



# Inland Intensification of TS Erin August 19, 2007

Kurtis Malone  
Student Volunteer-2010  
NWS Lincoln, IL



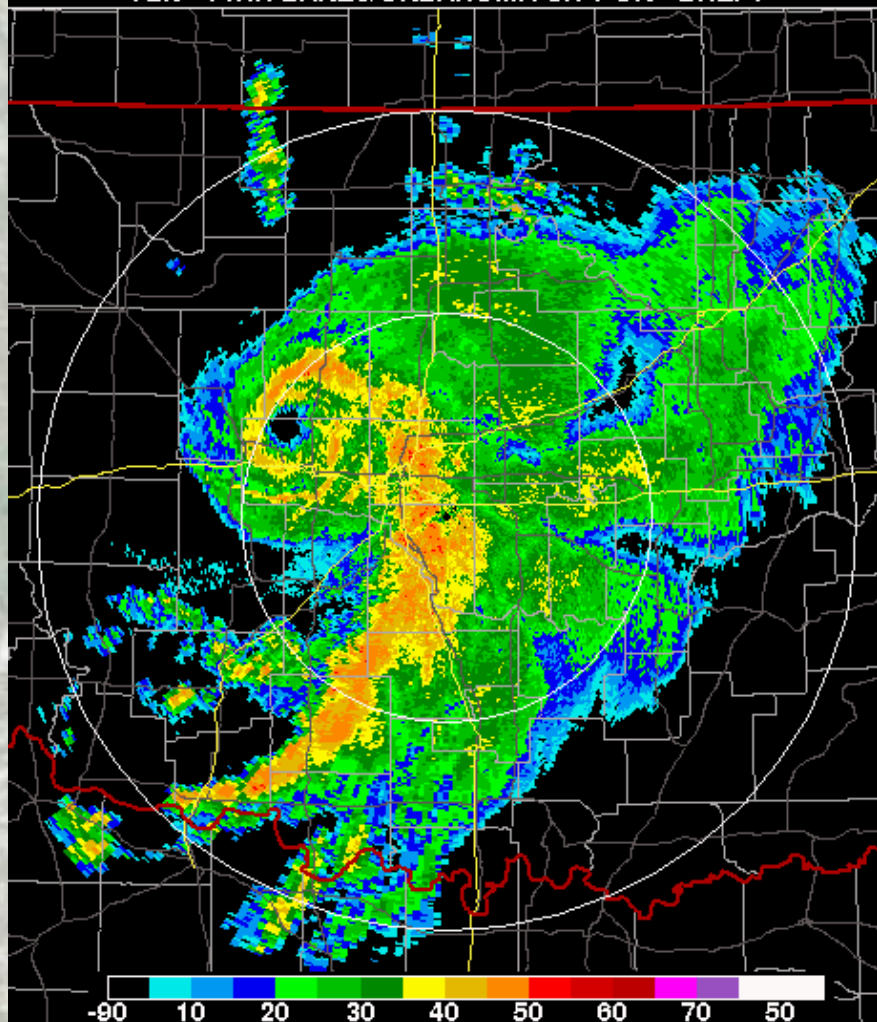
# Overview

- Background of re-intensification processes
- Tropical Storm Erin's Origins
- Synoptic Overview
- Observations
- Radar and Satellite
- Reports

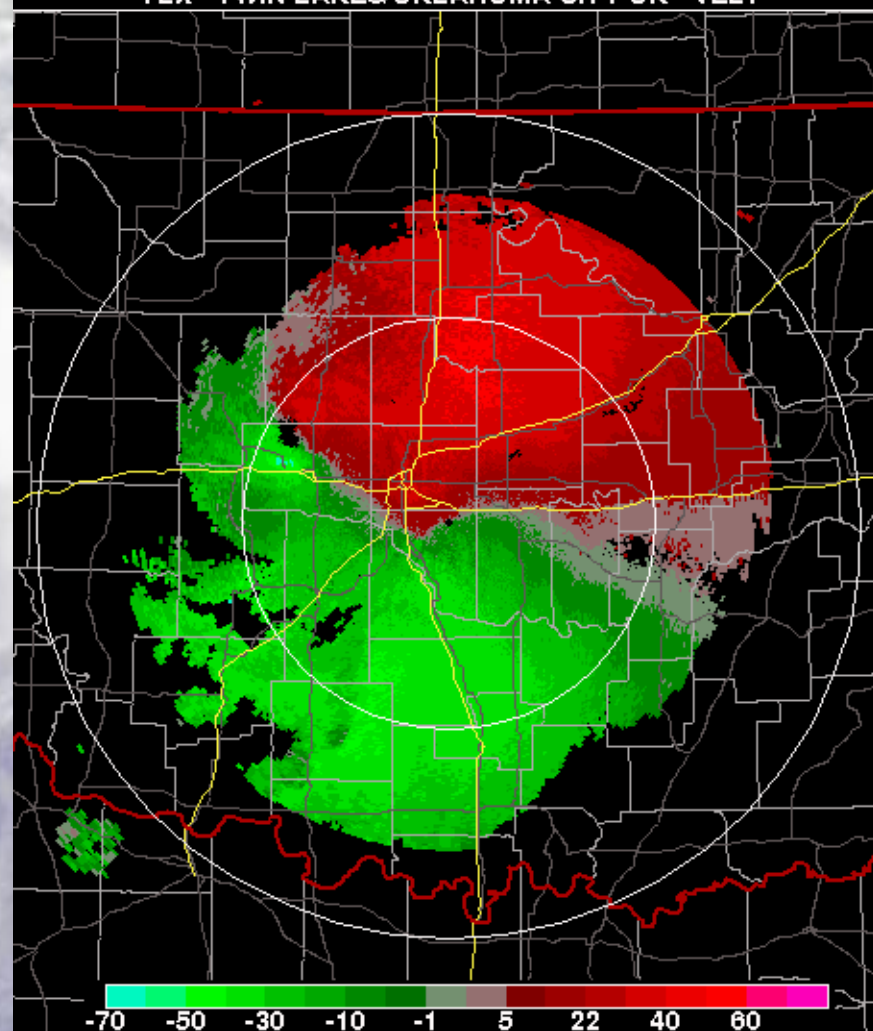


# Hurricane?

Base reflectivity (Dbz) El=0.5 1013Z 19 AUG 07  
TLX - TWIN LAKES/OKLAHOMA CITY OK - BREF1



Base velocity (knt) El=0.5 1018Z 19 AUG 07  
TLX - TWIN LAKES/OKLAHOMA CITY OK - VEL1



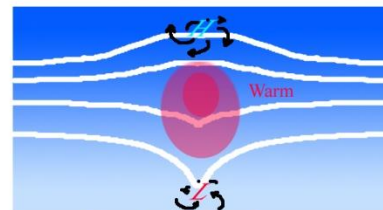
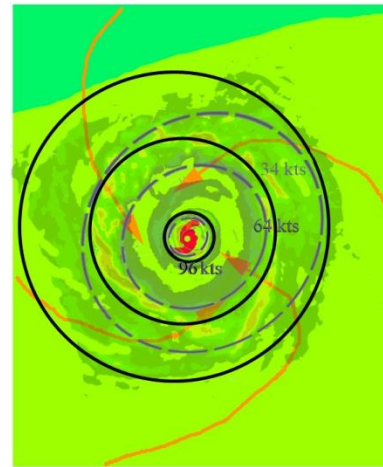


# Definitions from NHC

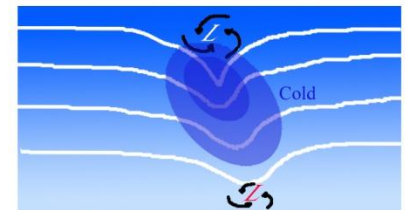
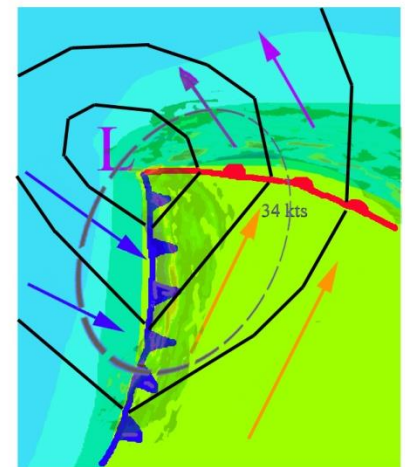
- Tropical cyclone: non-frontal synoptic low with organized convection
- Sub-tropical cyclone: low pressure system exhibiting characteristics of a tropical and mid-latitude cyclone
- Extra-tropical: a storm that gets its energy from horizontal temperature gradients that are associated with fronts

# Extra-tropical Transition

- A tropical cyclone can re-intensify by extra-tropical transition
- For the most common case a baroclinic zone must be present



Tropical Cyclone

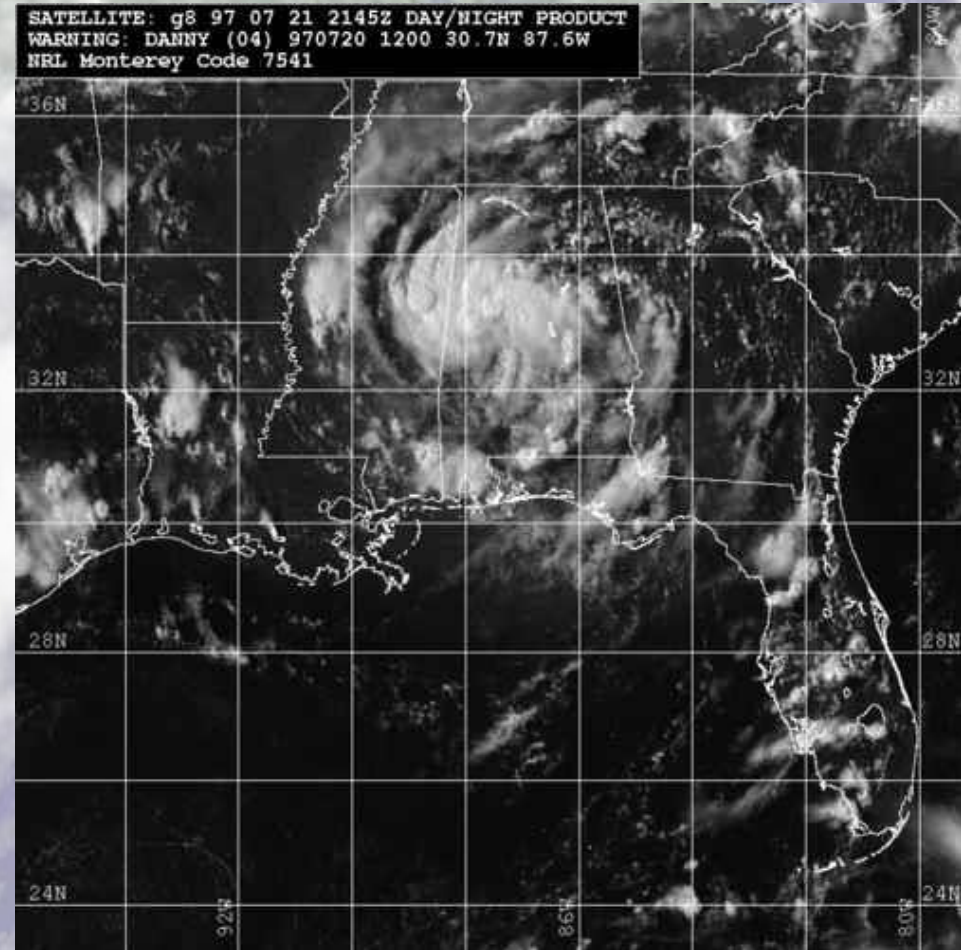


Extratropical Cyclone



# Another case

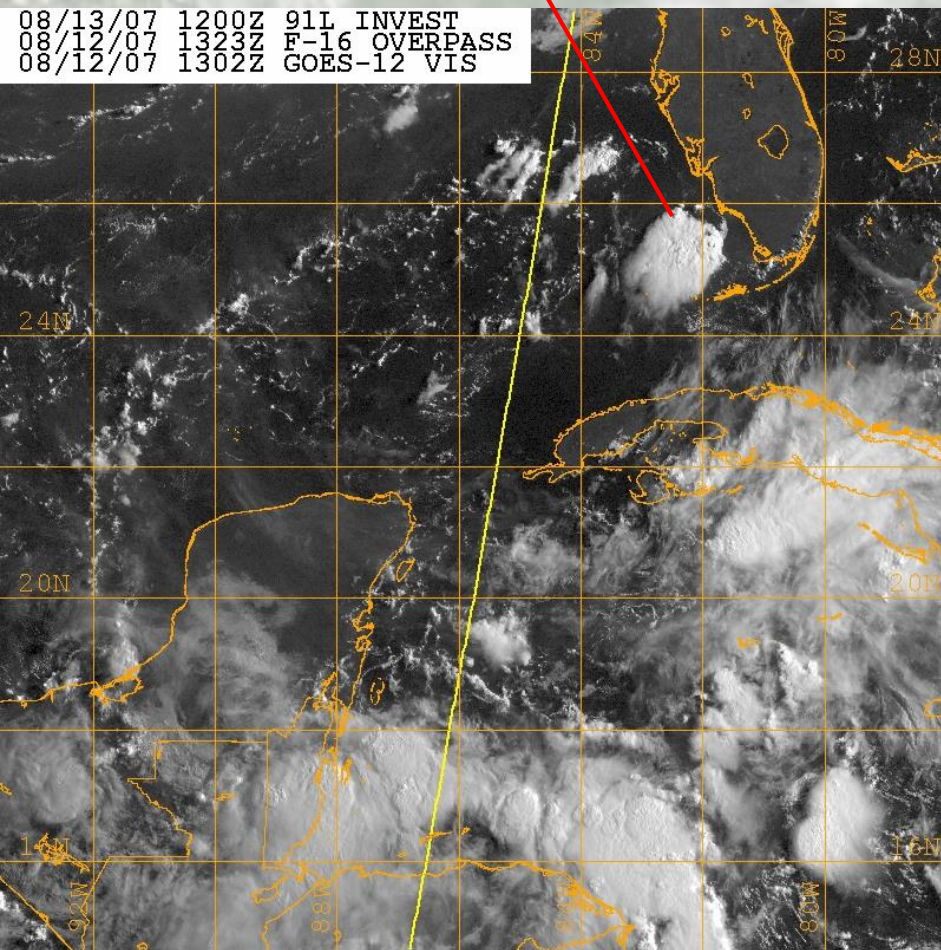
- Where intensification over land occurs and regains tropical characteristics
- Some cases include Hurricane Danny (1997), Hurricane David (1979), and Tropical Storm Erin (2007)





