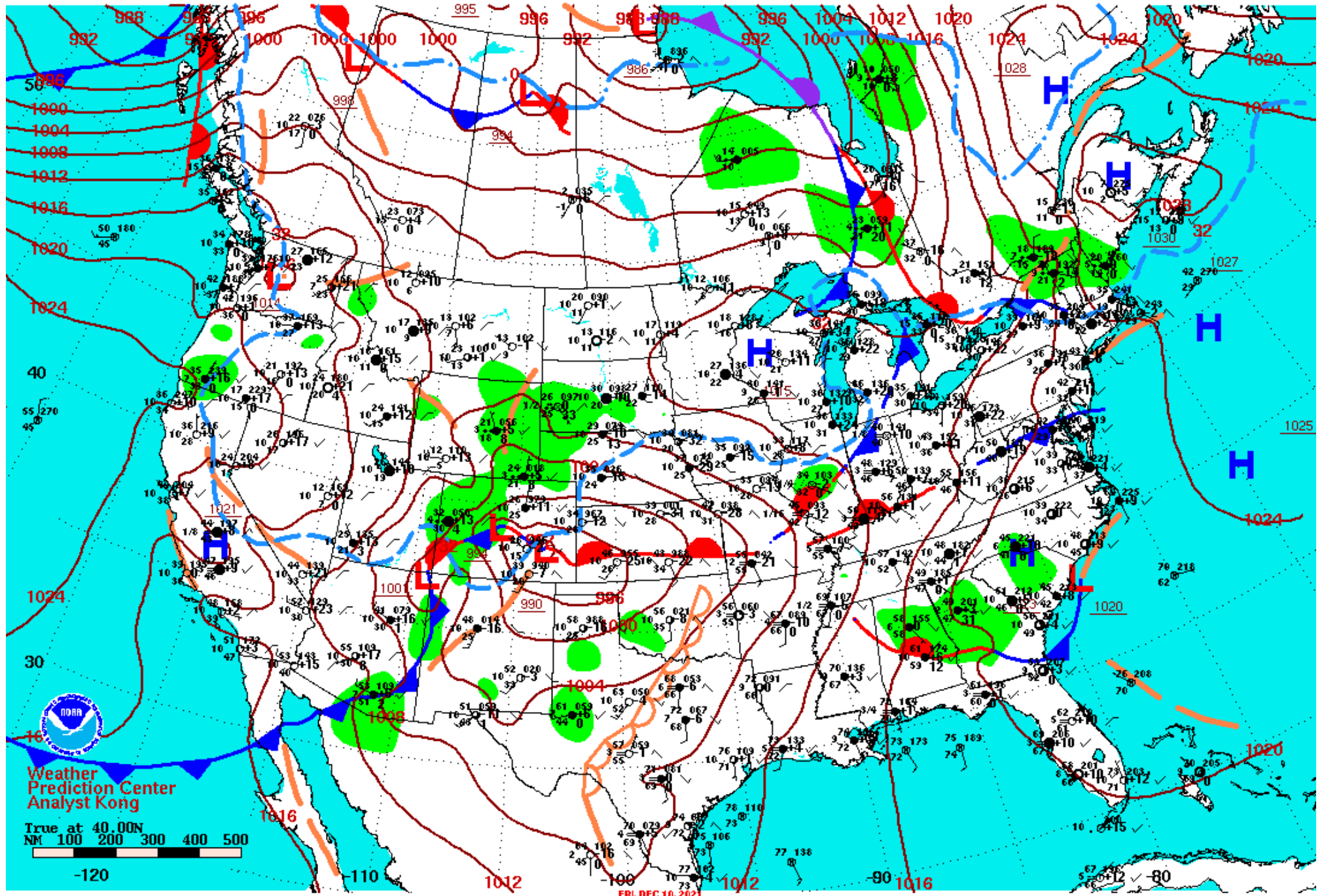
December 10, 2021 – 88 fatalities 634+ injuries



