

April 25, 2008 Mitchell County KS EF2 Tornado

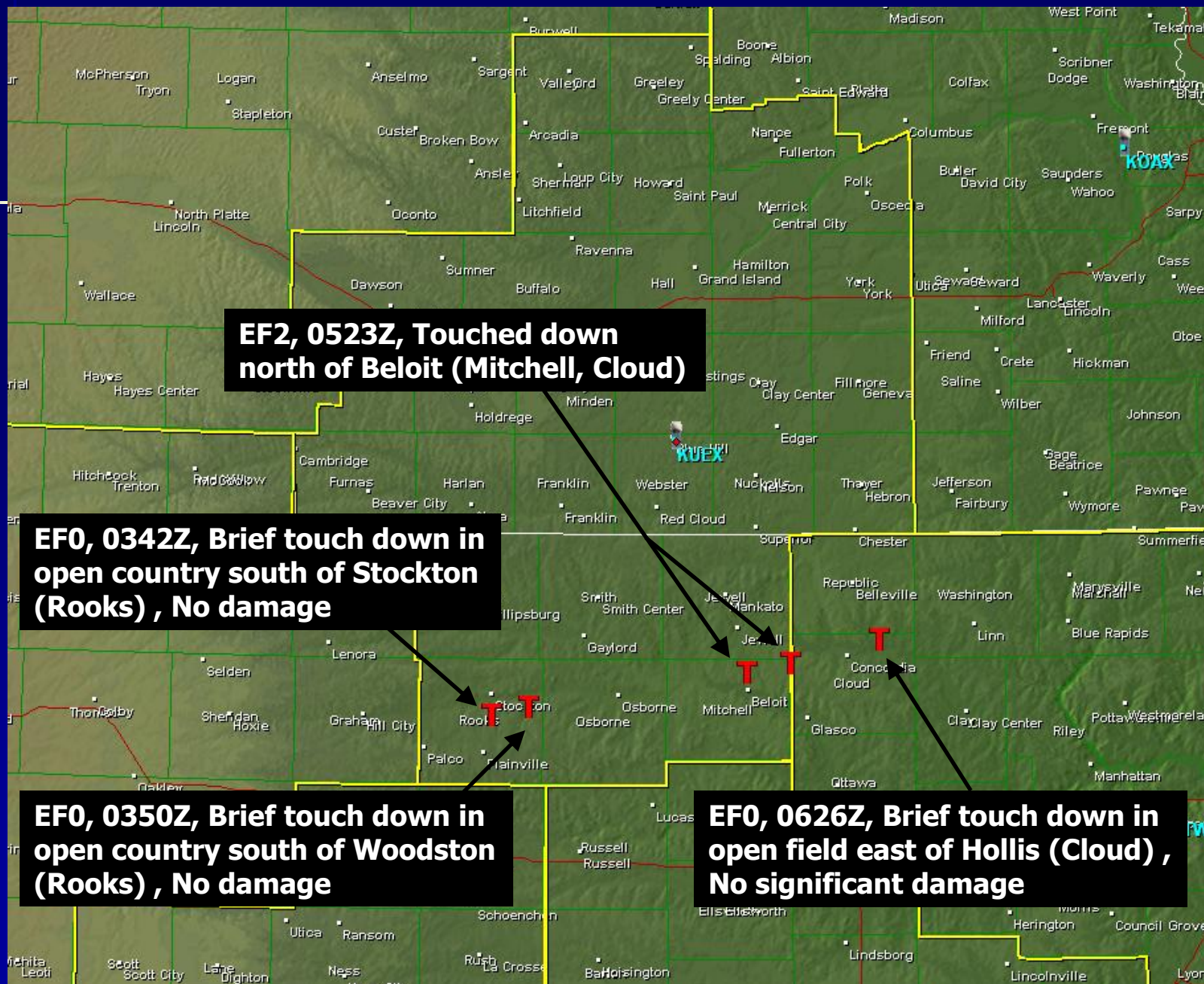
Part I Mesoscale Analysis

Kurt Buffalo – WFO Hastings
Aaron Johnson – WFO Hastings

Overview

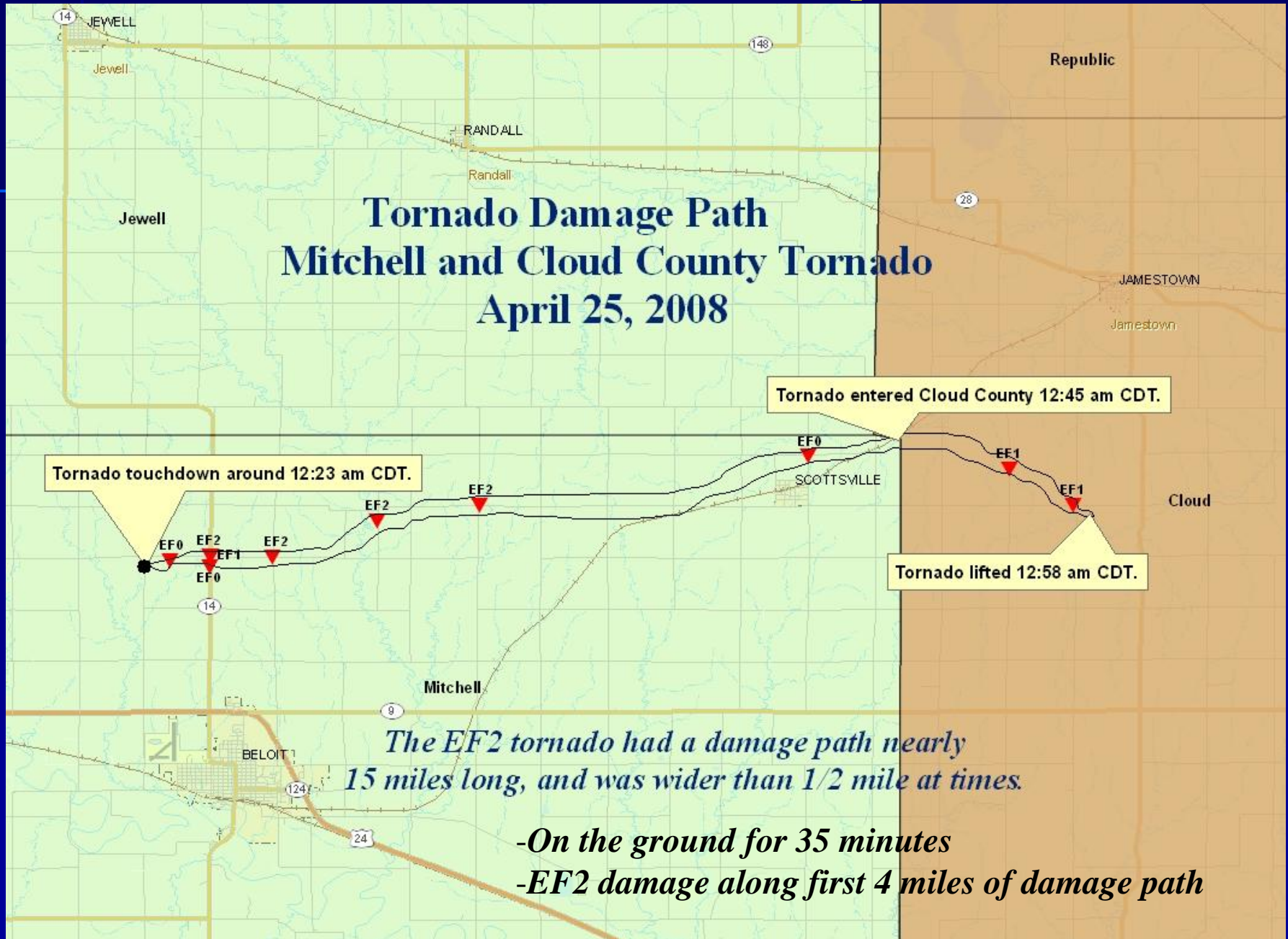
- Long-lived supercell developed over northwest Kansas during the late afternoon of April 24
 - Progressed eastward into north central Kansas during the late evening hours
 - Nontornadic for the first several hours during the late afternoon and evening before eventually turning tornadic during the late evening to early overnight hours in north central Kansas
- Analysis of the mesoscale environment showed the supercell was moving into a more favorable tornadic environment during the late evening/early overnight as it progressed east **if** it could remain surface-based
 - Battling the strong climatological trend for nocturnal convection to become elevated

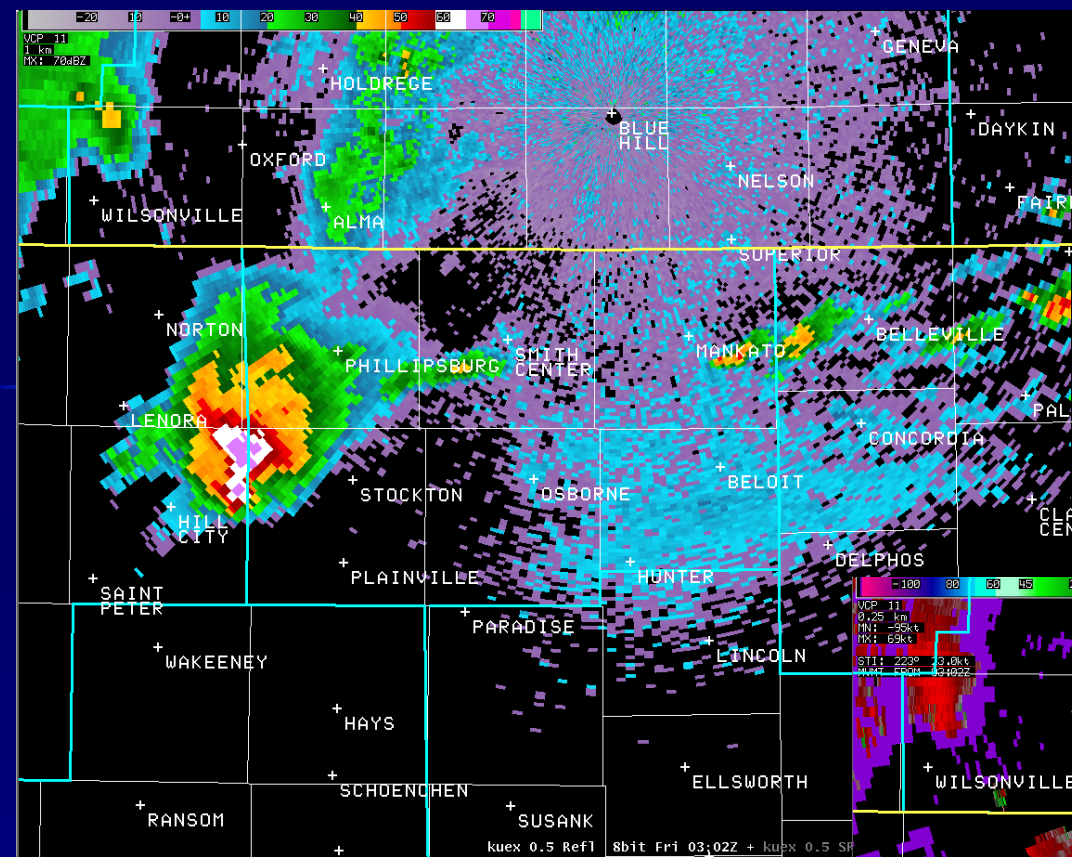
Tornadoes Produced by Long-Lived Supercell



