

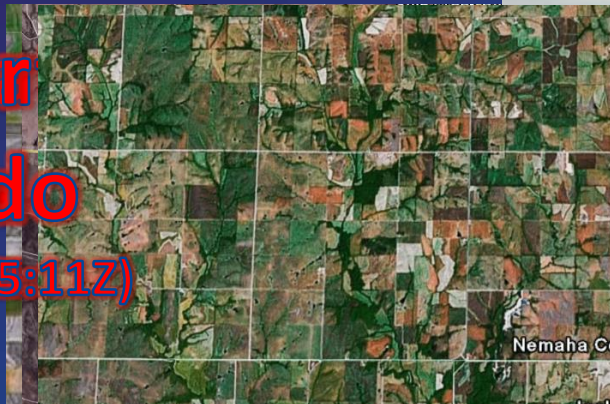


Evolution of Environmental Conditions Supportive of Tornadic Supercells on 11 June 2008


Dennis Cavanaugh, Scott Blair, Joshua
Bousted and Elizabeth Lunde
NOAA/NWS WFO Topeka, KS

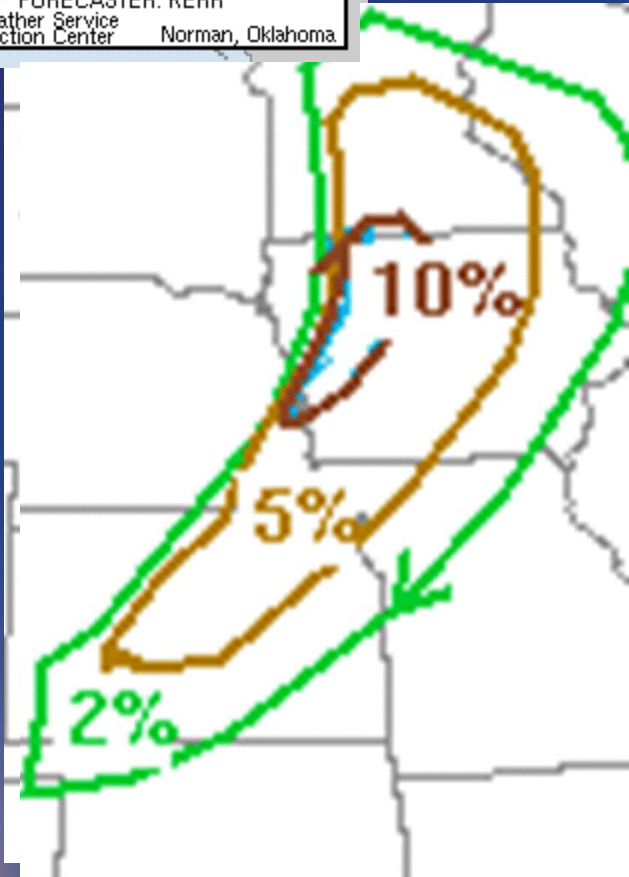
The Night of June 11, 2008

Söldjler
Tornado
(04:48Z-05:11Z)



Why is this event important?

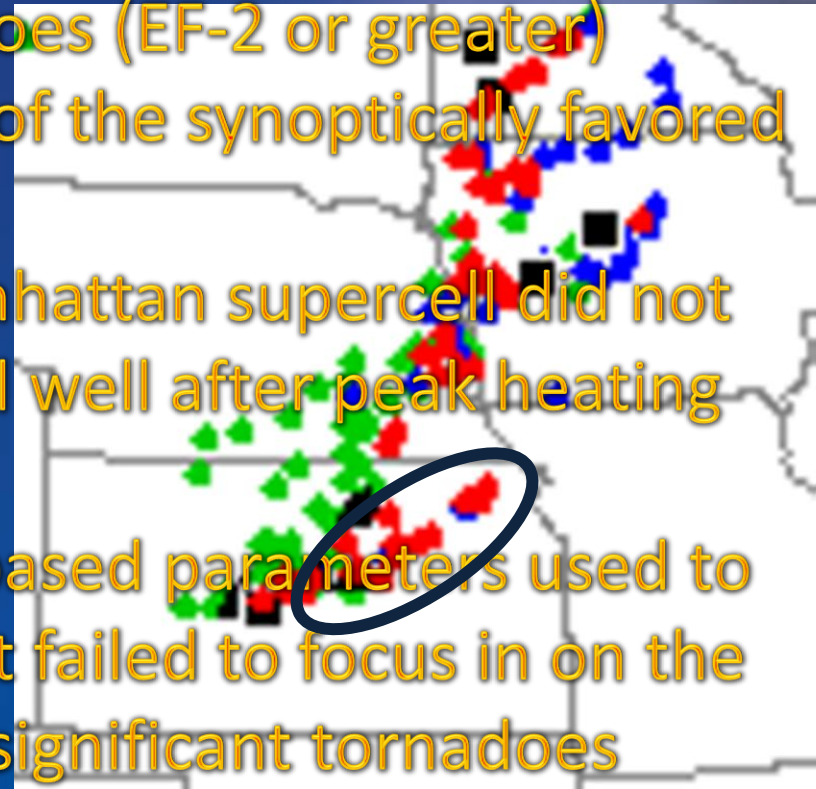
 SPC DAY1 TORN OUTLOOK
ISSUED: 0053Z 06/12/2008
VALID: 12/0100Z-12/1200Z
FORECASTER: KERR
National Weather Service
Storm Prediction Center Norman, Oklahoma.



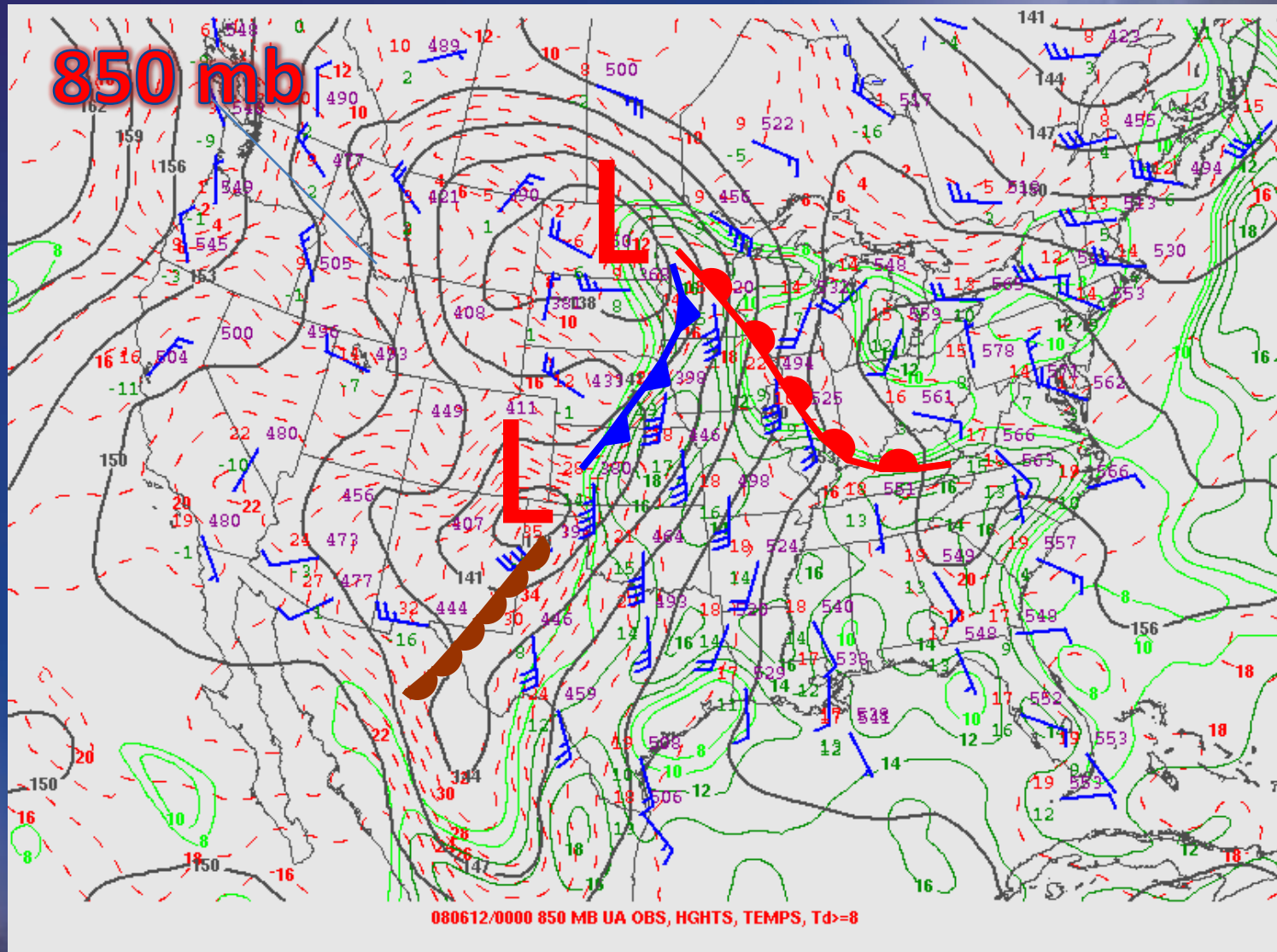
tornadoes (EF-2 or greater)
south of the synoptically favored