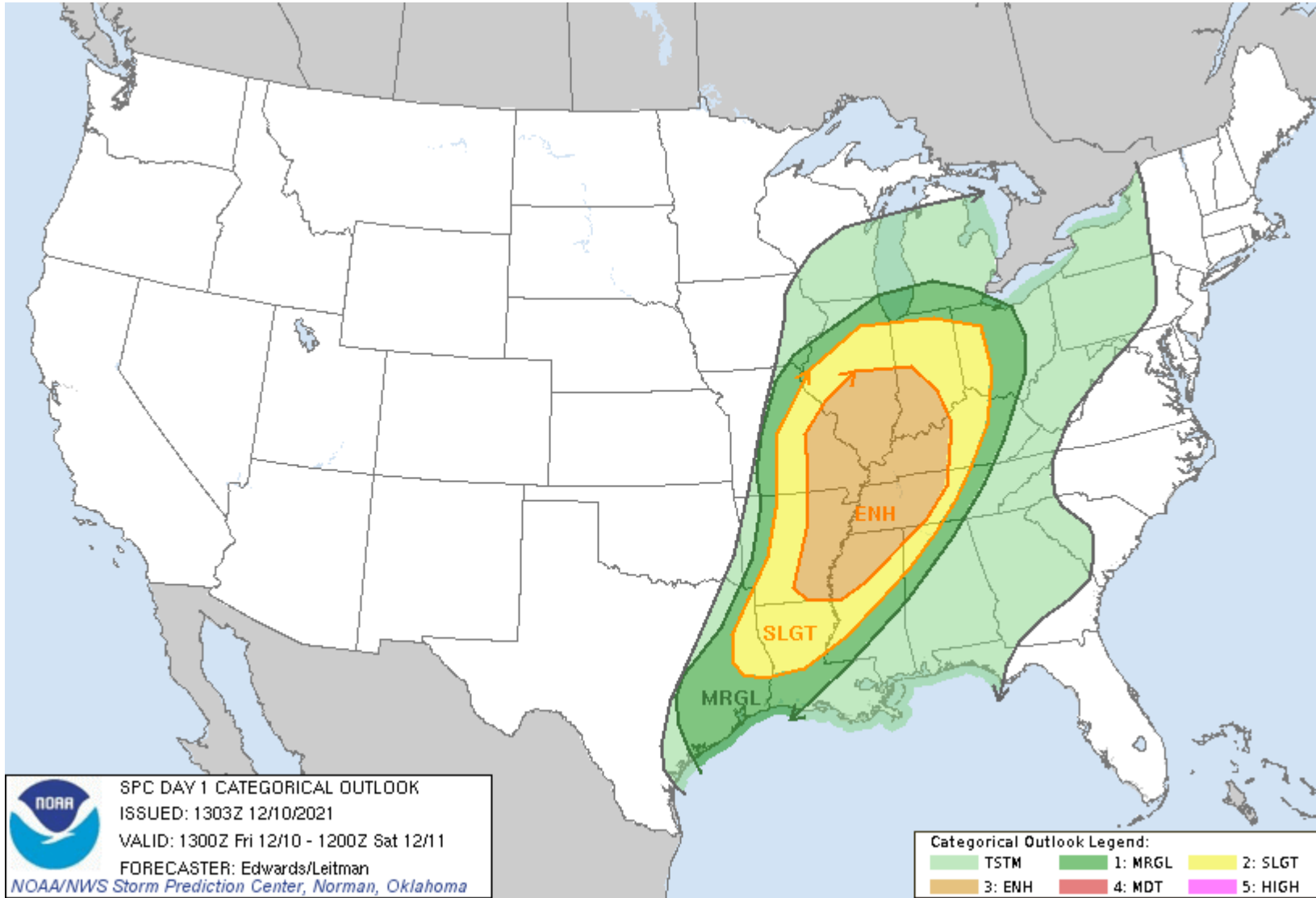


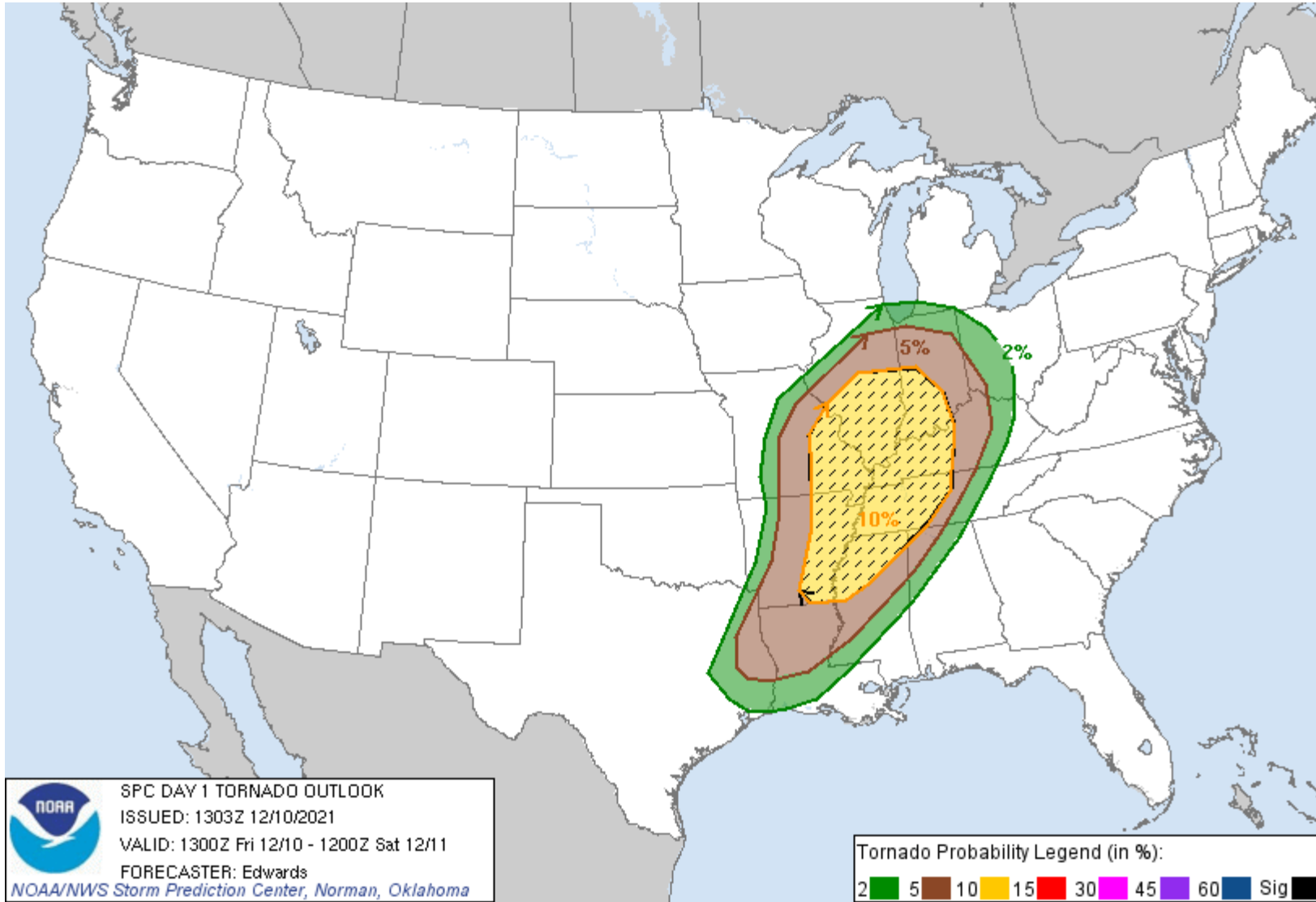
FRI, DEC 10, 2021

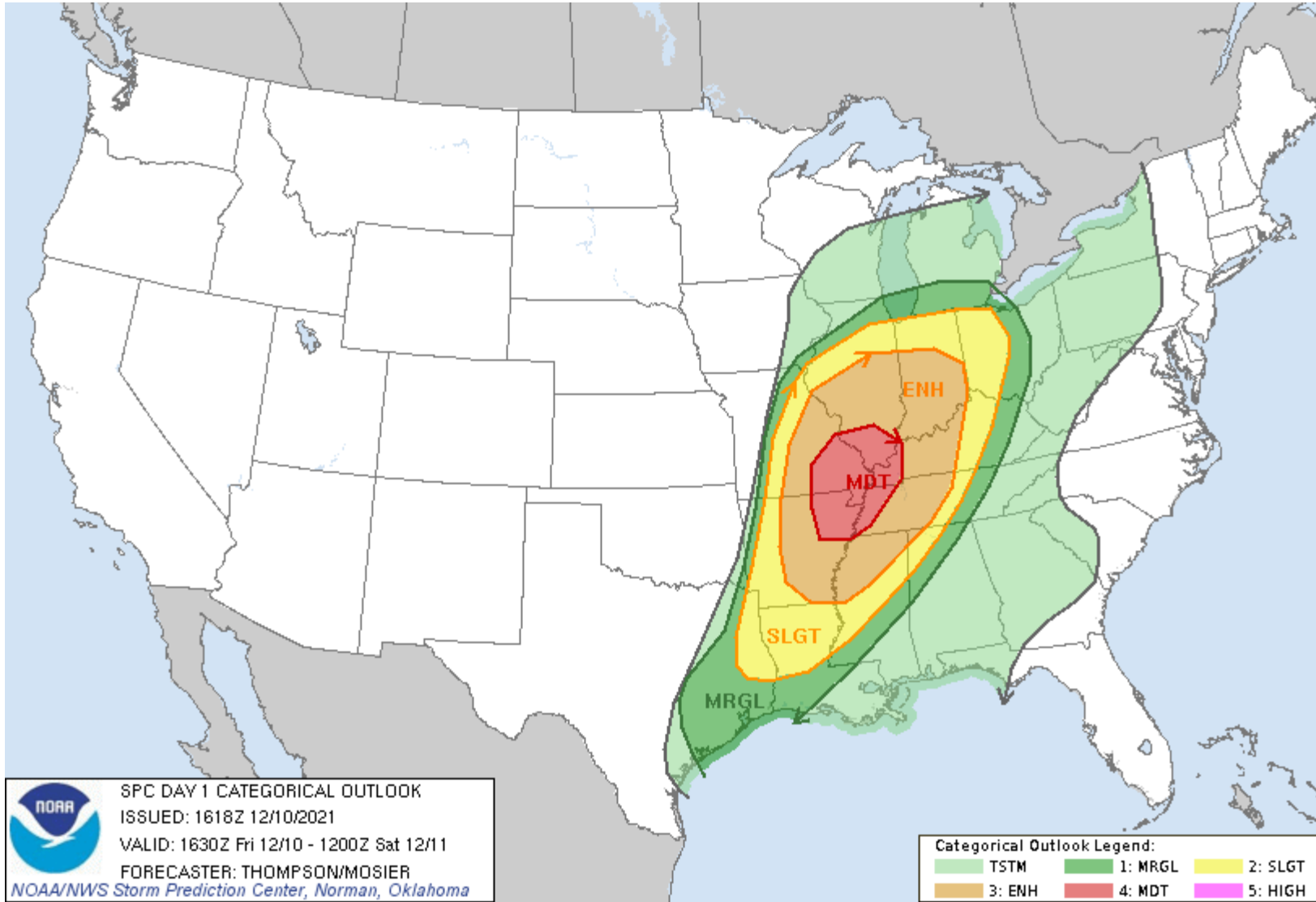
500-Millibar Height Contours at 7:00 A.M. E.S.T.



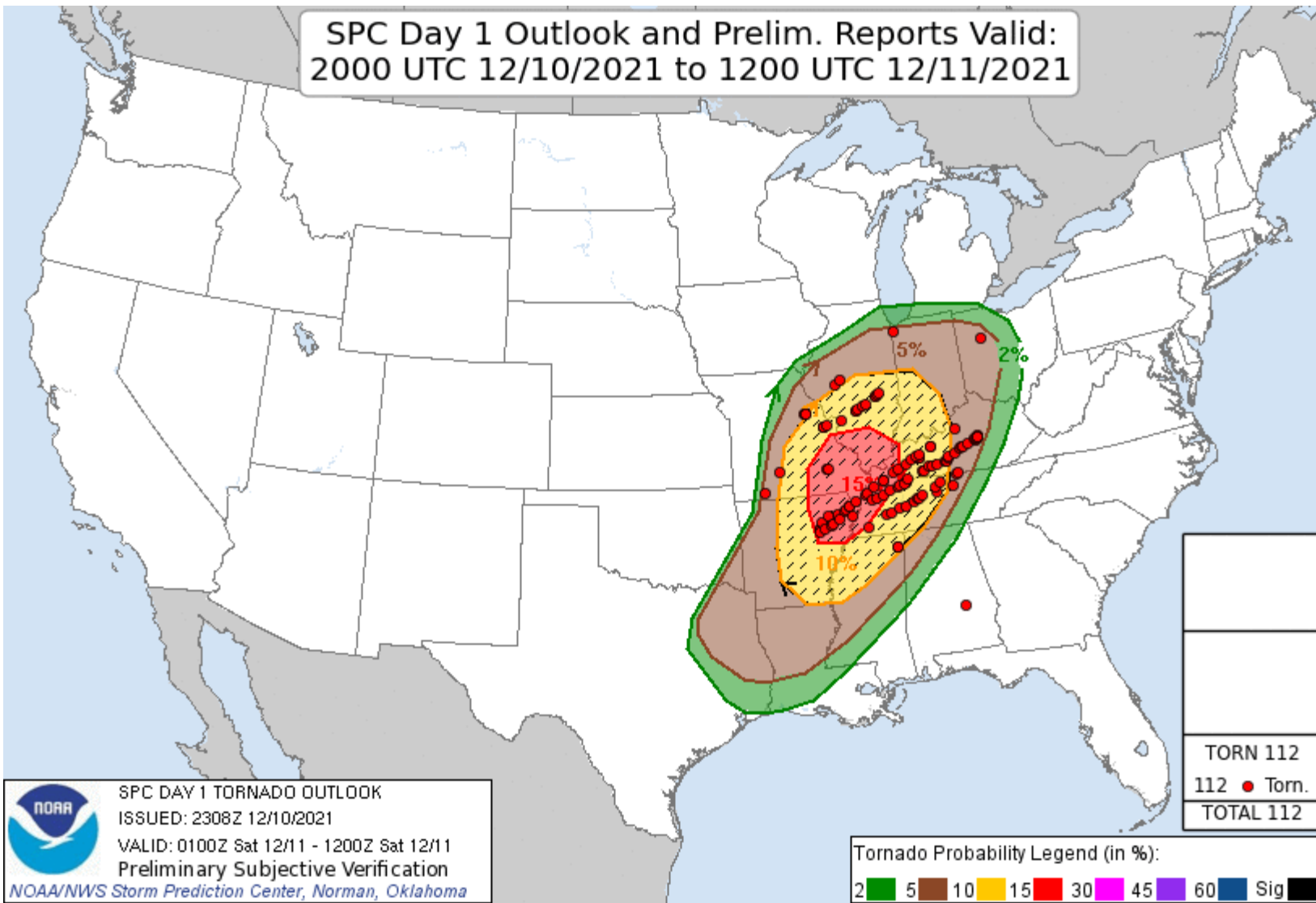
Surface Weather Map and Station Weather at 7:00 A.M. EST