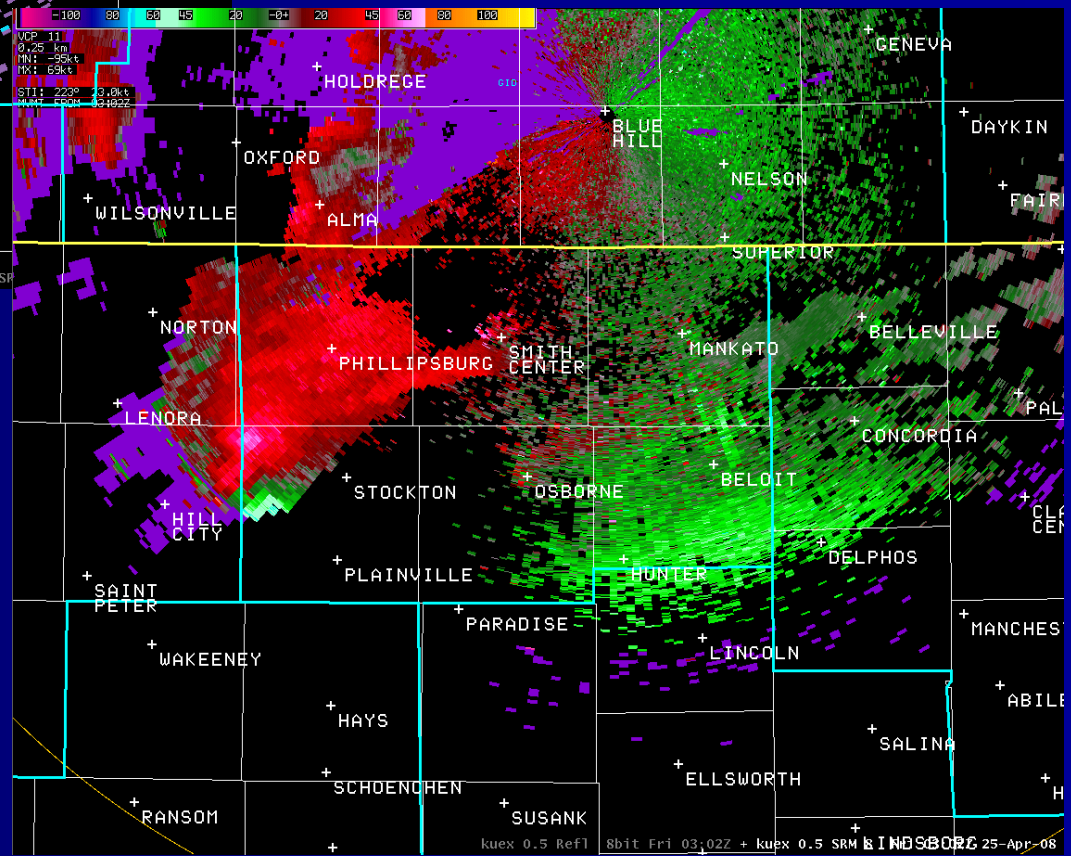
Mitchell/Cloud County Tornado

Tornado Damage Path Mitchell and Cloud County Tornado April 25, 2008



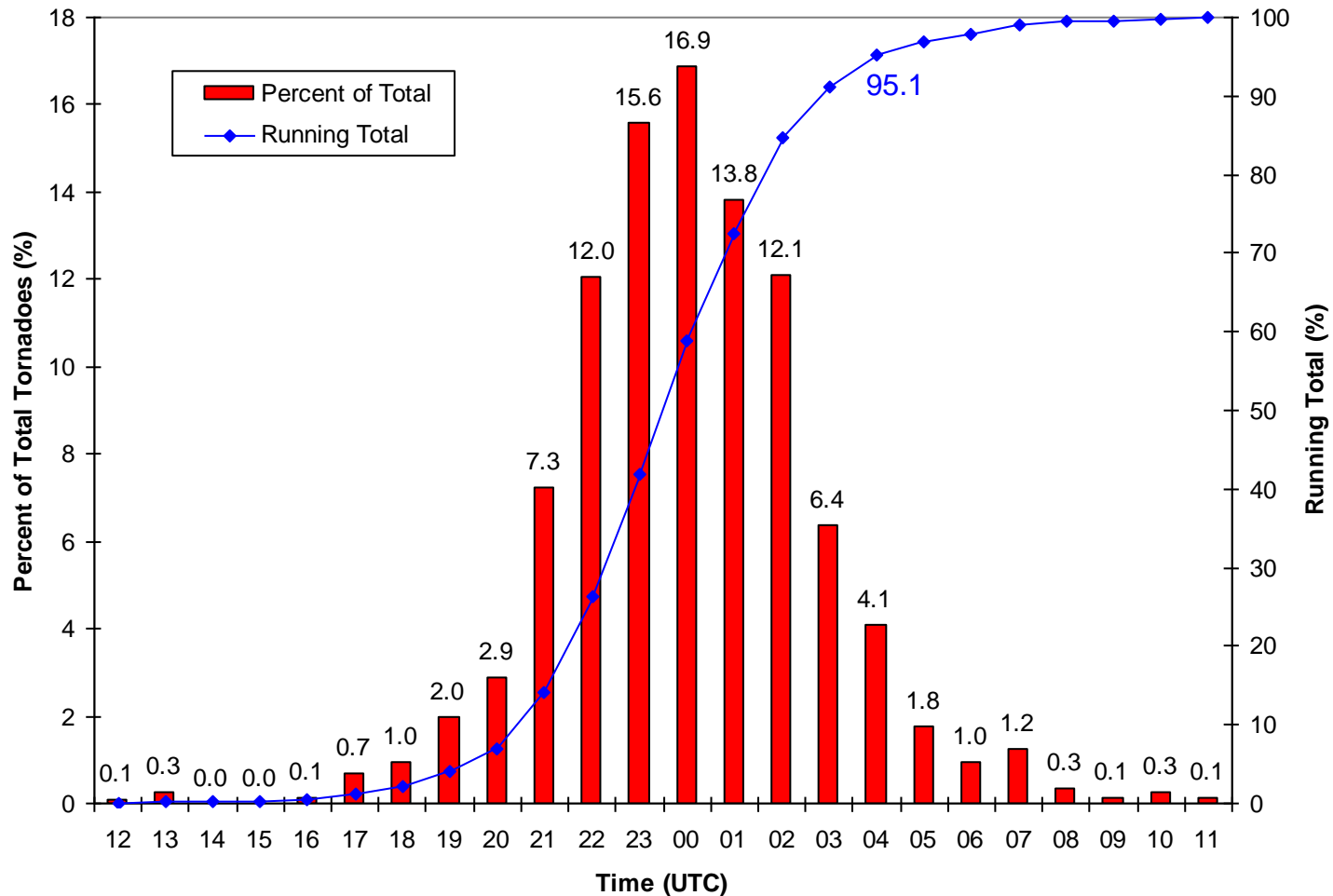


0.5° SRM



0.5° Reflectivity

Hourly Tornado Distribution for KUEX Coverage Area (1980-2006)