Manhattan supercell did not
develop until well after peak heating

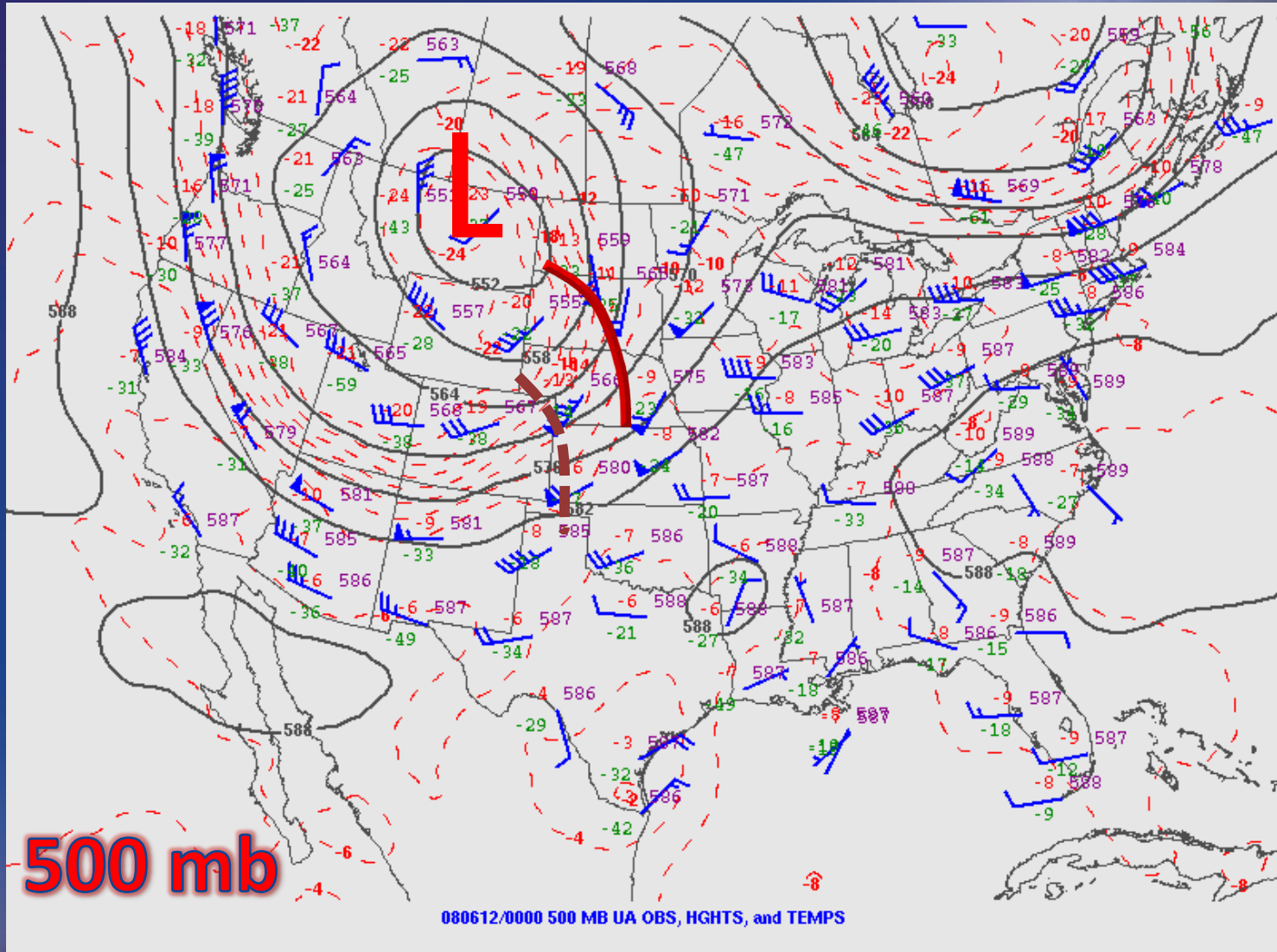
model based parameters used to
forecast failed to focus in on the
area where significant tornadoes



