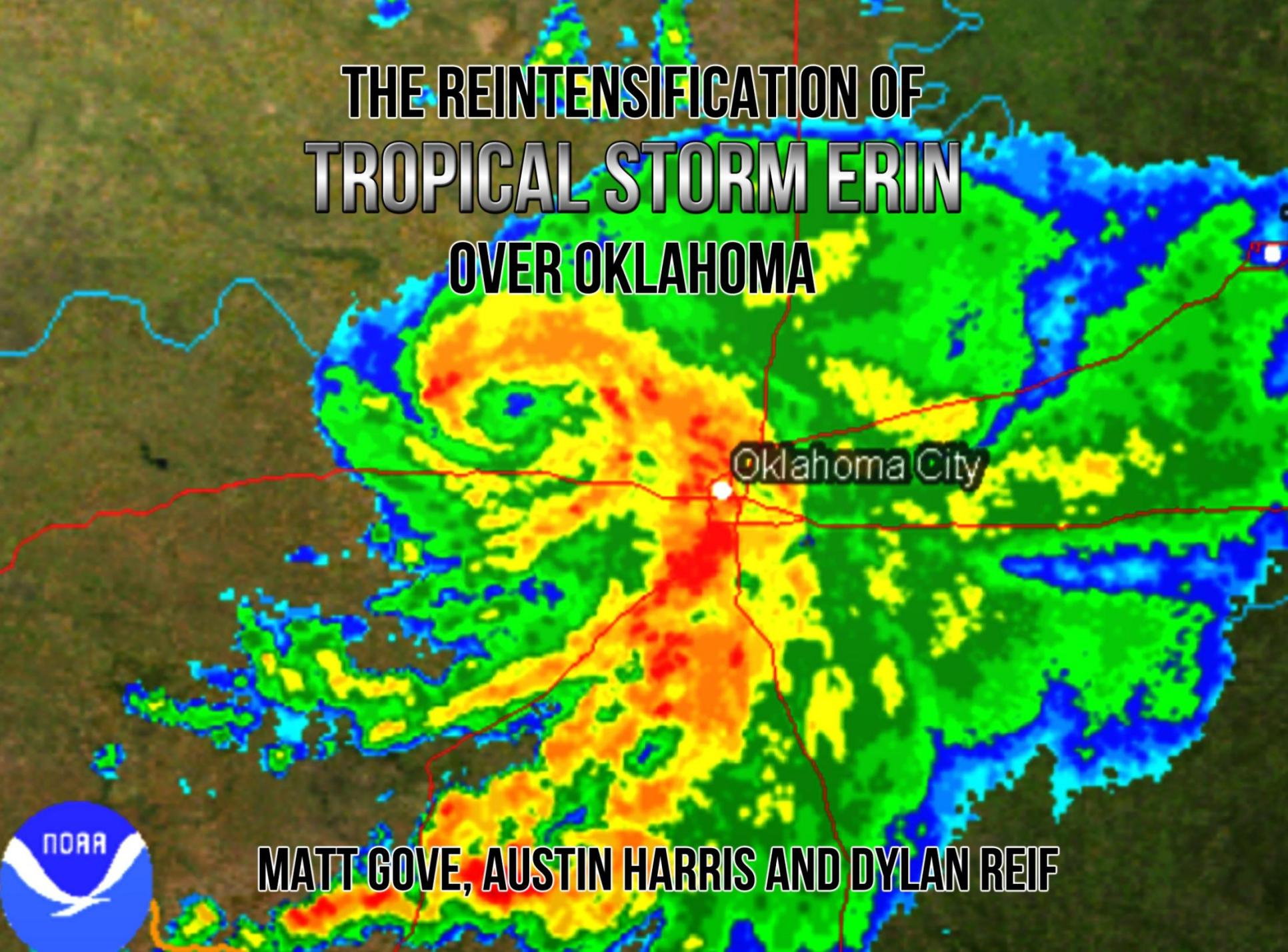


THE REINTENSIFICATION OF TROPICAL STORM ERIN OVER OKLAHOMA



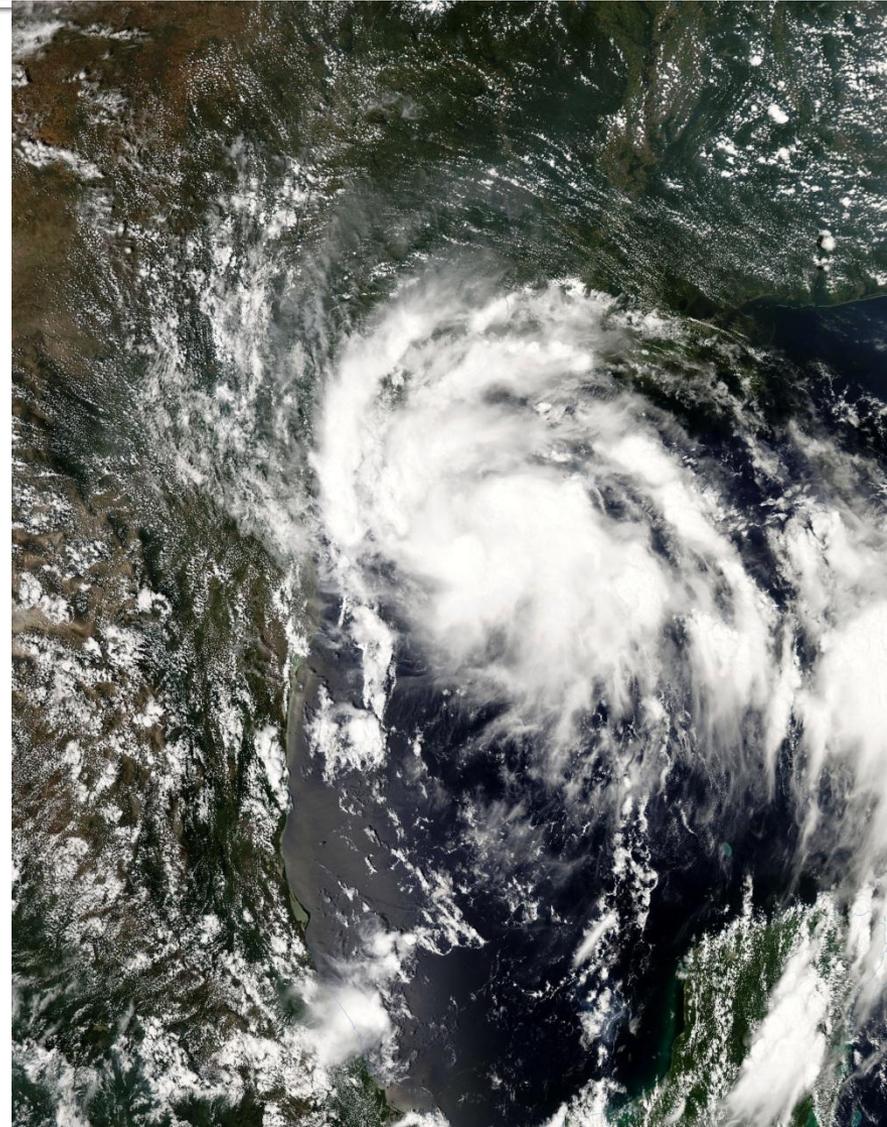
Oklahoma City



MATT GOVE, AUSTIN HARRIS AND DYLAN REIF

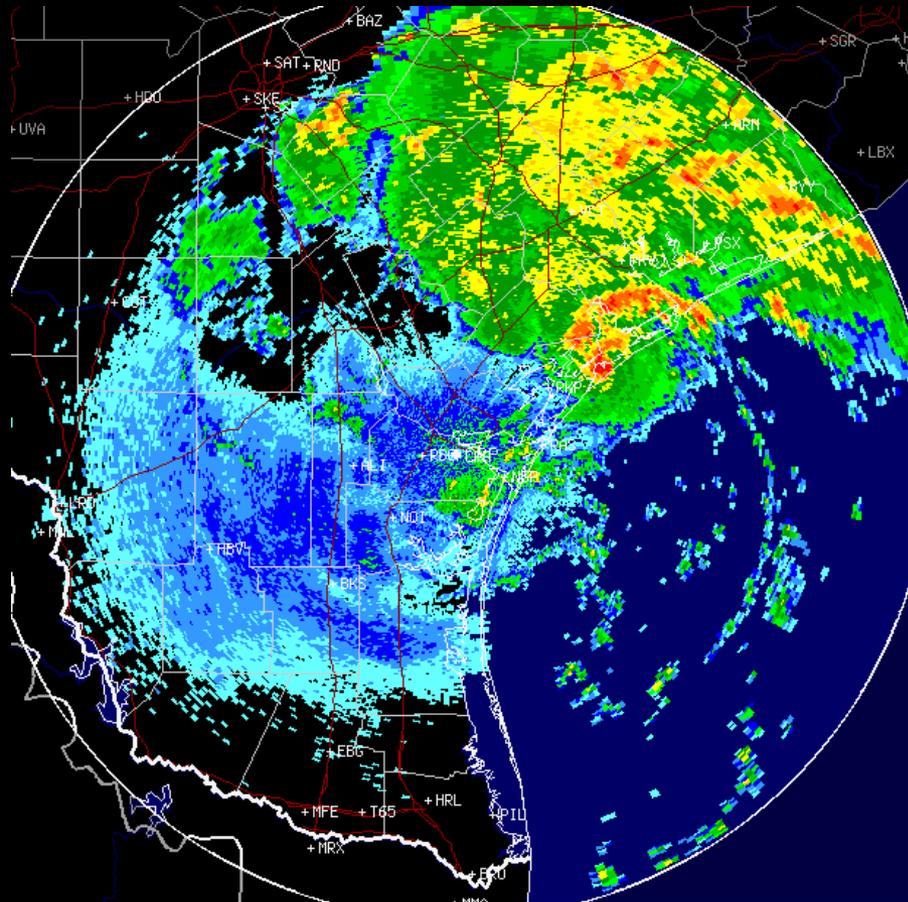
Why study Erin?

- She reintensified over land without the presence of a baroclinic zone
 - Two other recorded storms have done this in North America: TS David (1979) and TS Danny (1997).
 - However, neither of these two storms reintensified to a strength greater than they had at landfall.



San Jose Island, Tex.

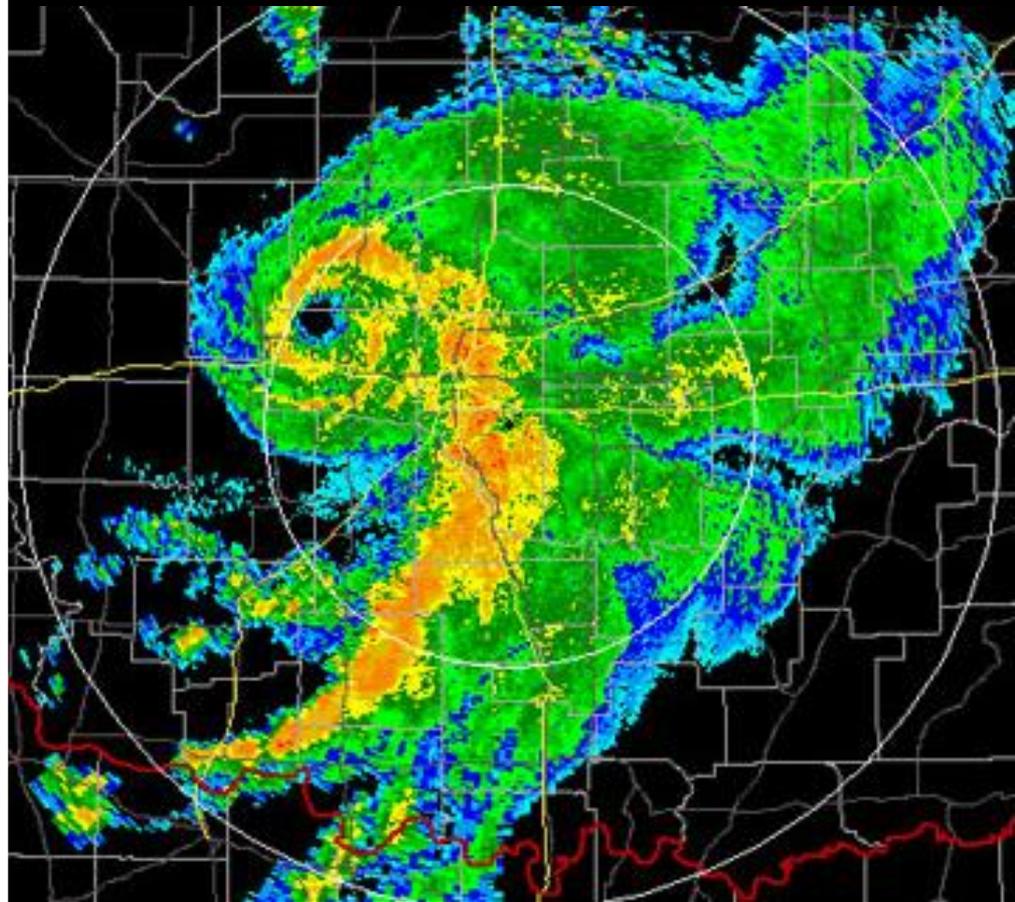
August 16, 2007 1000 UTC



1006 hPa 30 kt

Watonga, Okla.