SPC Day 1 Outlook and Prelim. Reports Valid:
2000 UTC 12/10/2021 to 1200 UTC 12/11/2021

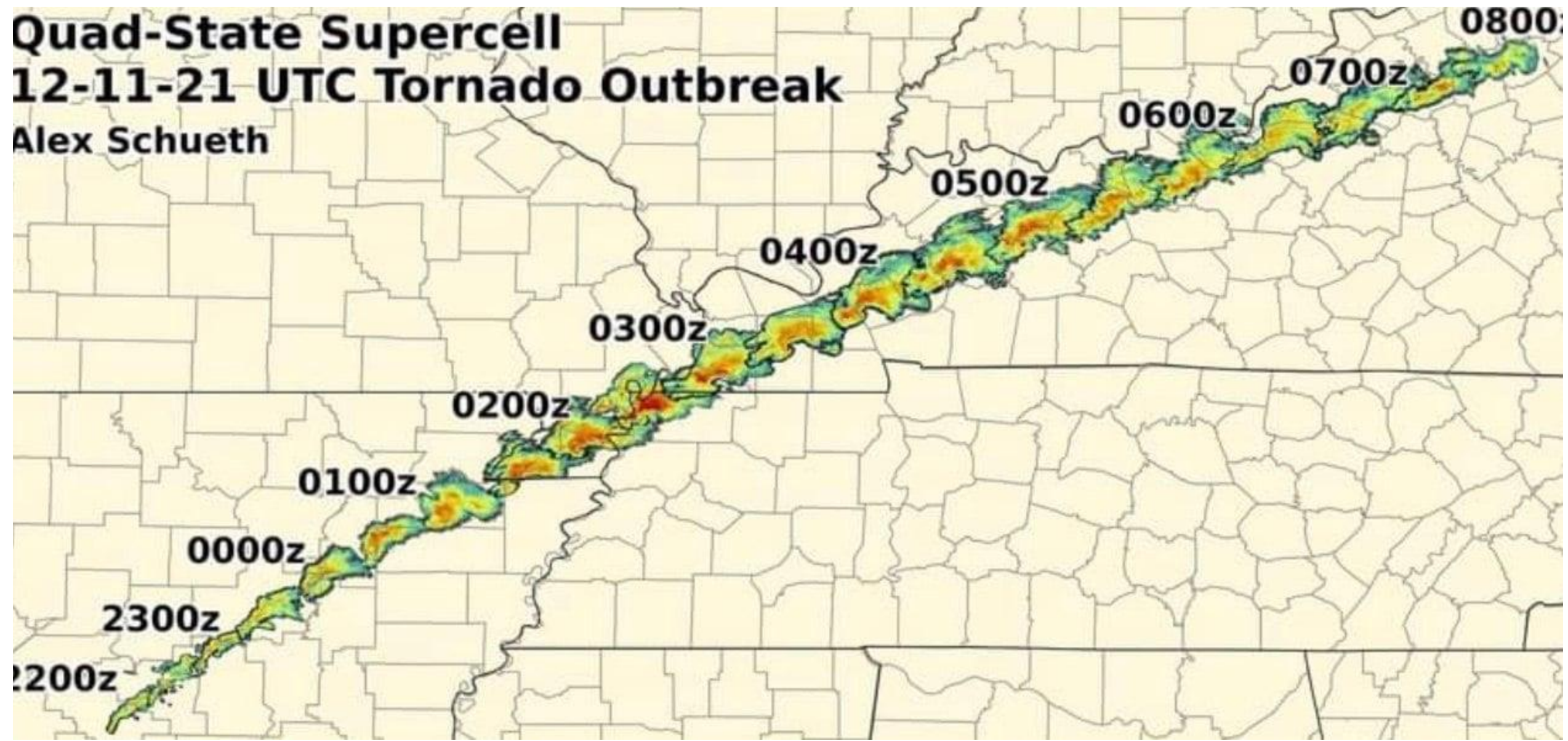


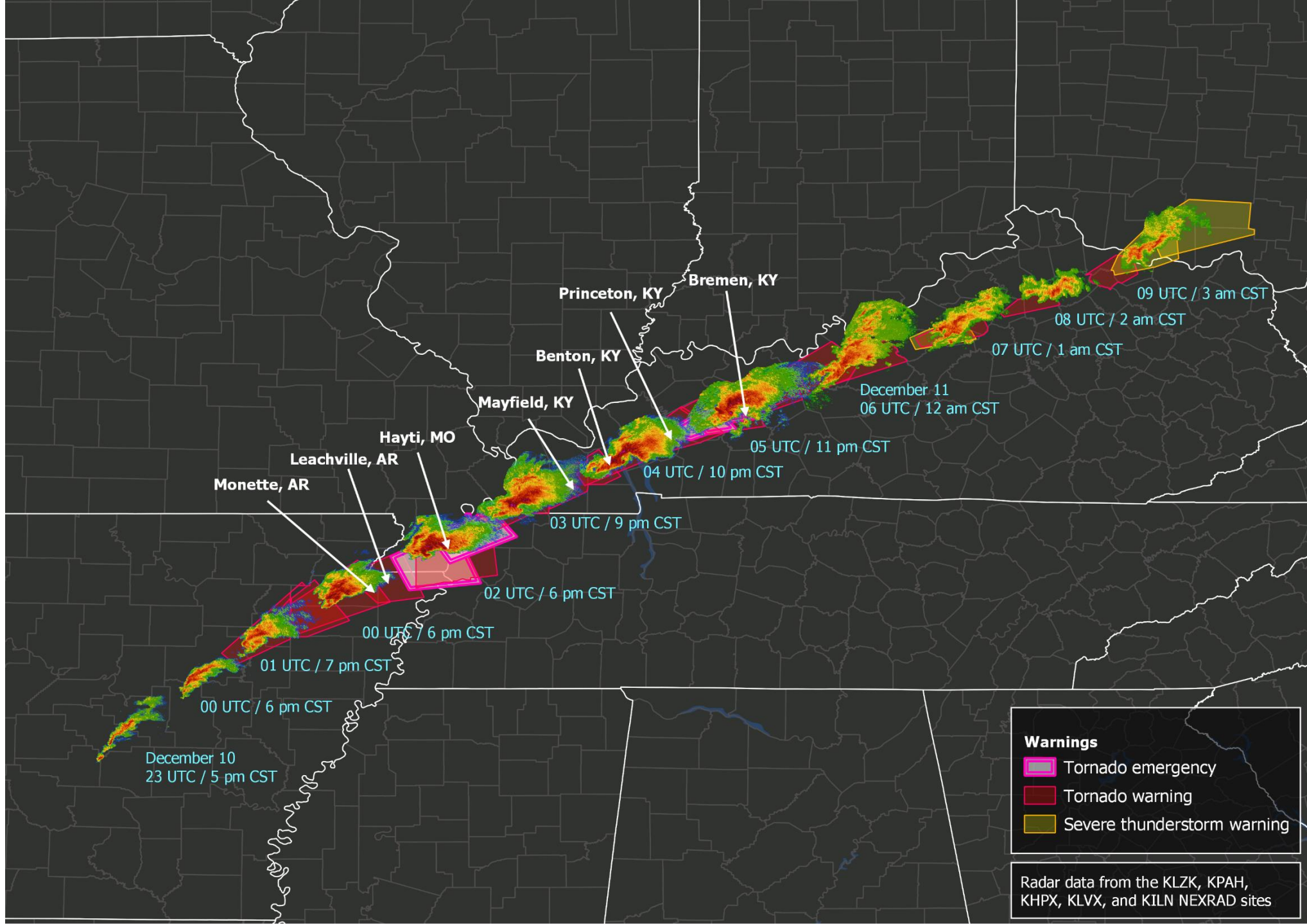
 SPC DAY 1 TORNADO OUTLOOK
ISSUED: 2308Z 12/10/2021
VALID: 0100Z Sat 12/11 - 1200Z Sat 12/11
Preliminary Subjective Verification
NOAA/NWS Storm Prediction Center, Norman, Oklahoma