# Erin Genesis

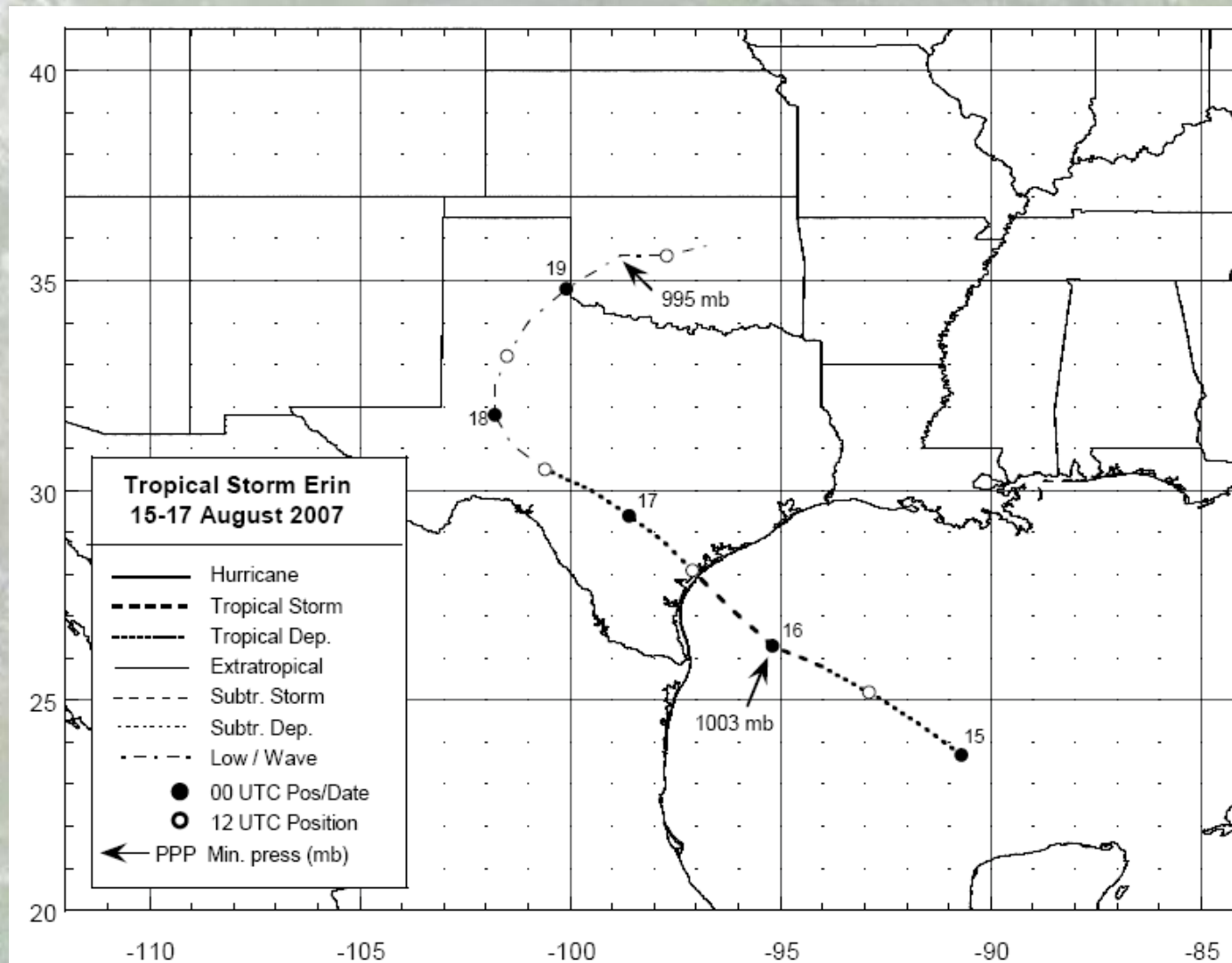
Erin



- Began as a tropical wave off the coast off Africa and traveled up to the Caribbean Sea
- Strengthened from Depression 5 into a tropical storm
- Highest winds were 35kts and lowest pressure was 1003hPa



# NHC Track



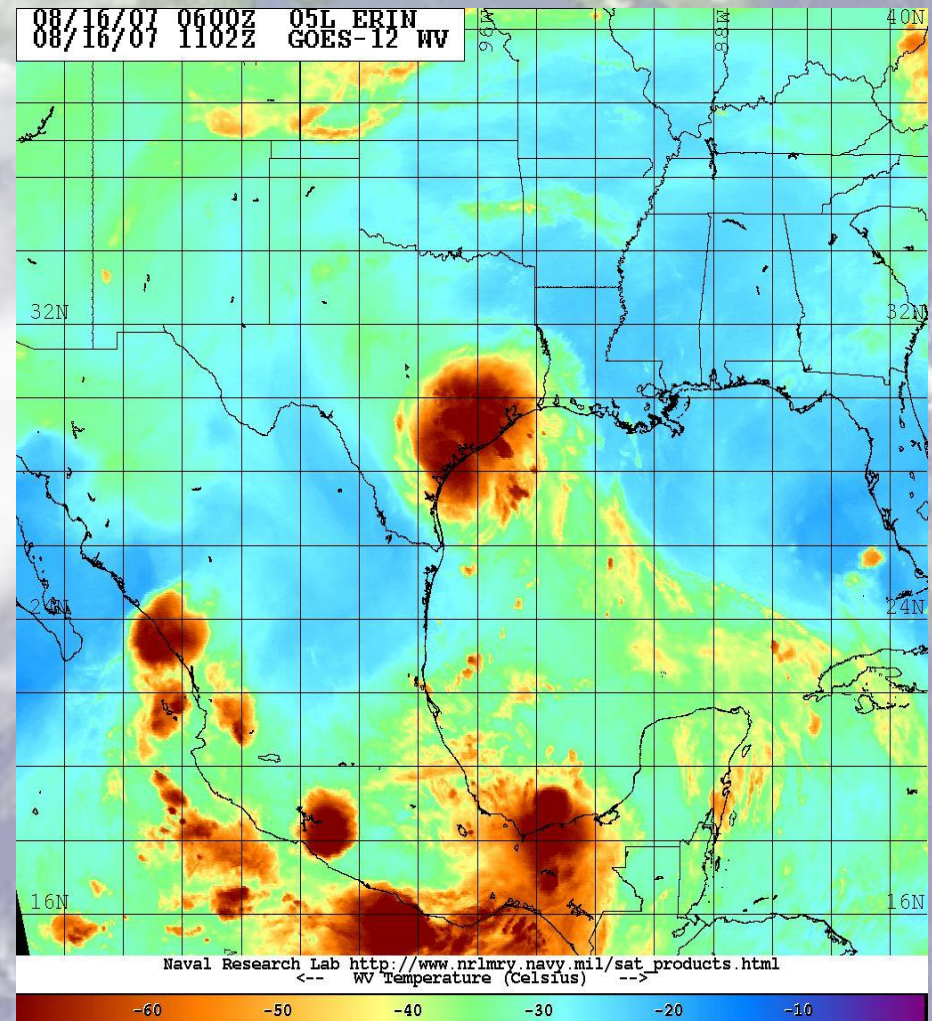
Best track positions for Tropical Storm Erin, 15-17 August 2007.



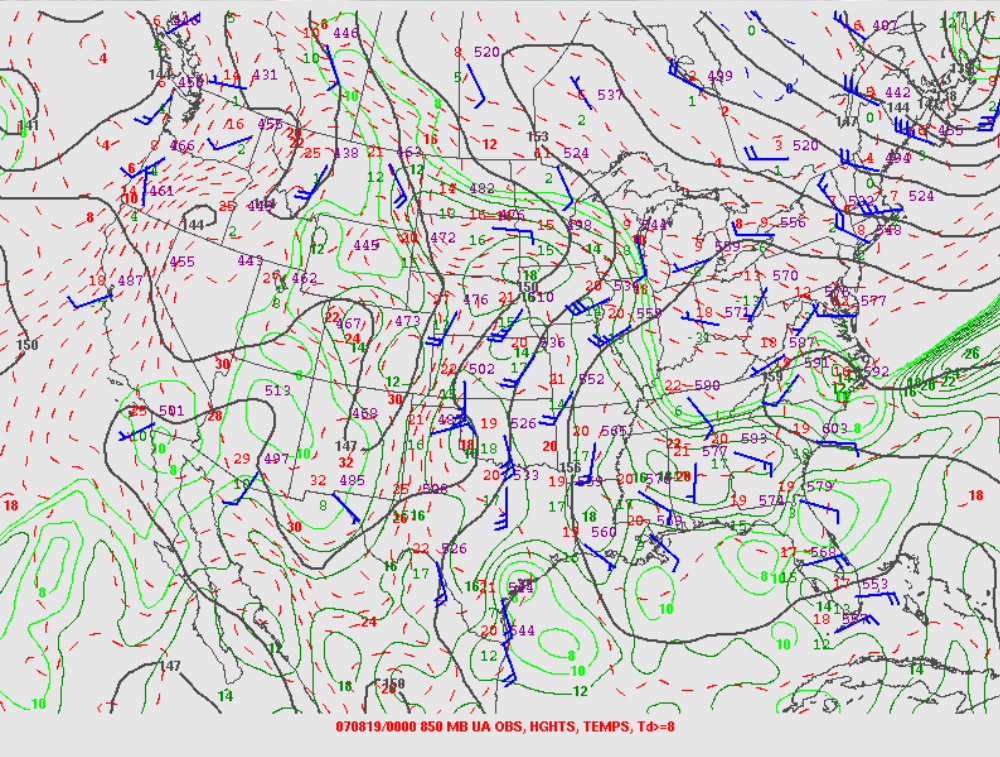


# Inland

- Made landfall on August 16<sup>th</sup> at 1030Z near San Jose, Texas
- Erin traveled over land and by August 19<sup>th</sup> it was over OK
- Once over OK it intensified in the early hours of the day

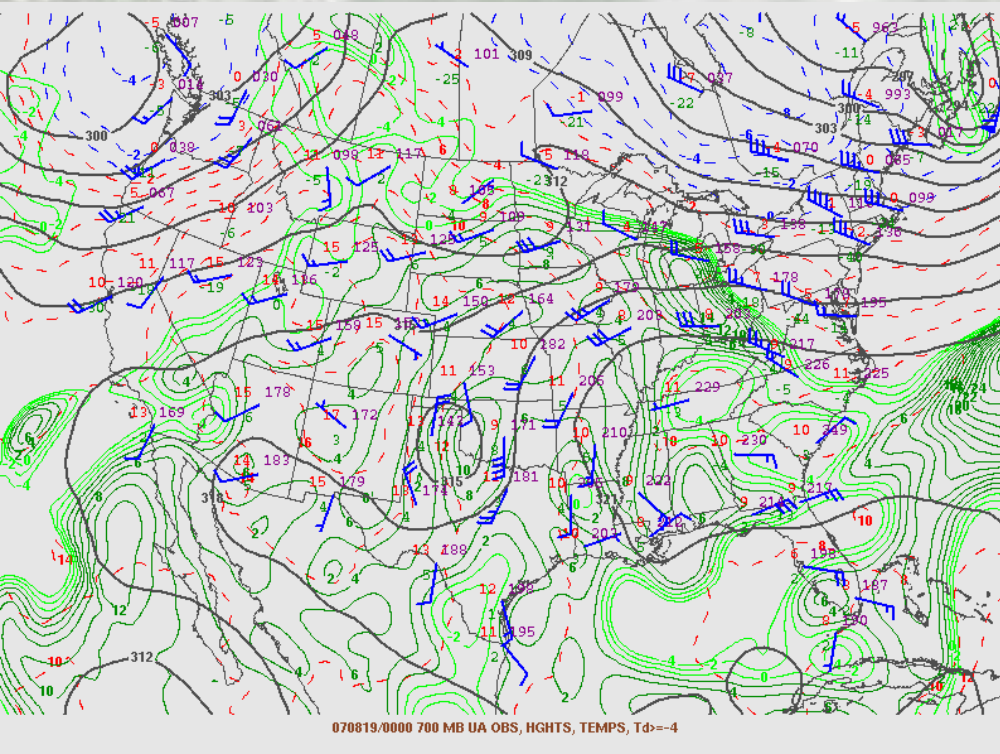


# Synoptic Pattern-850mb



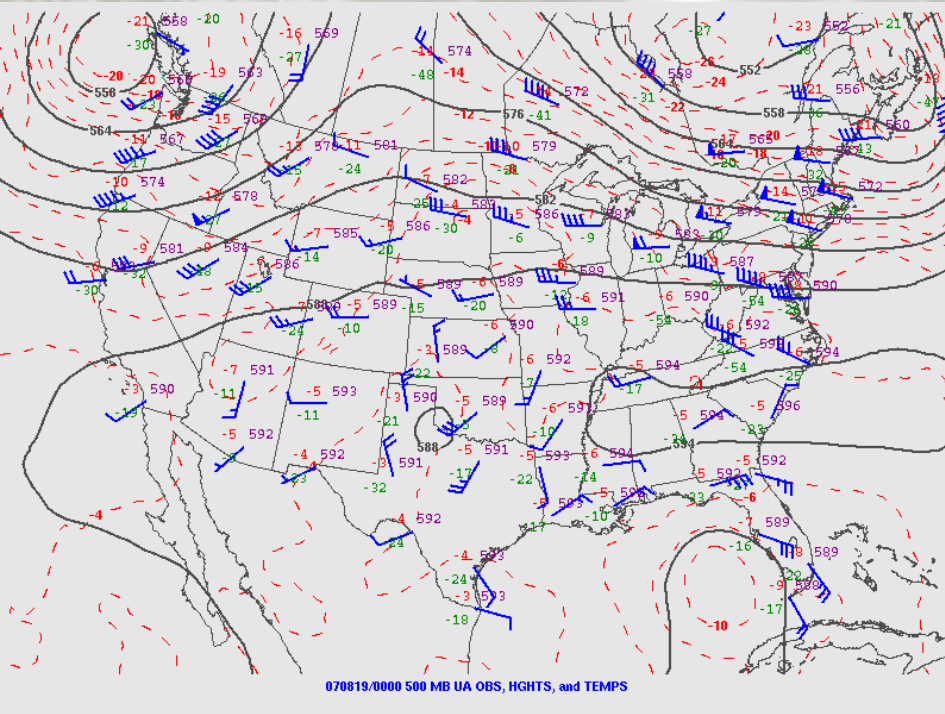
- Notice the flow from the gulf
- High dewpoint values from TX to OK
- The cyclone is the kink in the flow by the panhandle
- WAA occurring with the cyclone, the warm core nature of it

# Synoptic Pattern-700mb



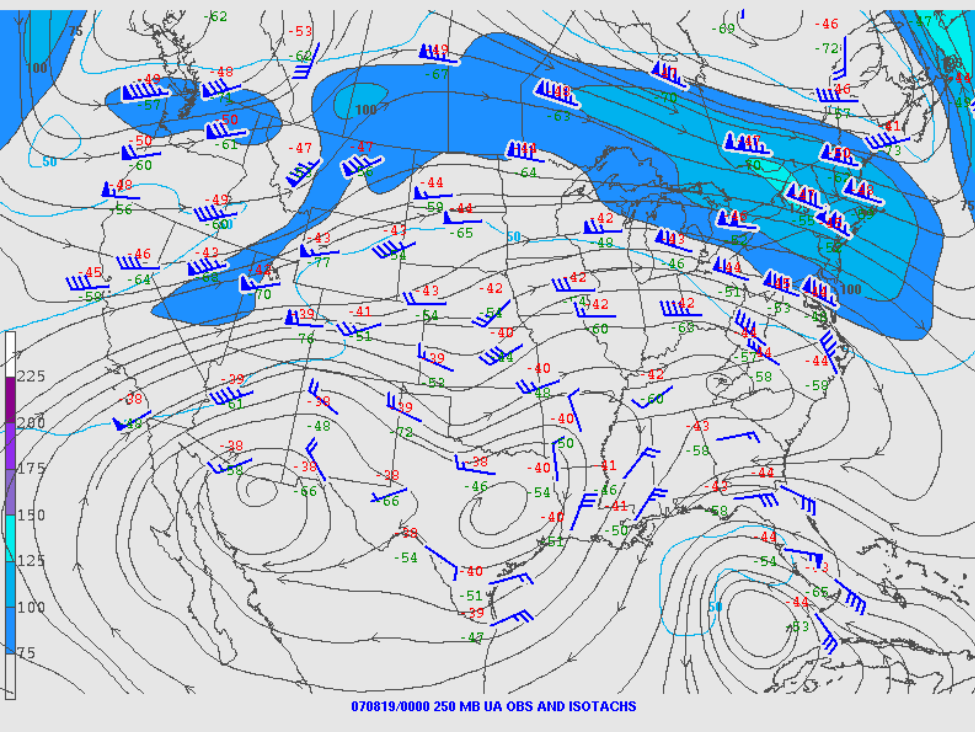
- low easily distinguishable
- cyclonic circulation
- moisture under the low