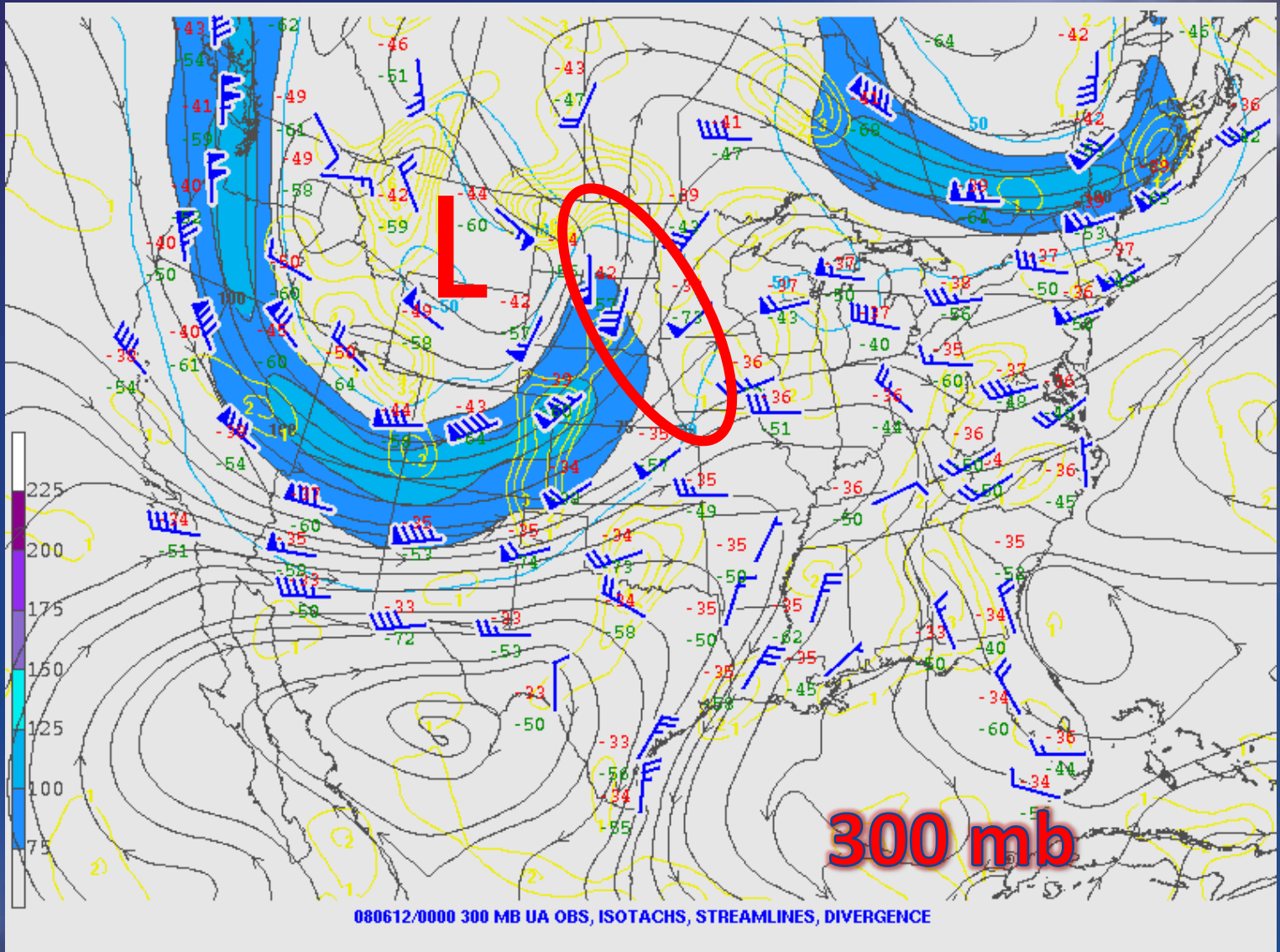
Synoptic Overview



Synoptic Overview



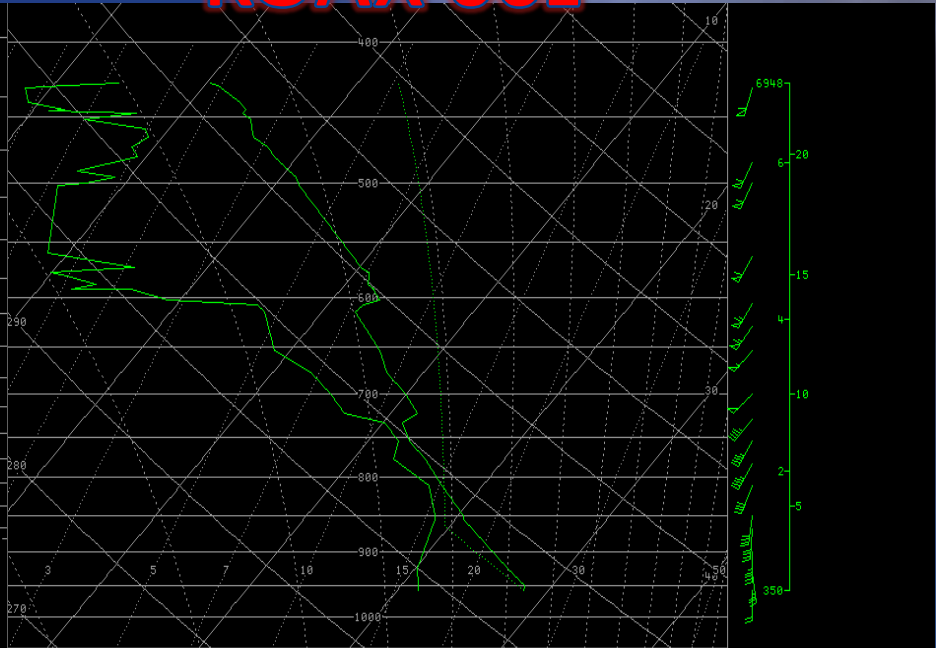
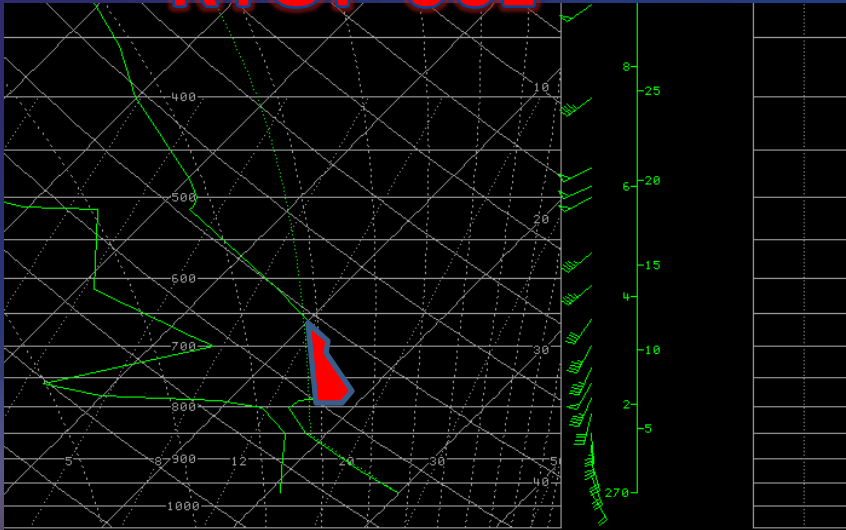
Synoptic Overview



Synoptic Overview

KTOP 00z

KOAX 00z



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PRECIP WATER= 1.54 in
K-INDEX= 35
TOTALS INDEX= 51
SWEAT INDEX= 495
DRY MICROBURST POT=2: GST < 30 kts
FREEZING LEVEL= 15550 ft ASL
WET-BULB ZERO HGT= 13232 ft ASL
0-5 KM AVG WIND= 210°/36 kts
0-5 KM STM MTN (30R75)= 240°/27 kts
0-3 KM STM REL HELICITY= 382 m²/s²
FORECAST MAX TEMP=NA
TRIGGER TEMP= 29° C/85° F
SOARING INDEX=NA
MDPI/WINDEX = 0.85/41

-PARCEL- T=SFC;Td=SFC
INIT PARCEL P= 972 85 69 ° mb
INIT PARCEL T/Td= 85/69° F;29/20° C
CONVECTIVE TEMP= 86° F
LIFTED INDEX= -6.8
CCL= 4552 ft ASL/ 855 mb
LCL= 4630 ft ASL/ 853 mb
LFC= 4630 ft ASL/ 853 mb
MAX HAILSIZE= 19.8 cm/7.8 in
MAX VERTICAL VELOCITY= 64 m/s
EQUIL LEVEL= 4521 ft ASL/154 mb
APPROX CLOUD TP=NA
POSITIVE ENERGY ABV LFC= 2974 J/KG
NEGATIVE ENERGY BLW LFC= -82 J/KG
BULK RICHARDSON NUMBER= 26.5
    
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PRECIP WATER= 1.74 in
K-INDEX= 42
TOTALS INDEX= 56
SWEAT INDEX= 566
DRY MICROBURST POT=NA
FREEZING LEVEL= 15384 ft ASL
WET-BULB ZERO HGT= 13013 ft ASL
0-5 KM AVG WIND= 209°/47 kts
0-5 KM STM MTN (30R75)= 239°/35 kts
0-3 KM STM REL HELICITY= 356 m²/s²
FORECAST MAX TEMP=NA
TRIGGER TEMP= 30° C/86° F