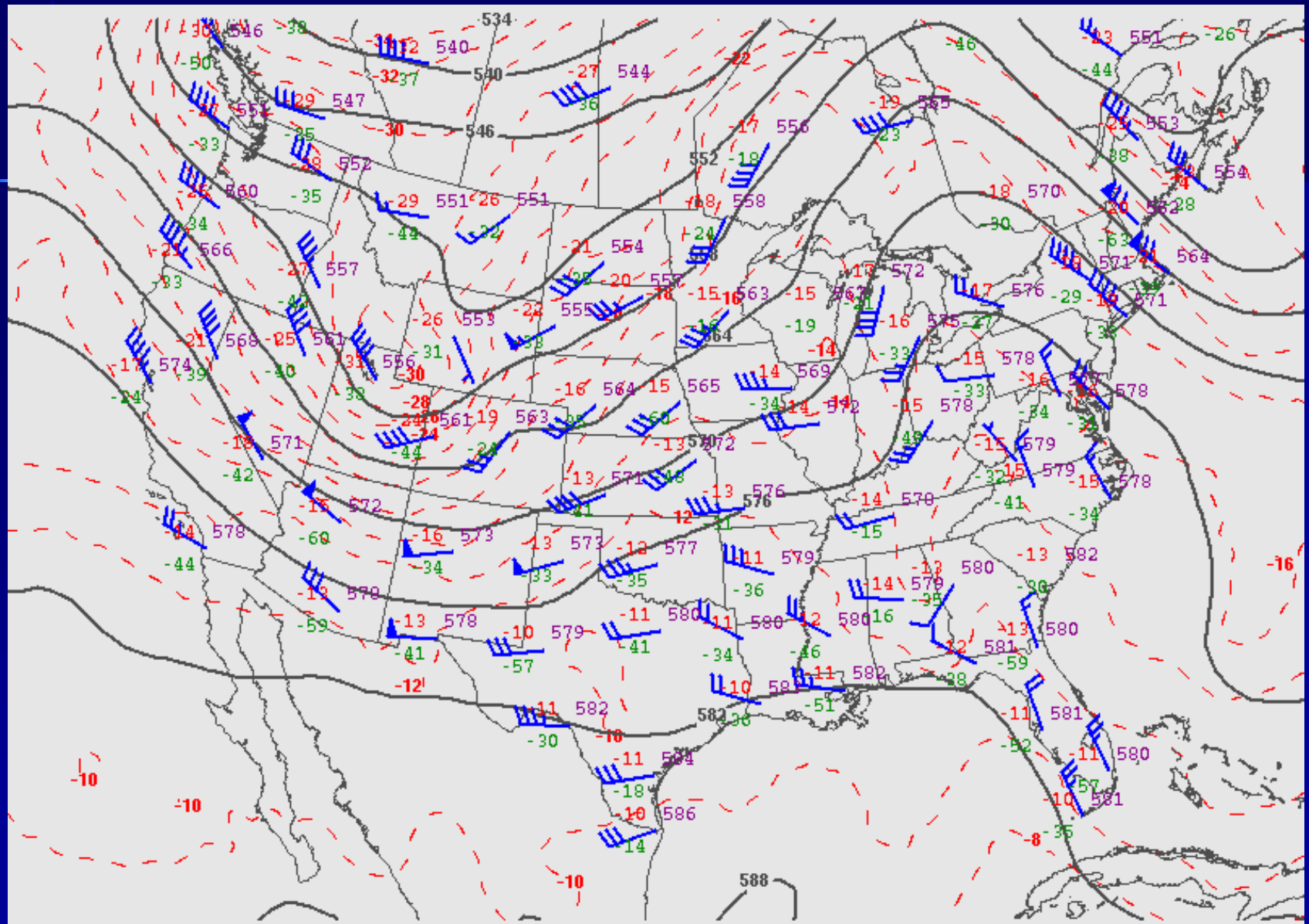


* Time of tornado reports rounded to the nearest hour

* 124 nm range around radar

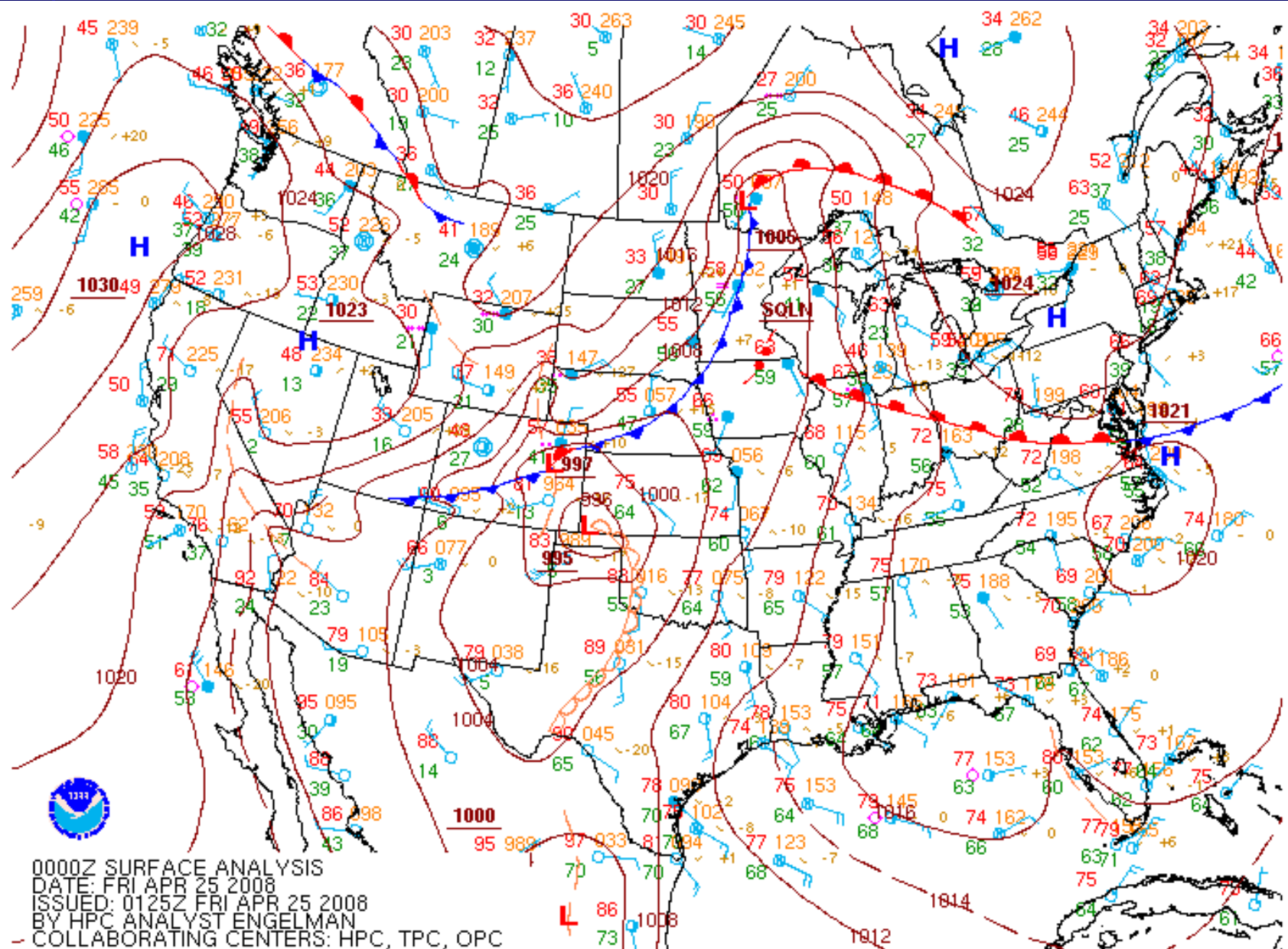
Adapted from <http://www.spc.noaa.gov/climo/online/rda/UEX.html>