# Synoptic Pattern-500mb



- Cyclonic circulation not as easily seen
- OUN reporting saturated environment
- near the axis of a weak ridge
- isentropic ascent in the area

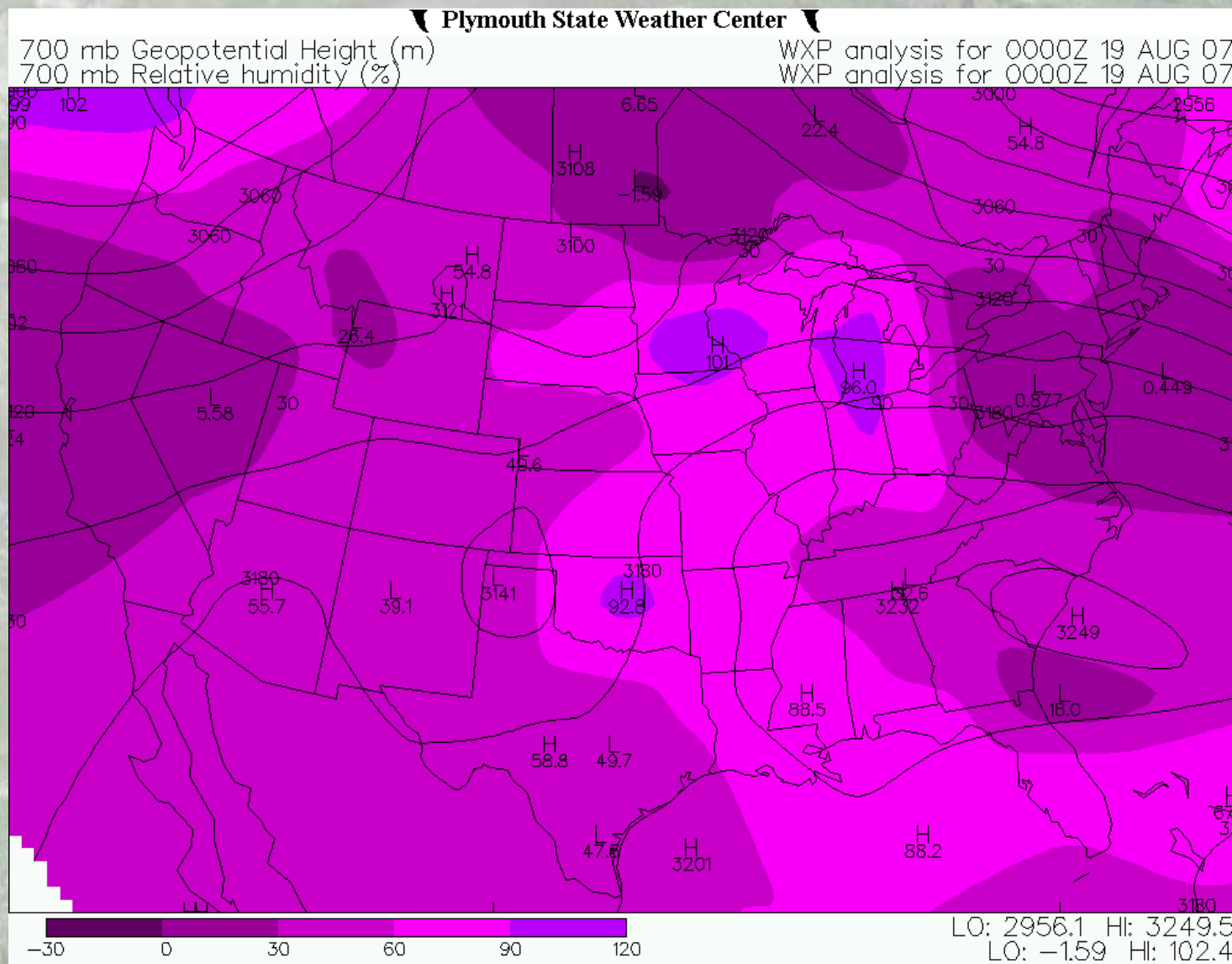
# Synoptic Pattern-250mb



- Trough in the streamlines
- Moisture not as great as below
- Anticyclonic circulation to the southeast, will turn the storm to the northeast



# Relative Humidity-700mb 00z



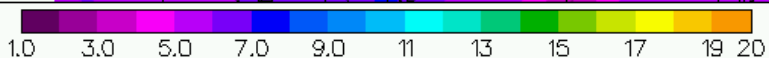
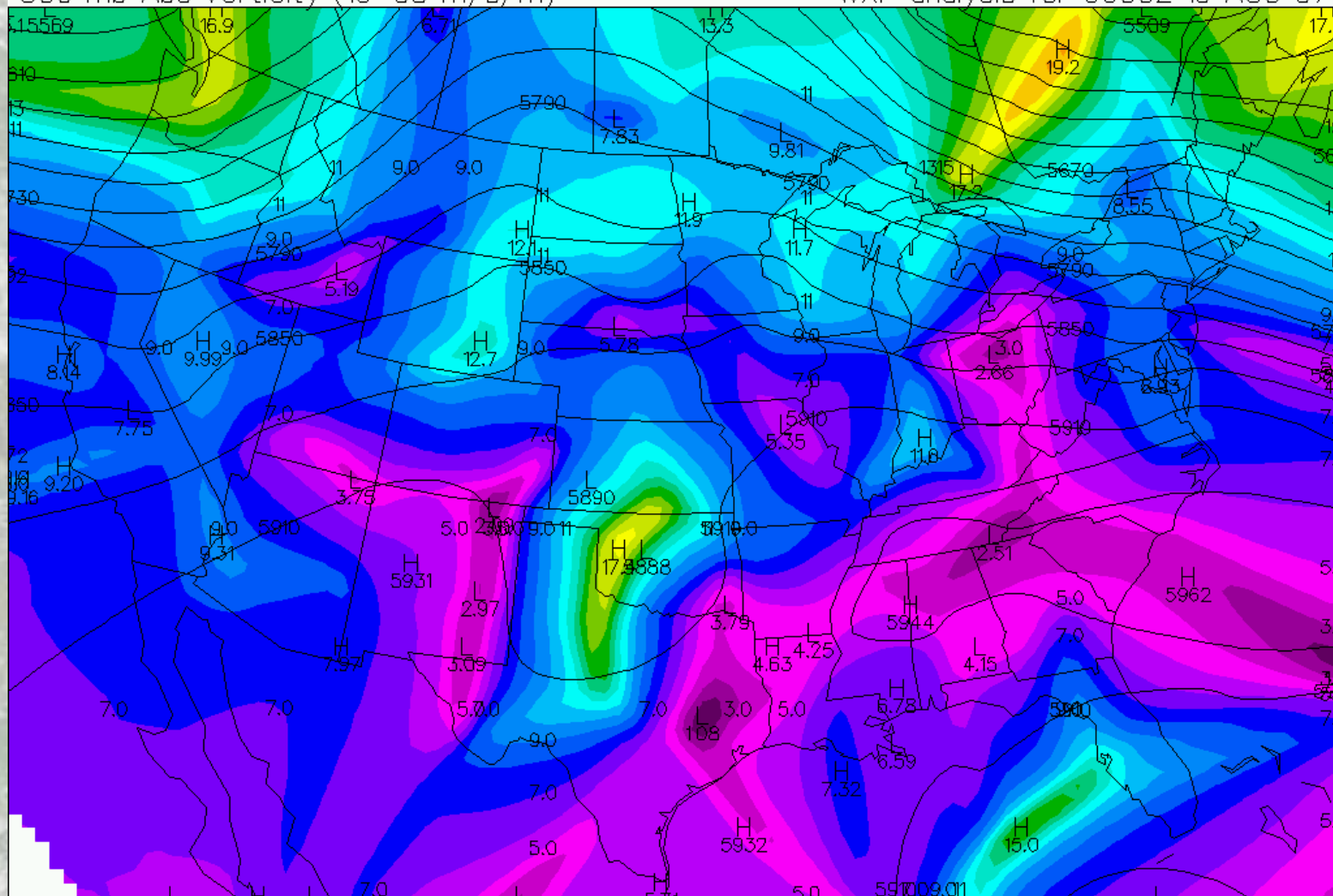


# 500mb Vort. 00z

▼ Plymouth State Weather Center ▼

500 mb Geopotential Height (m)  
500 mb Abs vorticity ( $1e-05$  m/s/m)

WXP analysis for 0000Z 19 AUG 07  
WXP analysis for 0000Z 19 AUG 07



LO: 5509.0 HI: 5962.2  
LO: 1.08 HI: 19.2

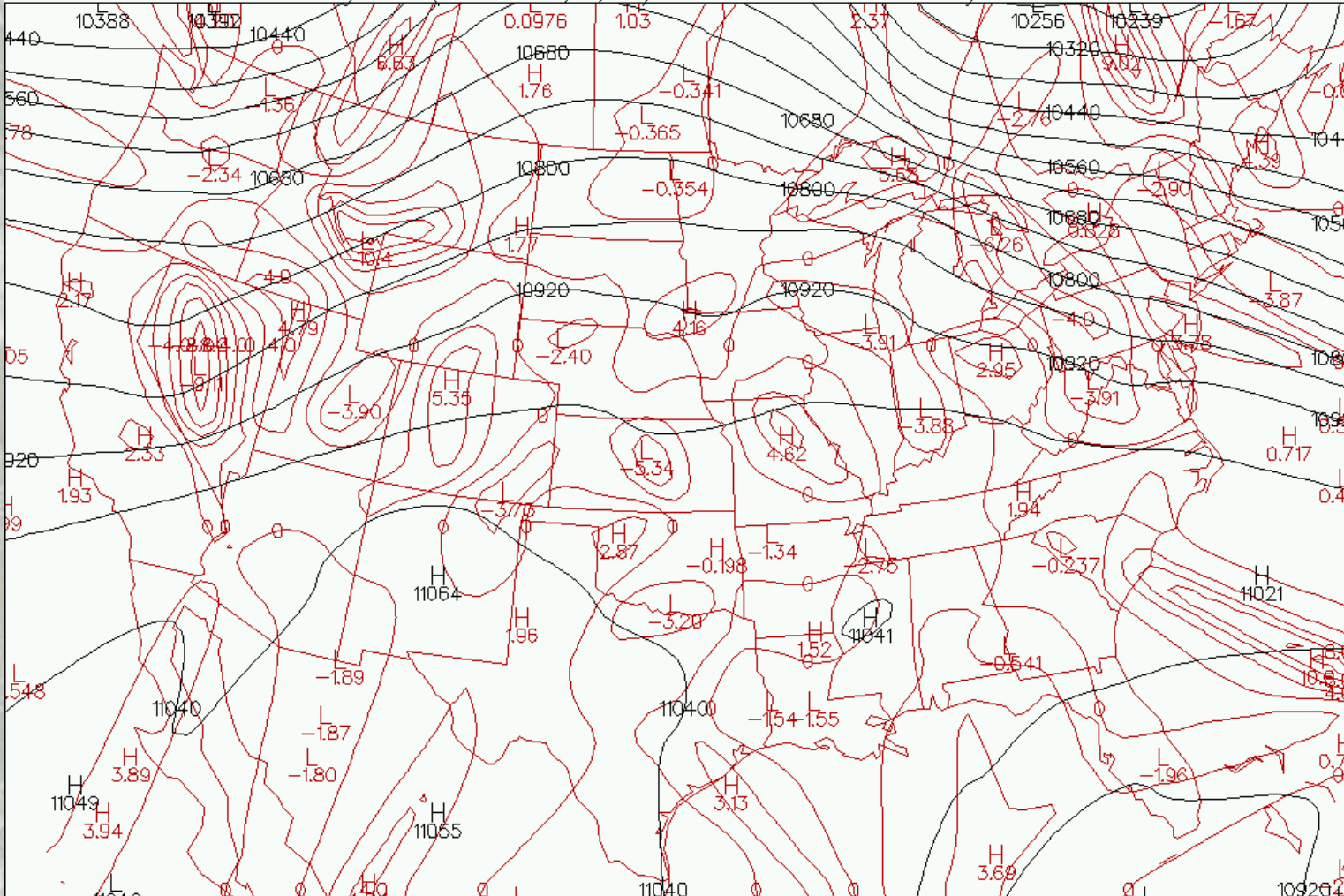


# 250mb Convergence 00z

▼ Plymouth State Weather Center ▼

250 mb Geopotential Height (m)  
250 mb v-999 Convergence (1e-05 m/s/m)

WXP analysis for 0000Z 19 AUG 07  
WXP analysis for 0000Z 19 AUG 07



INTERVAL: 60.0  
INTERVAL: 2.0

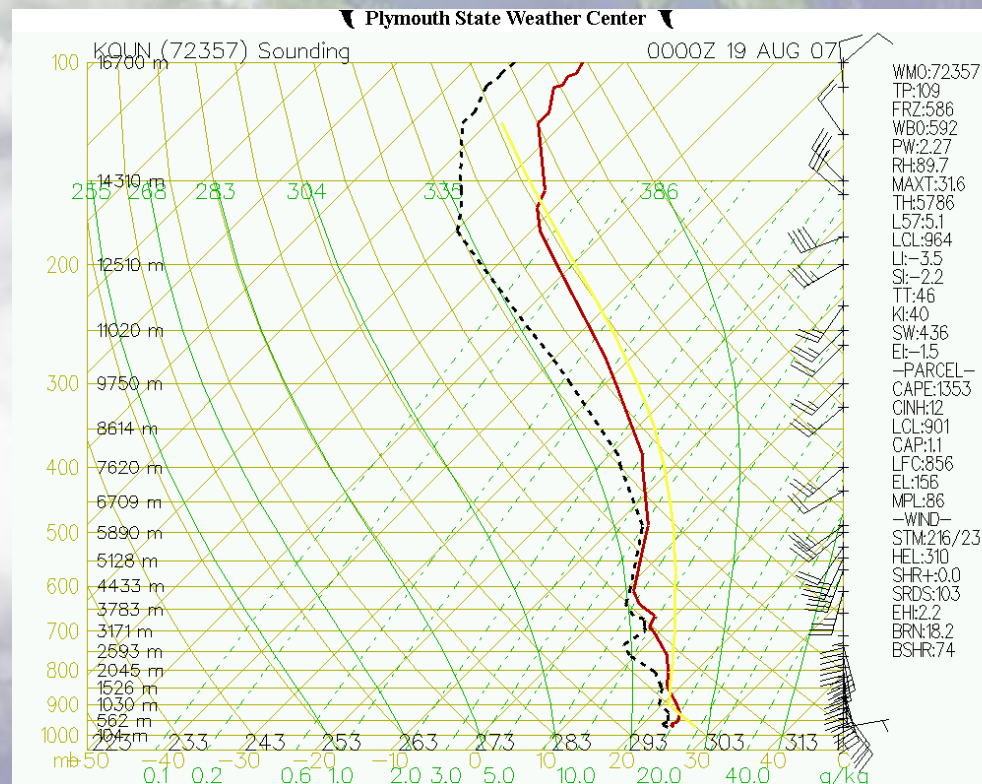
LO: 10239.4 HI: 11063.6  
LO: -10.4 HI: 10.6