August 19, 2007 1200 UTC

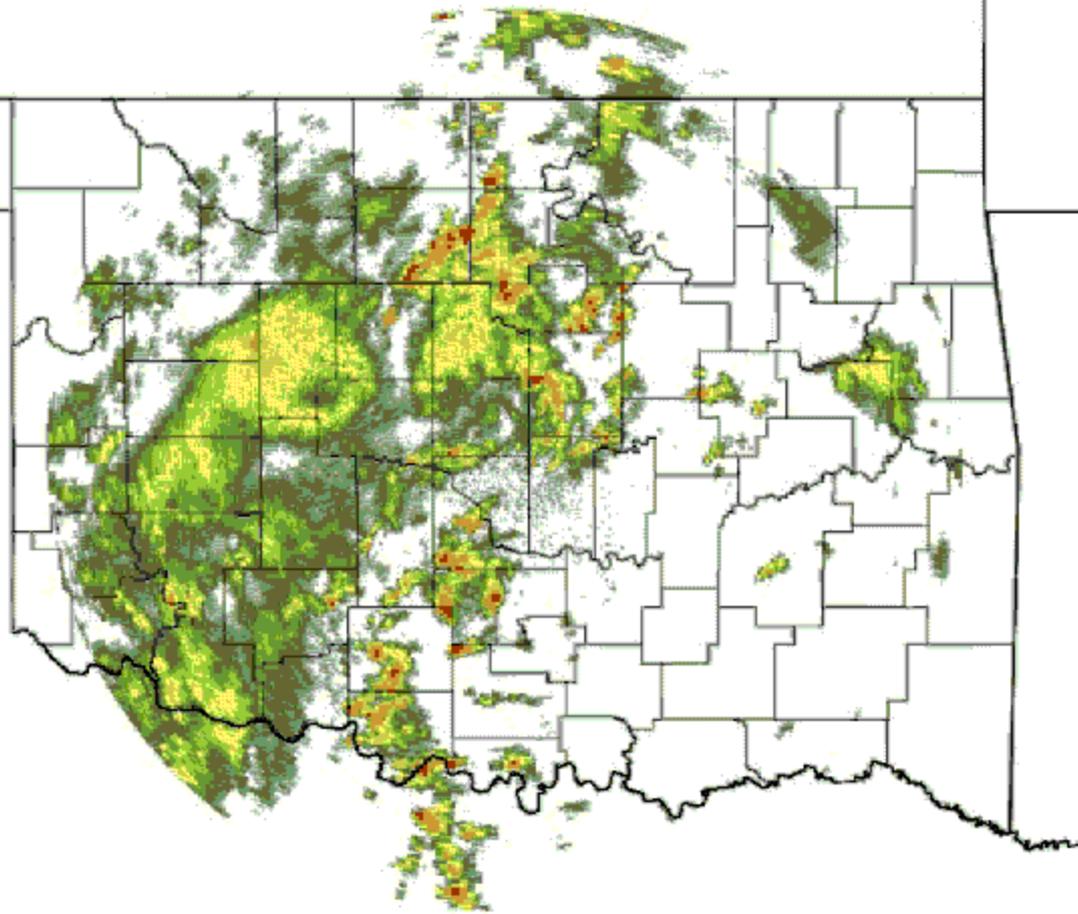


999.1 hPa 47 kt

Radar loop

Tropical Storm Erin

18-Aug-2007 16:00 PM CDT



Project Purpose

- Why did Erin reintensify over Oklahoma?
- We hypothesize that it was a combination of ideal conditions typical of hurricane development over water, and synoptic scale features that lead to the reintensification

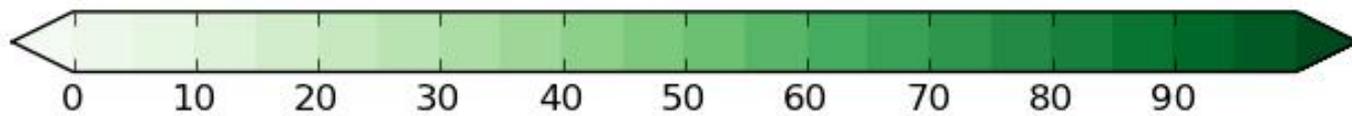
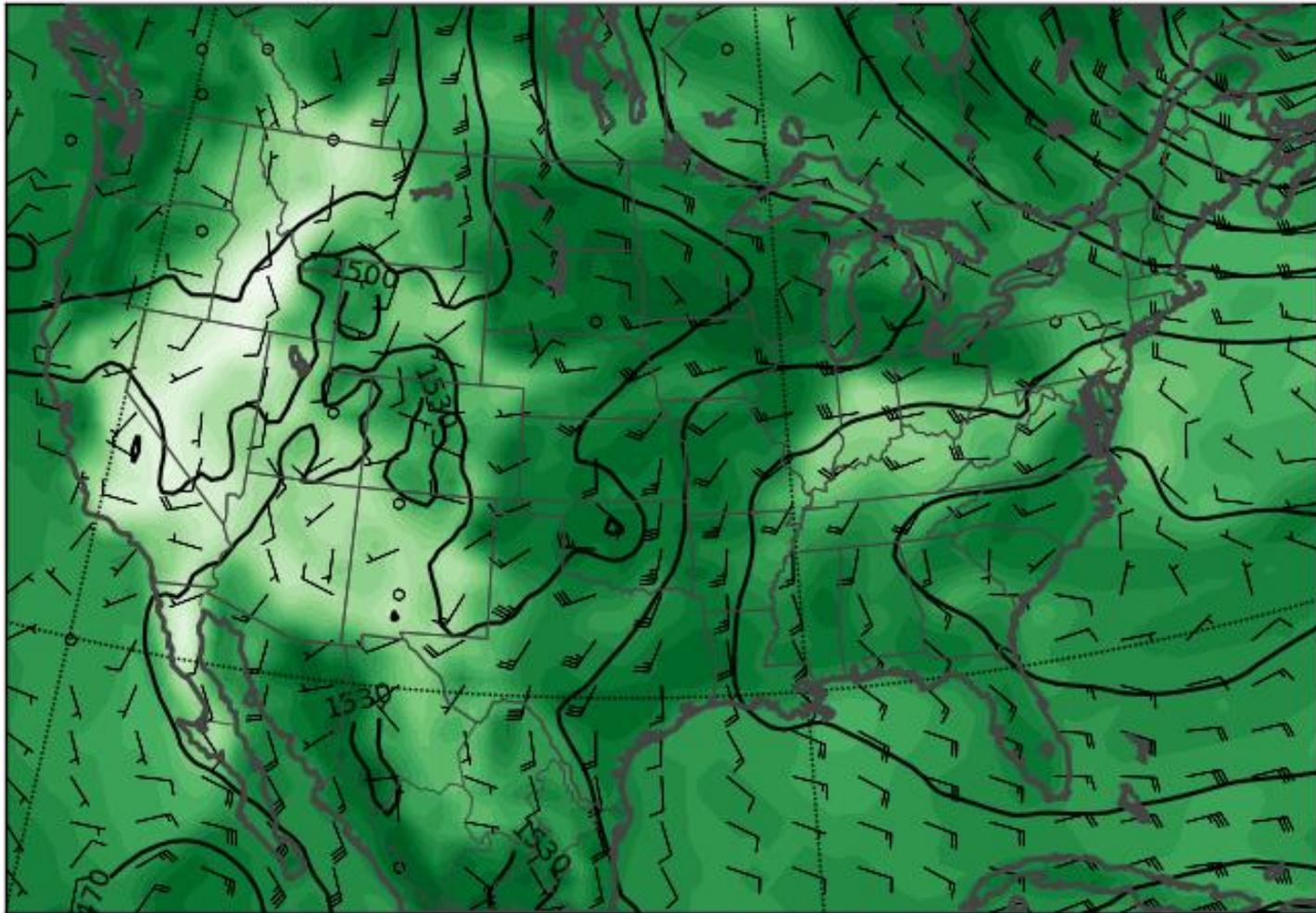
Objectives

- To test our hypothesis, we will examine the following during the time of reintensification
 - Compare and contrast Erin to the National Hurricane Center's known intensification conditions
 - We can do this because Erin was a warm-core system during the time of reintensification
 - Other reasons that are not listed in the Hurricane Center's intensification parameters
 - These include QG theory and overall synoptic patterns present during the time of reintensification

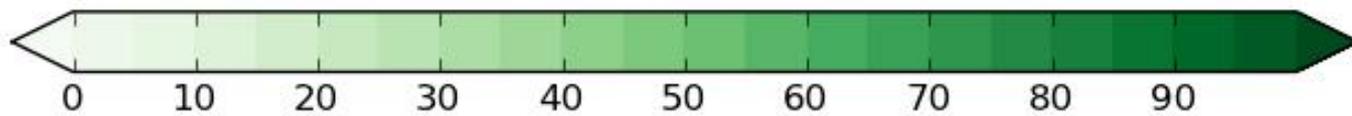
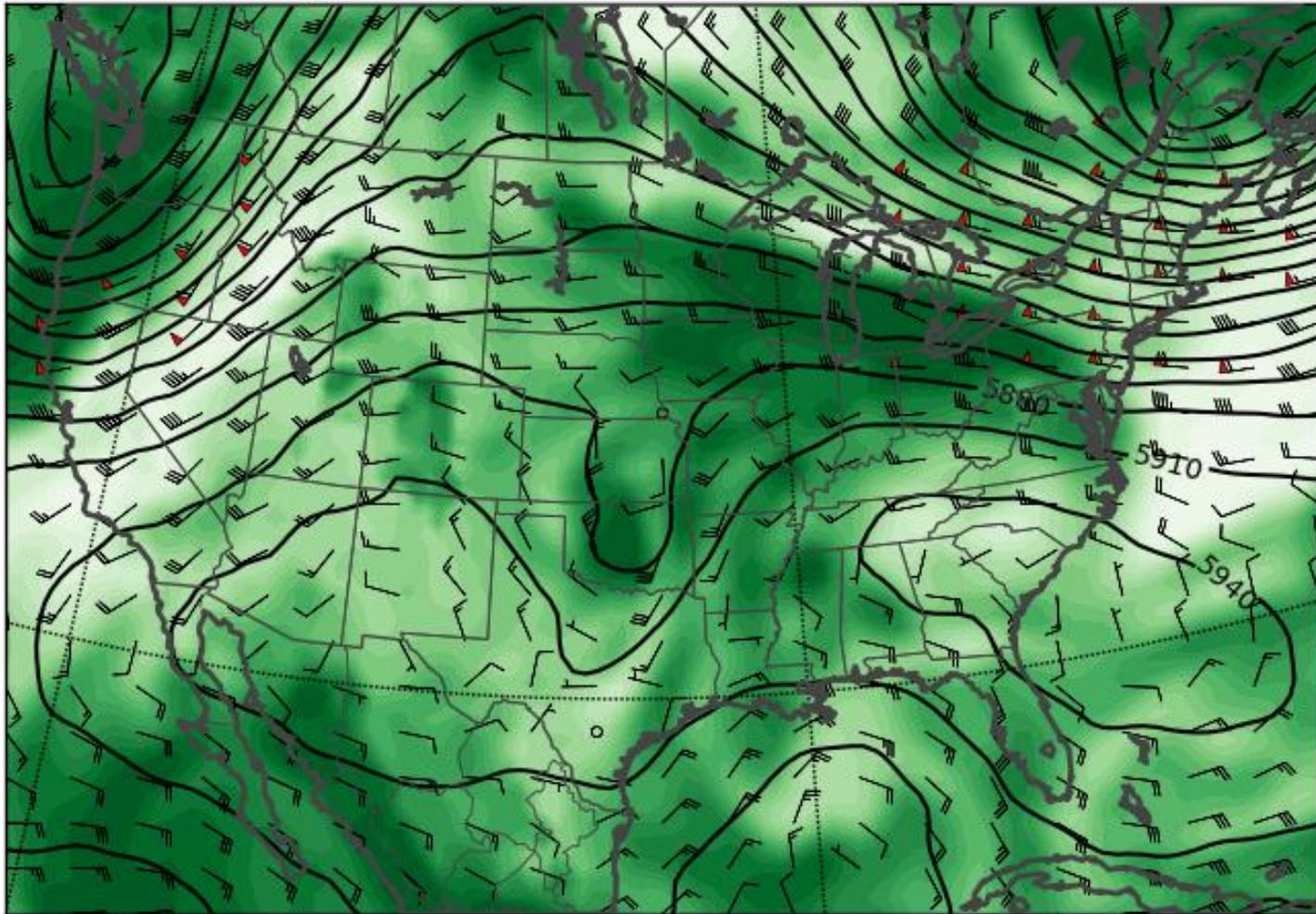
What does a tropical cyclone need to develop?

- National Hurricane Center has a few widely accepted parameters
 - **High Relative Humidity values from surface to mid levels**
 - **Saturated Lapse Rate near center of rotation**
 - Low vertical wind shear (one of the most important ingredients)
 - Ocean water temperature must be above 26 degrees Celsius (79 degrees Fahrenheit)

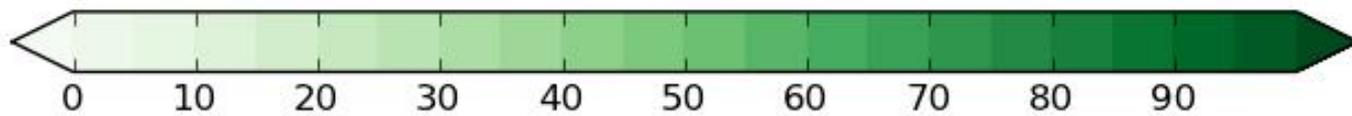
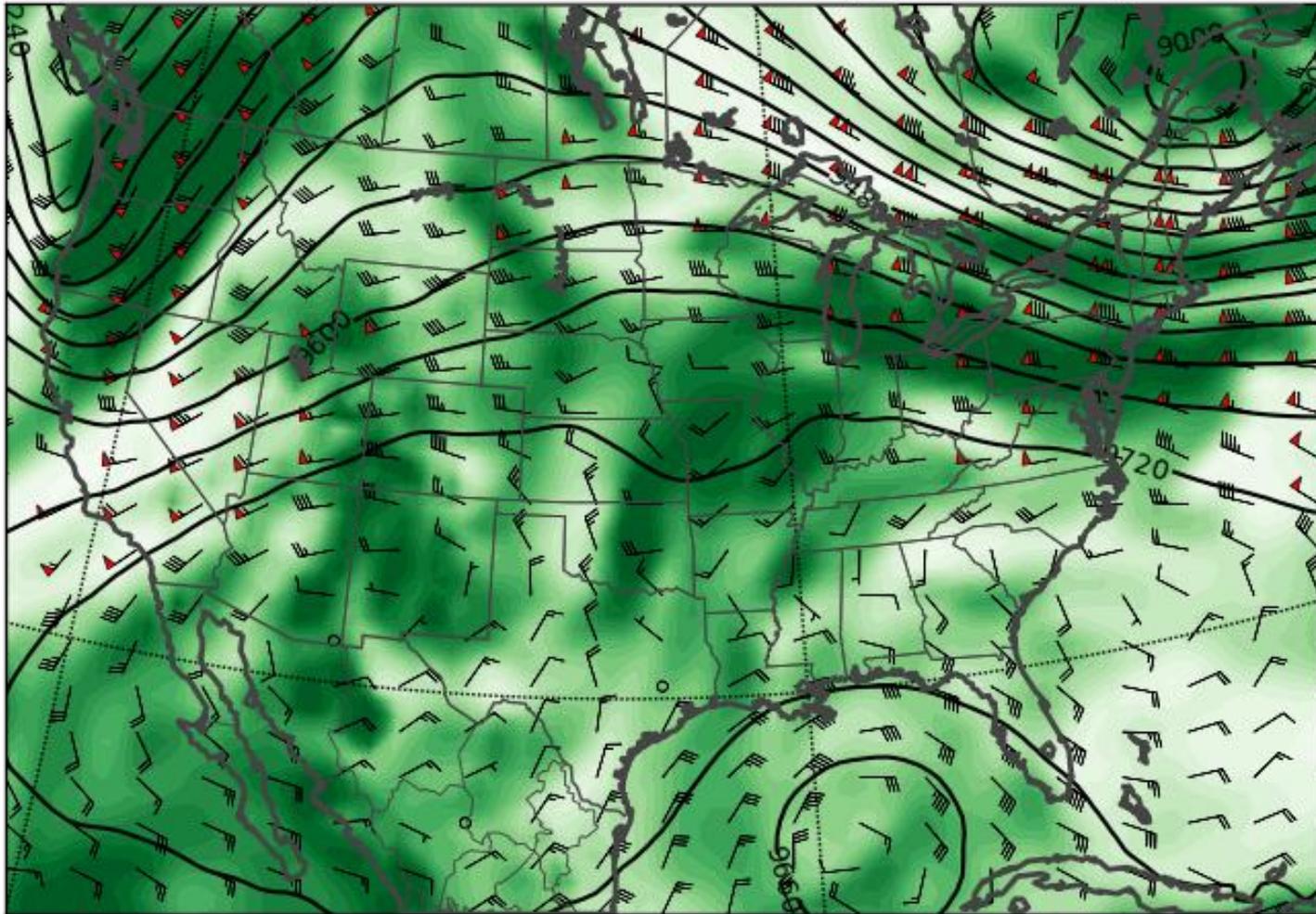
850 hPa geopotential heights and Relative Humidity valid 19 Aug 2007 at 1200 UTC