500 mb

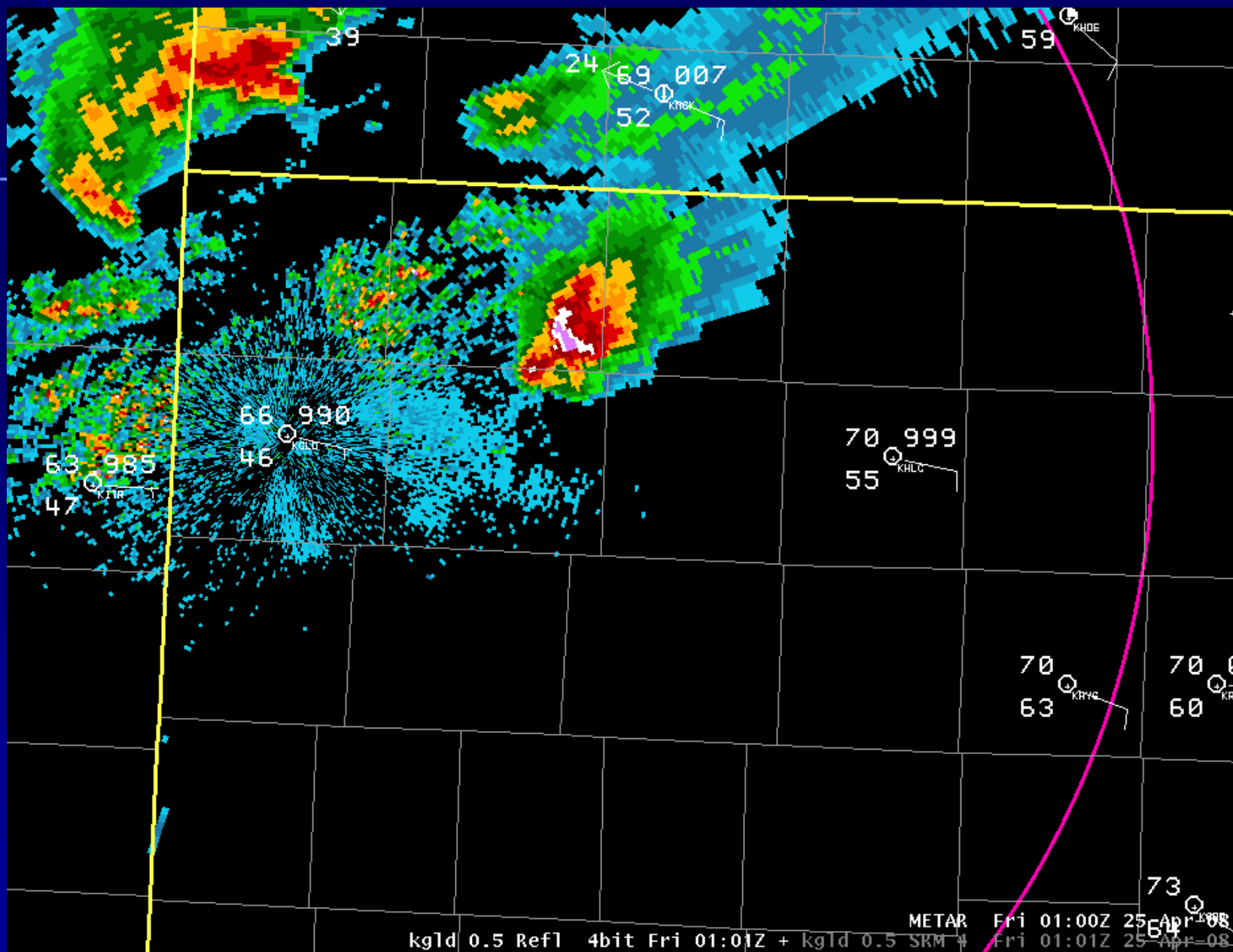


080425/0000 500 MB UA OBS, HGHTS, and TEMPS

Surface

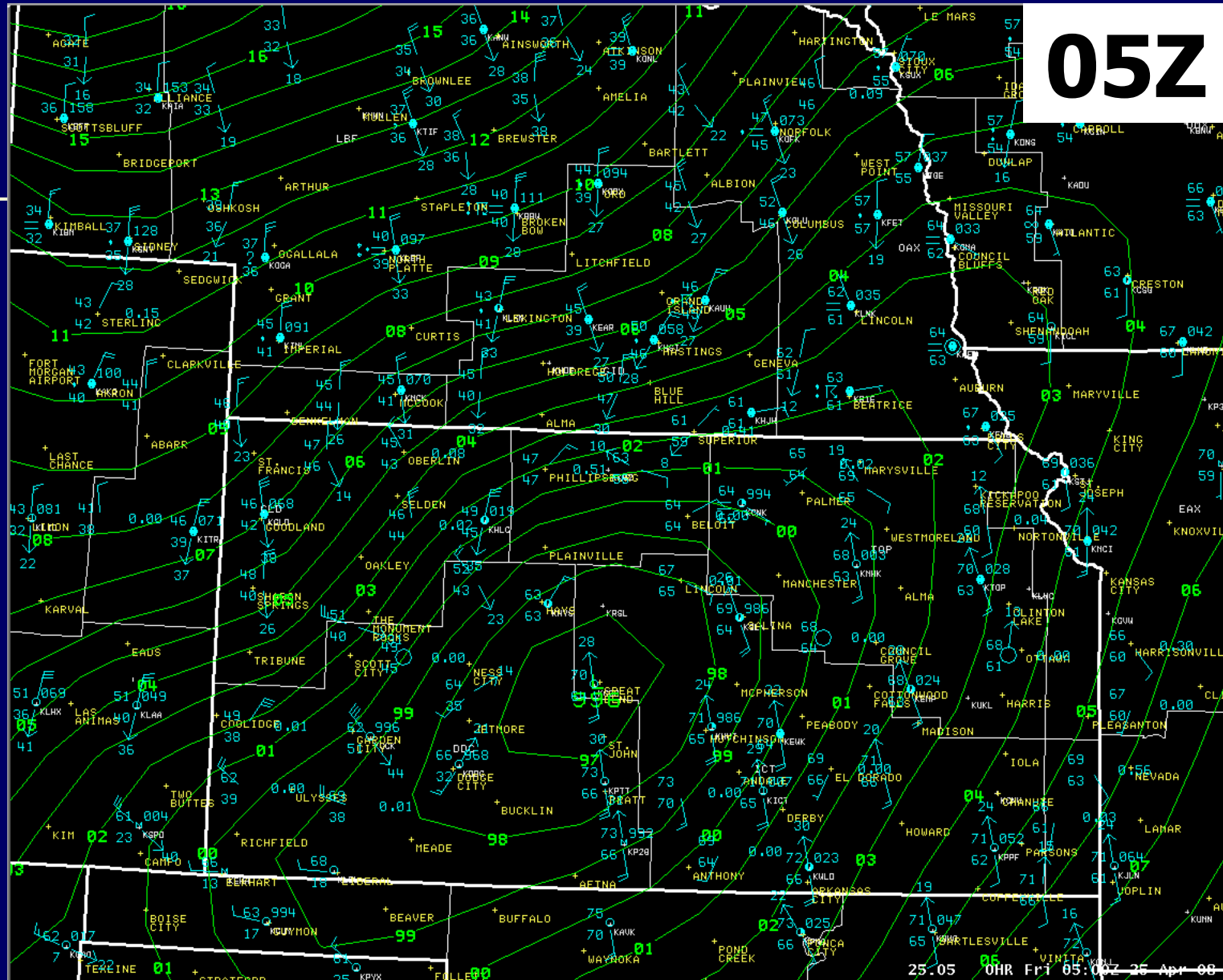


Environment over NW Kansas



Surface

05Z

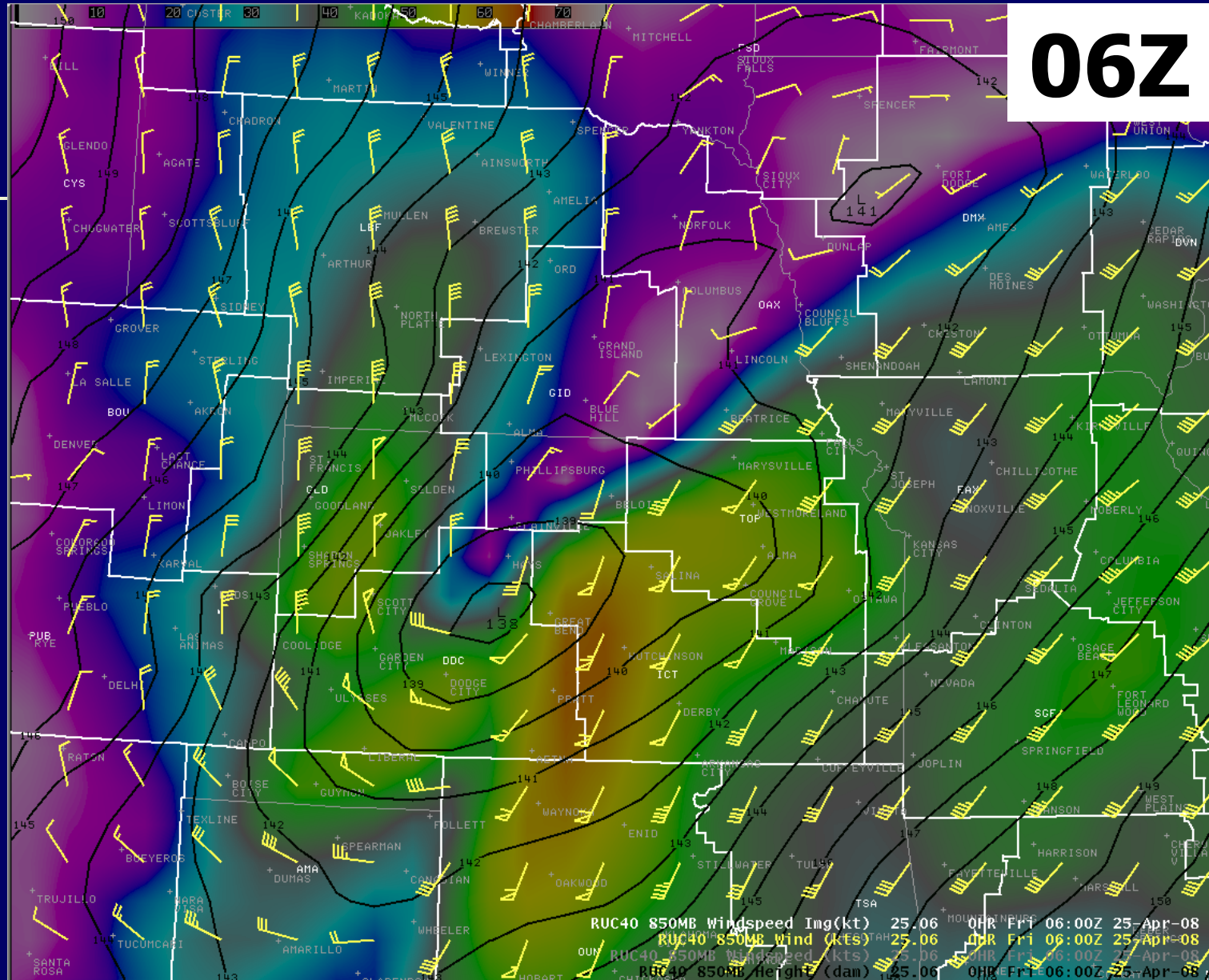


25:05 OHR Fri 05:00Z 25 Apr 08

Backing surface winds ahead of low lifting northeast

850 mb

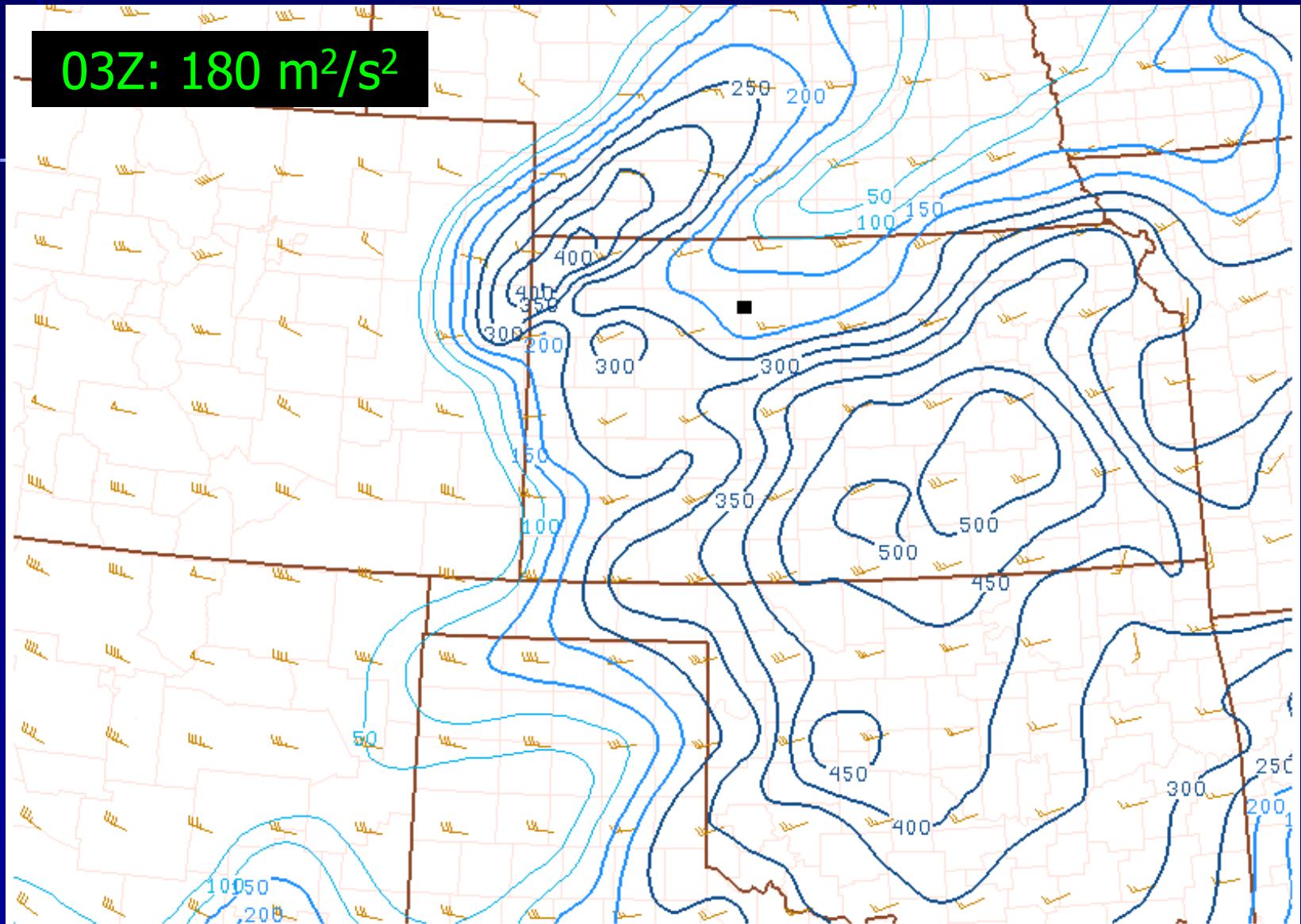