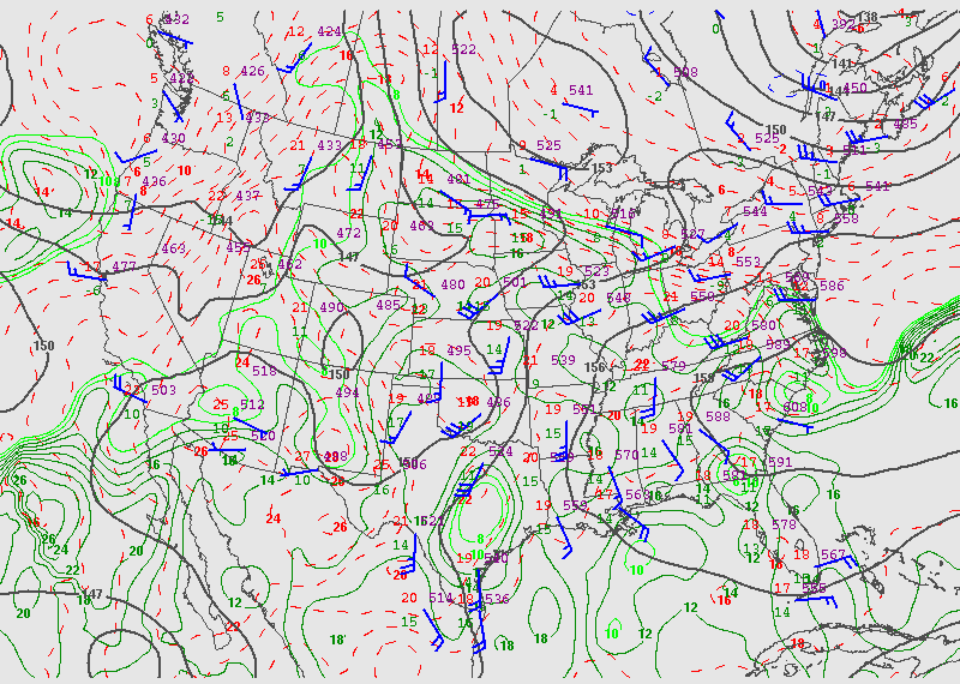




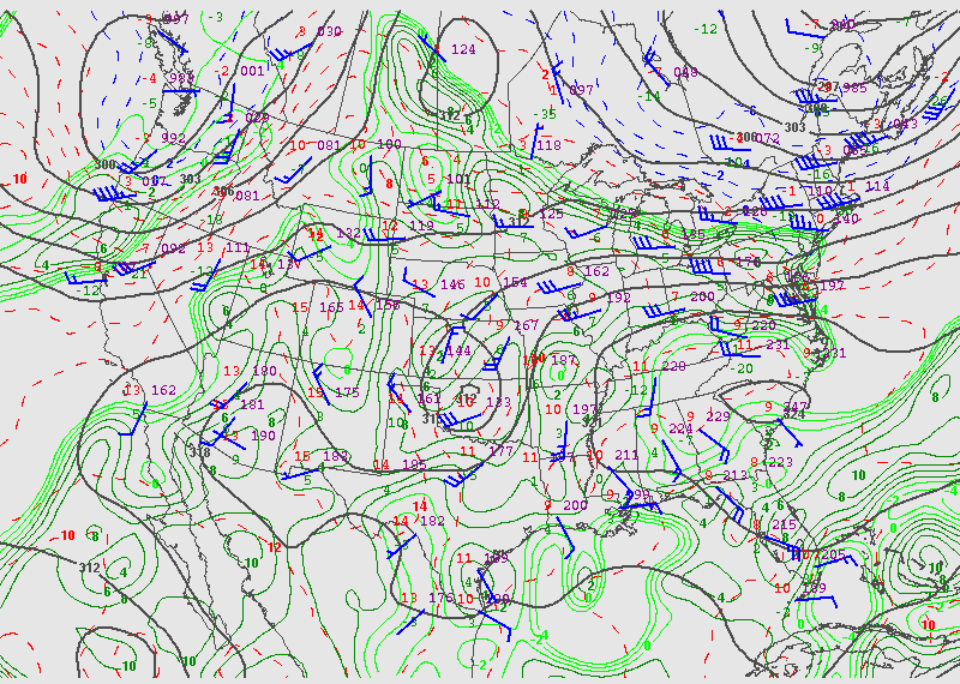
# OUN 00z Sounding

- Is of tropical nature with near saturation until 500mb
- Veering winds with height
- CAPE value over 1300
- Winds slightly decrease with height

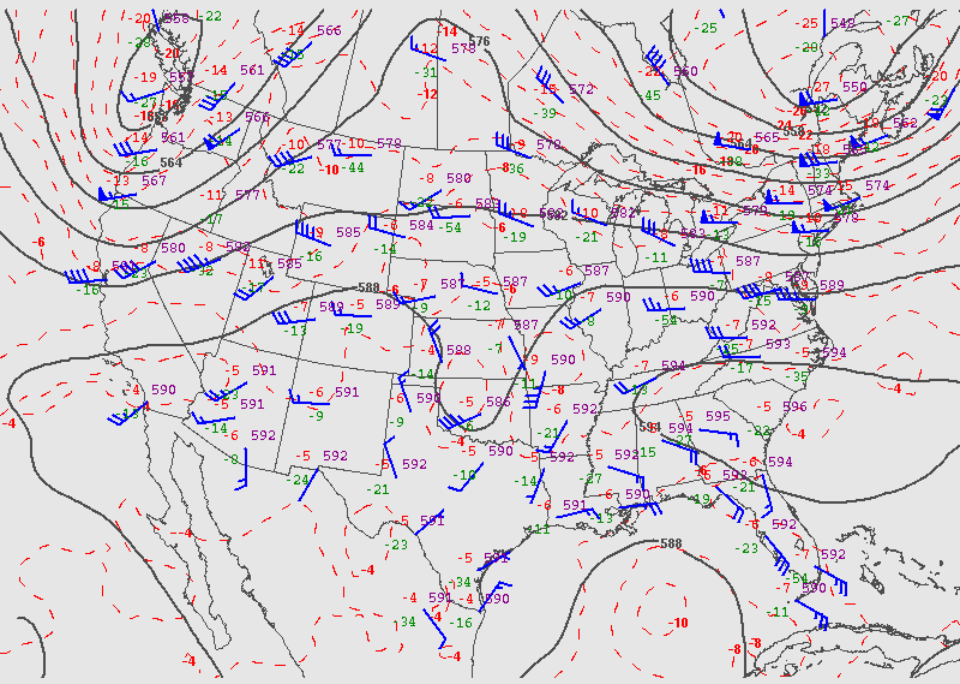




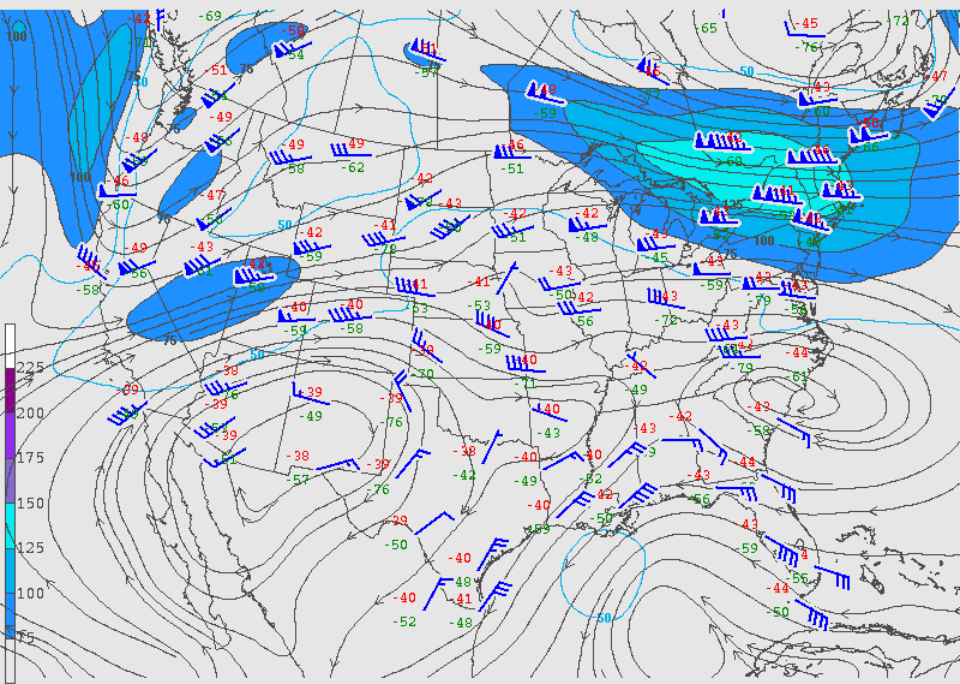
070819/1200 850 MB UA OBS, HGHTS, TEMPS, Td=8



070819/1200 700 MB UA OBS, HGHTS, TEMPS, Td=-4



070819/1200 500 MB UA OBS, HGHTS, and TEMPS



070819/1200 250 MB UA OBS AND ISOTACHS

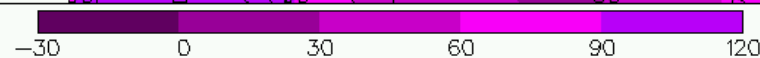
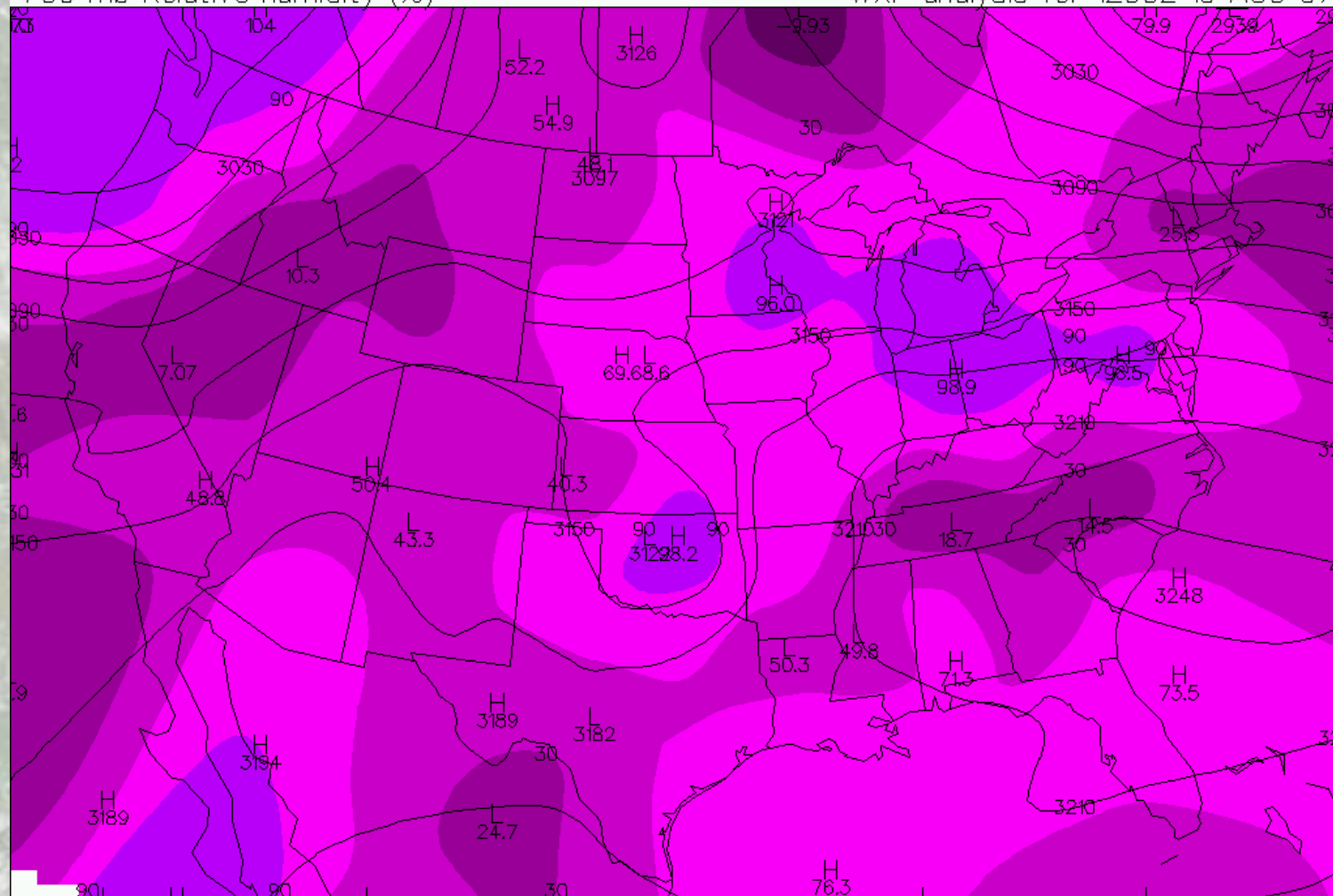


# Relative Humidity-700mb 12z

Plymouth State Weather Center

700 mb Geopotential Height (m)  
700 mb Relative humidity (%)

WXP analysis for 1200Z 19 AUG 07  
WXP analysis for 1200Z 19 AUG 07



LO: 2939.5 Hi: 3248.4  
LO: -9.93 Hi: 111.8

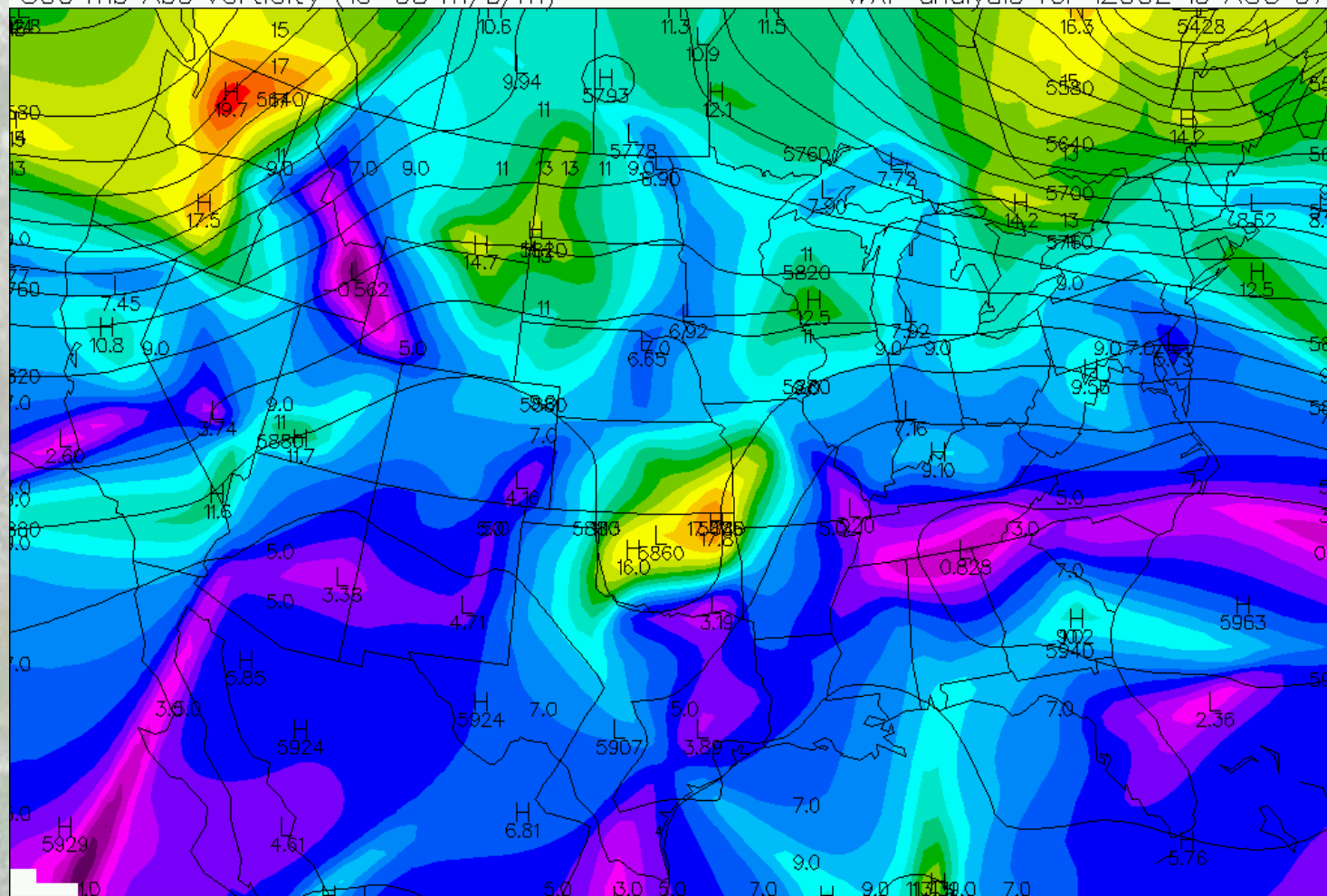


# 500mb Vort. 12z

▼ Plymouth State Weather Center ▼

500 mb Geopotential Height (m)  
500 mb Abs vorticity ( $1e-05$  m/s/m)