-PARCEL- T=SFC;Td=SFC
INIT PARCEL P= 957 83 70 ° mb
INIT PARCEL T/Td= 83/70° F;28/21° C
CONVECTIVE TEMP= 88° F
LIFTED INDEX= -8.0
CCL= 5126 ft ASL/ 833 mb
LCL= 4080 ft ASL/ 864 mb
LFC=NA
MAX HAILSIZE=NA
MAX VERTICAL VELOCITY=NA
EQUILIBRIUM LEVEL=NA
APPROX CLOUD TOP=NA
    
```

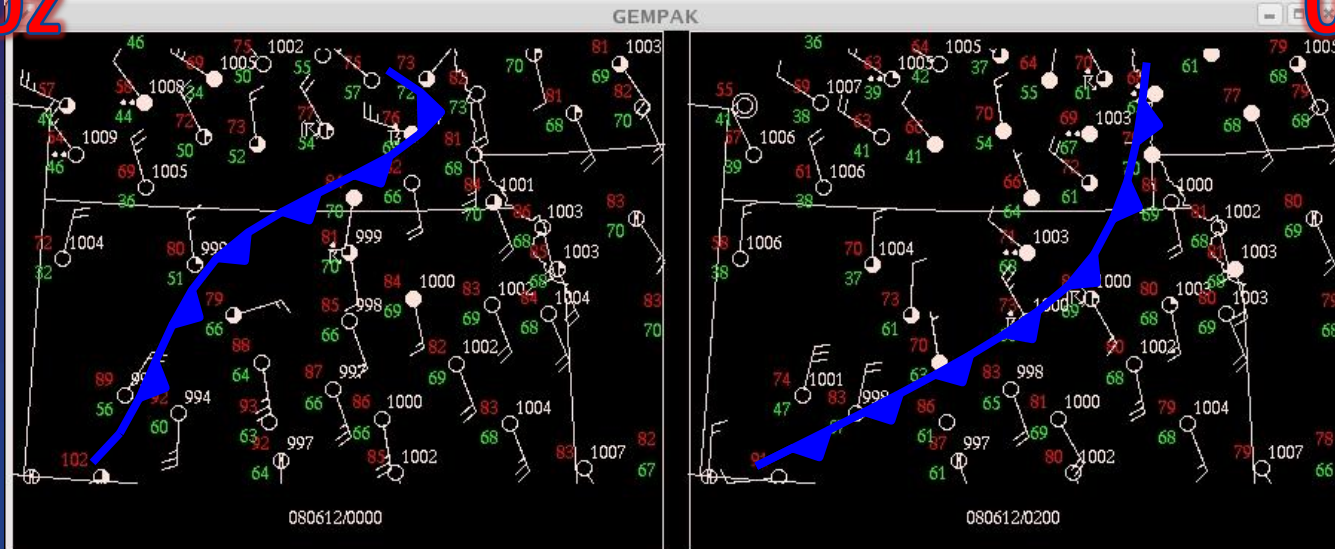
KTOP Skew Thu 00:00Z

KOAX Skew Thu 00:00Z 12-Jun-0

Evolution of Cold Front

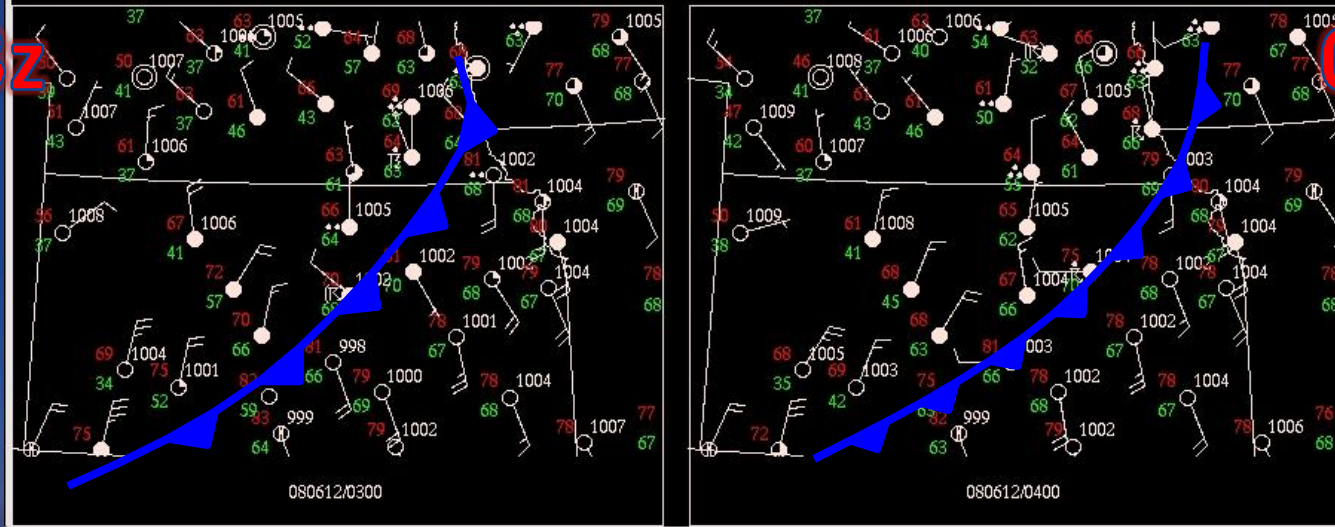
00z

02z

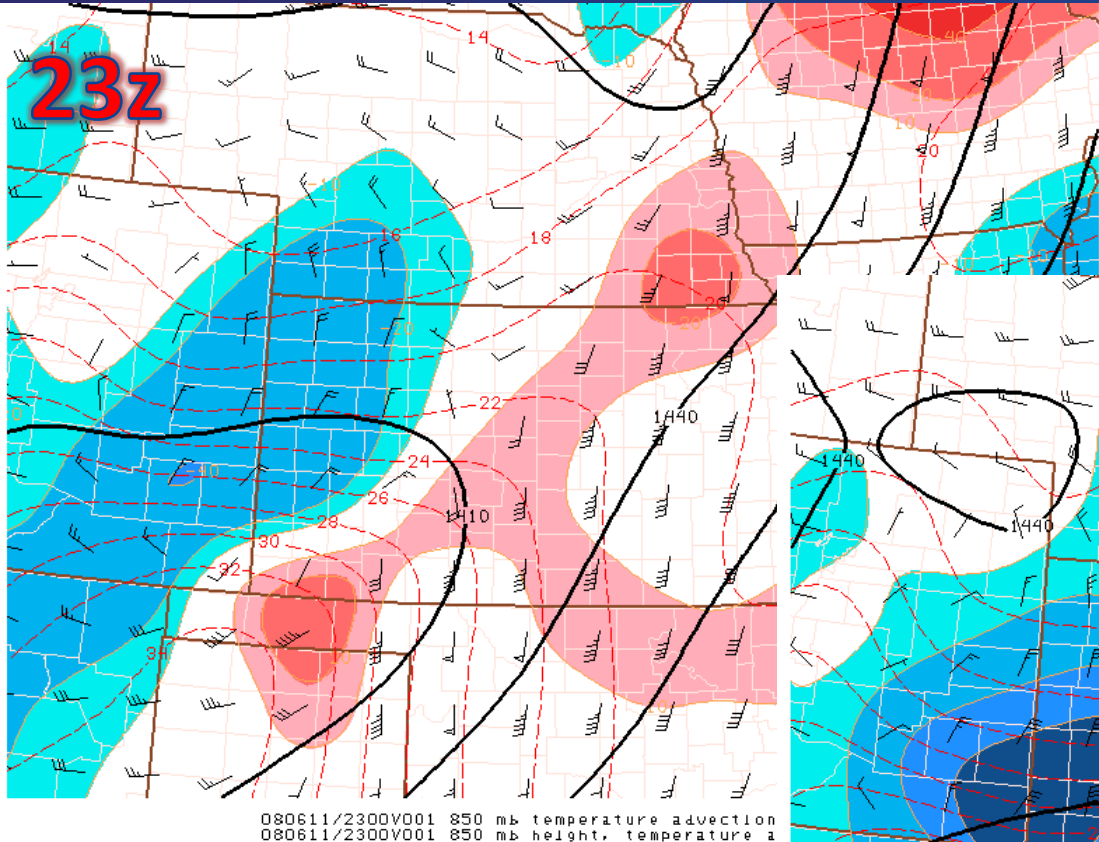


03z

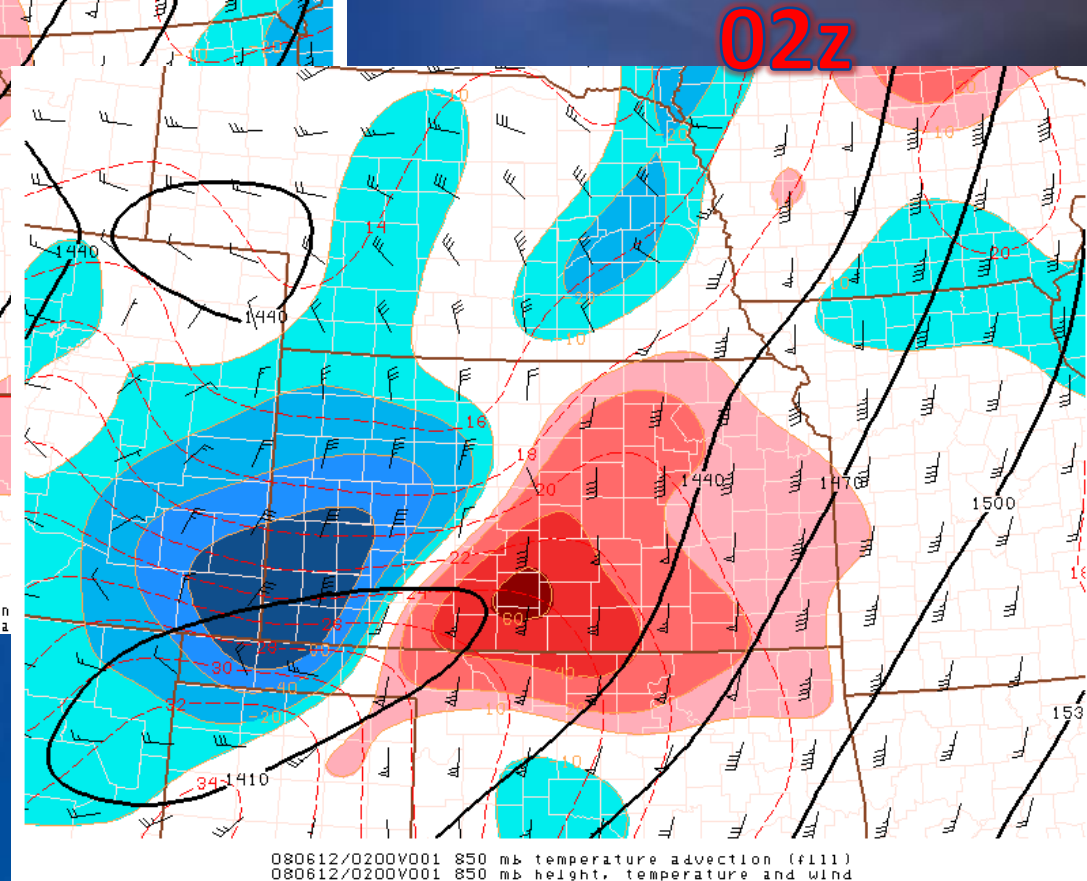
04z