500 hPa geopotential heights and Relative Humidity valid 19 Aug 2007 at 1200 UTC



300 hPa geopotential heights and Relative Humidity valid 19 Aug 2007 at 1200 UTC



72357 OUN Norman

100

200

300

400

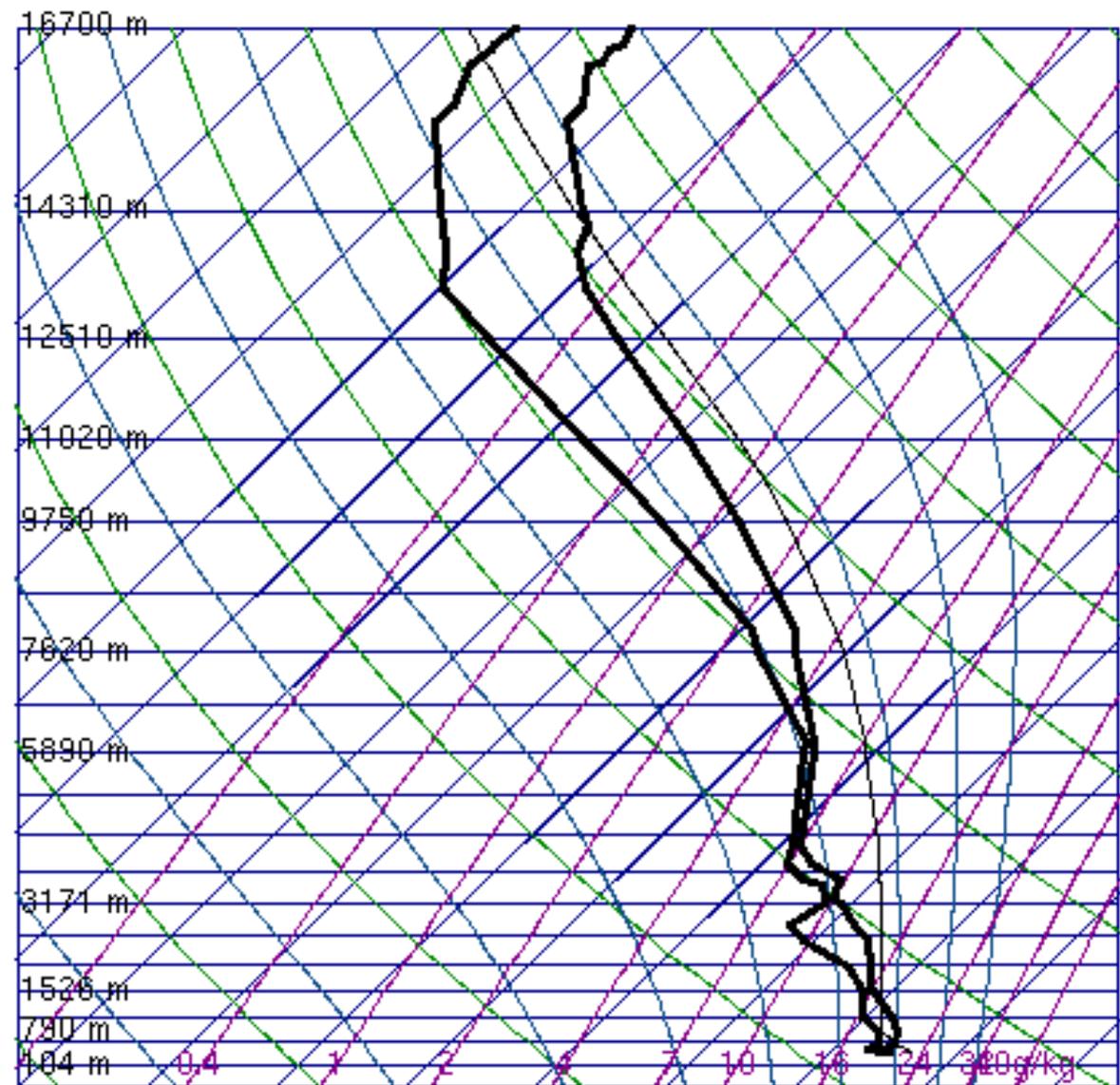
500

600

700

800

900



SLAT	35.18
SLON	-97.44
SELV	345.0
SHOW	-2.25
LIFT	-4.06
LFTV	-4.44
SWET	435.8
KINX	40.00
CTOT	22.50
VTOT	23.30
TOTL	45.80
CAPE	1729.
CAPV	1871.
CINS	-8.84
CINV	-5.66
EQLV	155.4
EQTV	155.4
LFCT	873.4
LFCV	883.6
BRCH	28.23
BRCV	30.53
LCLT	295.4
LCLP	928.1
MLTH	301.8
MLMR	18.69
THCK	5786.
PWAT	58.96

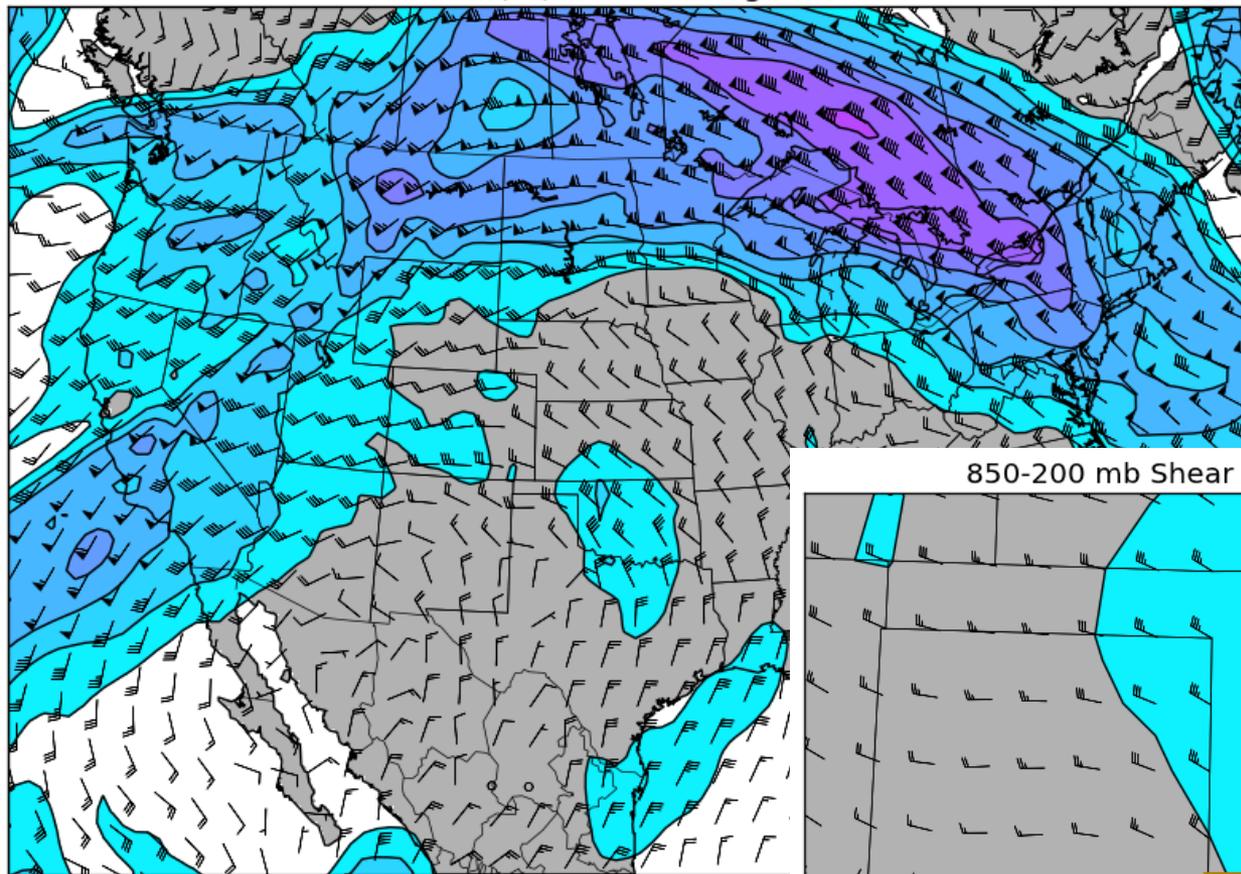
00Z 19 Aug 2007

University of Wyoming

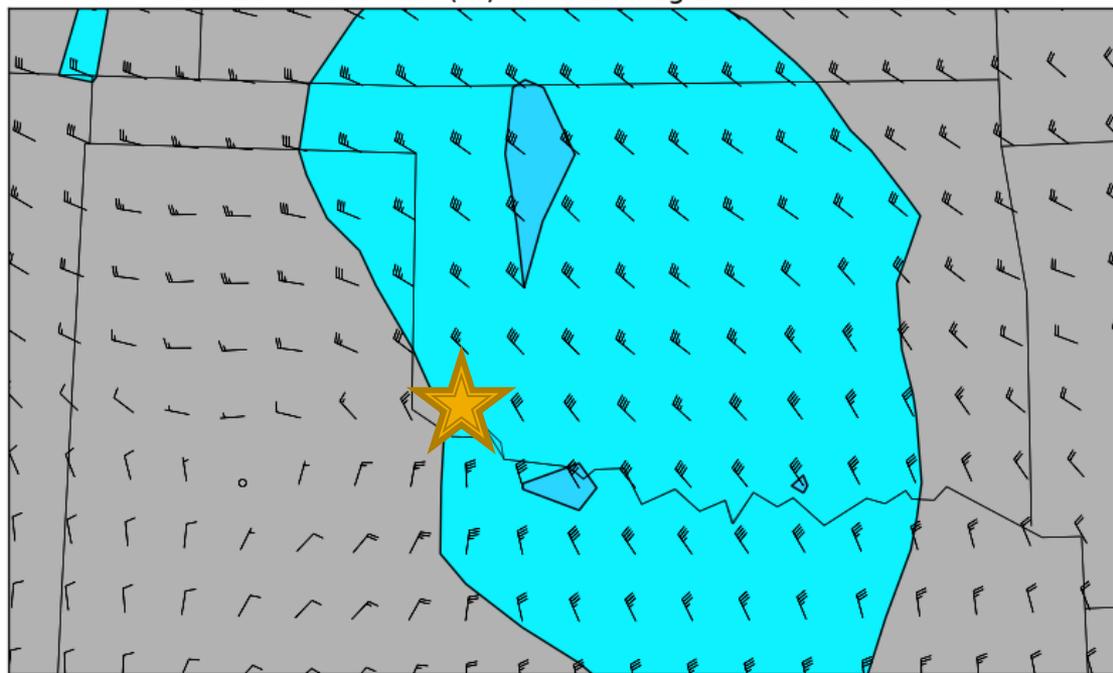
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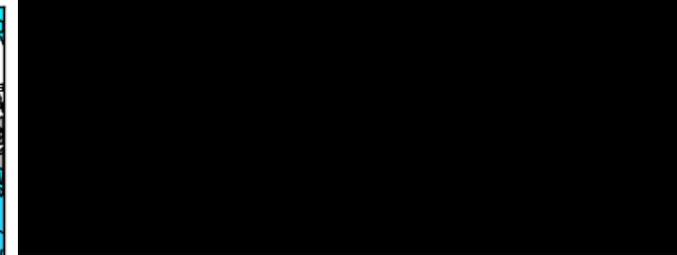
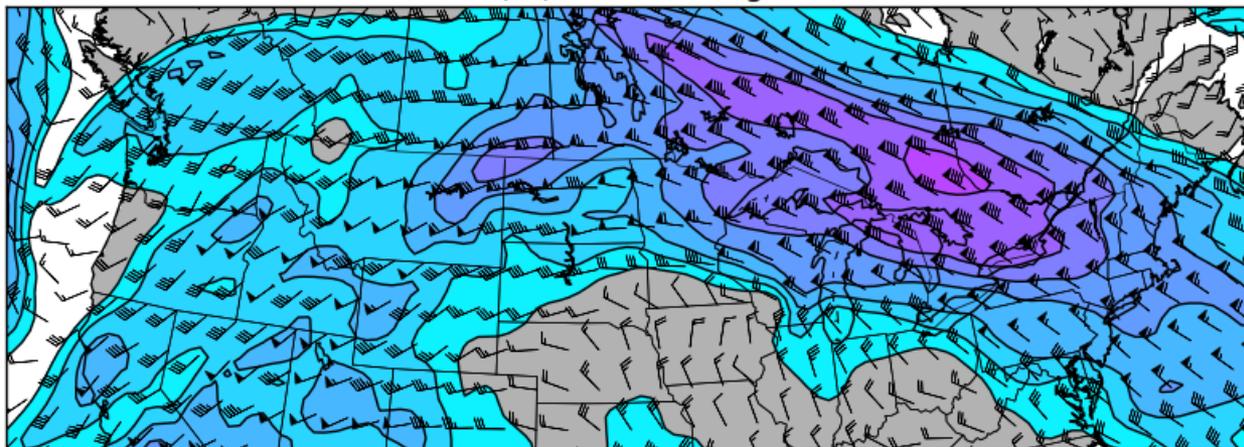
850-200 mb Shear (kt) valid 19 Aug 2007 at 0000 UTC



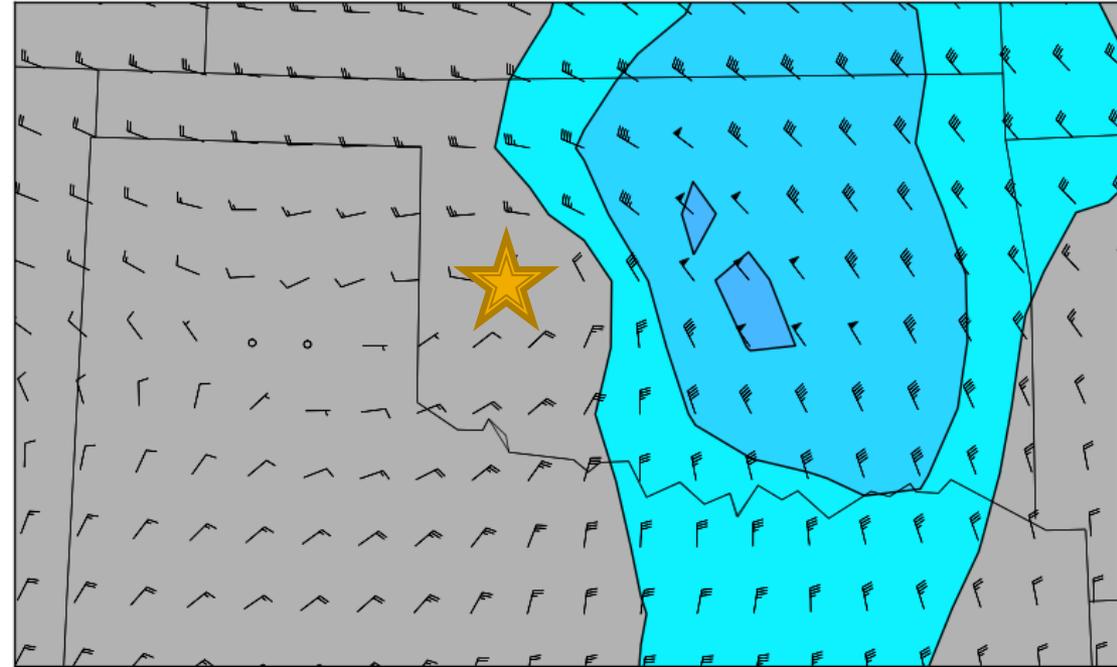
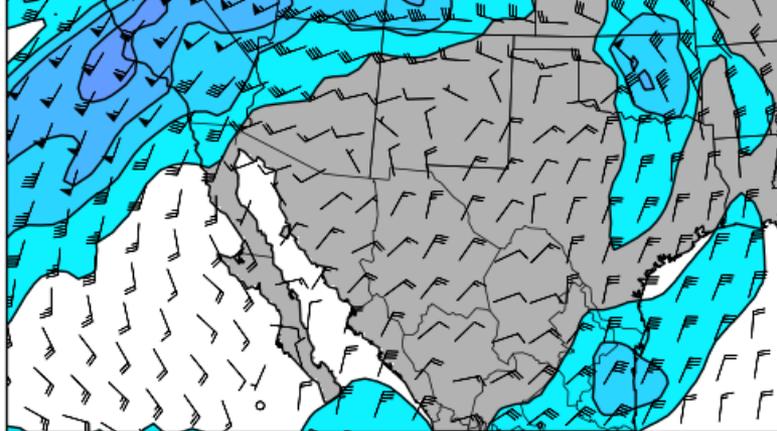
850-200 mb Shear (kt) valid 19 Aug 2007 at 0000 UTC