WXP analysis for 1200Z 19 AUG 07  
WXP analysis for 1200Z 19 AUG 07



LO: 5428.4 HI: 5963.0  
LO: -0.997 HI: 19.7

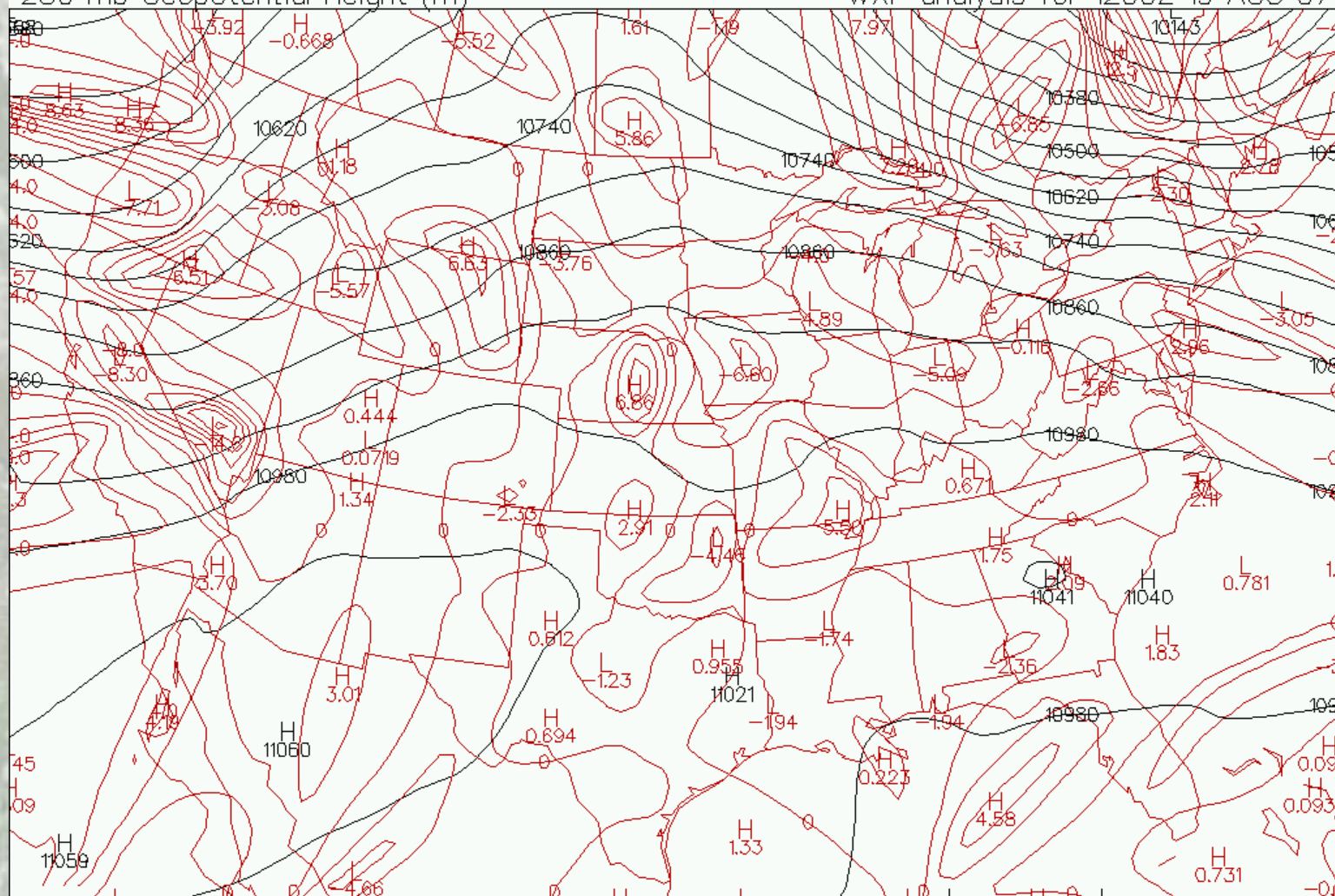


# 250mb Convergence 12Z

▼ Plymouth State Weather Center ▼

250 mb v-999 Convergence ( $1e-05$  m/s/m)  
250 mb Geopotential Height (m)