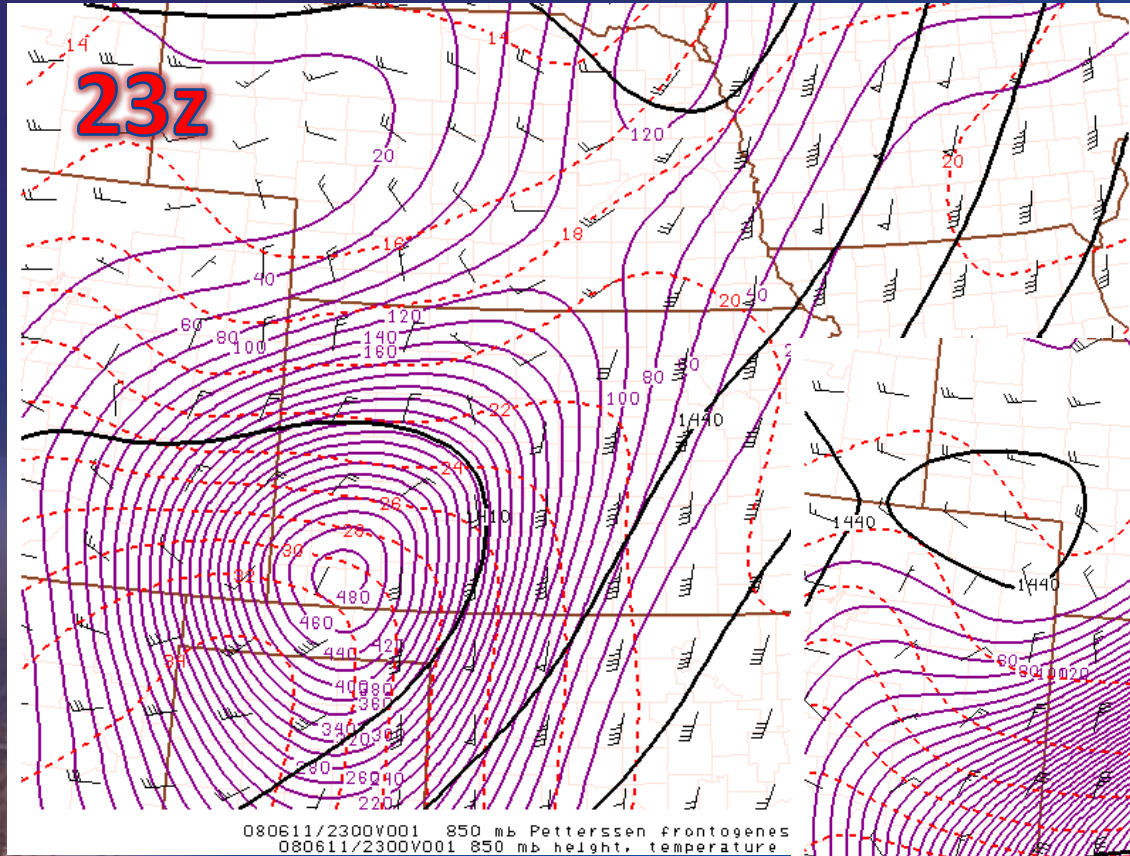
Rapid Increase of Low Level Thermal Gradient



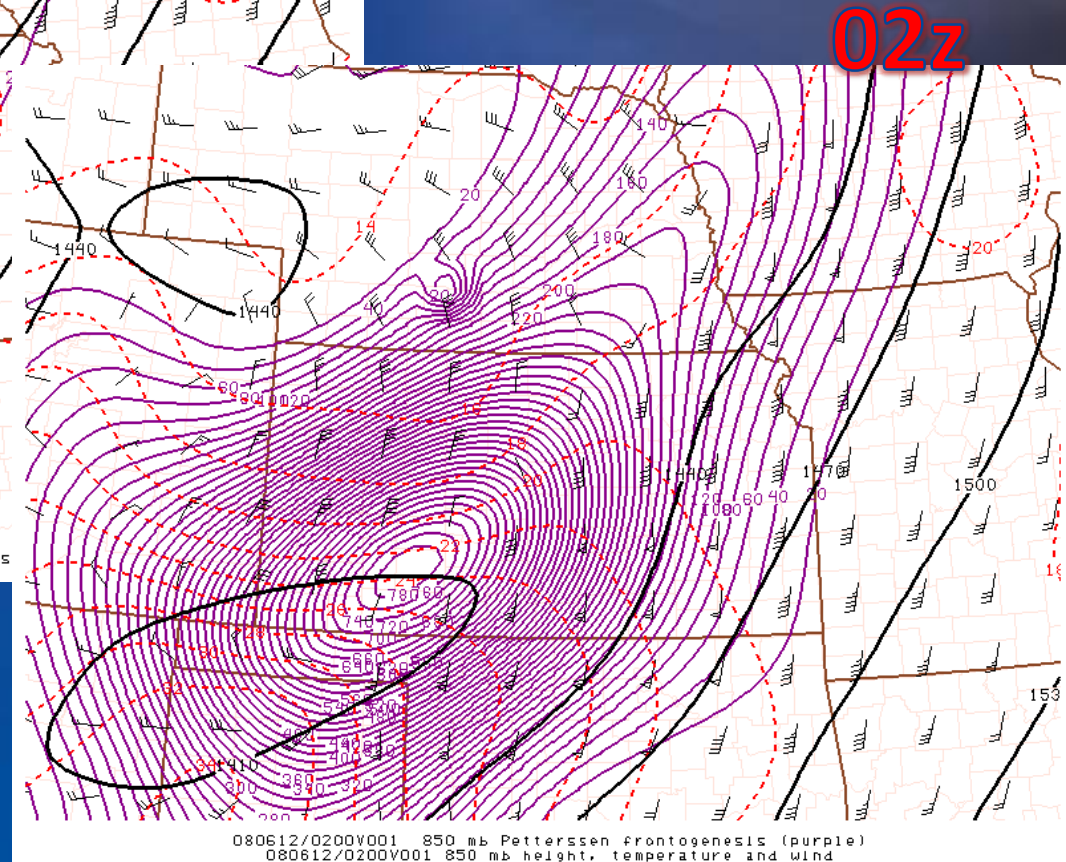
850 mb



Low Level Frontogenesis Increases



850 mb



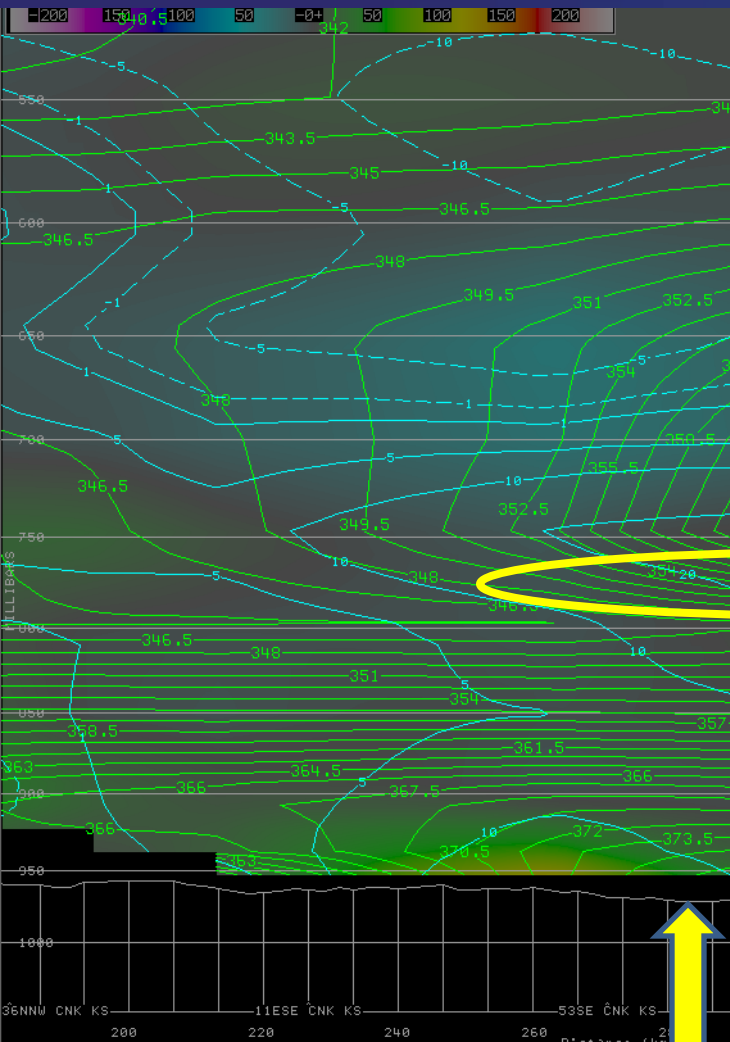
- Sat. Eq.
Pot. Temp.

- Temp.
Advection

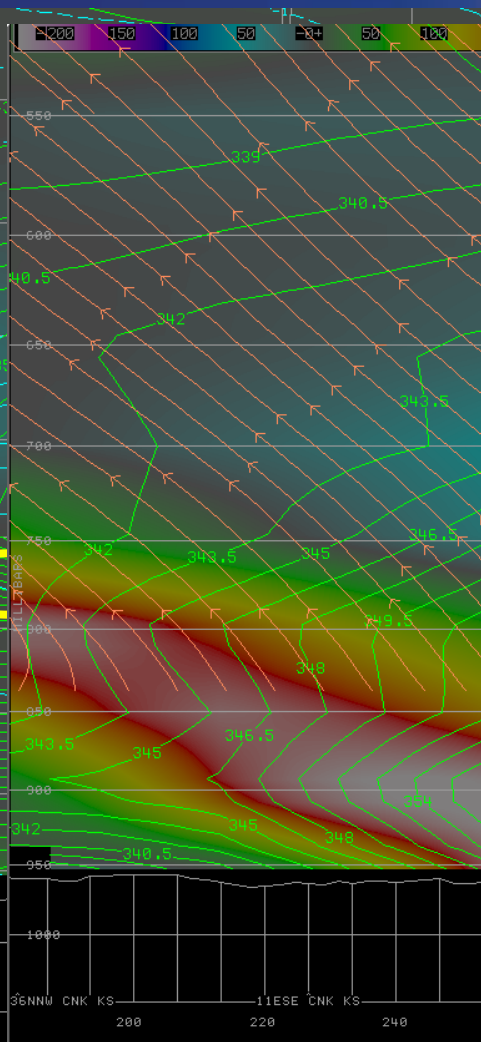
-Ageo. Vert.
Circ.

Background Image is
Pettersen
Frontogenesis

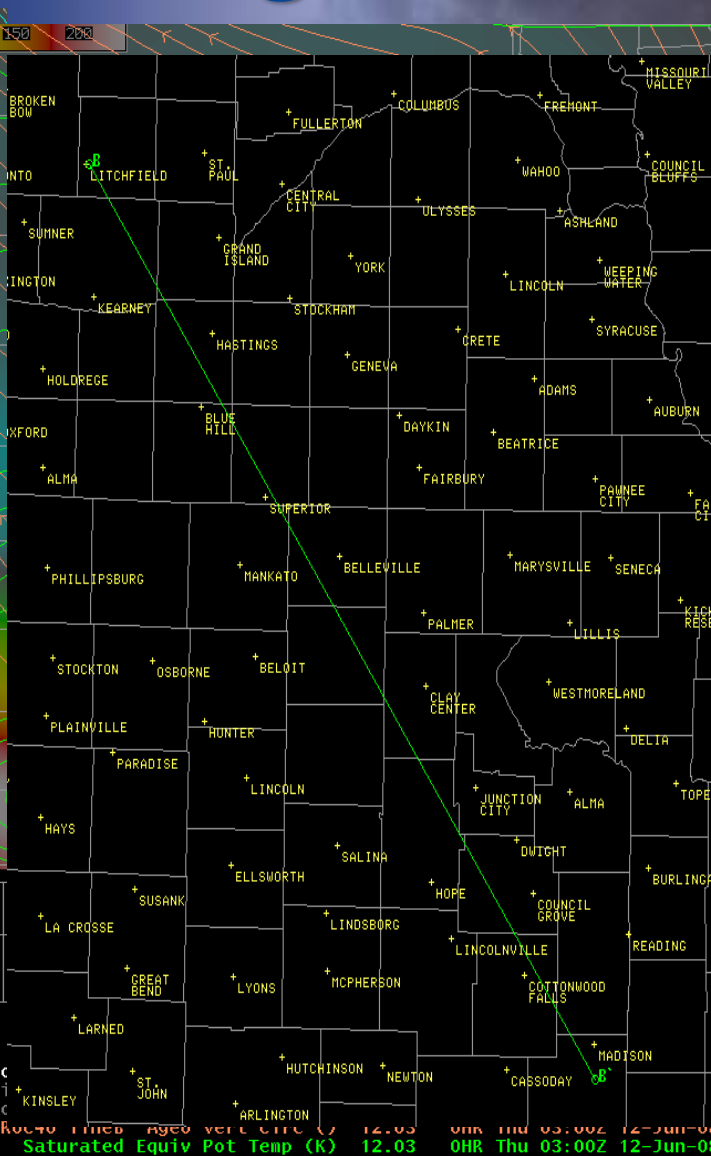
A Cross Section Look at Front



RUC40 lineB 2-D Frontogenesis/Mag Fn Ing(K/
 RUC40 lineB Temperature Adv