Mayfield and the Kentucky tornado

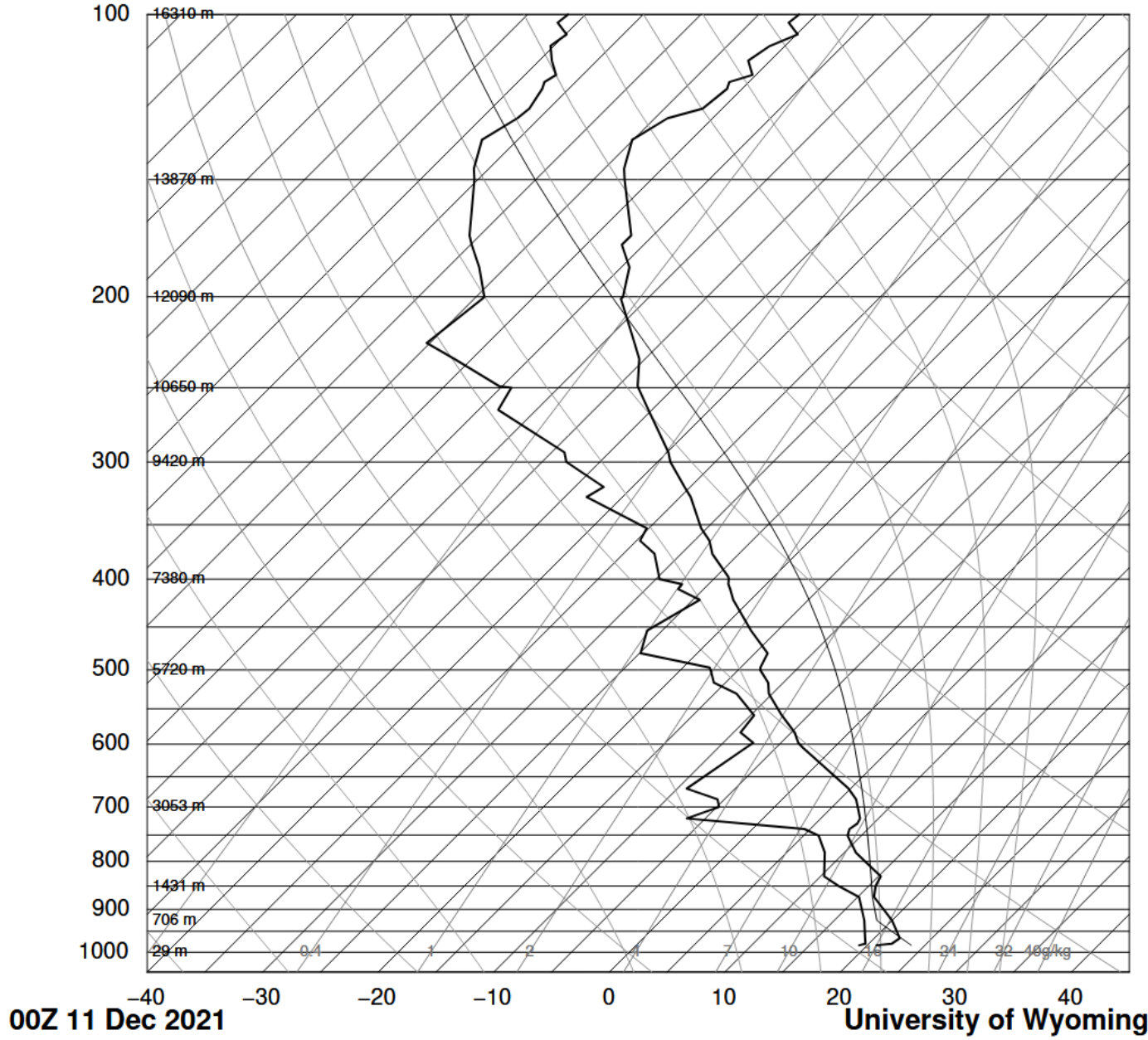
Quad-State Supercell 12-11-21 UTC Tornado Outbreak

Alex Schueth





72340 LZK Little Rock



SLAT	34.84
SLOn	-92.26
SELV	173.0
SHOW	-3.88
LIFT	-6.50
LFTV	-6.95
SWET	480.1
KINX	29.10
CTOT	25.50
VTOT	28.70
TOTL	54.20
CAPE	1619.
CAPV	1751.
CINS	-24.4
CINV	-13.1
EQLV	210.4
EQTV	210.1
LFCV	809.9
LFCV	873.8
BRCH	8.98
BRCV	9.71
LCLT	291.3
LCLP	919.0
LCLC	340.6
MLTH	298.4
MLMR	14.49
THCK	5691.
PWAT	38.24

Weather Conditions

Temperature: 73 °F
Dew Point: 66 °F
Humidity: 78 %
Wind: S at 17 MPH

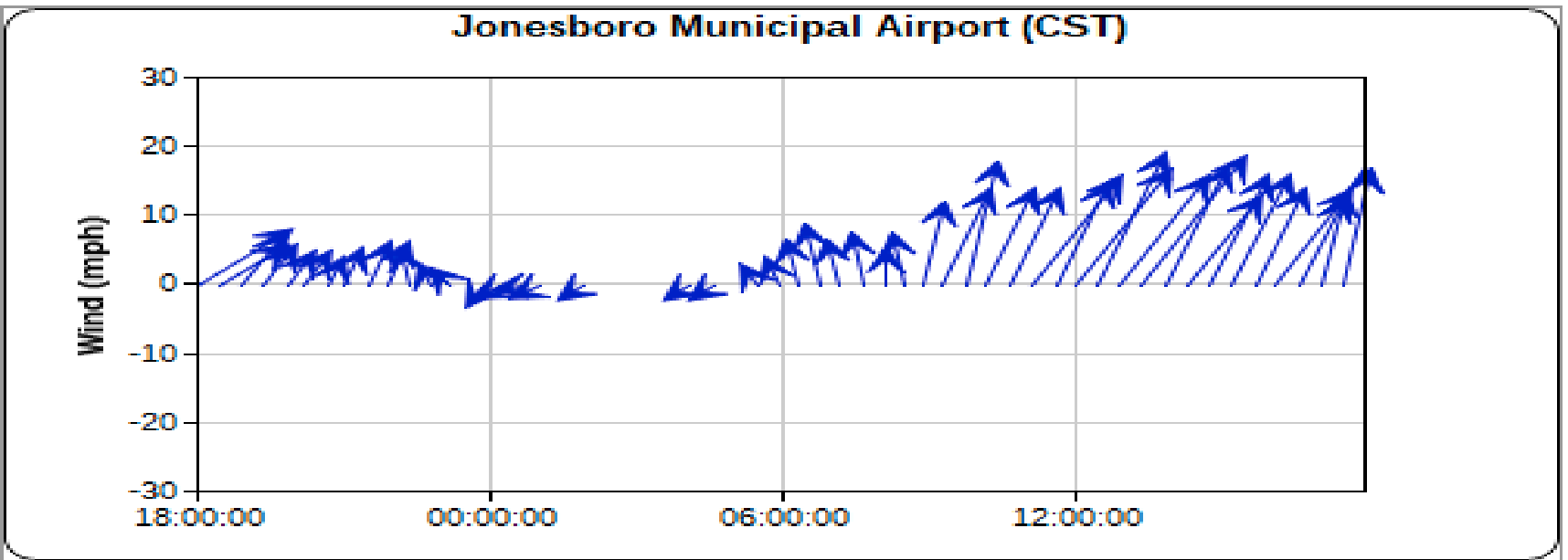
24 Hour Max/Min Events

Max Temperature: 75 °F
Min Temperature: 57 °F
Max RH: 100 %
Min RH: 69.21 %
Max Dew Point: 70 °F
Min Dew Point: 55 °F
Max Gust: 29 MPH

View :

-
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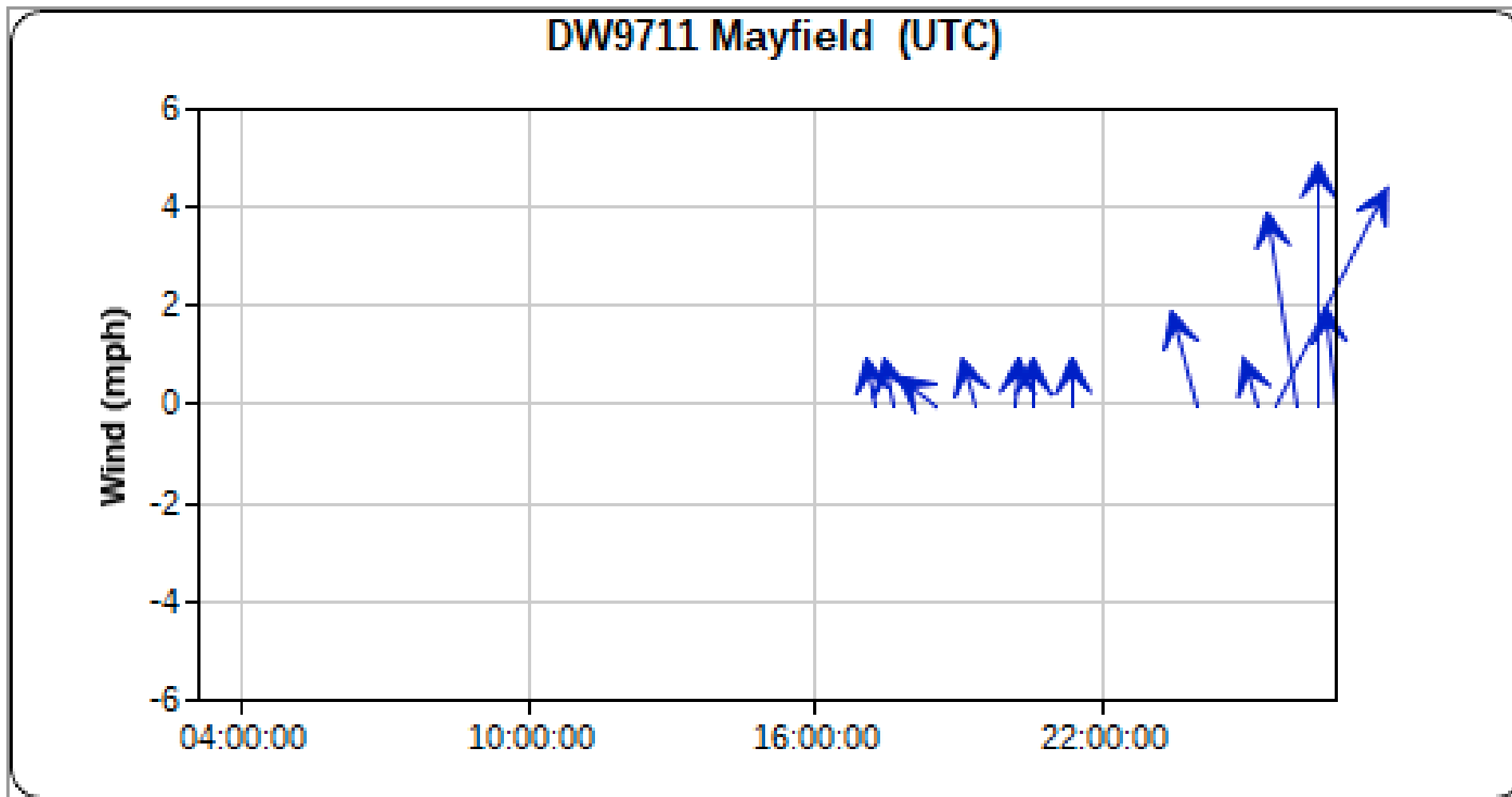
[Help](#)