WXP analysis for 1200Z 19 AUG 07  
WXP analysis for 1200Z 19 AUG 07



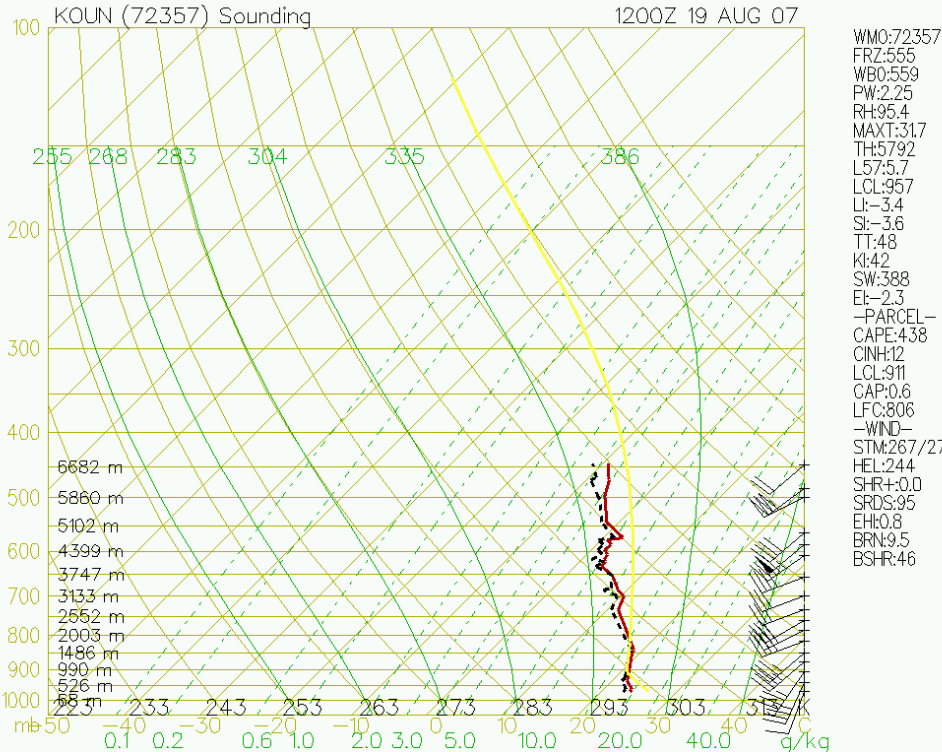
INTERVAL: 2.0  
INTERVAL: 60.0

LO: -14.6 HI: 12.5  
LO: 10143.3 HI: 11059.7



# OUN 12Z Sounding

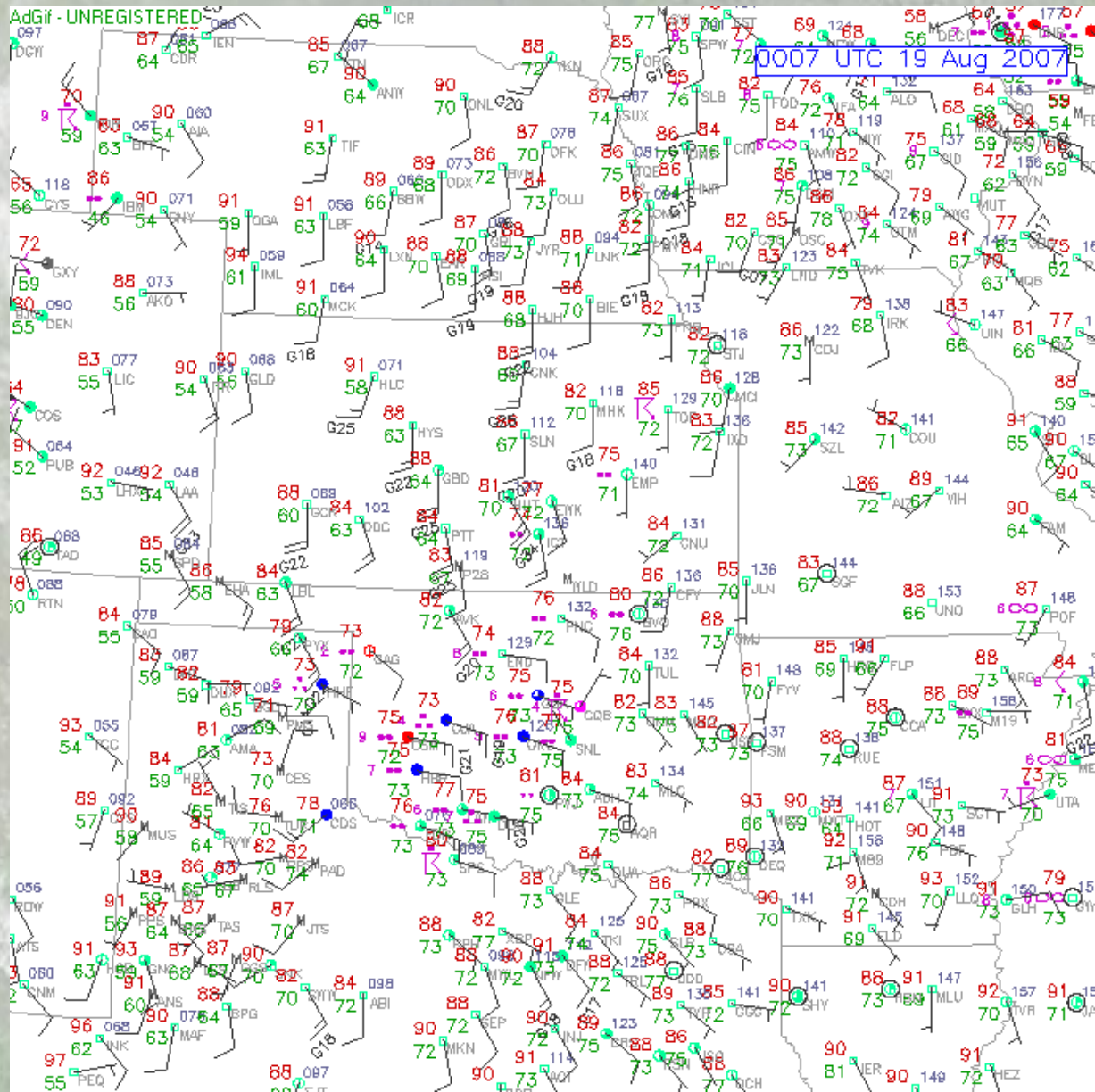
▼ Plymouth State Weather Center ▼

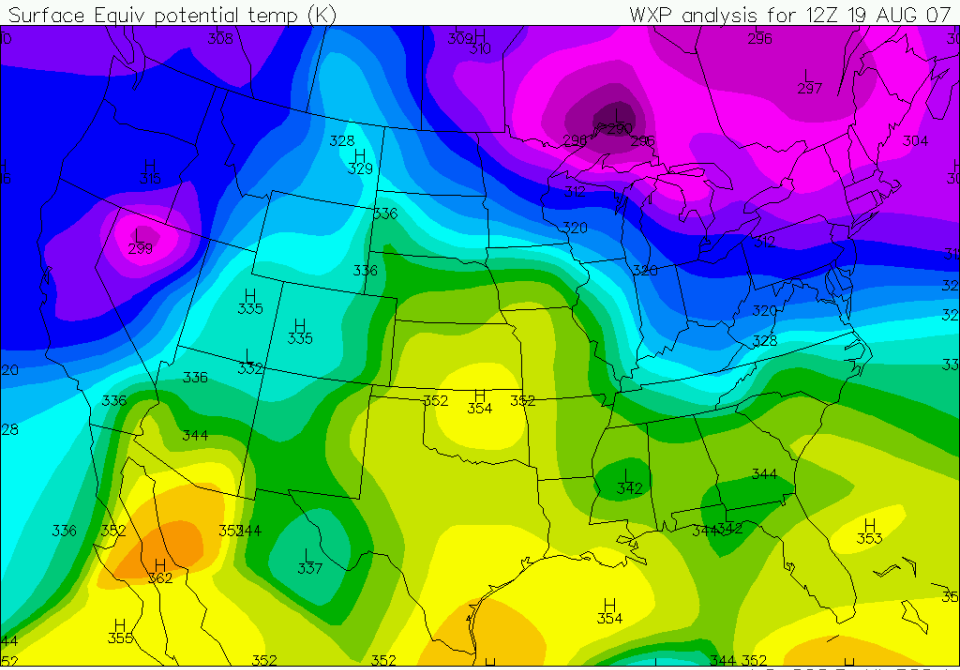
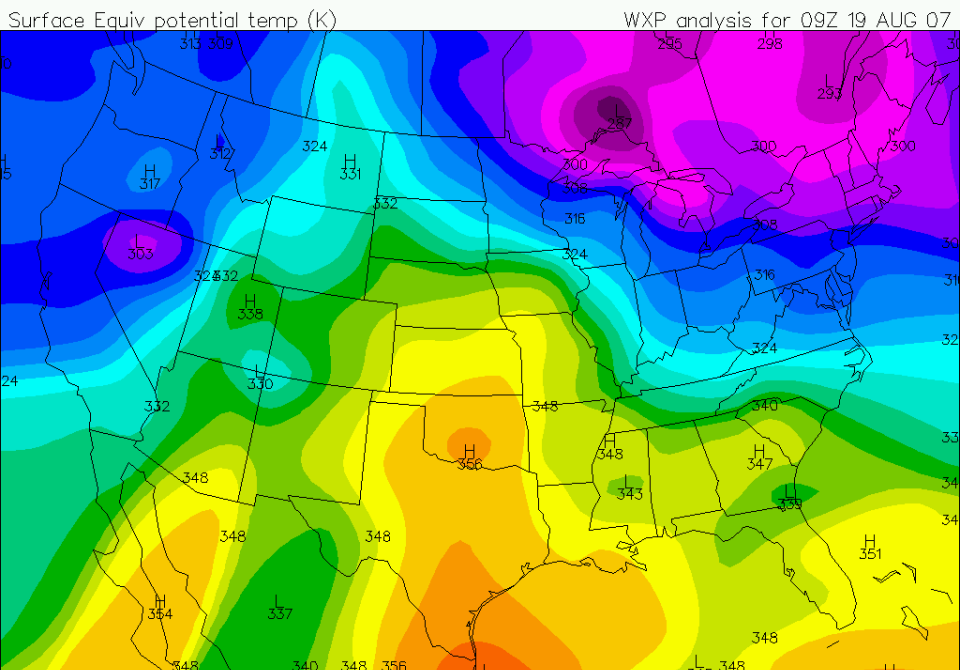
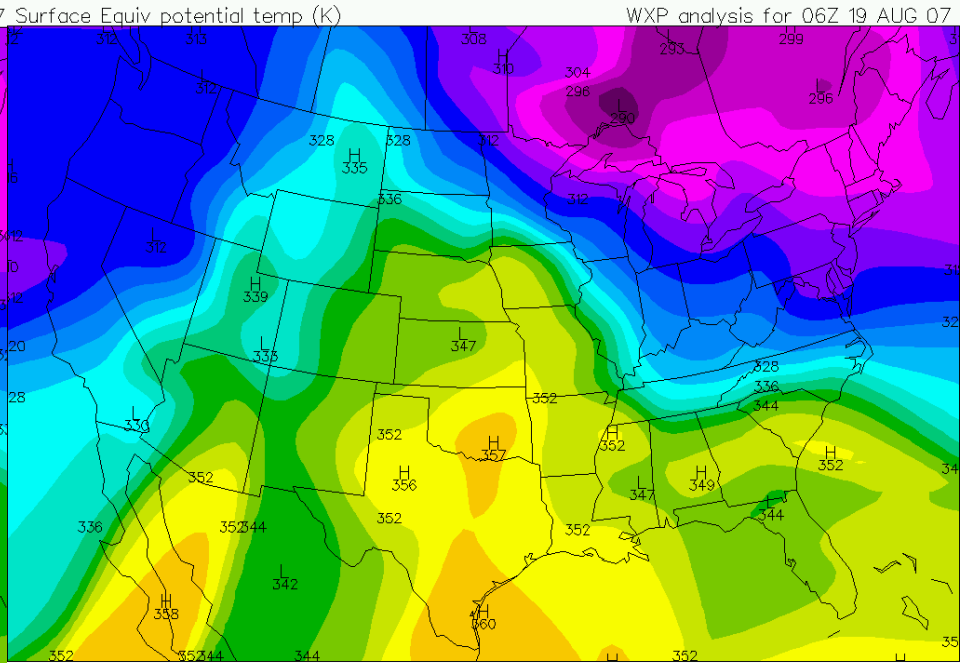
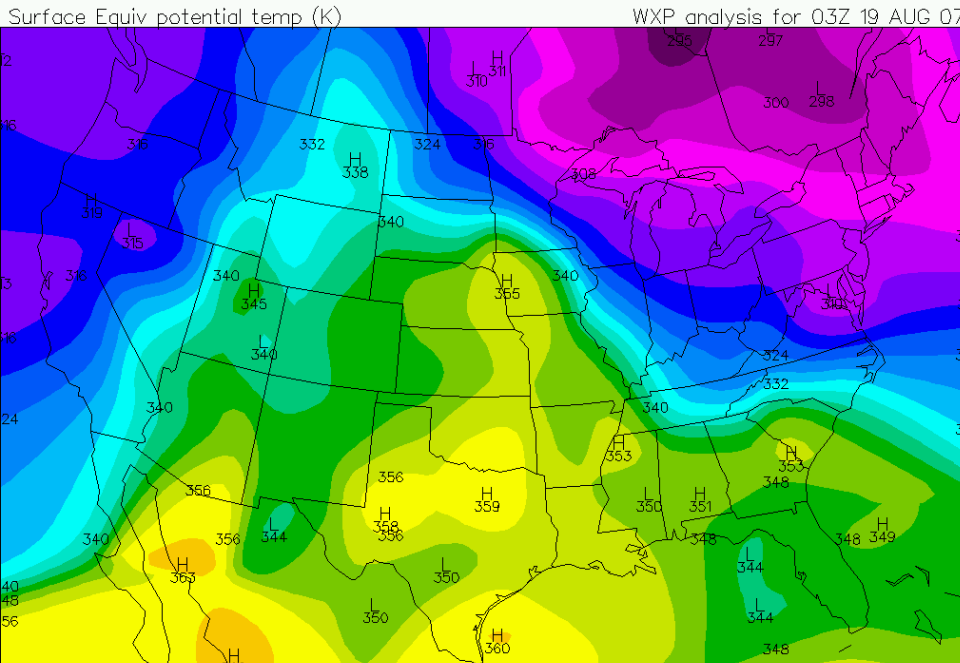


- Moist air remains
- Just above 600mb a 50kt wind
- Winds stay fairly consistent with data given

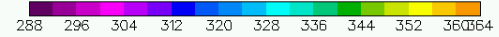


# Surface Observations





LO: 286.7 HI: 360.8



LO: 290.3 HI: 362.4



# SLP Over Time

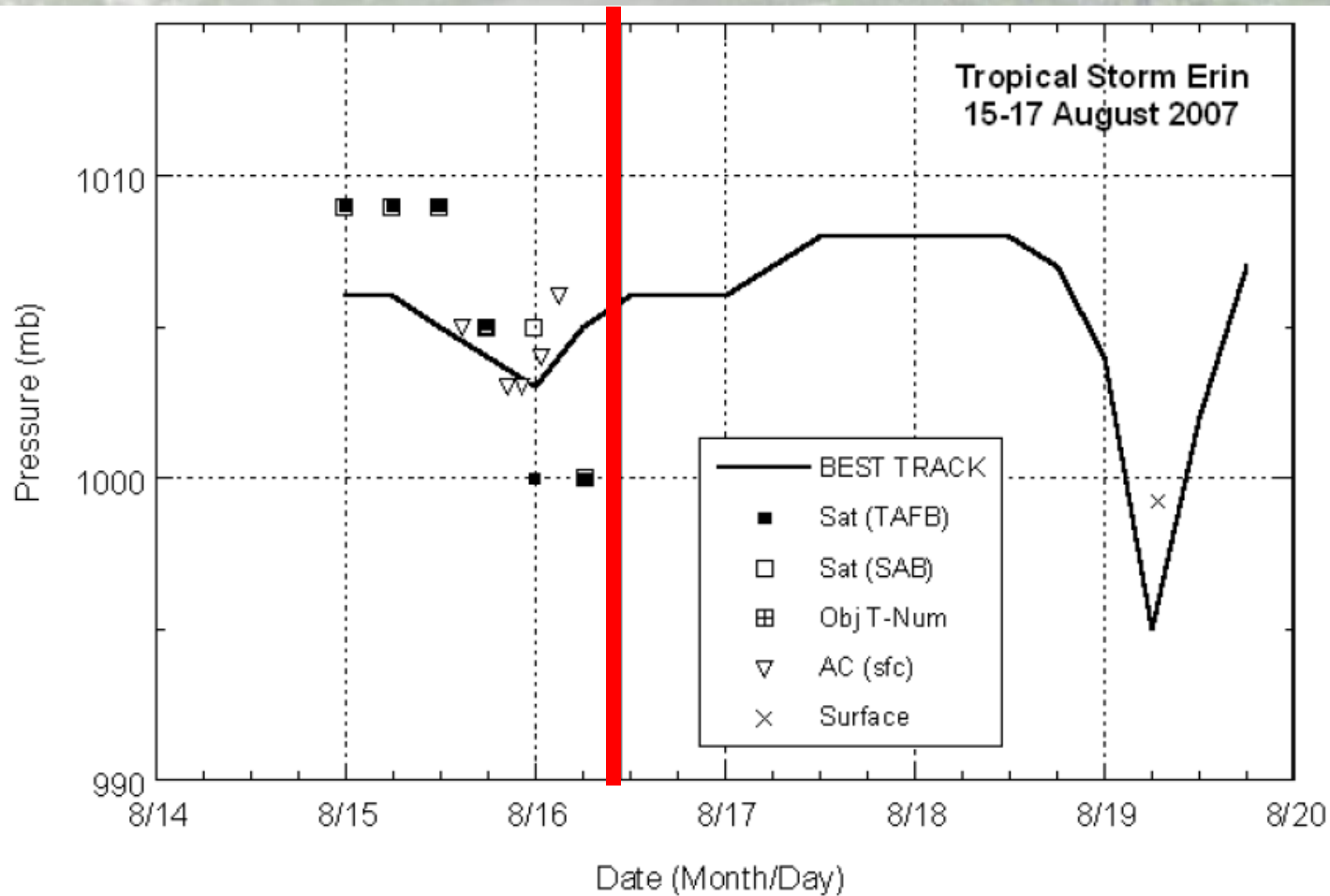


Figure 3. Selected pressure observations and best track minimum central pressure curve for Tropical Storm Erin, 15-17 August 2007. Solid vertical line indicates time of landfall of the center on the Texas coast.

# Winds Over Time

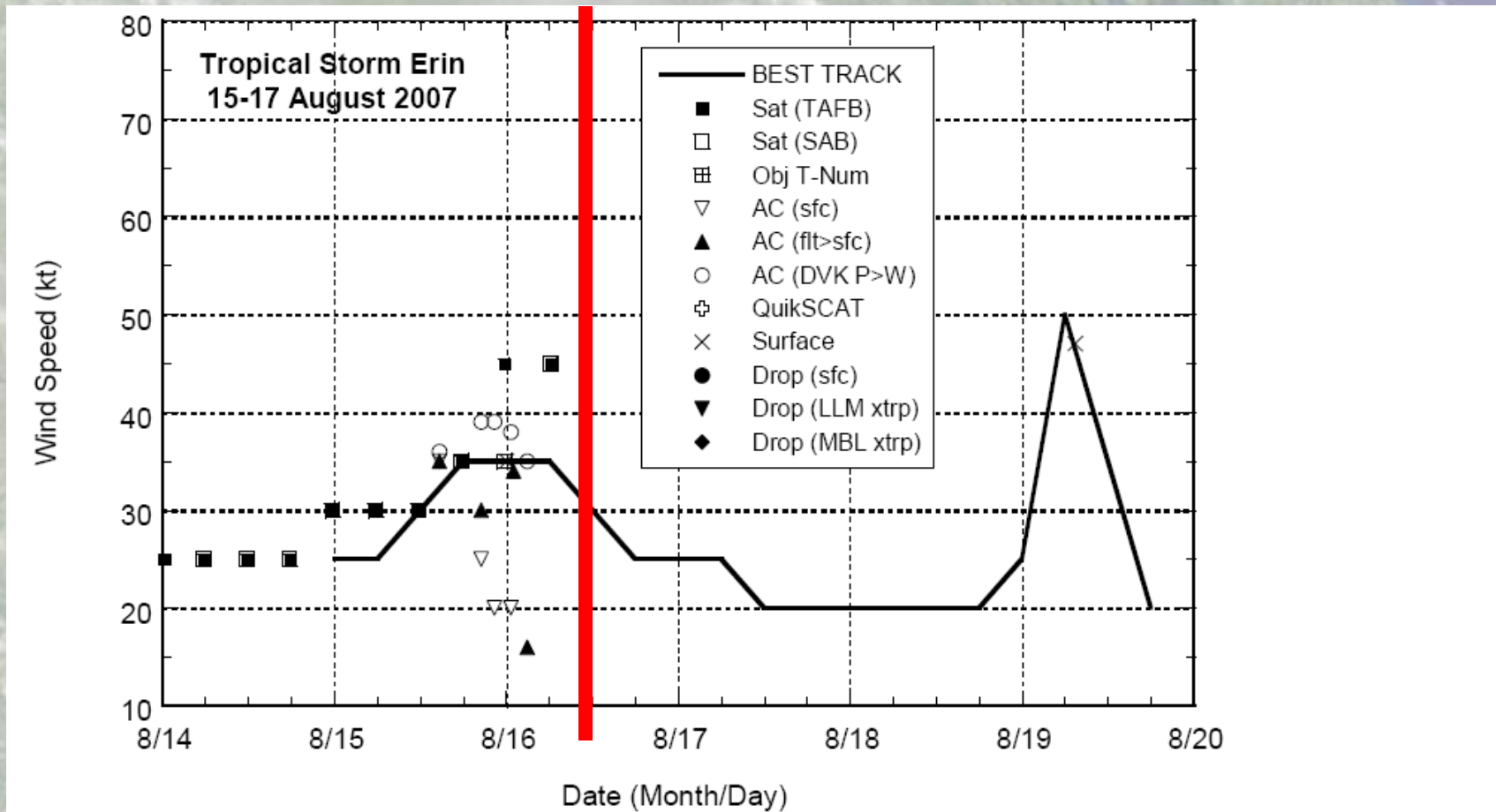
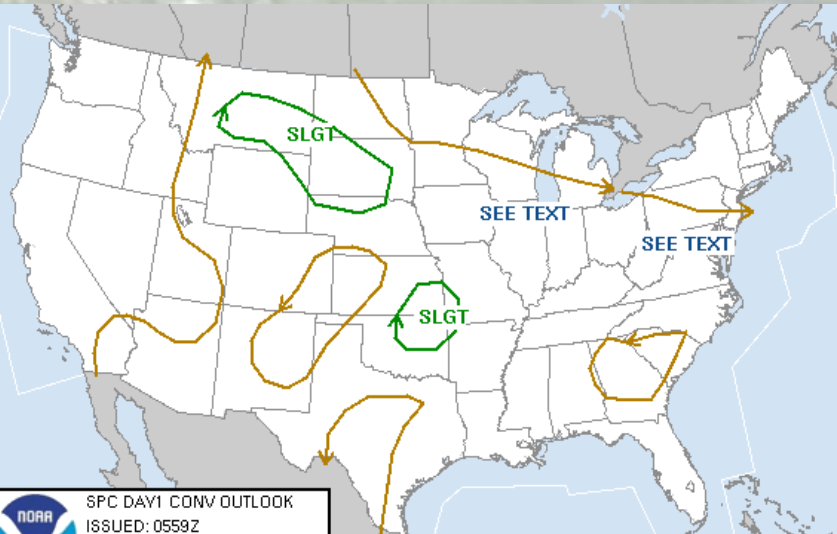



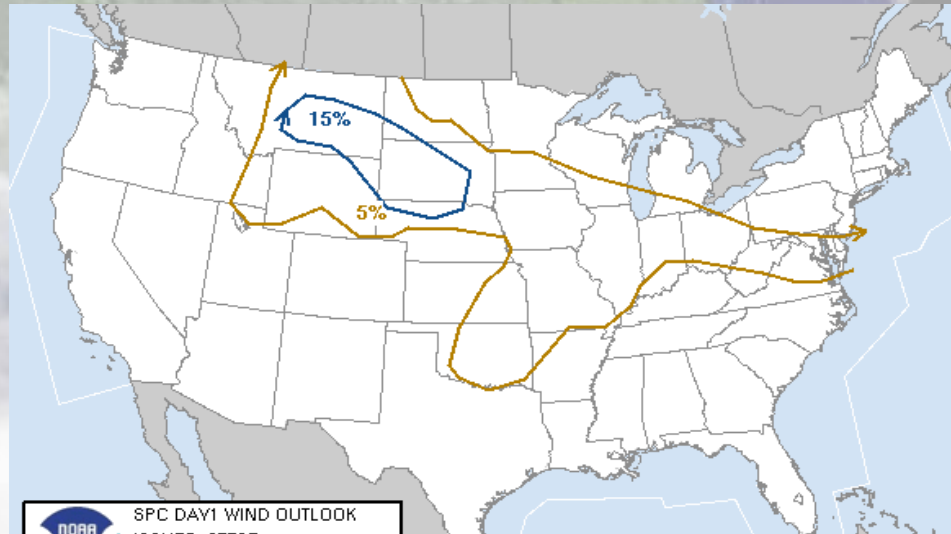
Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Tropical Storm Erin, 15-17 August 2007. Solid vertical line indicates time of landfall of the center on the Texas coast. Aircraft observations have been adjusted for elevation using 90%, 80%, and 80% reduction factors for observations from 700 mb, 850 mb, and 1500 ft, respectively.