 RUC40 lineB 2-D Frontogenesis/Mag Fn (K/
 RUC40 lineB Ageo Vert
 RUC40 lineB Saturated Equiv Pot



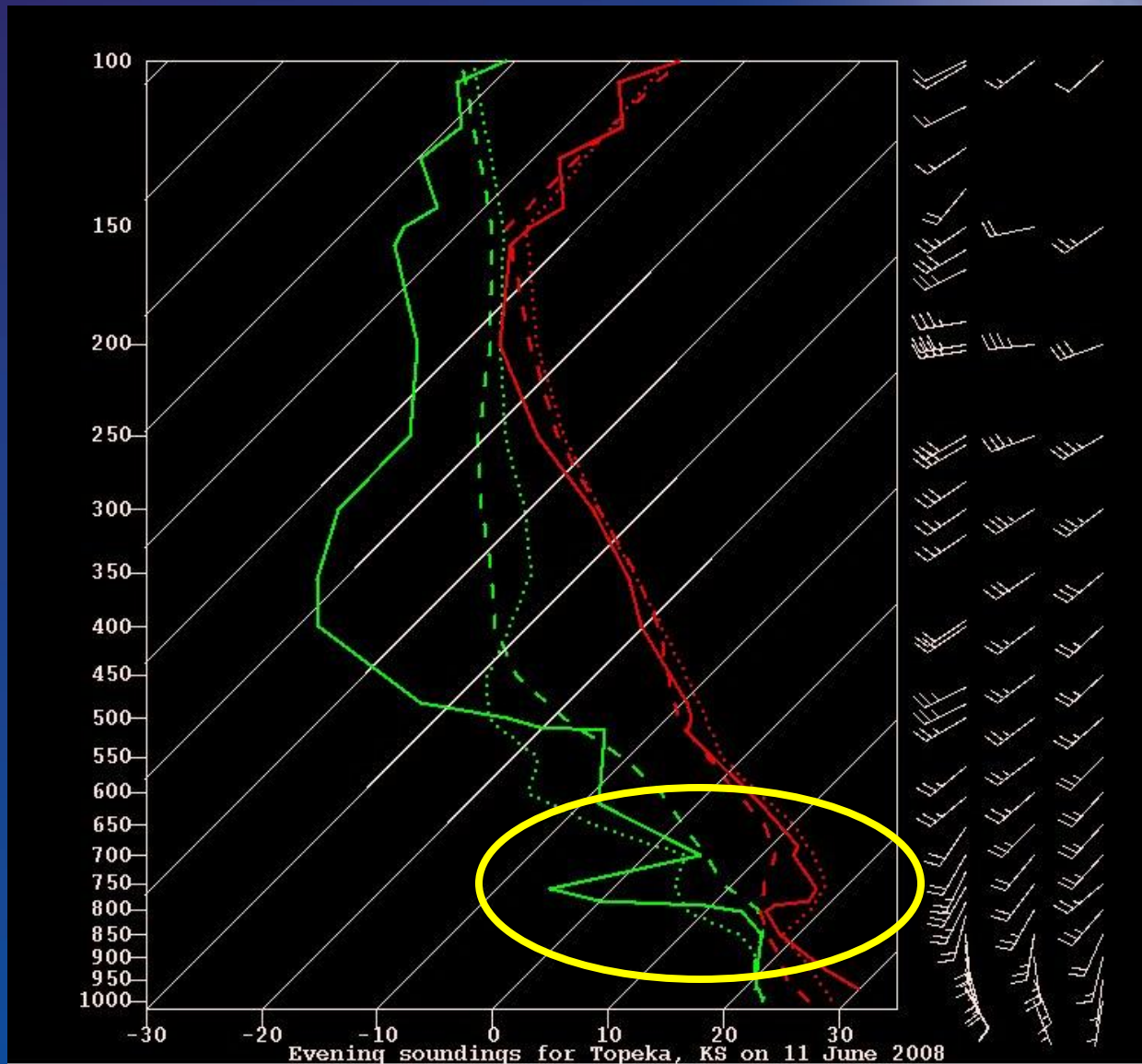
RUC40 lineB 2-D Frontogenesis/Mag Fn
 RUC40 lineB Temperature Adv
 RUC40 lineB 2-D Frontogenesis/Mag Fn (K/
 RUC40 lineB Ageo Vert



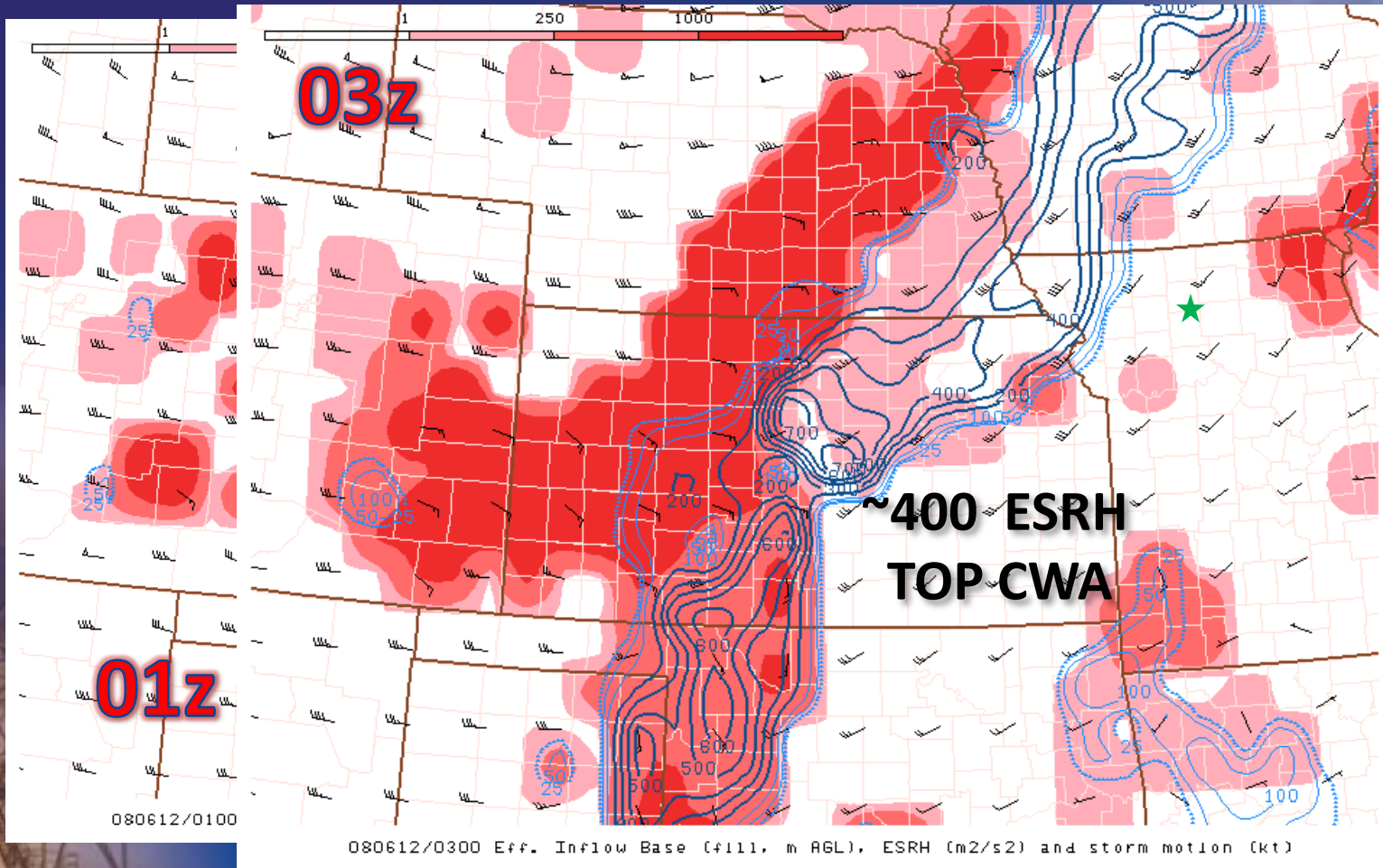
RUC40 lineB Ageo Vert Circ (K) 12.03
 RUC40 lineB Saturated Equiv Pot Temp (K) 12.03
 OHR Thu 03:00Z 12-Jun-03

Thermodynamic Evolution

KTOP - 00z Observed - 03z RUC - 06z RUC



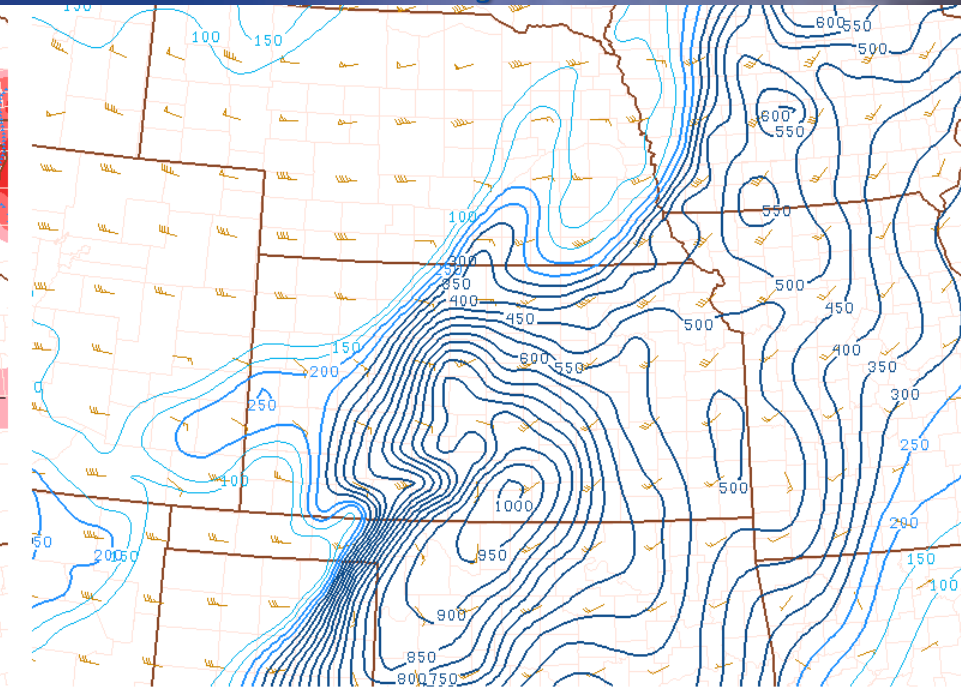