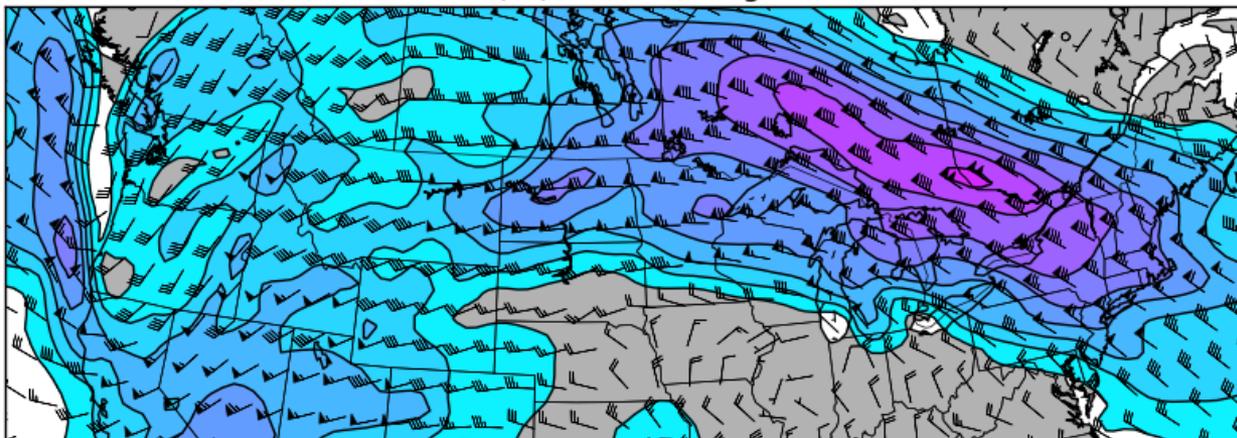
850-200 mb Shear (kt) valid 19 Aug 2007 at 0600 UTC



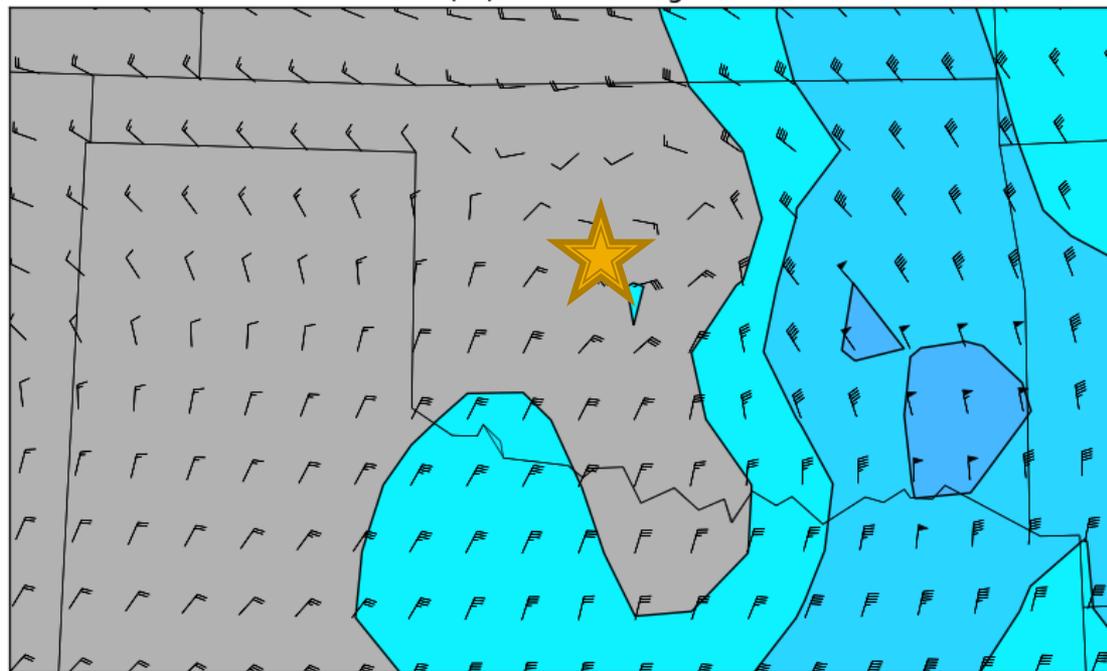
850-200 mb Shear (kt) valid 19 Aug 2007 at 0600 UTC



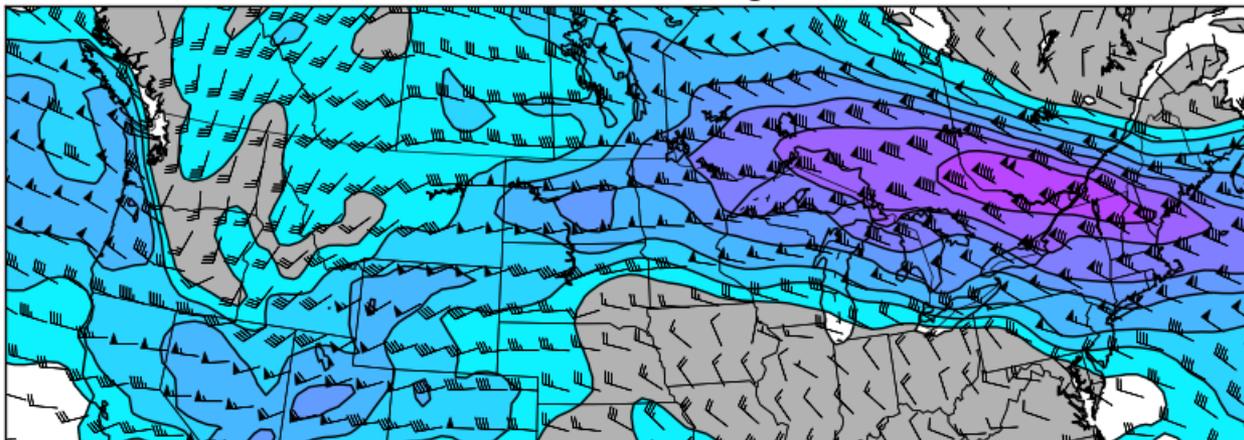
850-200 mb Shear (kt) valid 19 Aug 2007 at 1200 UTC



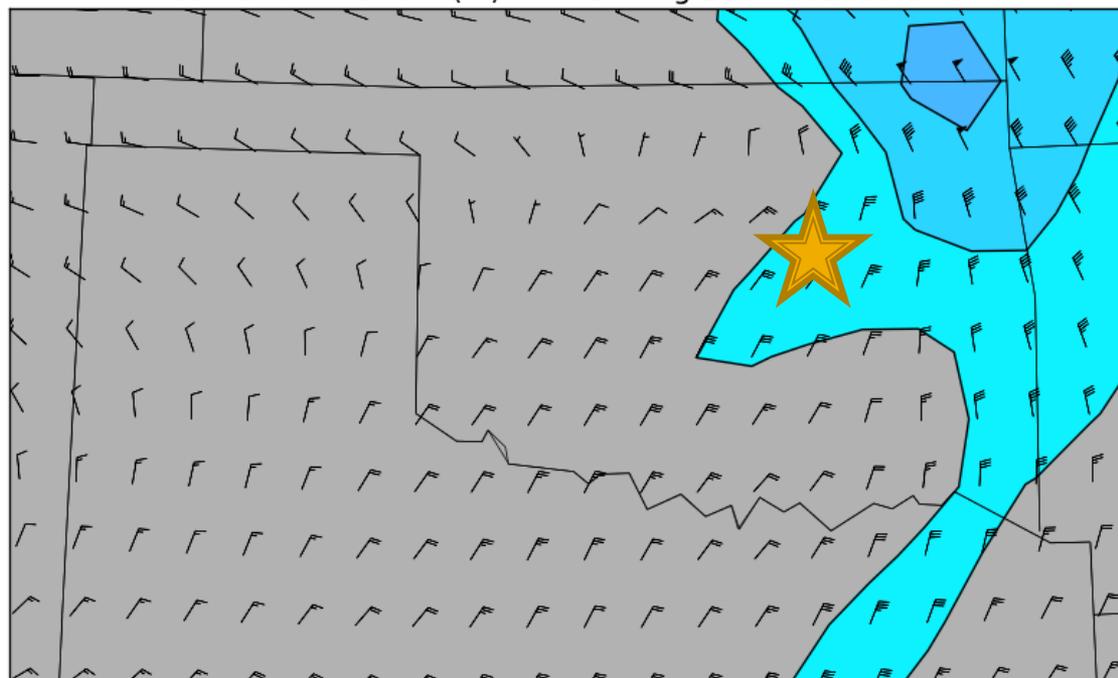
850-200 mb Shear (kt) valid 19 Aug 2007 at 1200 UTC



850-200 mb Shear (kt) valid 19 Aug 2007 at 1800 UTC



850-200 mb Shear (kt) valid 19 Aug 2007 at 1800 UTC



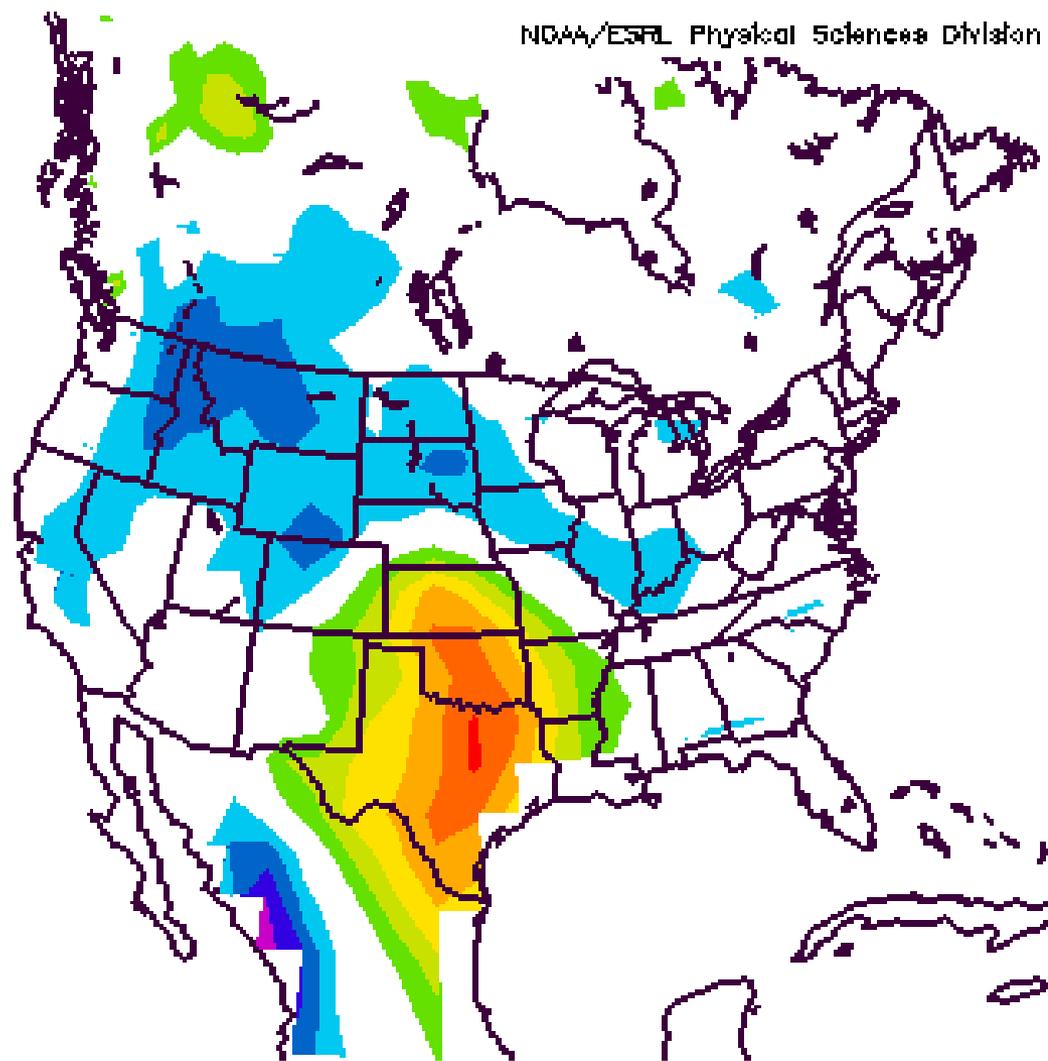
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NCEP/NCAR Reanalysis