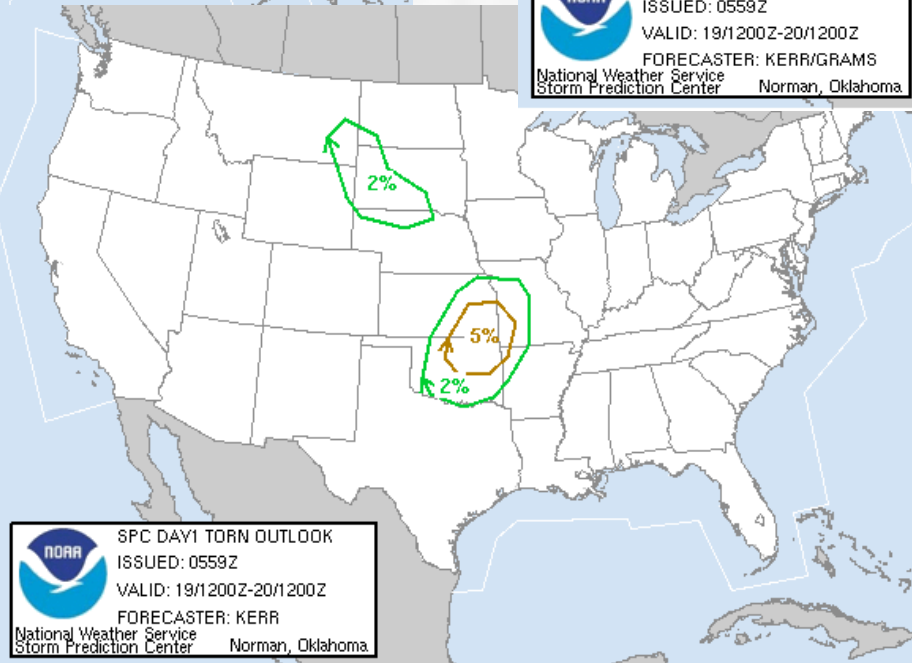
# SPC Forecasts 06z




 SPC DAY1 CONV OUTLOOK  
ISSUED: 0559Z  
VALID: 19/1200Z-20/1200Z  
FORECASTER: KERR/GRAMS  
National Weather Service  
Storm Prediction Center Norman, Oklahoma



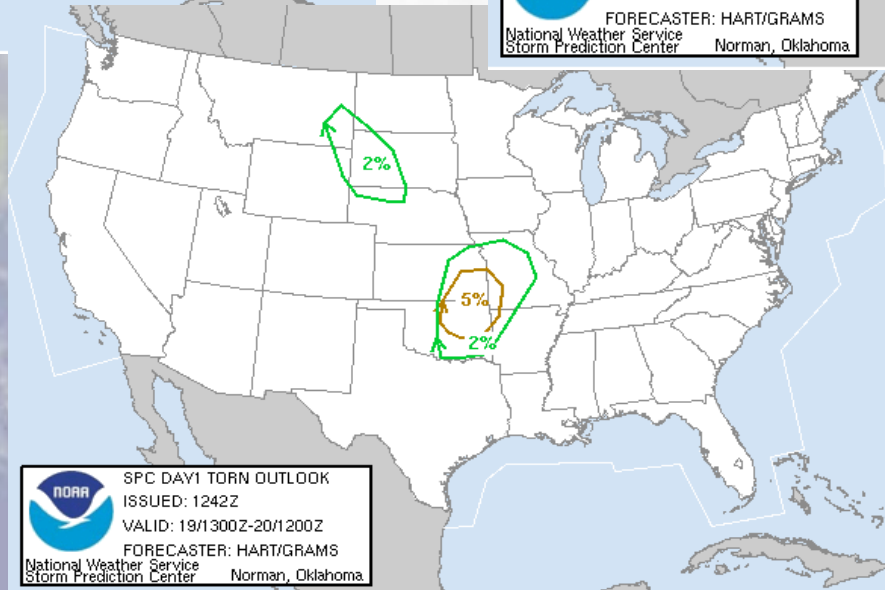
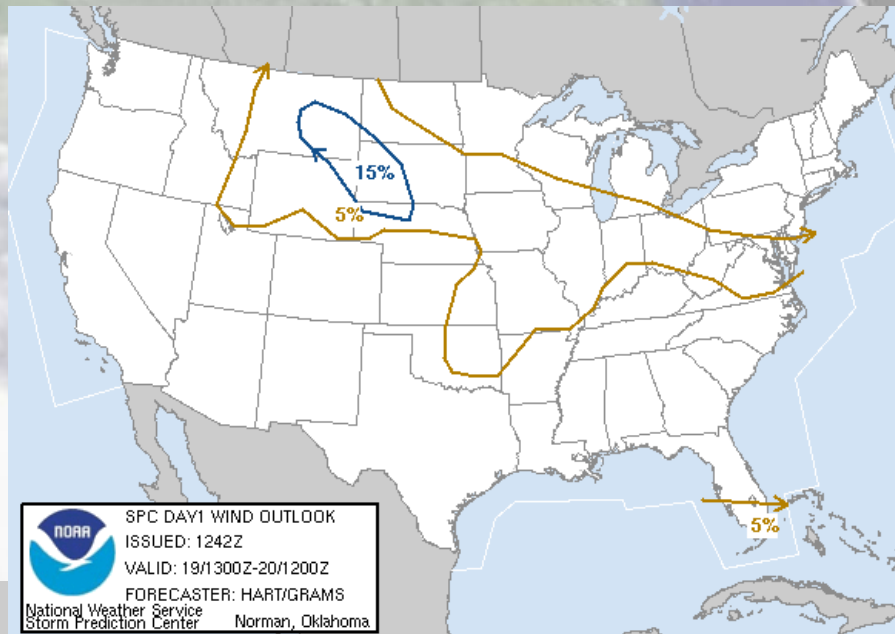
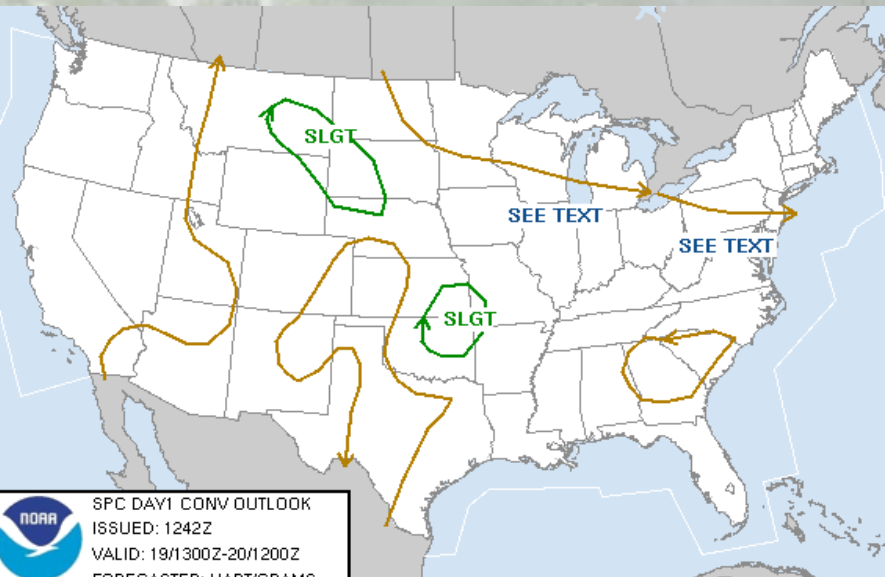
 SPC DAY1 WIND OUTLOOK  
ISSUED: 0559Z  
VALID: 19/1200Z-20/1200Z  
FORECASTER: KERR/GRAMS  
National Weather Service  
Storm Prediction Center Norman, Oklahoma



 SPC DAY1 TORN OUTLOOK  
ISSUED: 0559Z  
VALID: 19/1200Z-20/1200Z  
FORECASTER: KERR  
National Weather Service  
Storm Prediction Center Norman, Oklahoma