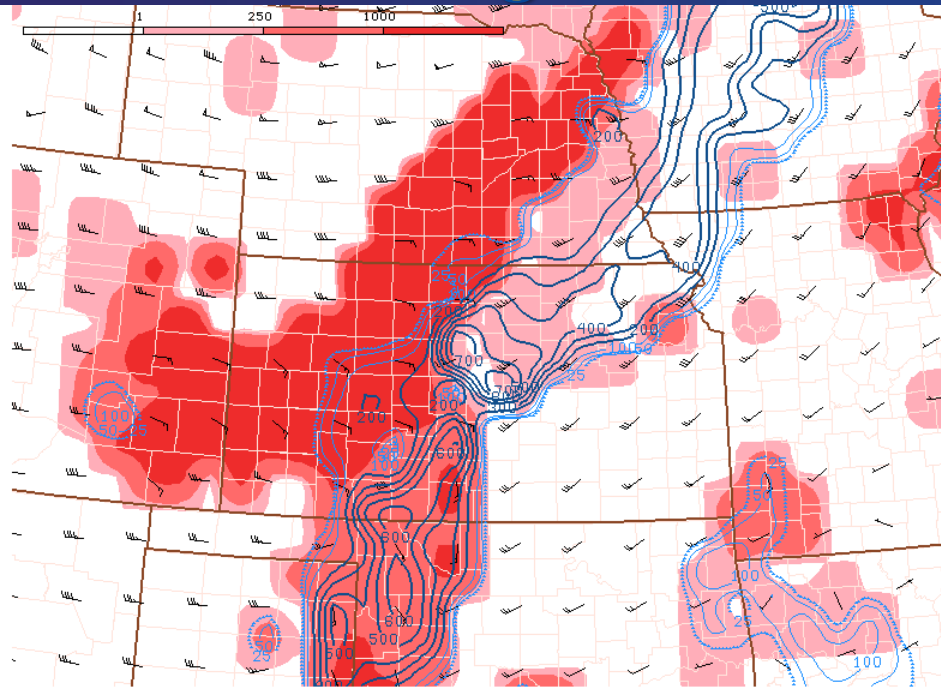
Increased Effective Layer SRH



Parameters and TOR Threat

SPSPG Effective σ SRH-03ZZ

SFSPG 0-3 km SRH-03ZZ



080612/0300 Eff. Inflow Base (fill, m AGL), ESRH (m2/s2) and storm motion (kt)

080612/0300 0-3 km SRH (m2/s2) and storm motion (kt)



Conclusions

- ❑ On the night of June 11th, low level frontogenetic forcing seems to have played a critical role in destabilizing the atmosphere along a narrow band on the leading edge of a cold front which allowed thunderstorms to remain surface based after sunset.
- ❑ The low level jet increase after sunset significantly increased low level SRH.
- ❑ Storm motion was parallel to the frontal boundary, providing an ideal environment for supercell thunderstorms to tilt and stretch enhanced horizontal vorticity increasing the probability these storms would produce a tornado.
- ❑ Effective layer parameters seemed more effective than fixed layer parameters when analyzing tornado potential.
- ❑ A mesoscale analyst can recognize rapidly evolving mesoscale features and mentally adjust model data.

Questions?