[Change to UTC Time](#)

[Additional Tabular and Graphical Displays](#)

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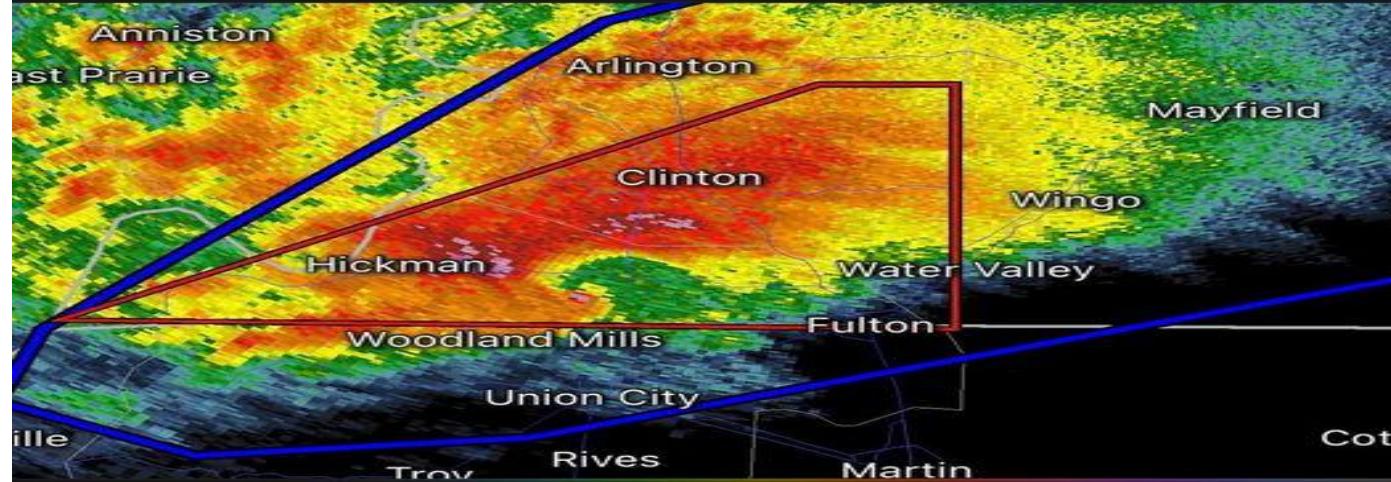
[Download Data](#)

9:00 ↗



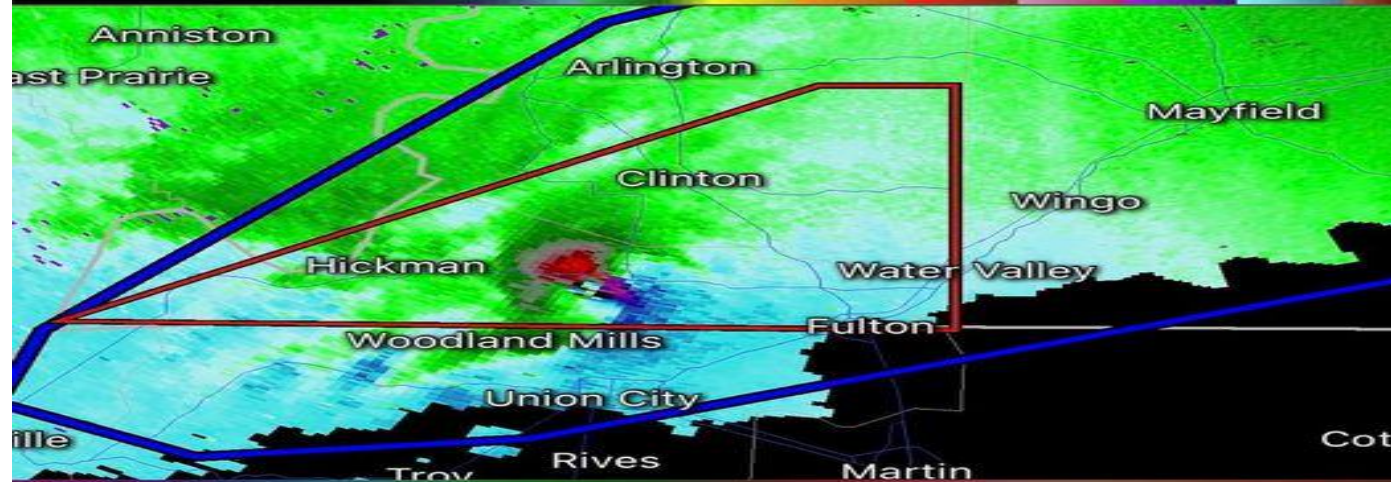
KPAH Paducah
VCP 212: Precipitation Mode

28



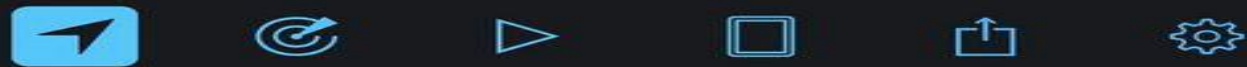
Super-Res Reflectivity Tilt 1
Elevation = 0.5°