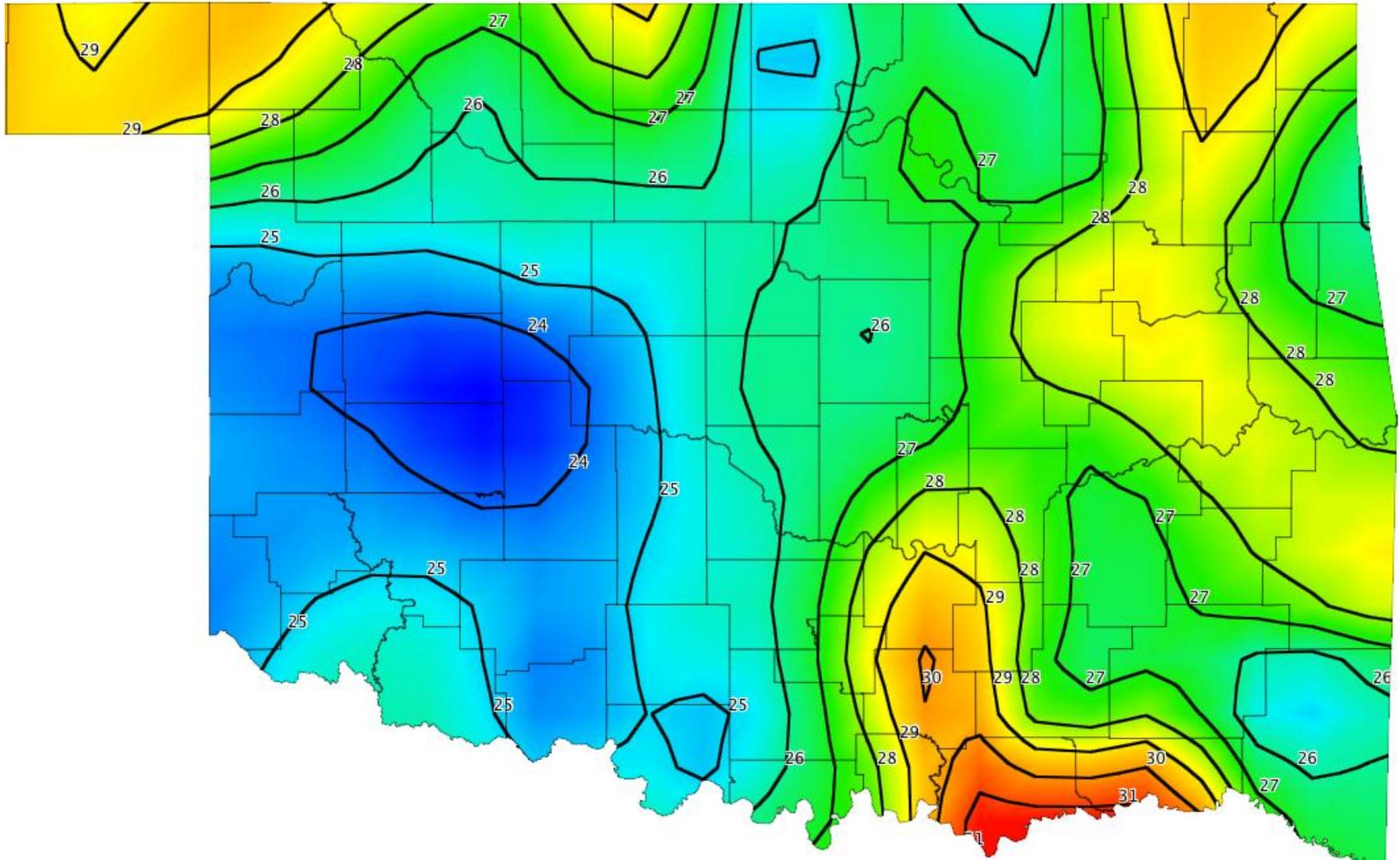
Surface Soil Moisture (fraction) Composite Anomaly 1981–2010 clima

NOAA/ES&L Physical Sciences Division

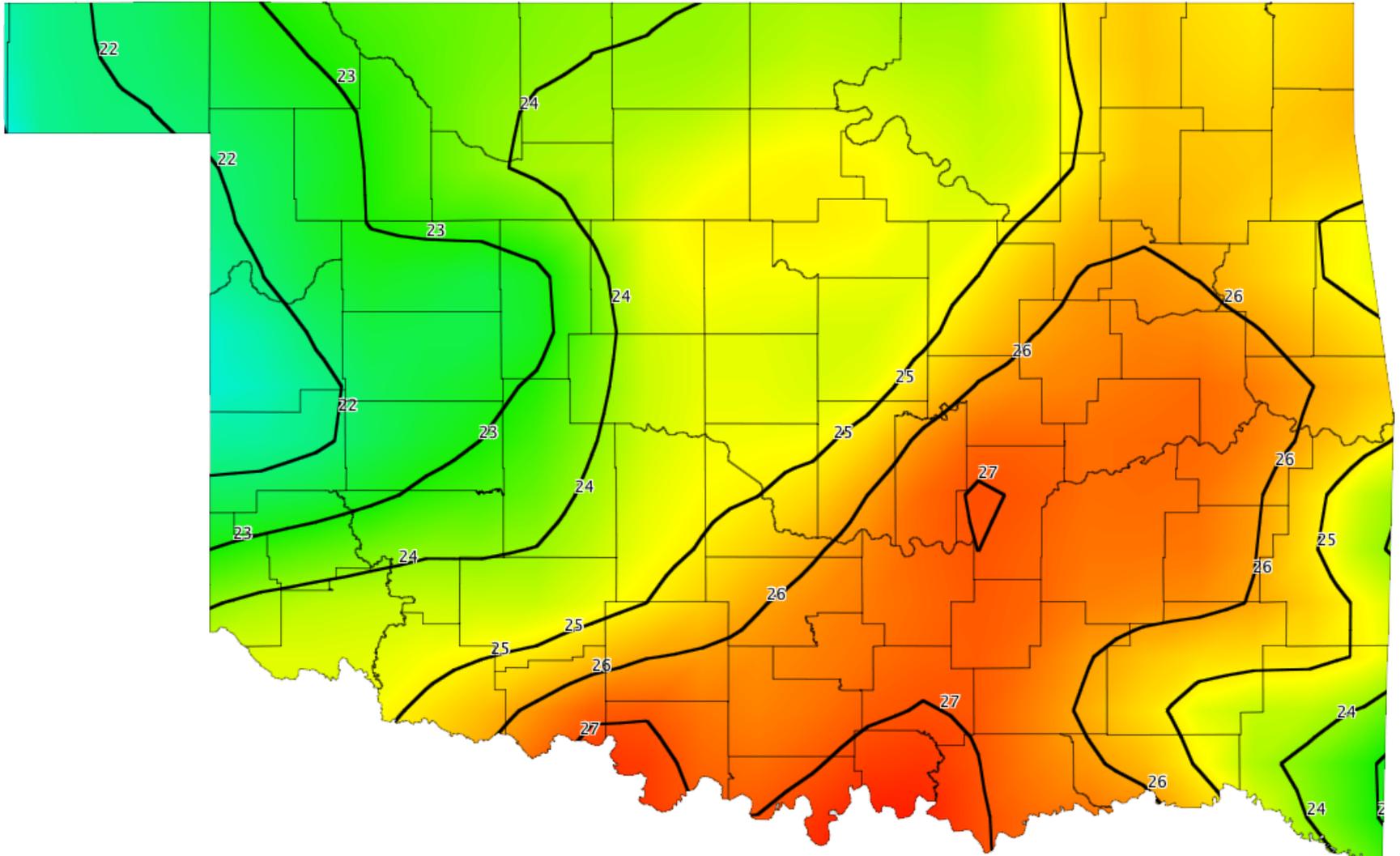


Jul 2007

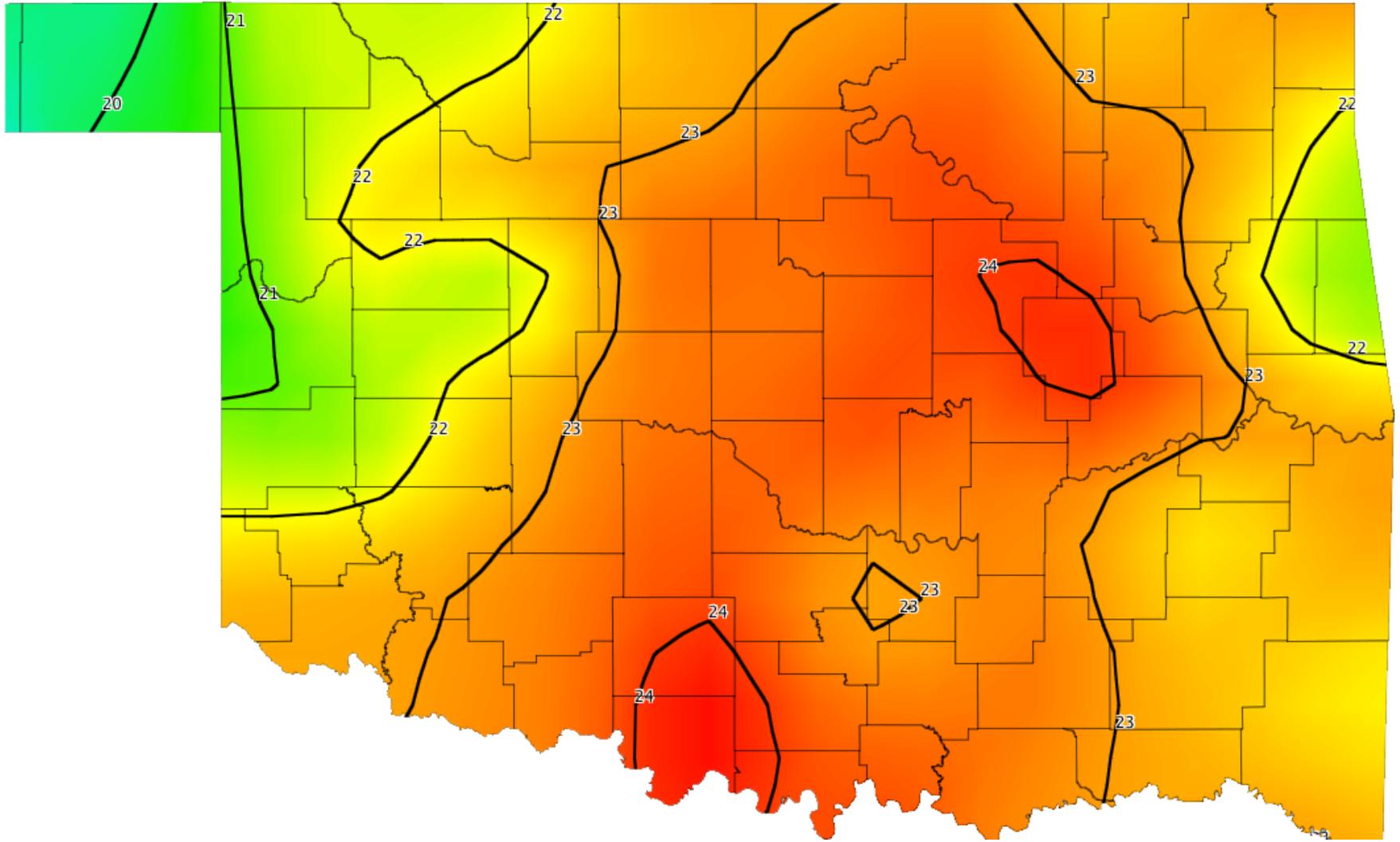
Soil Temperature (Celsius) Valid August 19, 2007 at 1:00 am CDT



Air Temperature (Celsius) Valid August 19, 2007 at 1:00 am CDT



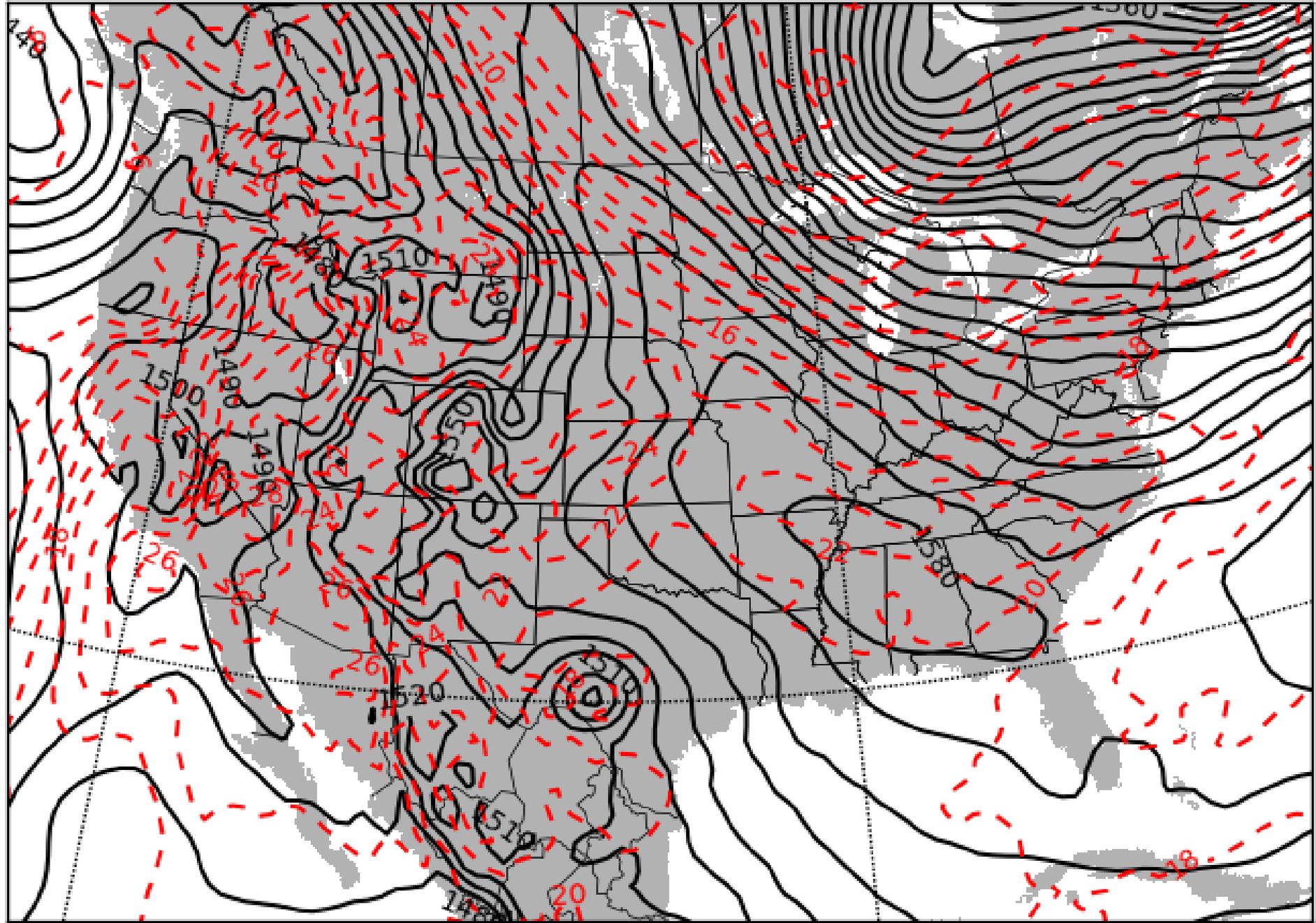
Dewpoint Temperature (Celsius) Valid August 19, 2007 at 1:00 am CDT