06Z



Intensifying south/southwesterly LLJ

0-1 km SRH (m^2/s^2)

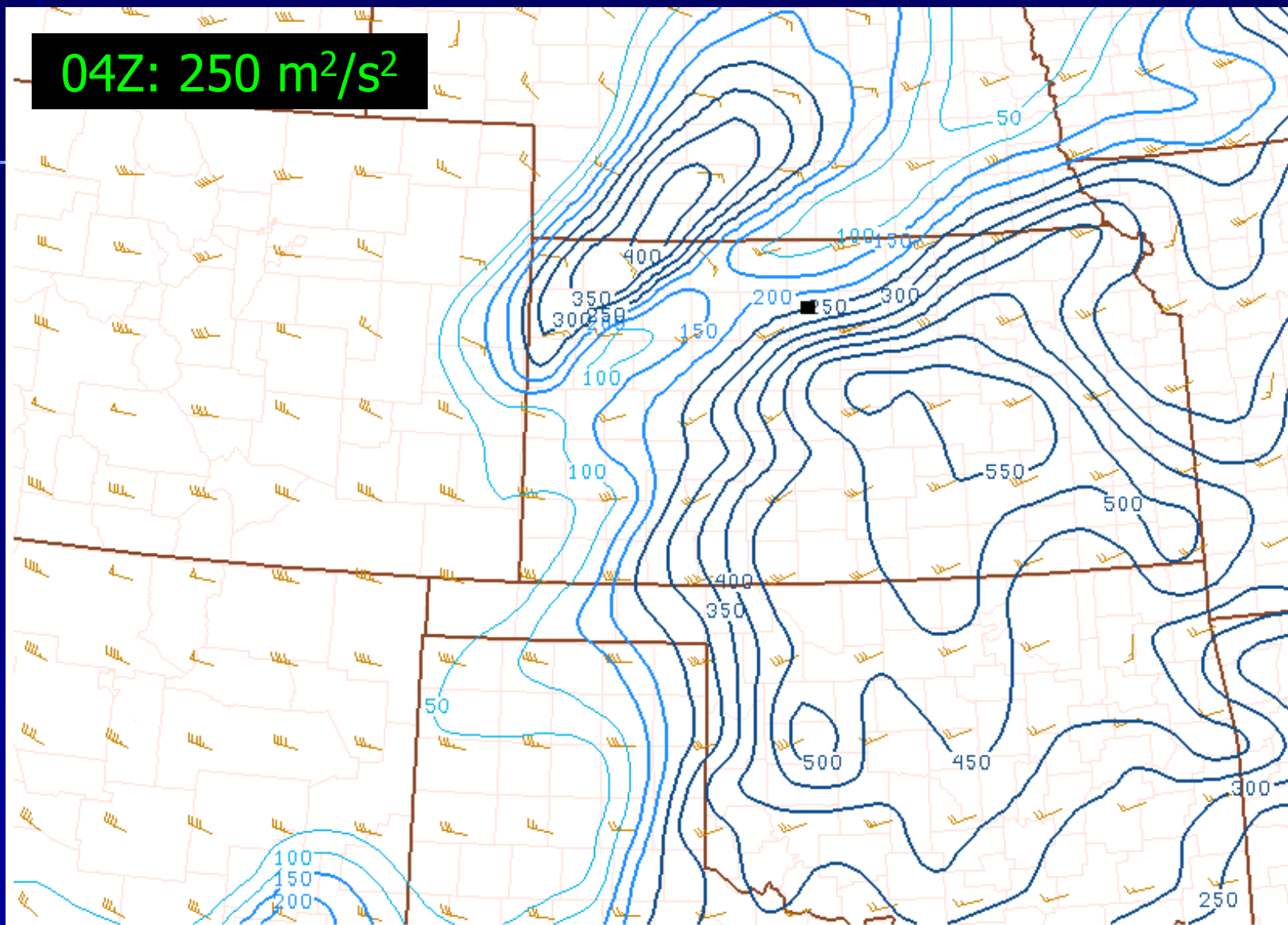
03Z: $180 \text{ m}^2/\text{s}^2$



080425/0300 0-1 km SRH (m^2/s^2) and storm motion (kt)

0-1 km SRH (m^2/s^2)

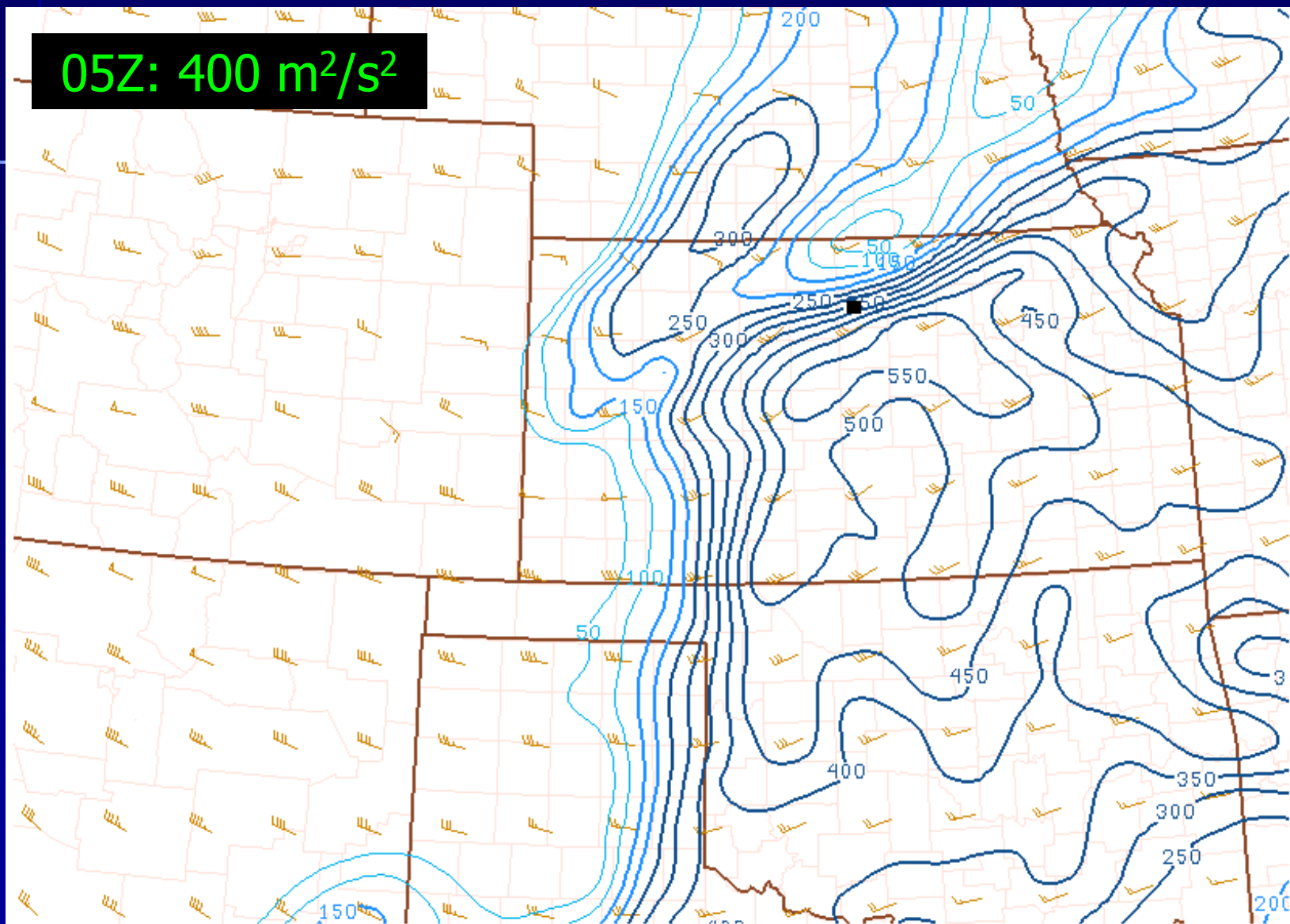
04Z: $250 \text{ m}^2/\text{s}^2$



080425/0400 0-1 km SRH (m^2/s^2) and storm motion (kt)