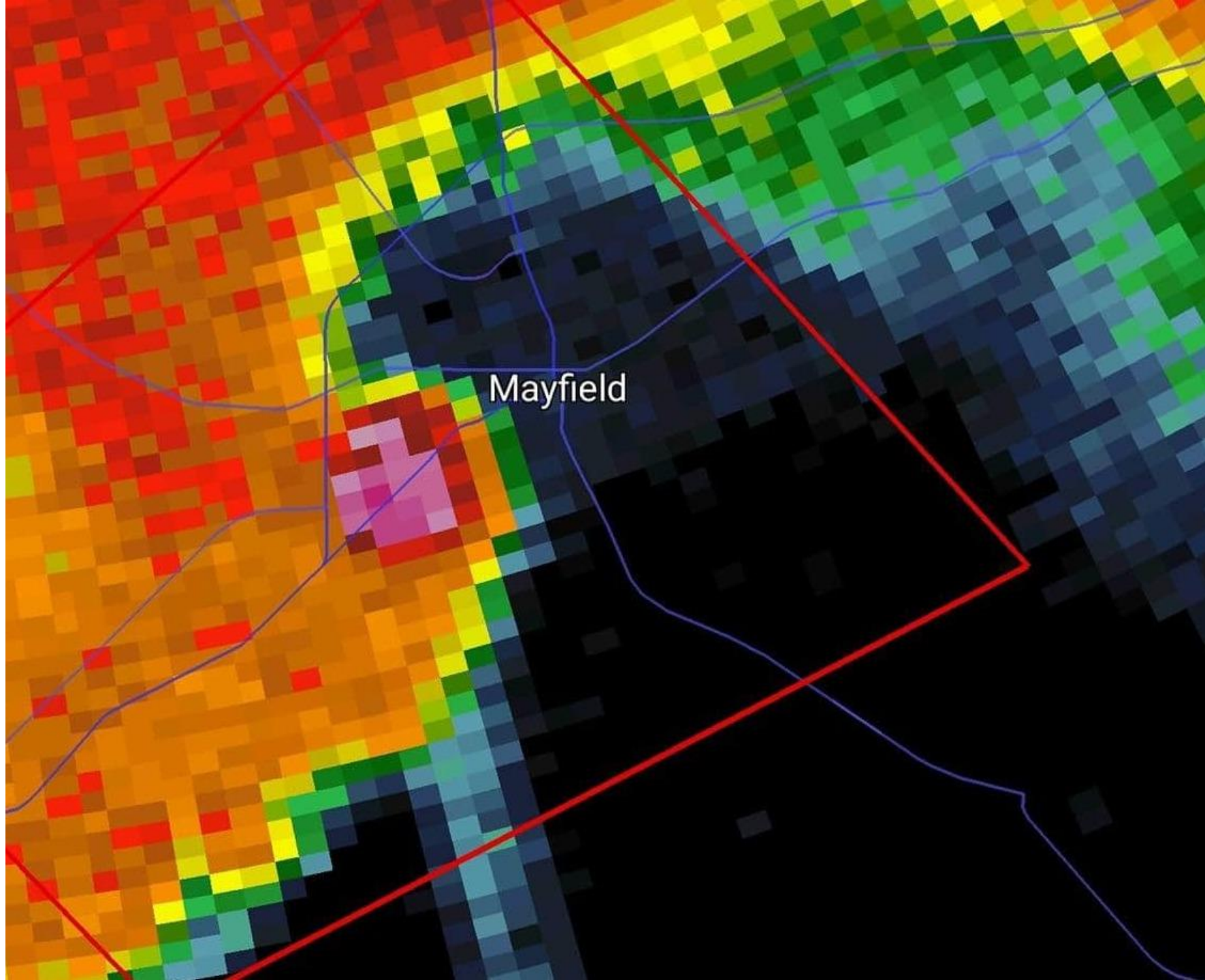
8:59 PM
Updated: 9:00 PM



Super-Res Velocity Tilt 1
Elevation = 0.5°

8:59 PM
Updated: 9:00 PM





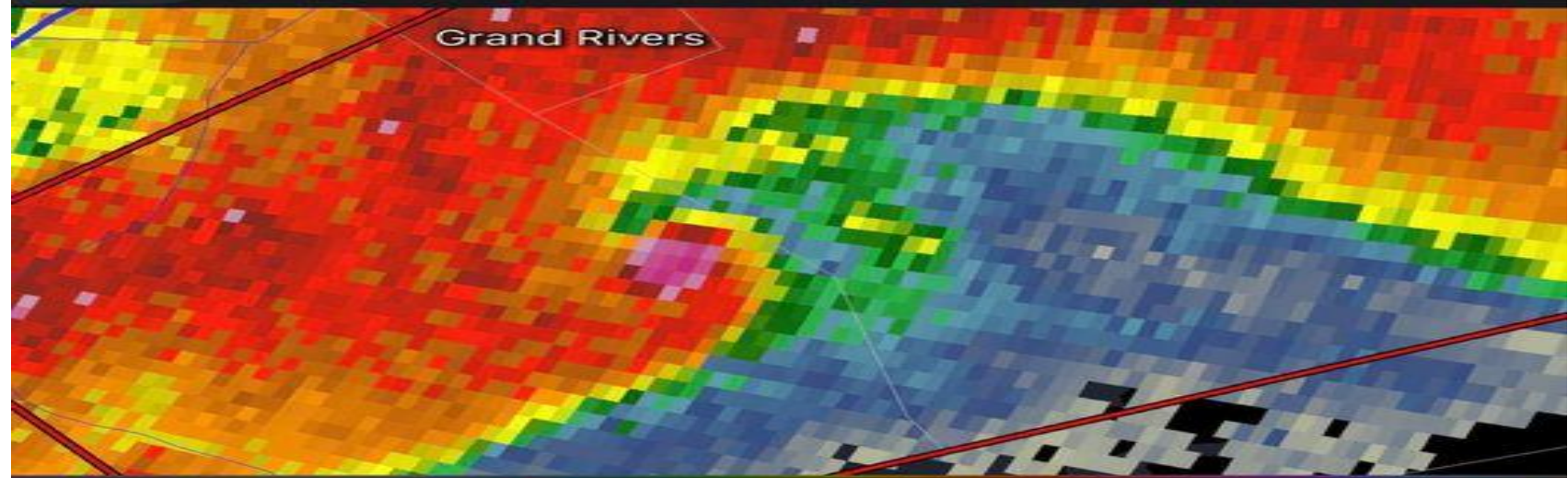
Mayfield



KPAH Paducah

VCP 212: Precipitation Mode

24



Super-Res Reflectivity Tilt 1
Elevation = 0.5°

9:58 PM
Updated: 10:00 PM



Super-Res Velocity Tilt 1
Elevation = 0.5°

9:56 PM
Updated: 10:00 PM



Near Mayfield, Kentucky
(photographer unknown)



Near Mayfield, Kentucky (photographer unknown) Yikes!!!





Tim Marshall ,
Dawson,
Springs, KY
12/13/21



Dawson Springs, KY
12/13/21 by Tim Marshall



Tim Marshall at
Candle Factory,
12/12/21, Mayfield,
KY



Dawson Springs, KY
Dec 15, 2021 photo by
Tim Marshall



Photo by Tim Marshall. Mayfield, KY Dec 15, 2021



Photo by Tim Marshall Dec 15, 2021 Mayfield, KY



Photo unknown,
probably Mayfield,
KY Dec 11, 2021



Preliminary Damage Rating: EF4

Preliminary Tornado Rating: EF4
Estimated Peak Winds: 190 mph
Path Length (for the NWS Paducah forecast area): 128 miles
Maximum Path Width: A mile or more.
Fatalities/Injuries: Total Unknown

Start Time: Dec. 10, 2021 8:56 pm CST, 5.5 mi. SW of Cayce, KY
End Time: Dec. 10, 2021 11:10 pm CST, 7.5 mi. NE of Bremen, KY



The EF scale and deaths

- The strength of the tornado often relates to the number who die and are injured.
- Strong tornadoes usually move fast, 50 mph. Even with great warnings and modern radar people don't react.
- Rural western Kentucky has poorly constructed houses.
- The workers at the Mayfield, KY candle factory were told if "you leave you lose your jobs."
- This was rated an EF4 tornado because the damage was partly a result of poor construction. The NWS had no other choice.
- Last EF5 in the USA was May20,2013 in Moore, Oklahoma.

The media and the “experts”

Center for Disaster Philanthropy

Unseasonably warm and humid weather created the perfect weather conditions for catastrophic thunderstorms. Climate change has moved the location of tornado alley and is likely to have impacted the strength of the late-in-the-year storm.

Nighttime tornadoes are twice as deadly as daytime tornadoes because of people sleeping through warnings; the twisters are also more difficult to see.

Final update – Jan. 13, 2022

Meteorologist Michael Mann of Penn State told USA Today: "The latest science indicates that we can expect more of these huge (tornado) outbreaks because of human-caused climate change."

Meteorologists believe that the warm, spring-like temperatures may have helped create the warm, moist conditions which form thunderstorms - leading to tornadoes.

John Allen, Associate Professor of Meteorology, Central Michigan University says in an essay for The Conversation: “Projections suggest that stronger, tornado-producing storms may be more likely as global temperatures rise, though strengthened less than we might expect from the increase in available energy.

“In a recent study, colleagues and I found that the rate of increase in severe storm environments will be greater in the Northern Hemisphere and that it increases more at higher latitudes.

Allen says he believes that warming temperatures will lead to more environments that are favourable for the formation of tornadoes.

Ryan Van Velzer – WFPL reporter Louisville, KY

Kentucky doesn't typically see severe thunderstorms in December. Last Friday's weather pattern was driven by warm moist air from the Gulf of Mexico meeting cold air from the north and high wind speeds in the upper atmosphere.

The Gulf of Mexico is near-record hot right now, said Michael Mann, professor of atmospheric science at Penn State University and author of "The New Climate War." Those warmer temperatures increase evaporation, which adds more moisture to the atmosphere, which fuels thunderstorms.

The United States is experiencing a warmer than typical winter with the National Oceanic and Atmospheric Administration recording more than 5,000 record high temperatures over the last 30 days.

Jeff says:

- The discussions above are focused on ONE variable, surface temperatures (and a little humidity). The atmosphere is way more complex than surface temperatures.
- If climate change is increasing temperatures, then logically there must be some warming aloft. Climate change is just a surface-based condition?????
- In some ways warming surface temperatures would actually lead to a decrease in intense tornadoes because warmer surface temperatures alone raise the bases of the storm, forcing a greater distance to stretch low-level vorticity. Warming over NM and northern Mexico actually provides a stronger elevated warm layer or cap, decreasing convection in west Texas and Oklahoma and the western Plains.
- Rich Thompson of the SPC displayed a recent study from 2012-2020 that showed an increase in tornadoes related to linear systems (squall lines) and a decrease in isolated supercell tornadoes.
- Rich Thompson's study may be important and he notes that there has been a decrease in four-corner upper-air lows in recent years. This explains why there has been a decrease in tornadoes/severe weather in Oklahoma and Texas.
- Rich Thompson mentioned he did not know the reason for this decrease in upper-air lows but mentioned La Nina and El Nino but this has not been studied.
- Jeff reminds everyone that increasing surface temperatures means NOTHING if there's no speed and directional shear, moisture, and instability. Surface temperatures are only a tiny part of the balance that is needed to generate a tornado.