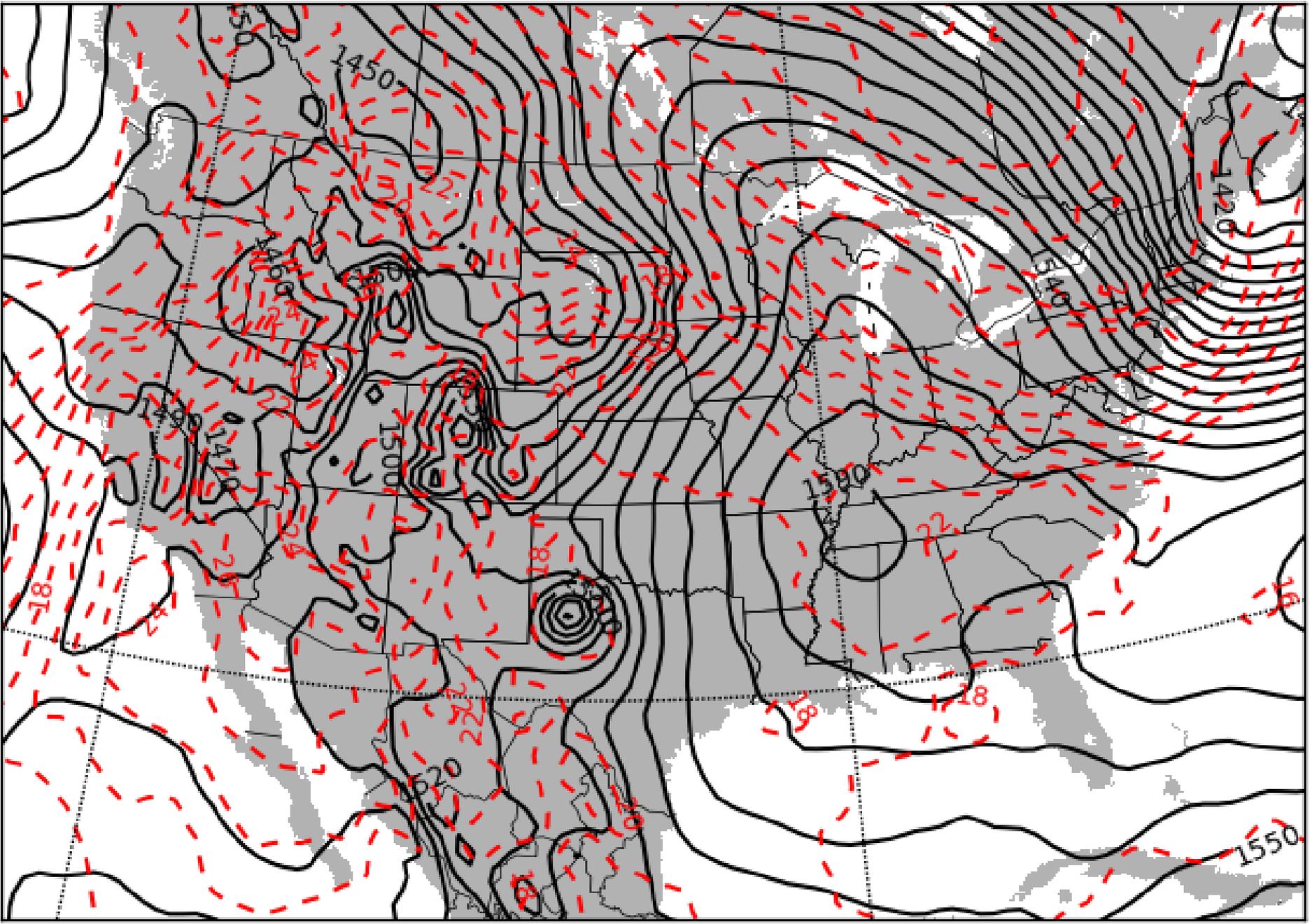
Other reasons for intensification?

- We've satisfied most of the NHC's conditions for hurricane development.
- What about other conditions that could've played a role?
 - Identify synoptic features
 - QG theory

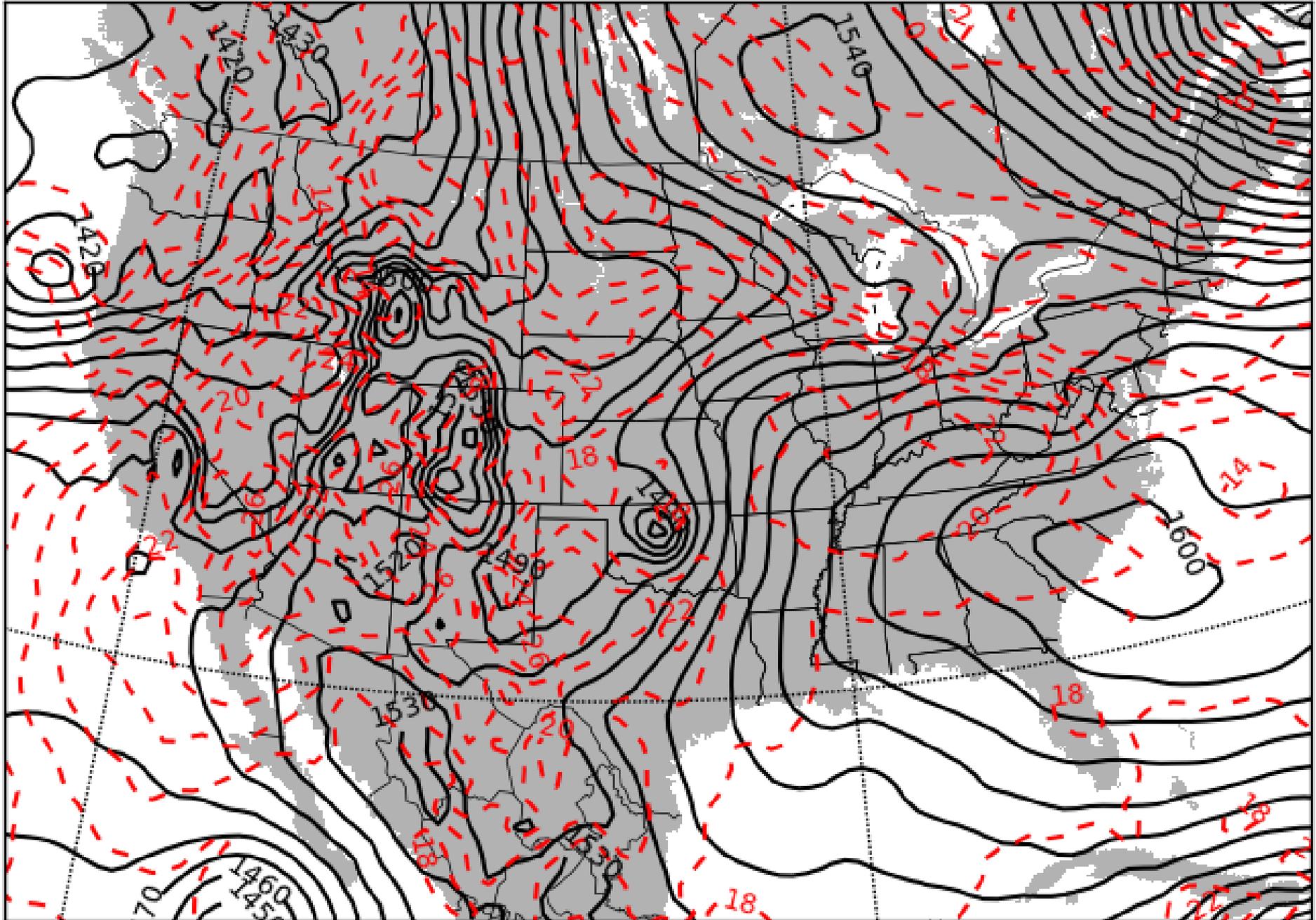
850 hPa geopotential heights valid 17 Aug 2007 at 1200 UTC

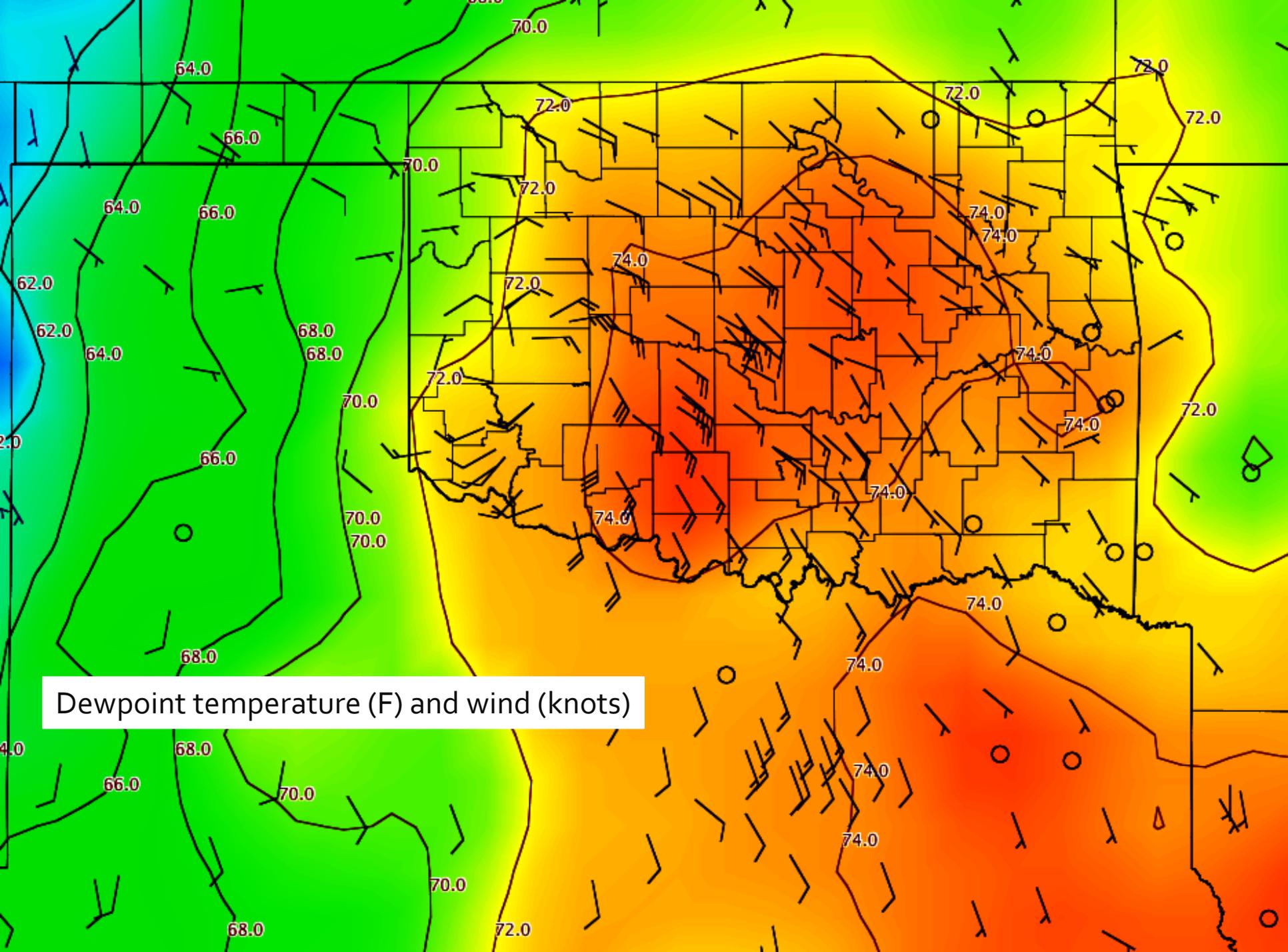


850 hPa geopotential heights valid 18 Aug 2007 at 1200 UTC



850 hPa geopotential heights valid 19 Aug 2007 at 1200 UTC





Dewpoint temperature (F) and wind (knots)