0-1 km SRH (m^2/s^2)

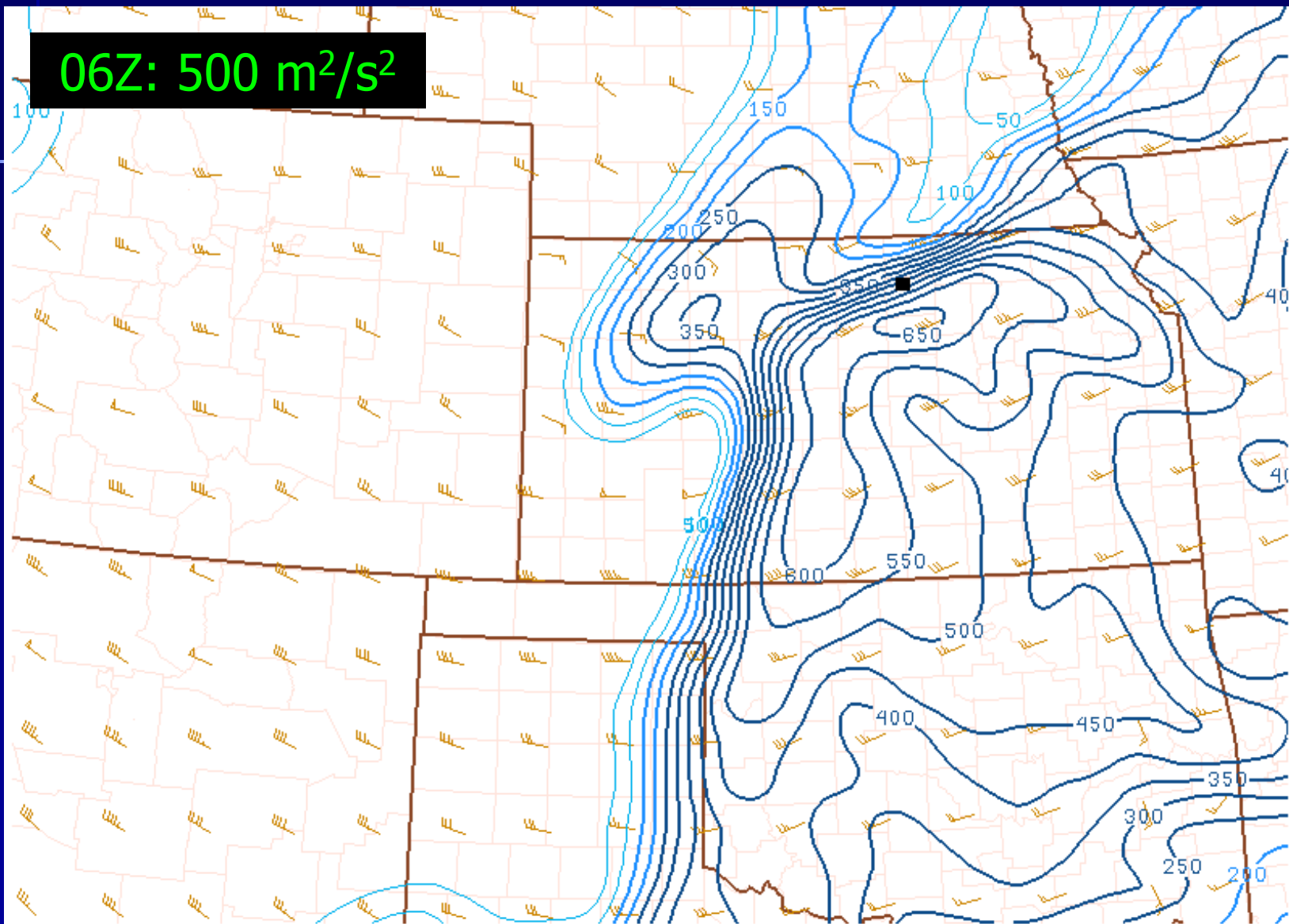
05Z: $400 \text{ m}^2/\text{s}^2$



080425/0500 0-1 km SRH (m^2/s^2) and storm motion (kt)

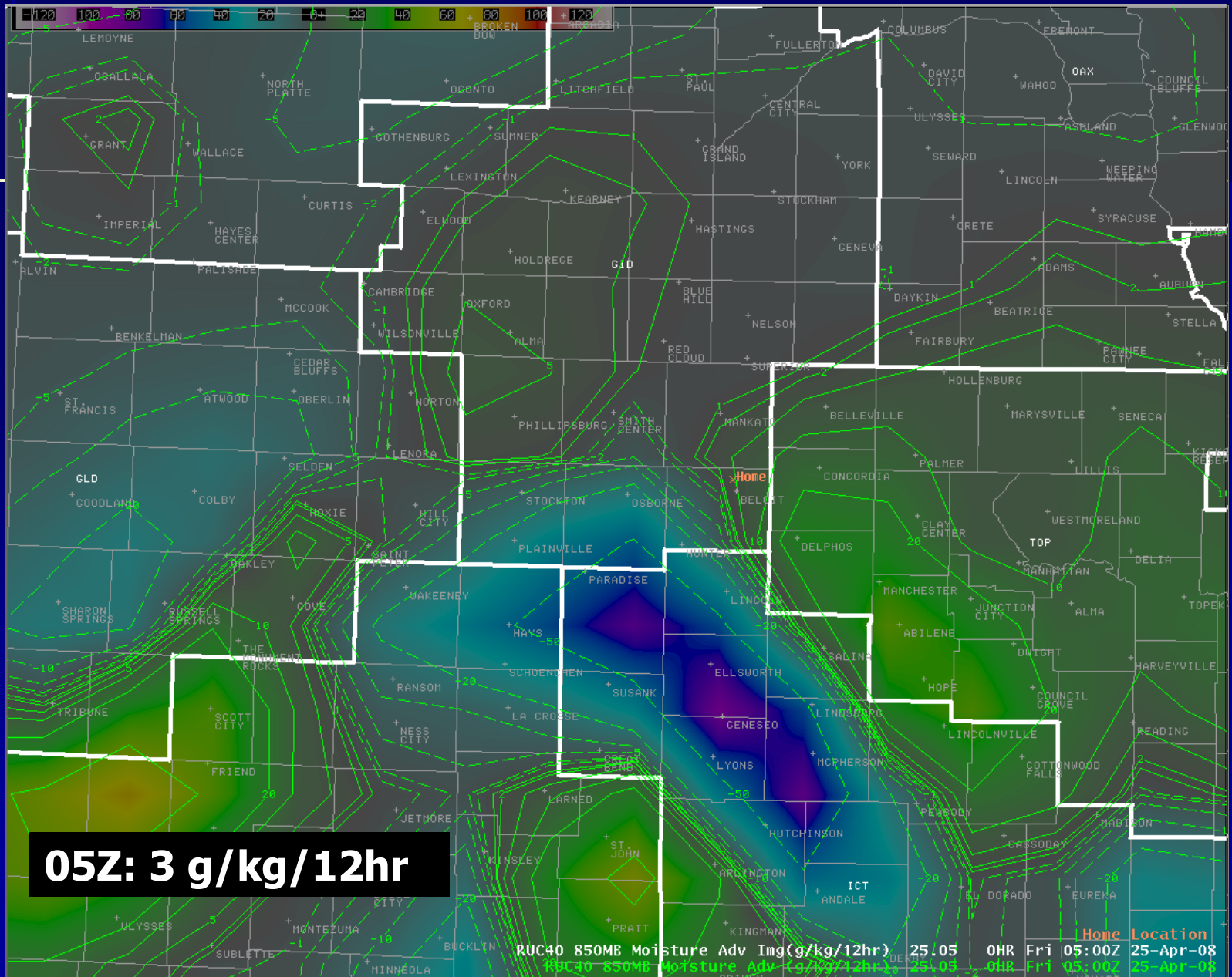
0-1 km SRH (m^2/s^2)