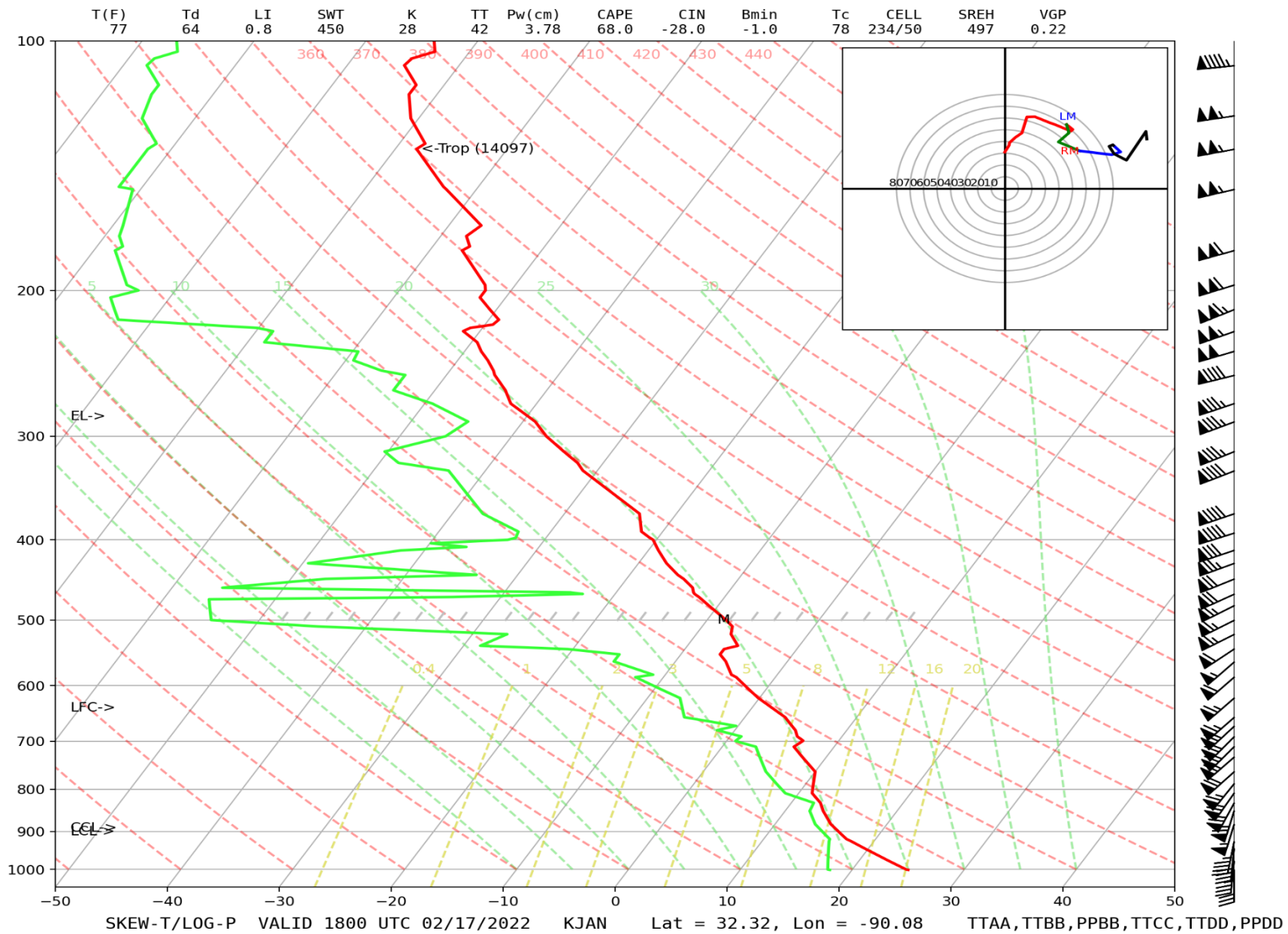
We think we know everything --- LOL

Feb 17, 2019 --- Tinian, New Mexico – Photo by Antonio Chiquito. Tornadoes can form at any time of the year. This is REAL!!!! There are no absolute rules in meteorology.

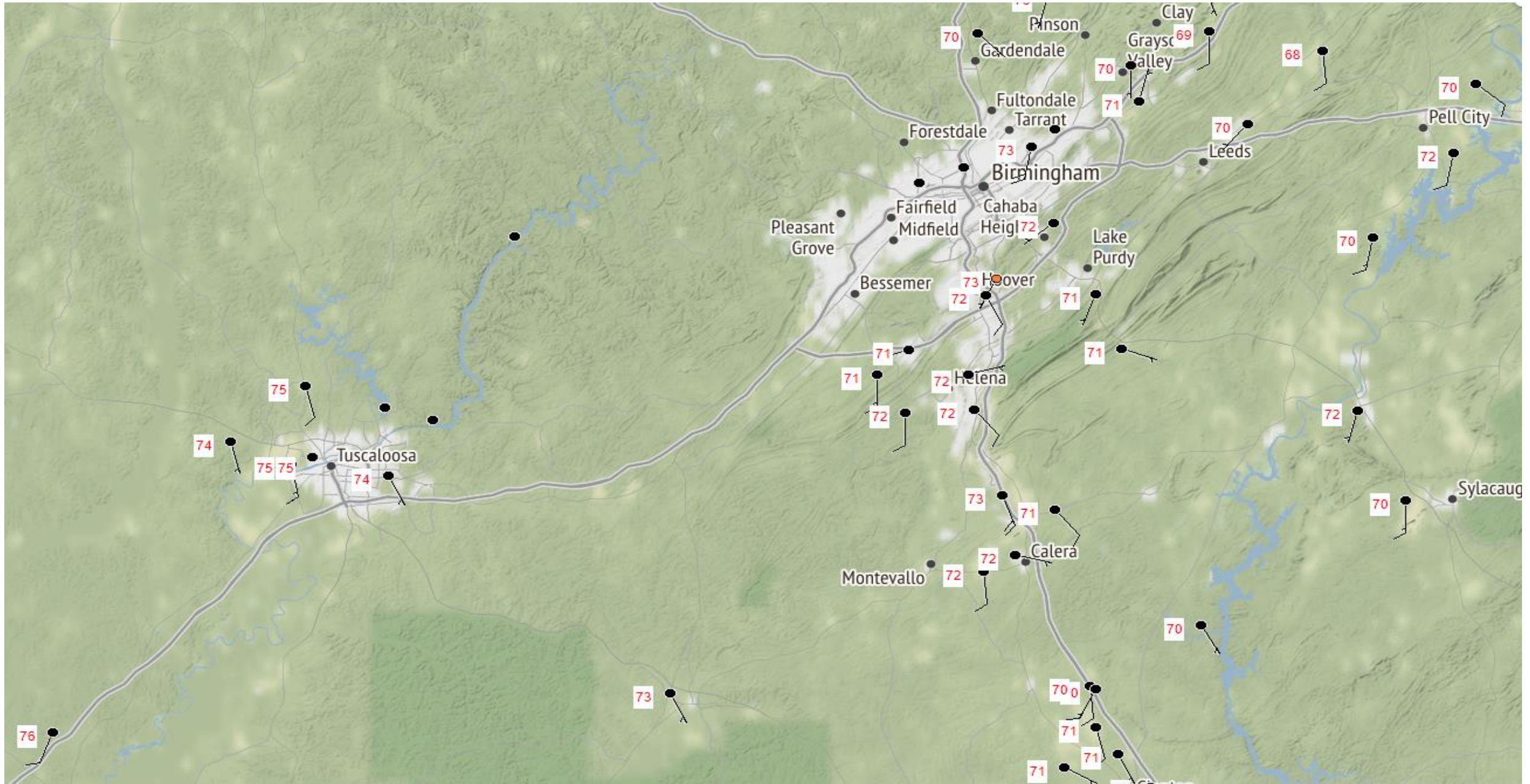


February 17, 2022

Feb 17, 2022 – Jackson, MS 1800 UTC



Feb 17, 2022 Central Alabama 2100 UTC.. Temperatures (F)



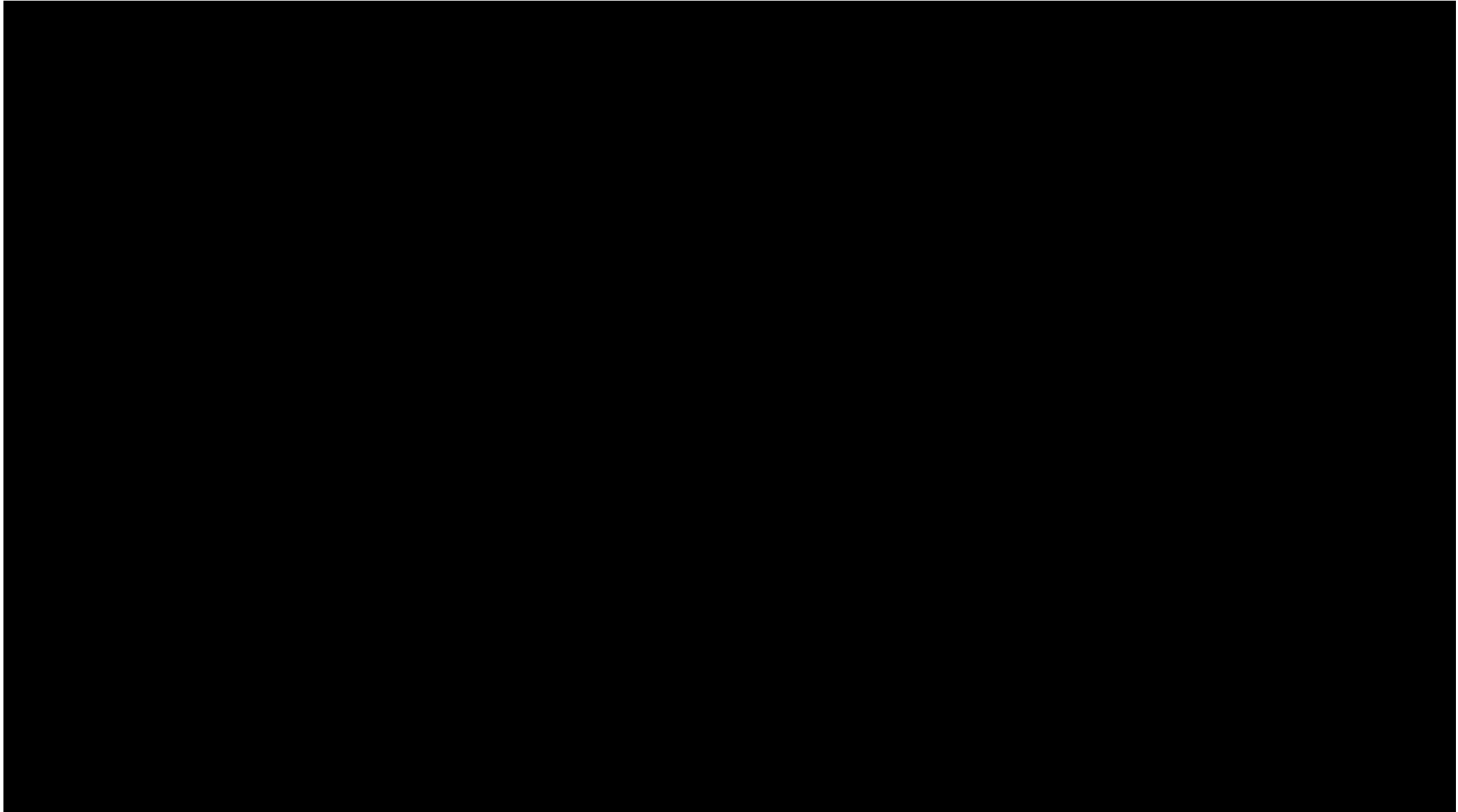
Two “cold season” days with similar temperatures

- Dec 10, 2021 --- 121 tornadoes
- Feb 17, 2022 --- 3 tornadoes

- Mild/warm temperatures tell a fraction of the tornado story.
- December 10, 2021 had long-track tornadoes that rated EF4
- February 17, 2022 had three confirmed tornadoes, one with EF1 rating in central Alabama.