72357 OUN Norman

100

200

300

400

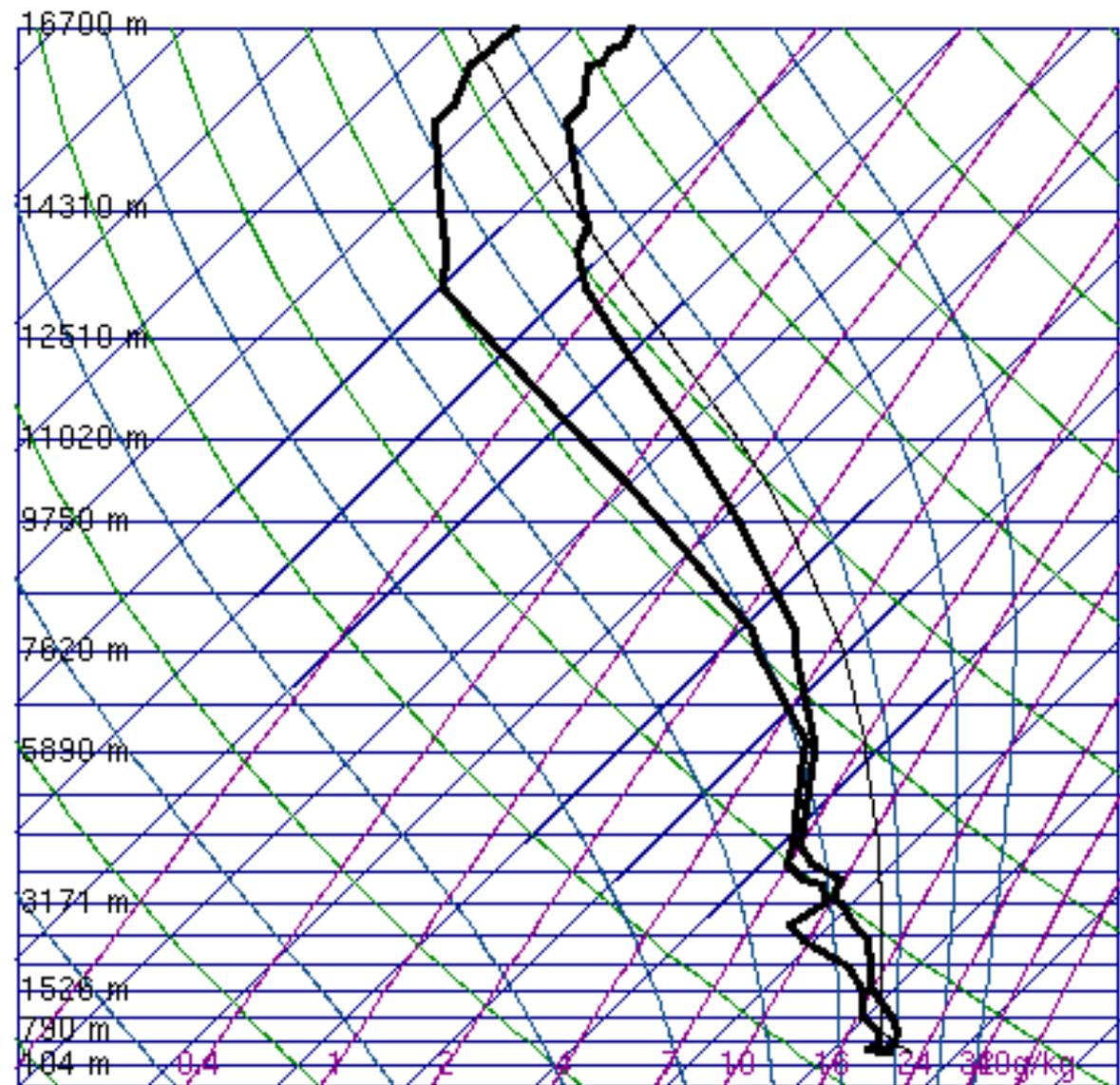
500

600

700

800

900

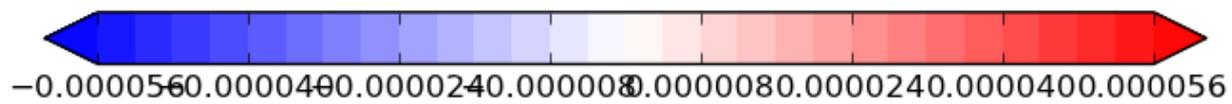
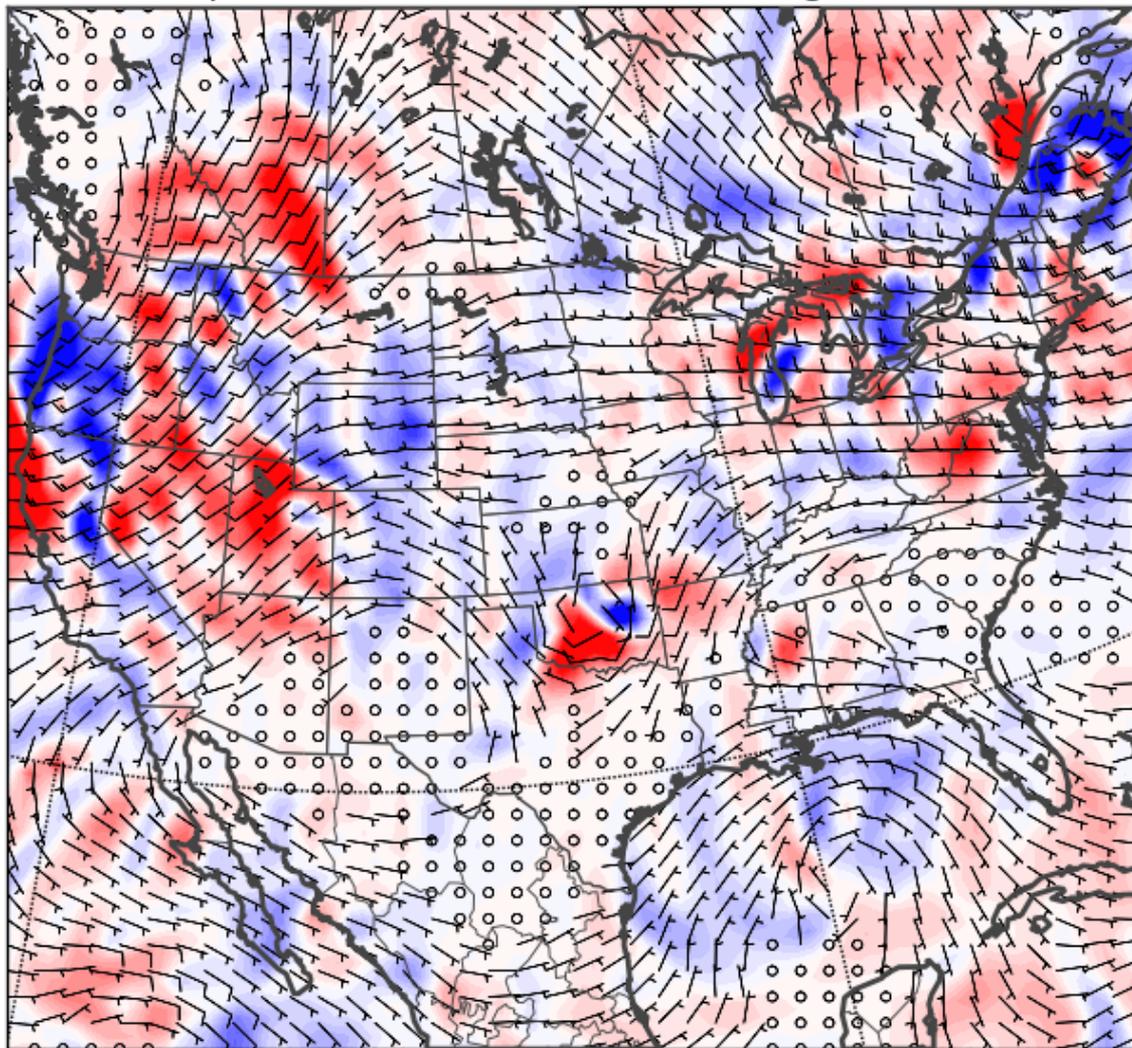


SLAT	35.18
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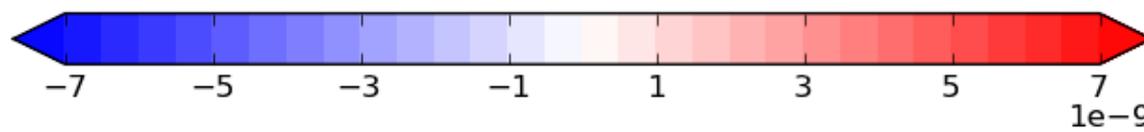
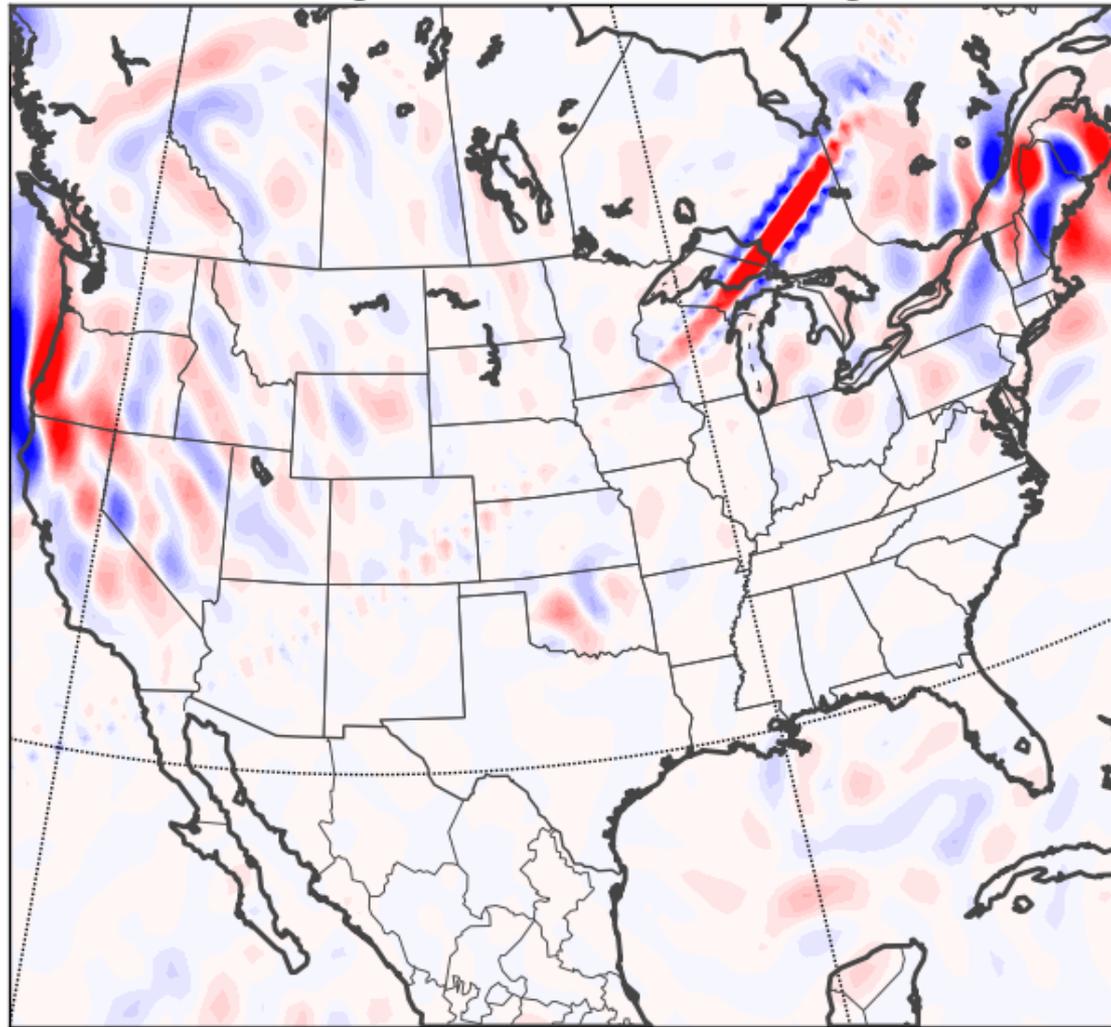
00Z 19 Aug 2007

University of Wyoming

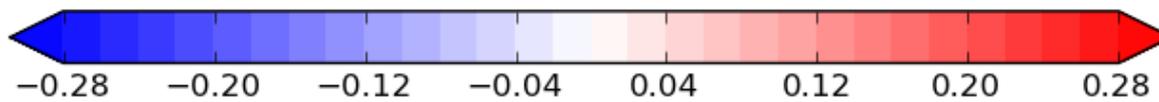
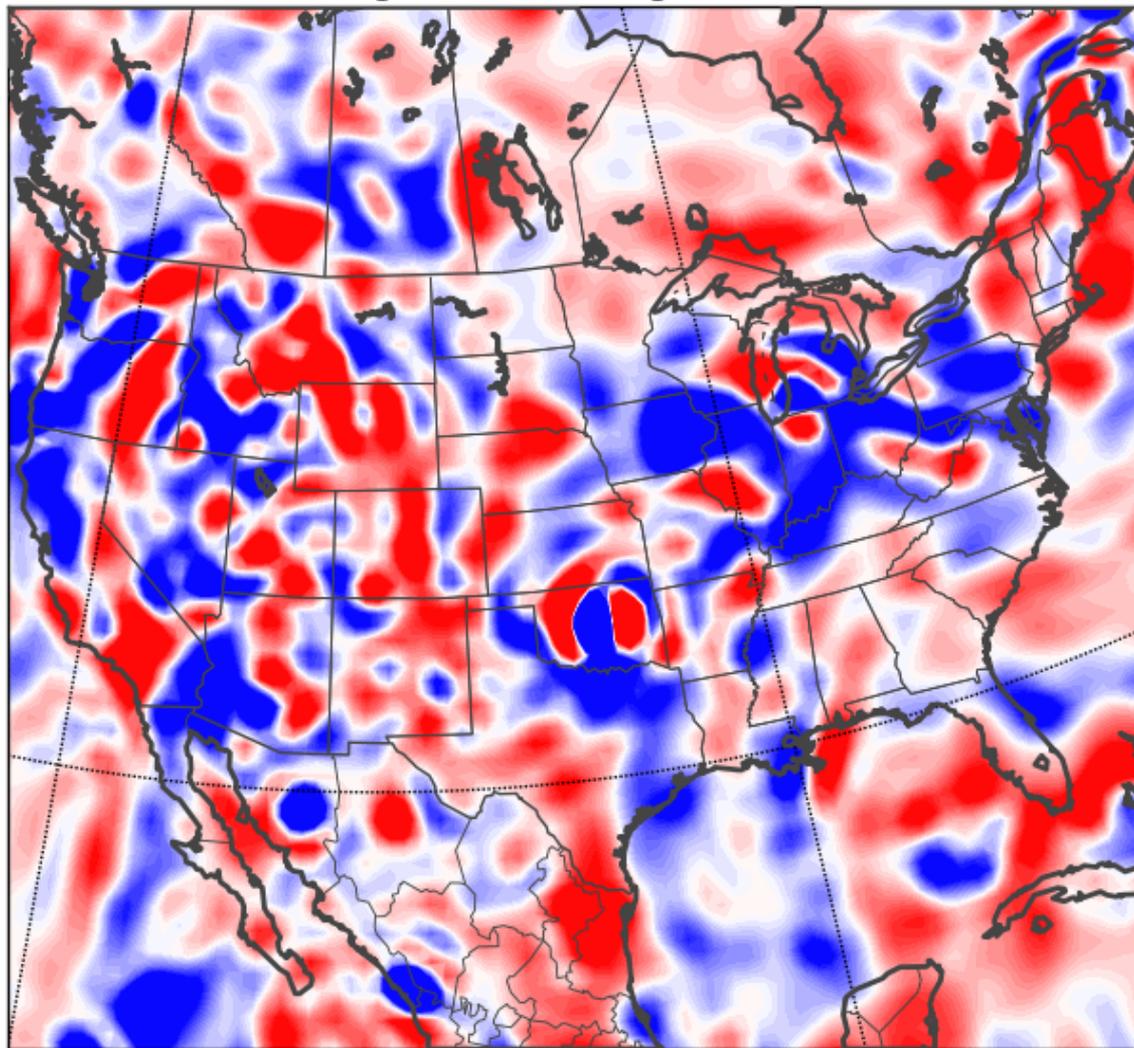
500 hPa temperature advection valid 19 Aug 2007 at 1200 UTC



300 hPa - 700 hPa diff. geo. vort. adv. valid 19 Aug 2007 at 1200 UTC



500 hPa omega valid 19 Aug 2007 at 1200 UTC



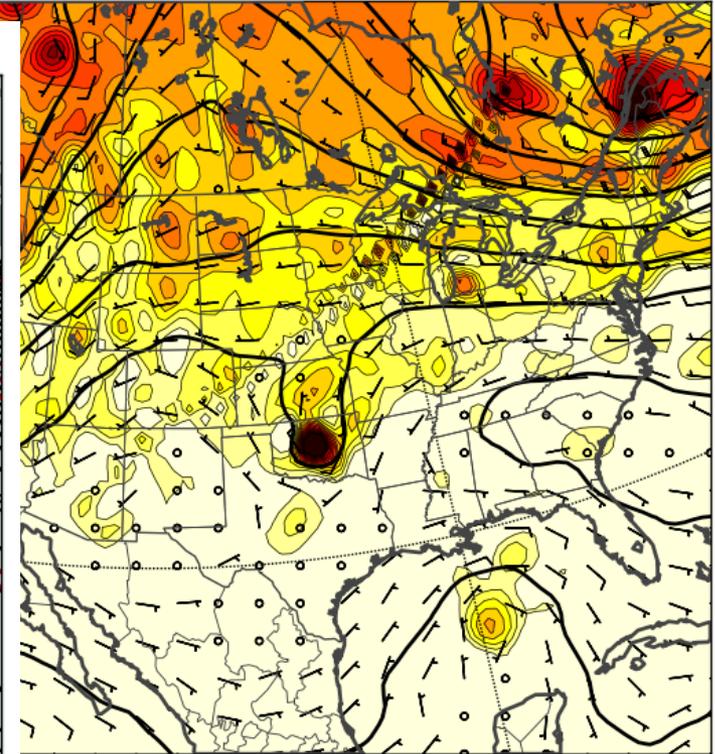
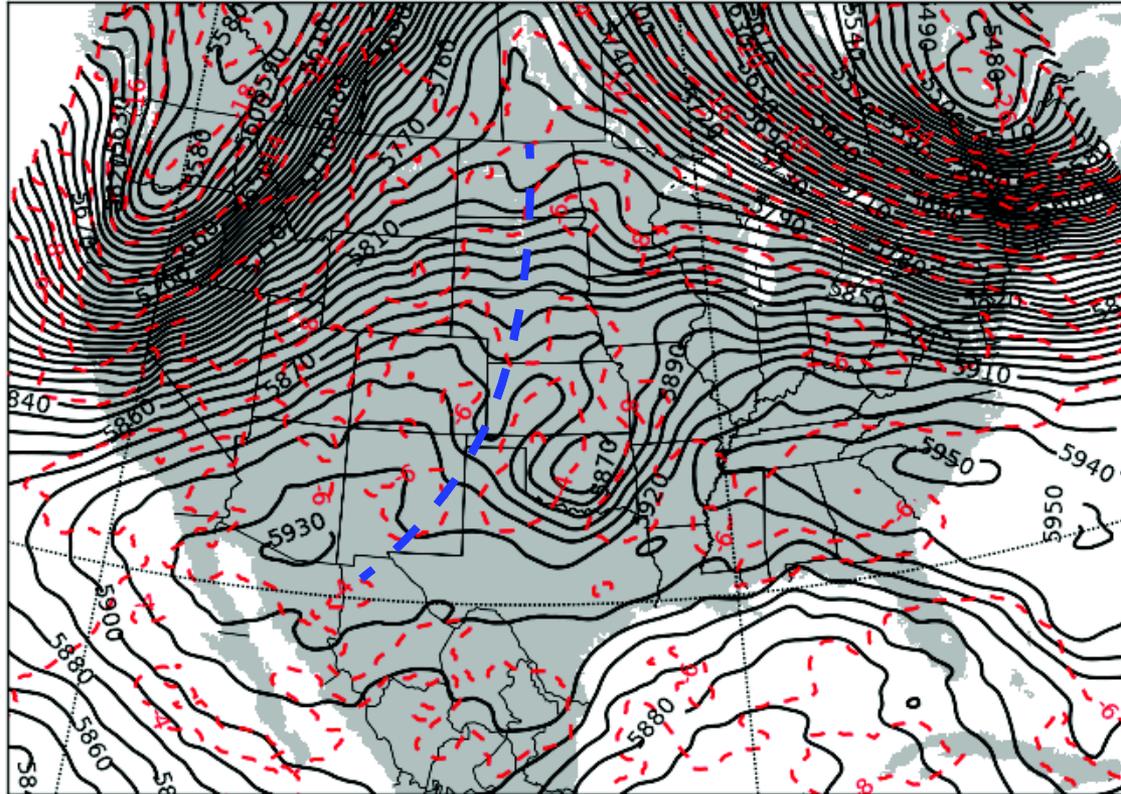
Shortwave responsible?