06Z: $500 \text{ m}^2/\text{s}^2$

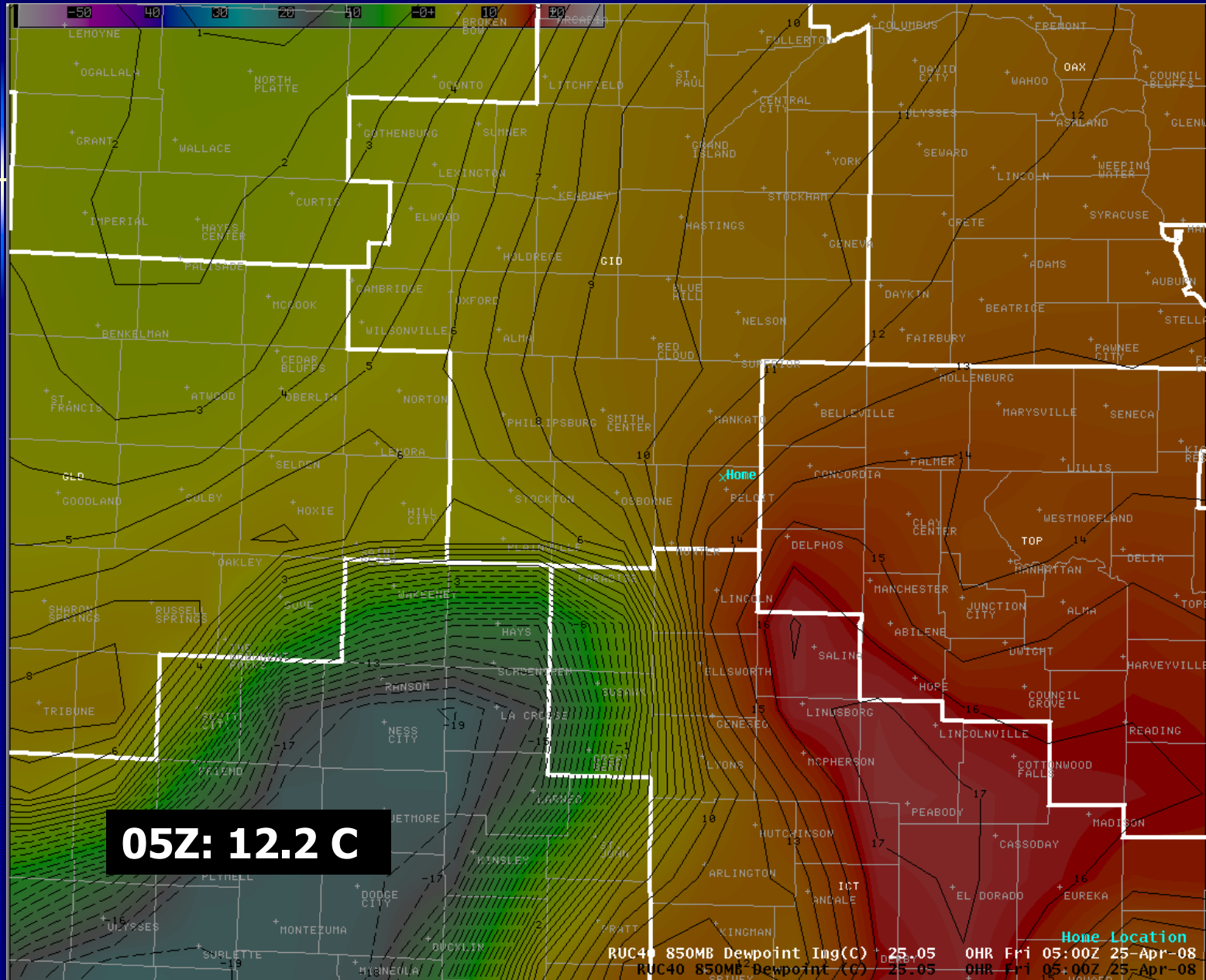


080425/0600 0-1 km SRH (m^2/s^2) and storm motion (kt)