Conclusions

- LOL.....There are no conclusions.....
- We have so much to learn about the atmosphere. It will tell us what we need to learn.
- We need to observe and learn from what the atmosphere tells us.
- The atmosphere is a VERY complex fluid!!!!
- Feb 17 and Dec 10 have similar environments but completely different results. WHY??????

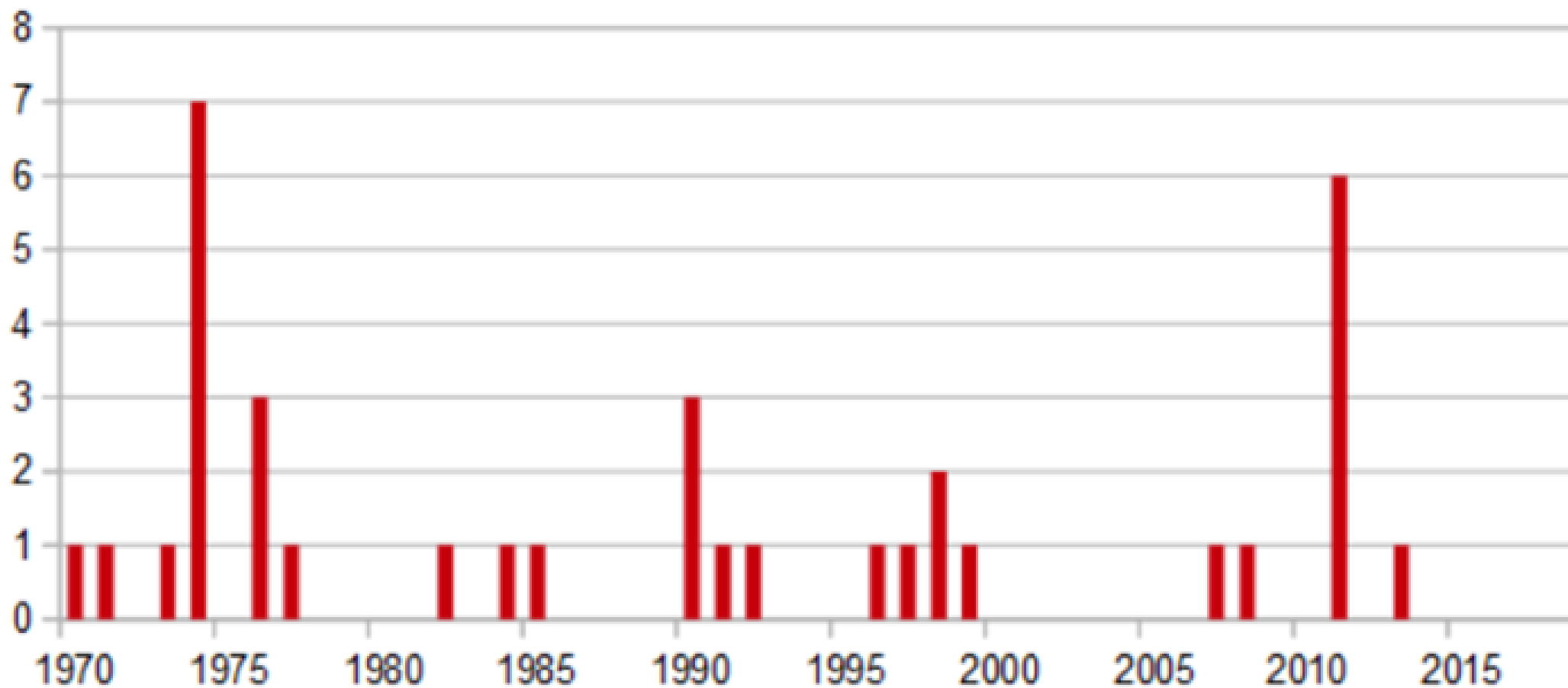


Bob Comments and slides

https://images.squarespace-cdn.com/content/v1/56530521e4b0c307d59bbe97/2e1666bd-60b9-404f-8dec-e6c7b6300afb/image_thumb-202.png?format=1500w

Annual Count of US EF-5 Tornadoes

1970 to 2019



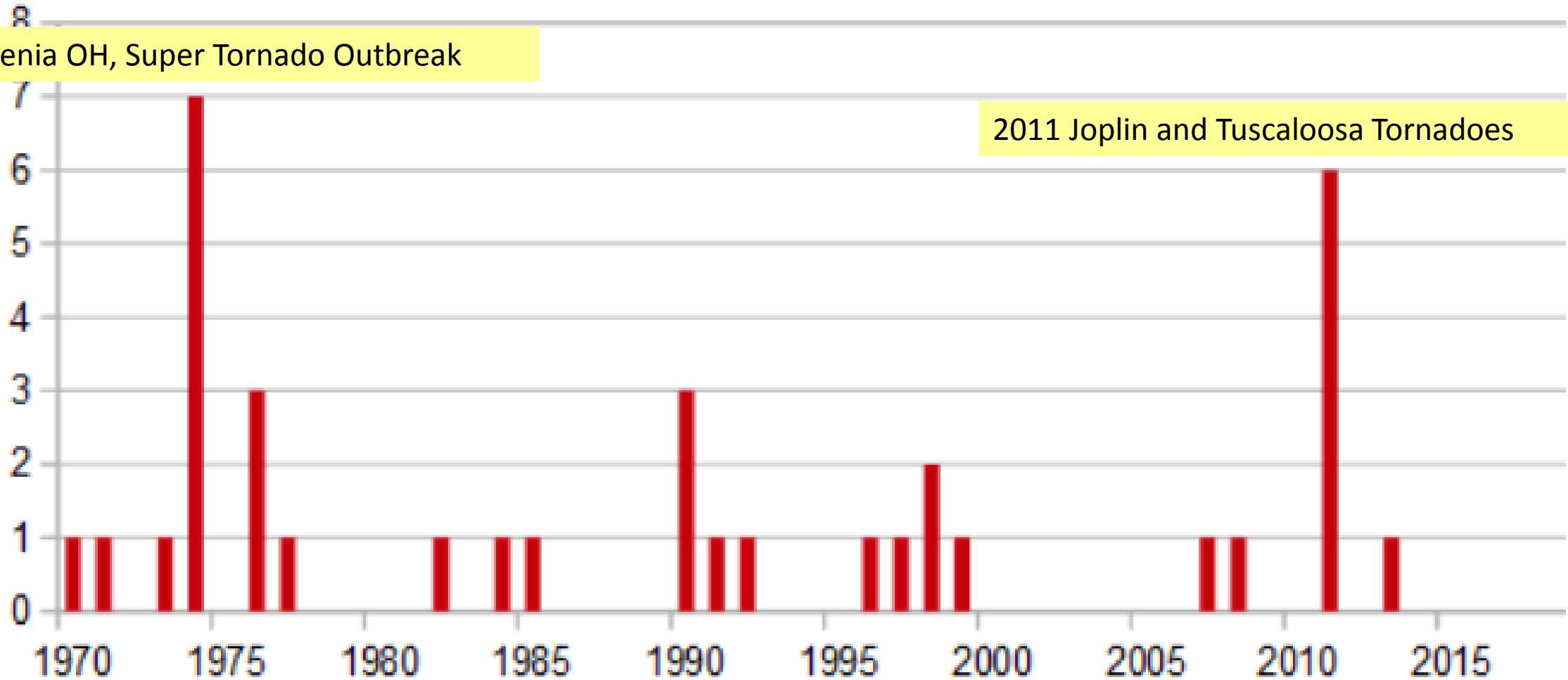
Annual Count of US EF-5 Tornadoes

1970 to 2019

F5/EF-5 Tornado count is decreasing!

1974 Xenia OH, Super Tornado Outbreak

2011 Joplin and Tuscaloosa Tornadoes



TIME ARCHIVE

1923 to the Present

Science
Another Ice Age?

Monday, Jun 24, 1974

In Africa, drought continues for the sixth consecutive year, adding terribly to the toll of famine victims. During 1972 record rains in parts of the U.S., Pakistan and Japan caused some of the worst flooding in centuries. In Canada's wheat belt, a particularly chilly and rainy spring has delayed planting and may well bring a disappointingly small harvest. Rainy Britain, on the other hand, has suffered from uncharacteristic dry spells the past few springs. A series of unusually cold winters has gripped the American Far West, while New England and northern Europe have recently experienced the mildest winters within anyone's recollection.



WELCOME TO SOUTHEAST NEW MEXICO WEATHER

Share

Saturday, February 05, 2011

A REVIEW OF THE ARCTIC INVASION JAN 31 - FEB 4, 2011.

<https://www.senewmexicowx.org/2011/02/review-of-arctic-invasion-jan-31-feb-4.html>



U.S. Annual Count of Strong to Violent Tornadoes (F3+) 1970-2020

Data Source: NOAA/NWS Storm Prediction Center