- Early on the 19th of Aug. T-storm activity increased when the surface low interacted with an “upper level shortwave”.
- An upper level shortwave forced deep convection, causing diffluence at the upper levels and confluence at the lower levels.
- Convection decreased when the shortwave passed and the eye dissipated.

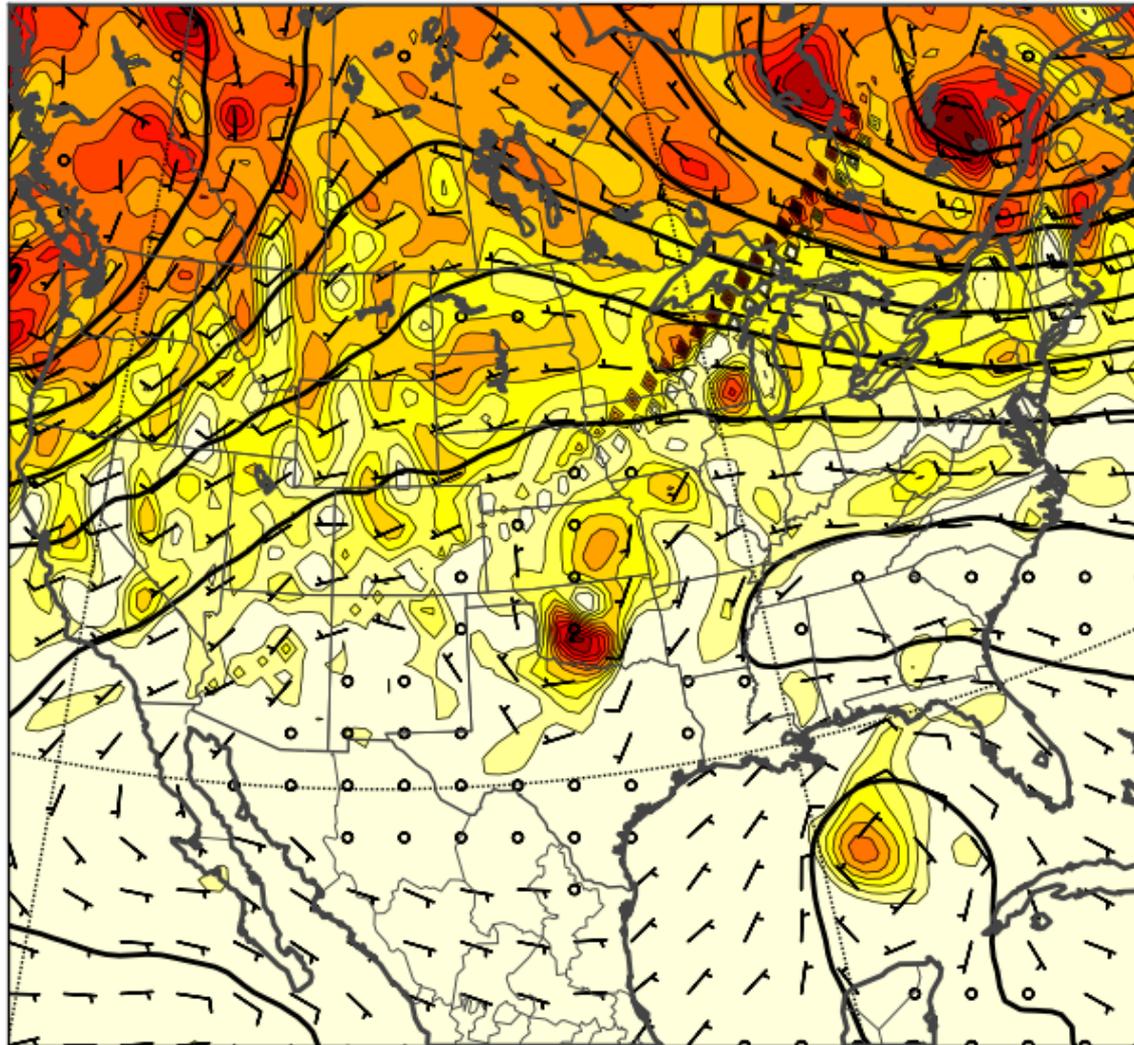
Possible shortwave?

500 hPa abs. geostrophic vorticity and wind 19 Aug 2007 at 1200 UTC

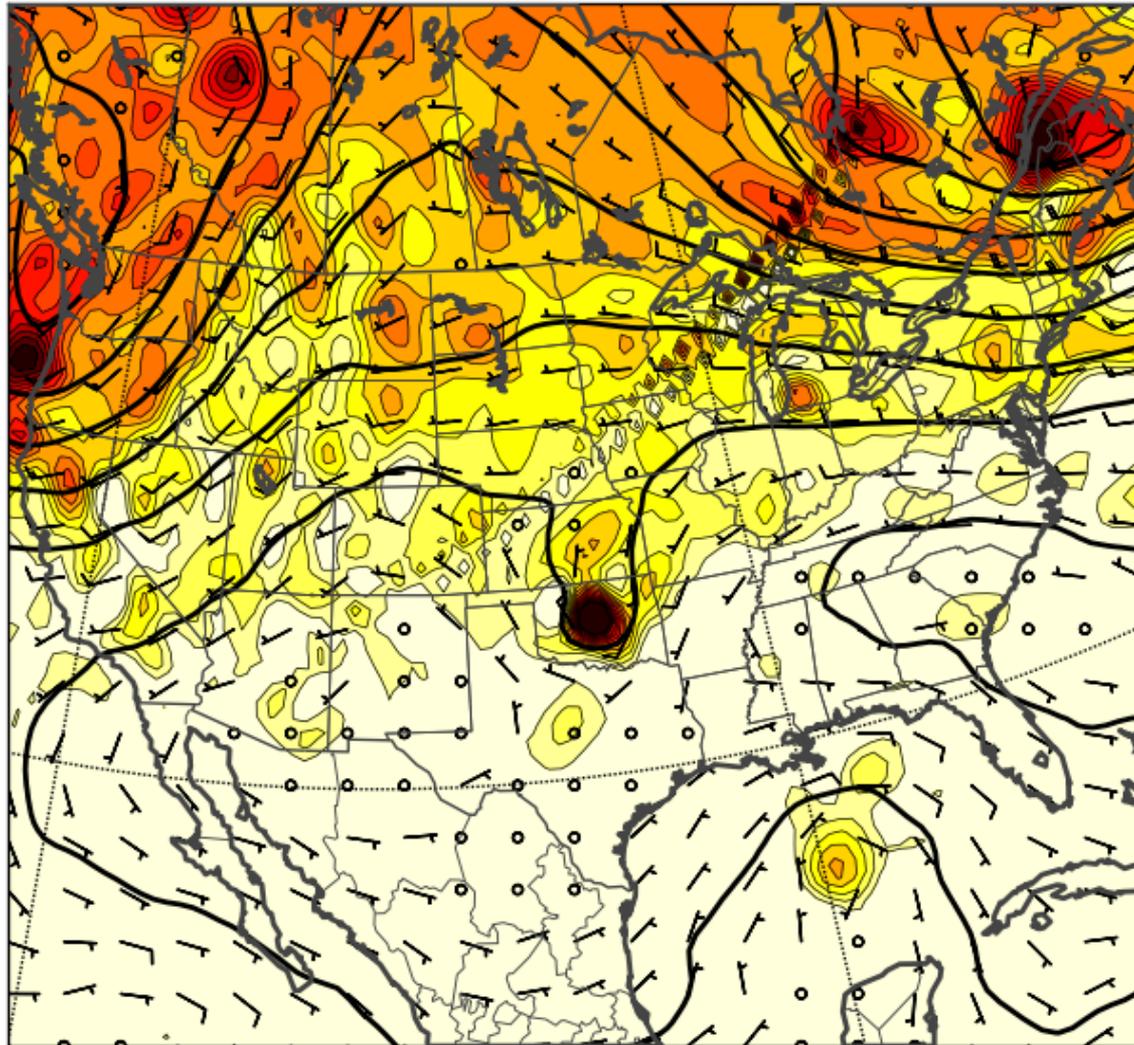
500 hPa geopotential heights valid 19 Aug 2007 at 1200 UTC



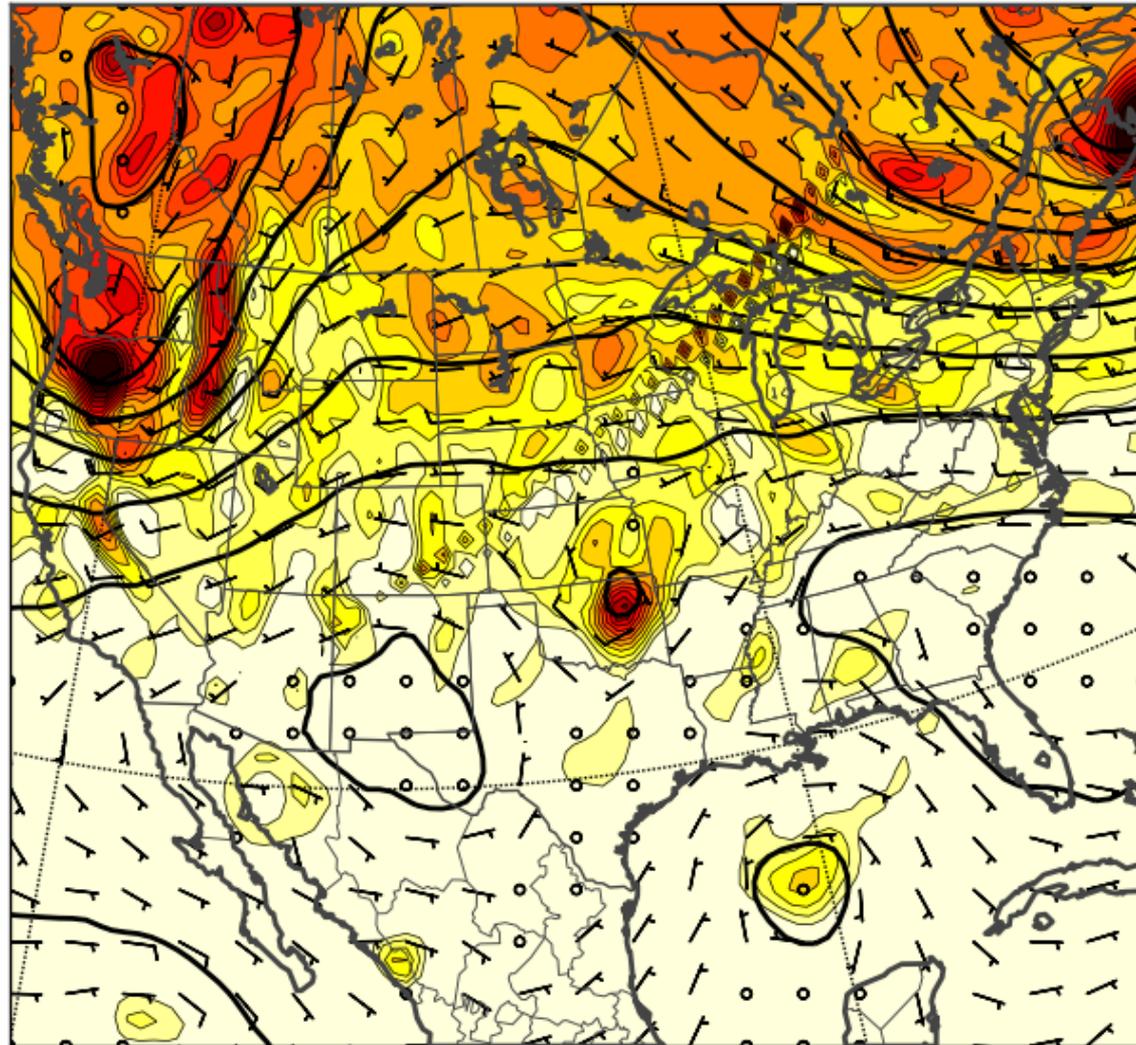
500 hPa abs. geostrophic vorticity and wind 19 Aug 2007 at 0600 UTC



500 hPa abs. geostrophic vorticity and wind 19 Aug 2007 at 1200 UTC



500 hPa abs. geostrophic vorticity and wind 19 Aug 2007 at 1800 UTC



Conclusions

- The area surrounding Watonga, OK during the period of reintensification satisfied the conditions favorable for over water hurricane development
- Synoptic scale features over the central United States, combined with lifting mechanisms seen in the QG Omega Equation, created a favorable environment for reintensification of a tropical system over land.

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- Arndt, D.S., Basara, J.B., McPherson, R.A., Illston, B.G., McManus, G.D., and D.B. Demko, 2009: Observations of the Overland Reintensification of Tropical Storm Erin (2007), *Bull. Amer. Meteor. Soc.*, **90**, 1079–1093.
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- Brennan, M.J., Knabb, R.D., Mainelli, M. and T.B. Kimberlain, 2009: Atlantic Hurricane Season of 2007, *Mon. Wea. Rev.*, **137**, 4061-4088.
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Questions?

PV Cross Section through Watonga, OK valid 19 Aug 2007 at 1200 UTC