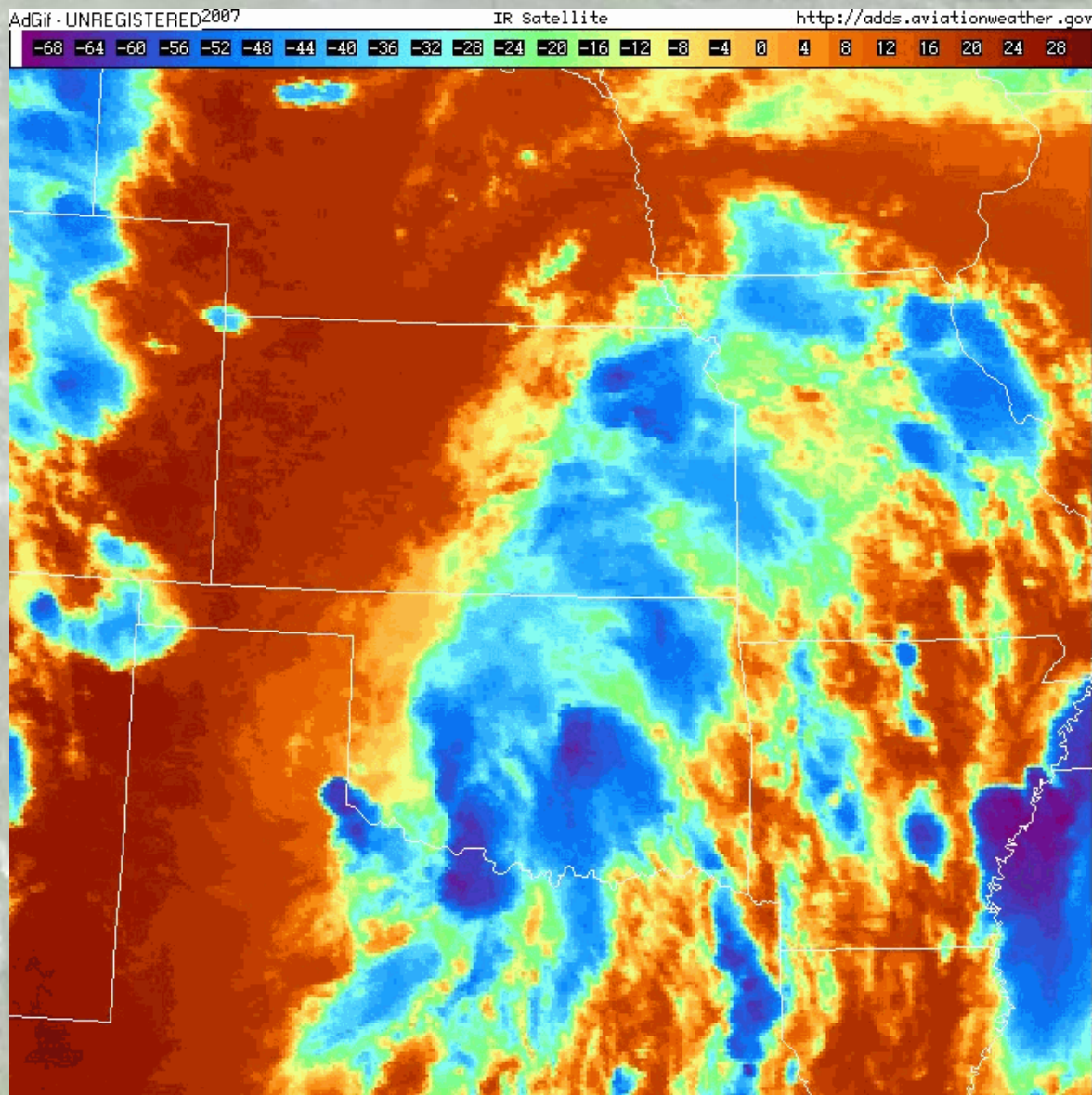


# SPC Forecasts 12z



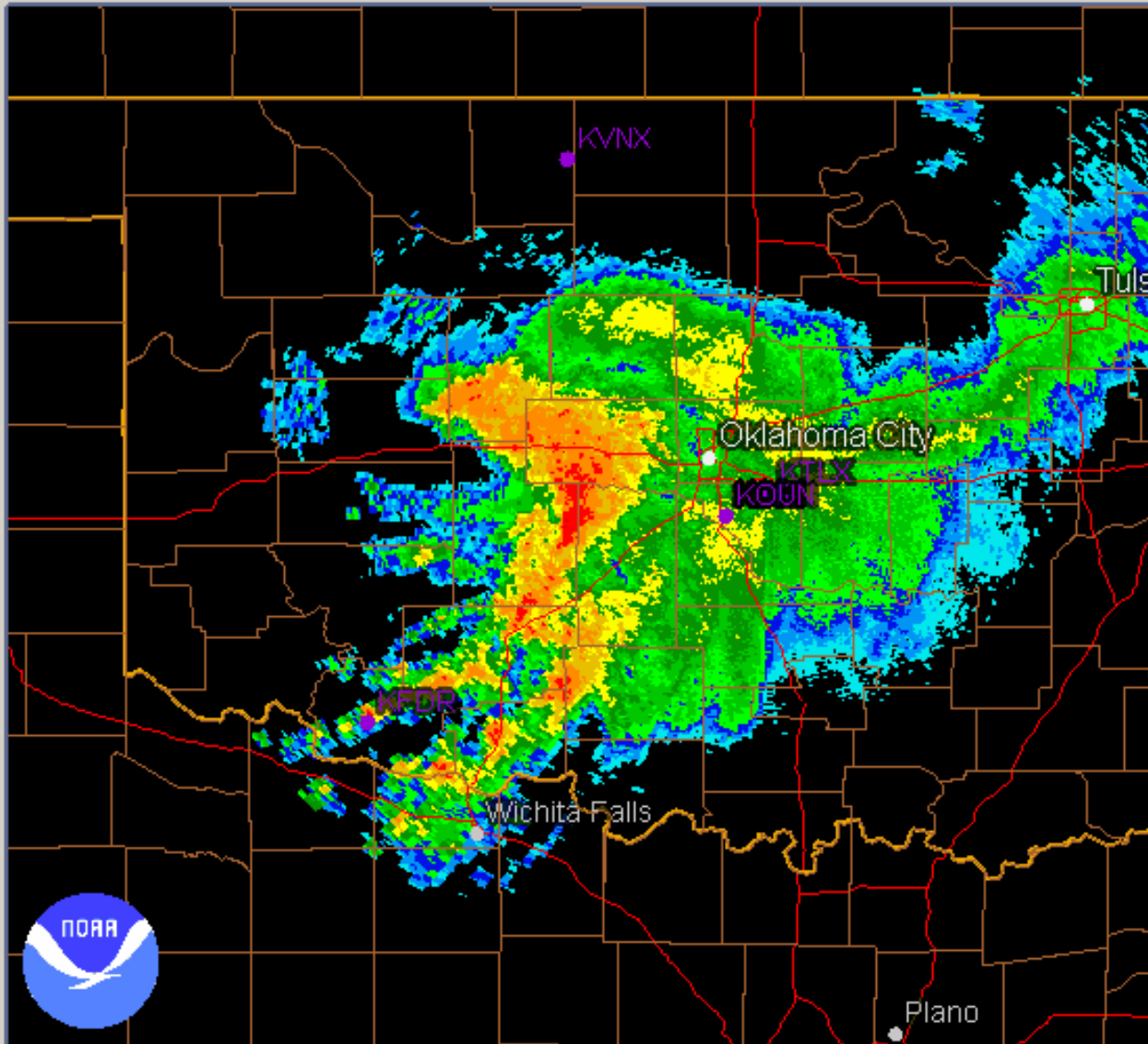


# IR Aug 19, 2007 00z-23z



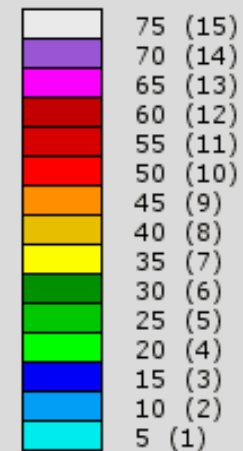


# Radar Loop Aug 19, 2007 07z-16z

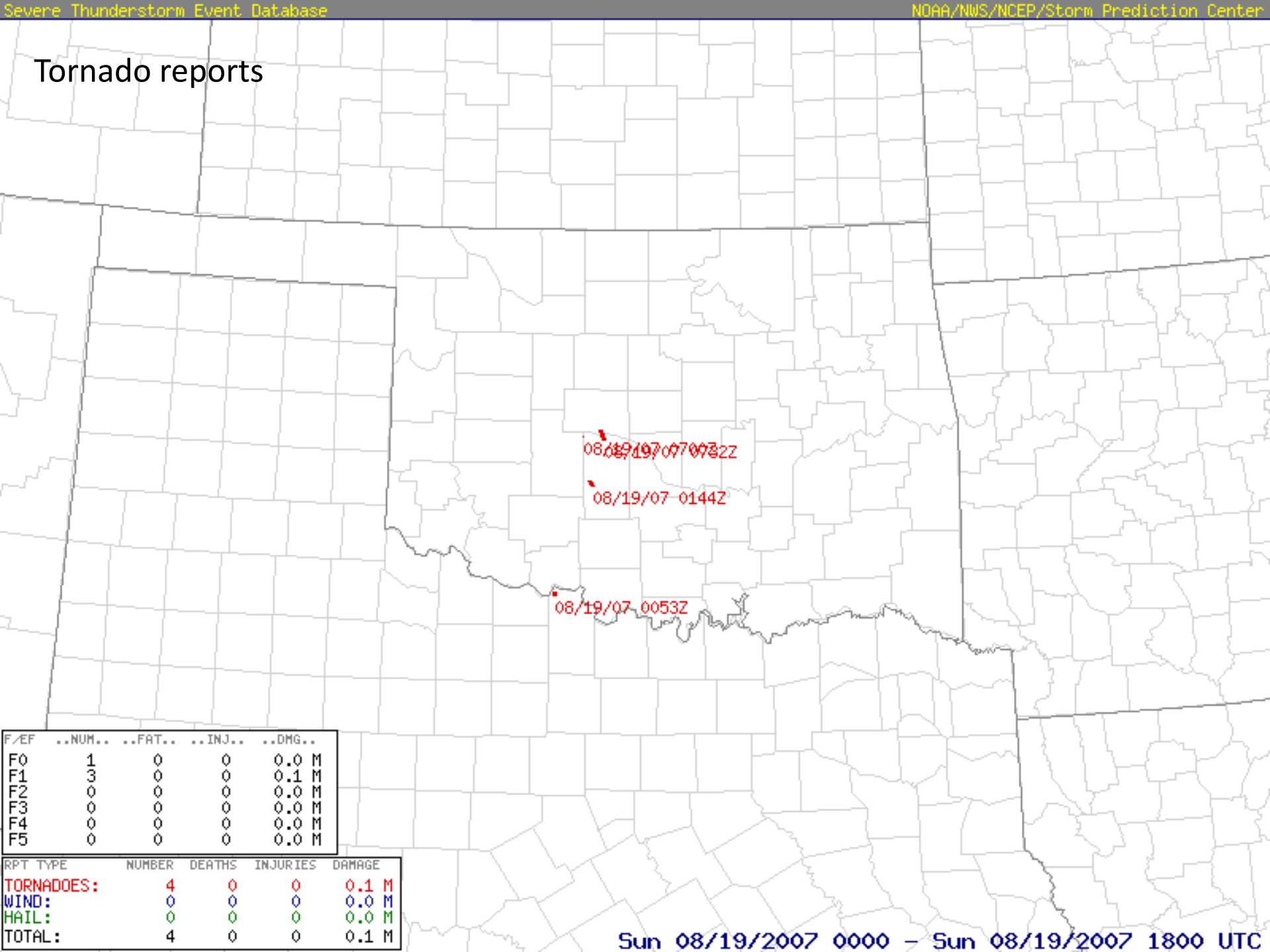


NEXRAD LEVEL-III  
BASE REFLECTIVITY  
KTLX - OKLAHOMA CITY, OK  
08/19/2007 07:01:14 GMT  
LAT: 35/19/58 N  
LON: 97/16/40 W  
ELEV: 1277 FT  
MODE/VCP: A / 11  
ELEV ANGLE: 0.50 °  
MAX: 55 dBZ

Legend: dBZ (Category)



## Tornado reports

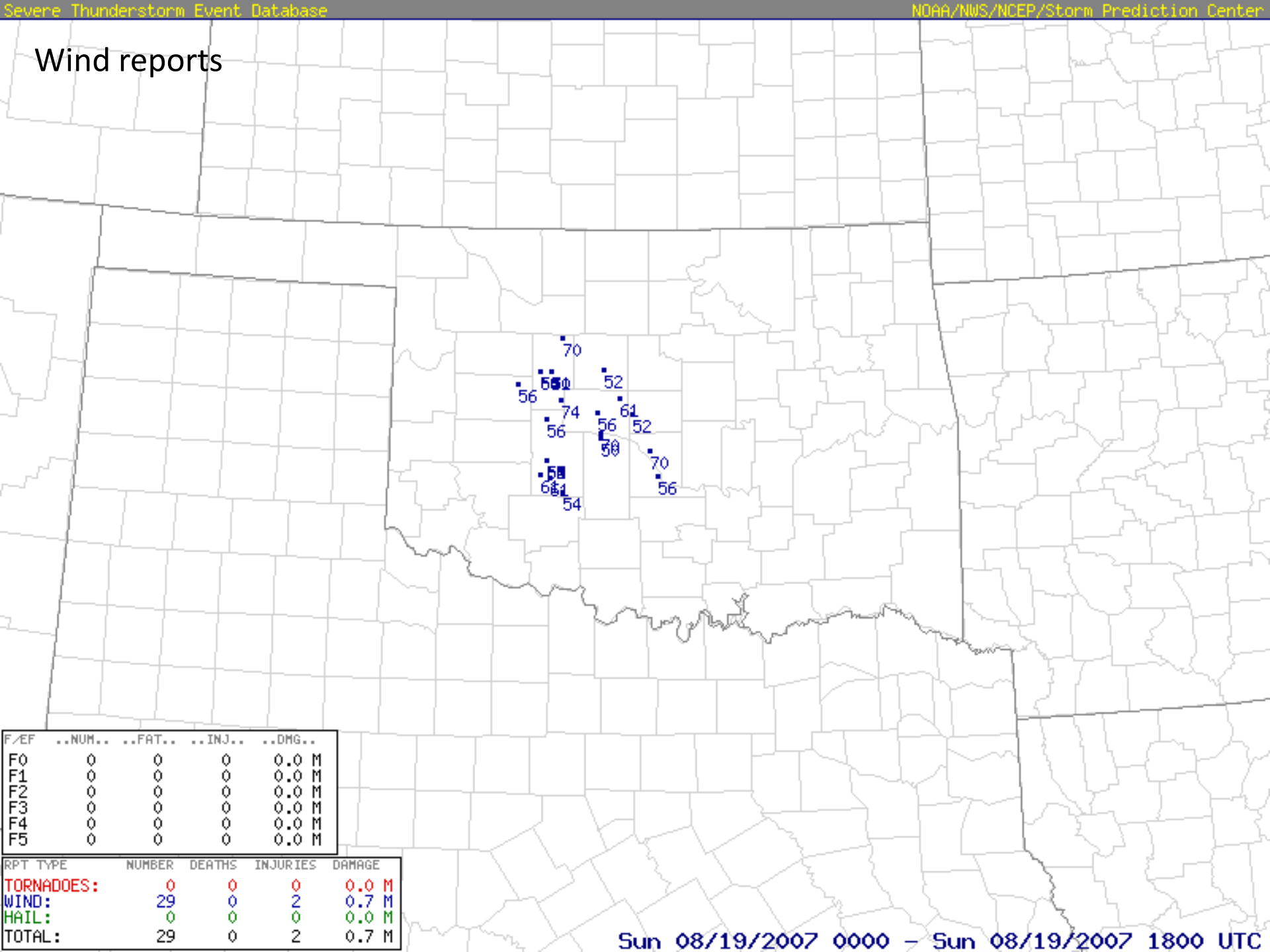


F/EF	..NUM..	..FAT..	..INJ..	..DMG..
F0	1	0	0	0.0 M
F1	3	0	0	0.1 M
F2	0	0	0	0.0 M
F3	0	0	0	0.0 M
F4	0	0	0	0.0 M
F5	0	0	0	0.0 M

RPT TYPE	NUMBER	DEATHS	INJURIES	DAMAGE
TORNADOES:	4	0	0	0.1 M
WIND:	0	0	0	0.0 M
HAIL:	0	0	0	0.0 M
TOTAL:	4	0	0	0.1 M

Sun 08/19/2007 0000 - Sun 08/19/2007 1800 UTC

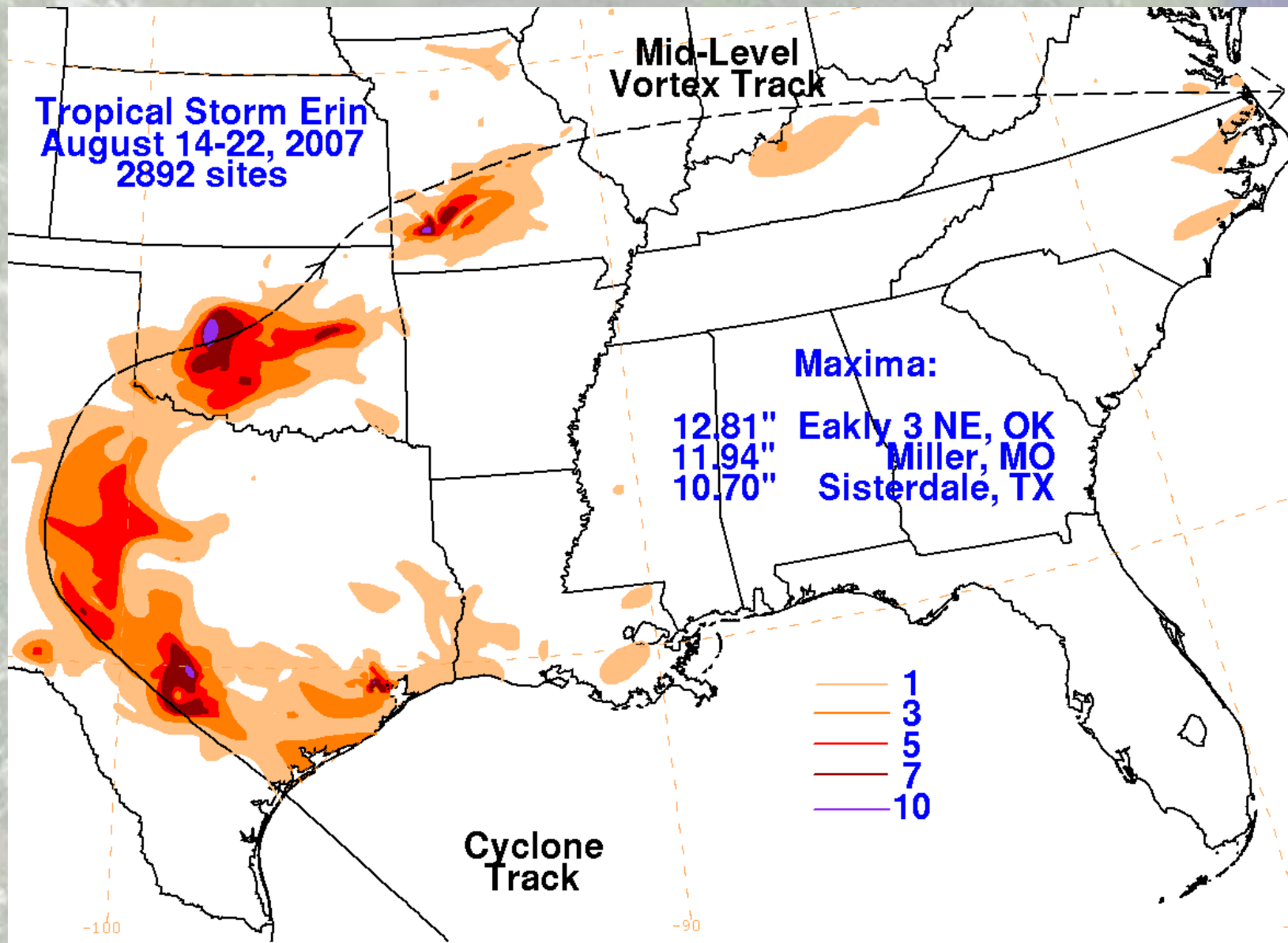
## Wind reports







# Rainfall Rates





# Damages



Courtesy of Wikipedia



# Sugar Creek





# NHC Report

- “The upper-level forcing was apparently a dominant mechanism, which is in contrast to tropical cyclones that are maintained primarily by extraction of heat energy from the ocean. Since the system was clearly non-frontal, designating it as an extratropical cyclone is also not the most appropriate solution. In addition, the prevailing view among the NHC’s Hurricane Specialists is that the system’s duration over Oklahoma on 19 August was also too short to classify it as a subtropical cyclone...the system is simply designated as a “low”.



# Conclusion

- Erin re-intensified over land due to unique conditions
- Once on land Erin regained tropical features like a distinct eyewall appearance on radar
- Severe weather did occur with high winds and some weak tornadoes
- This case is not completely understood



# Sources

- Arndt, Derek et.al., 2009: Observations of the Overland Reintensification of Tropical Storm Erin (2007). *BAMS*, 1079-1093.
- Knabb, R. D., 2008: Tropical Storm Erin. National Hurricane Center, 17 pp. [www.nhc.noaa.gov/pdf/TCR-AL052007\\_Erin.pdf](http://www.nhc.noaa.gov/pdf/TCR-AL052007_Erin.pdf)
- Storm Prediction Center
- National Hurricane Center
- Hydrometeorological Prediction Center
- Plymouth State University