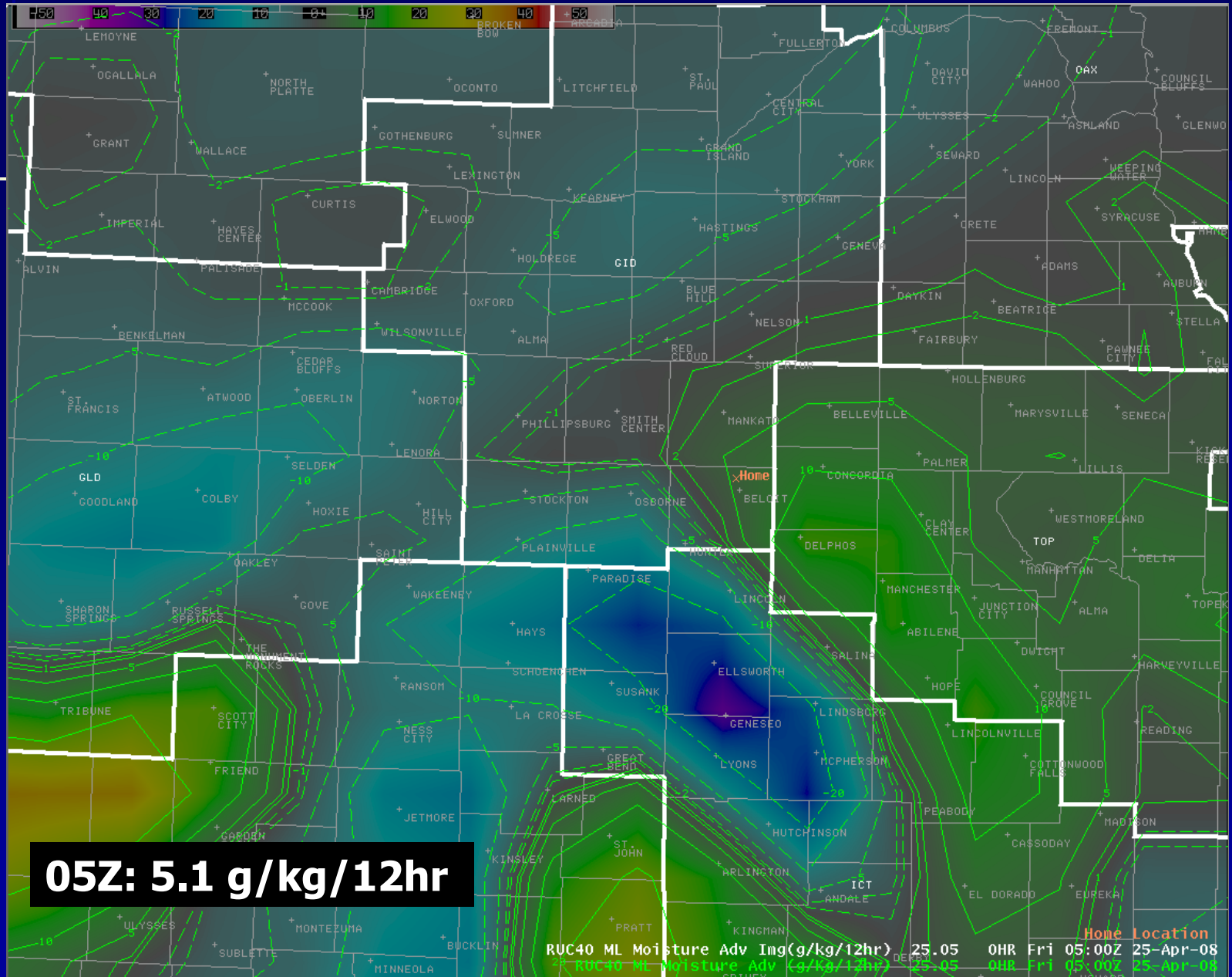
850 mb Moisture Advection



850 mb Dewpoints



0-1 km AGL Mixed Layer Moisture Advection

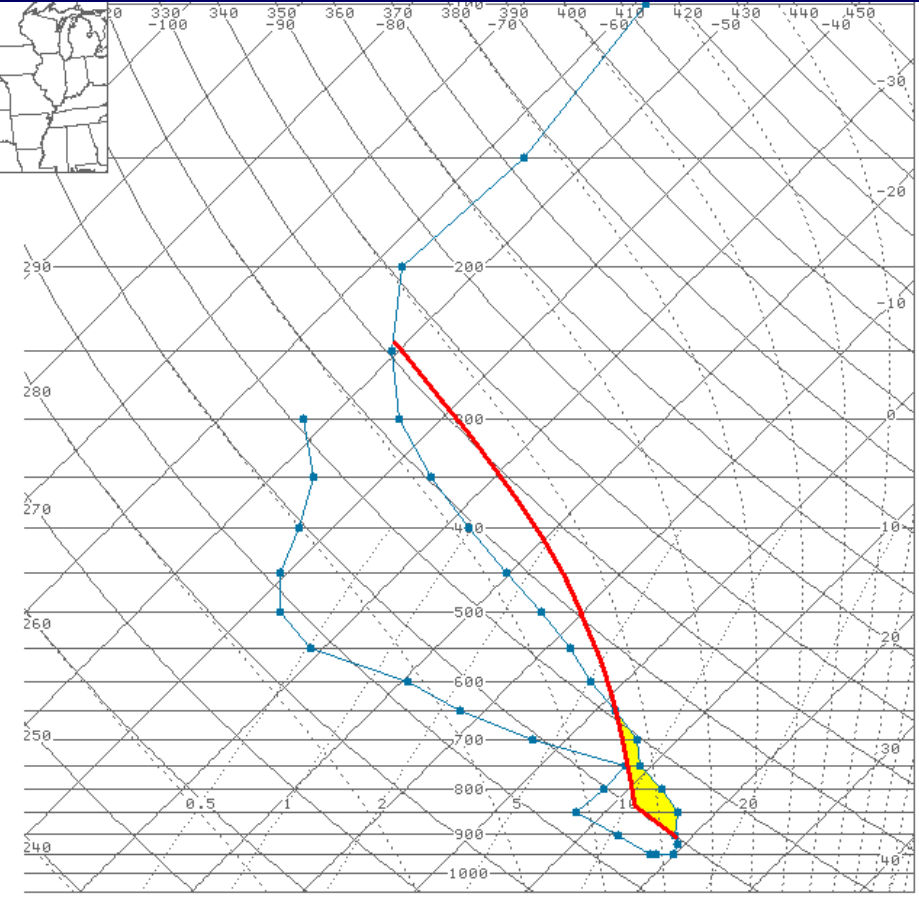


05Z: 5.1 g/kg/12hr

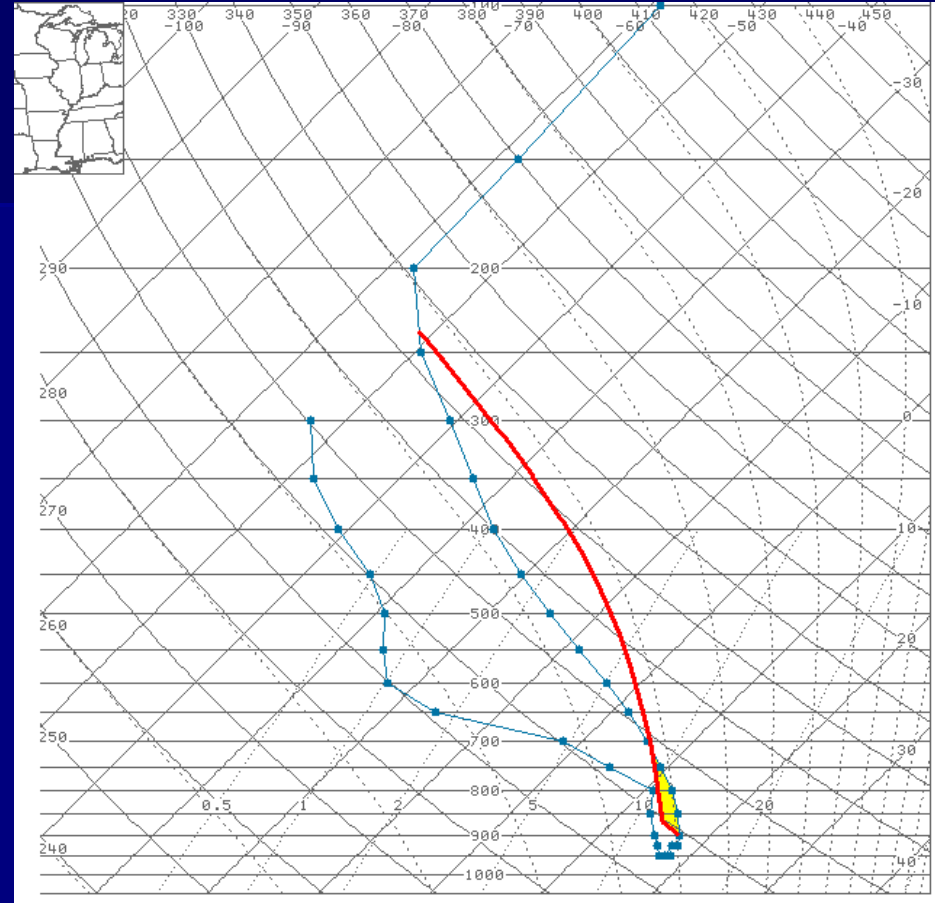
Home Location

RUC40 ML Moisture Adv Ing(g/kg/12hr) 25.05 OHR Fri 05:00Z 25-Apr-08
RUC40 ML Moisture Adv (g/kg/12hr) 25.05 048 Fri 05:00Z 25-Apr-08

RUC Proximity Soundings for EF2 Tornado



03Z: MLCAPE = 1200 J/kg
MLCIN = -160 J/kg

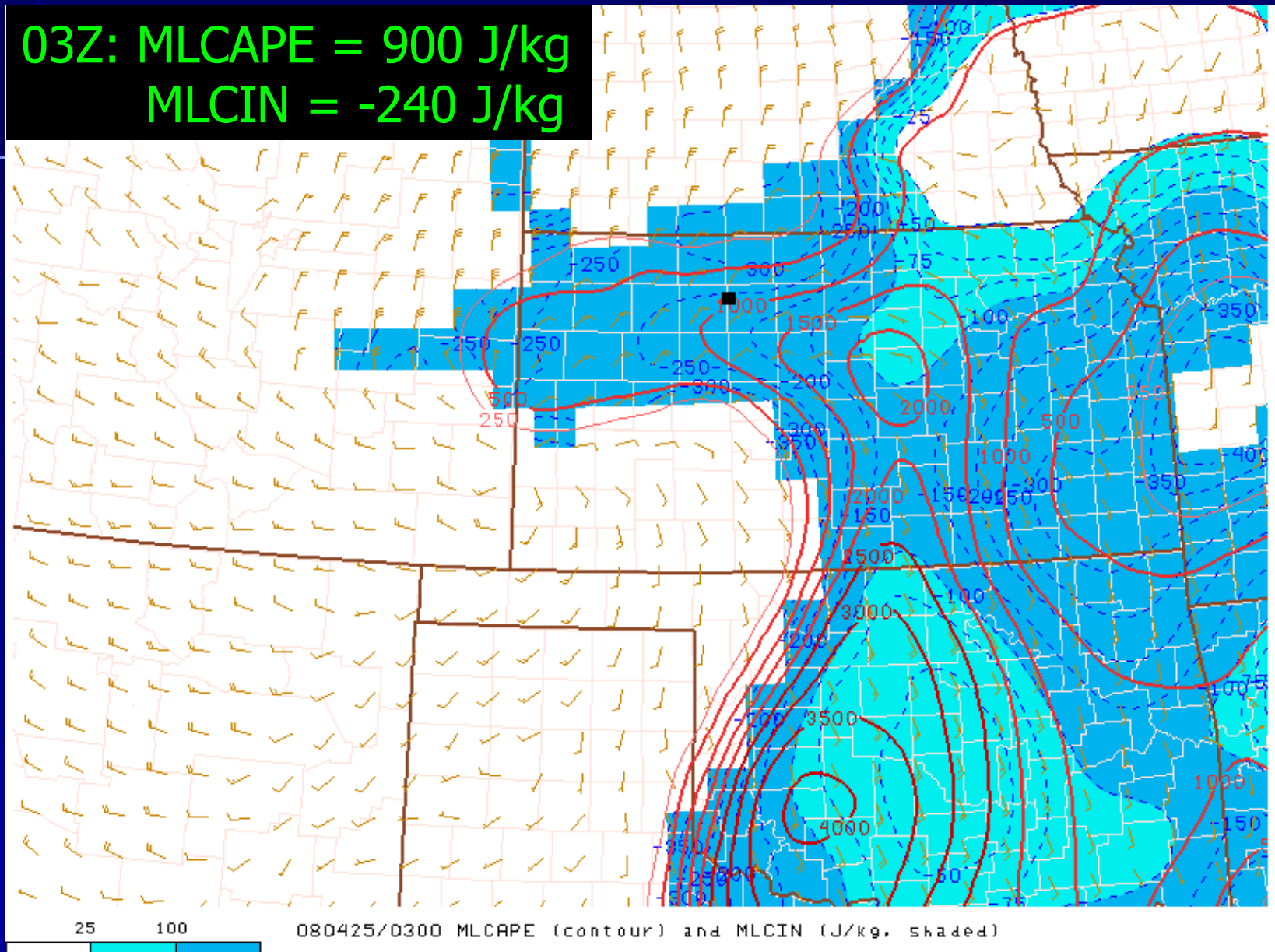


05Z: MLCAPE = 1600 J/kg
MLCIN = -65 J/kg

Moistening of the BL → Decreased inhibition, increased instability

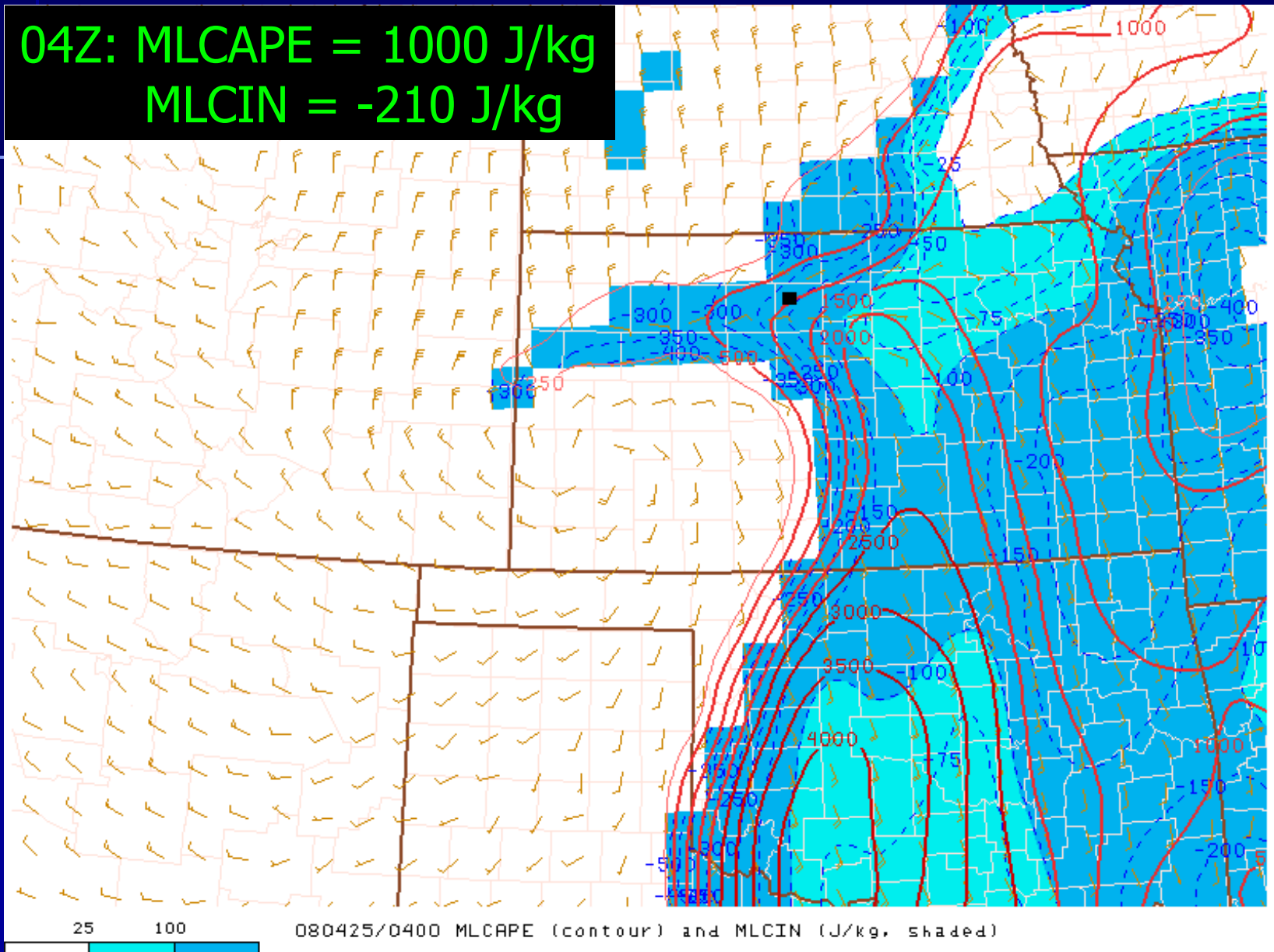
100 mb MLCAPE/MLCIN (J/kg)

03Z: MLCAPE = 900 J/kg
MLCIN = -240 J/kg



100 mb MLCAPE/MLCIN (J/kg)

04Z: MLCAPE = 1000 J/kg
MLCIN = -210 J/kg

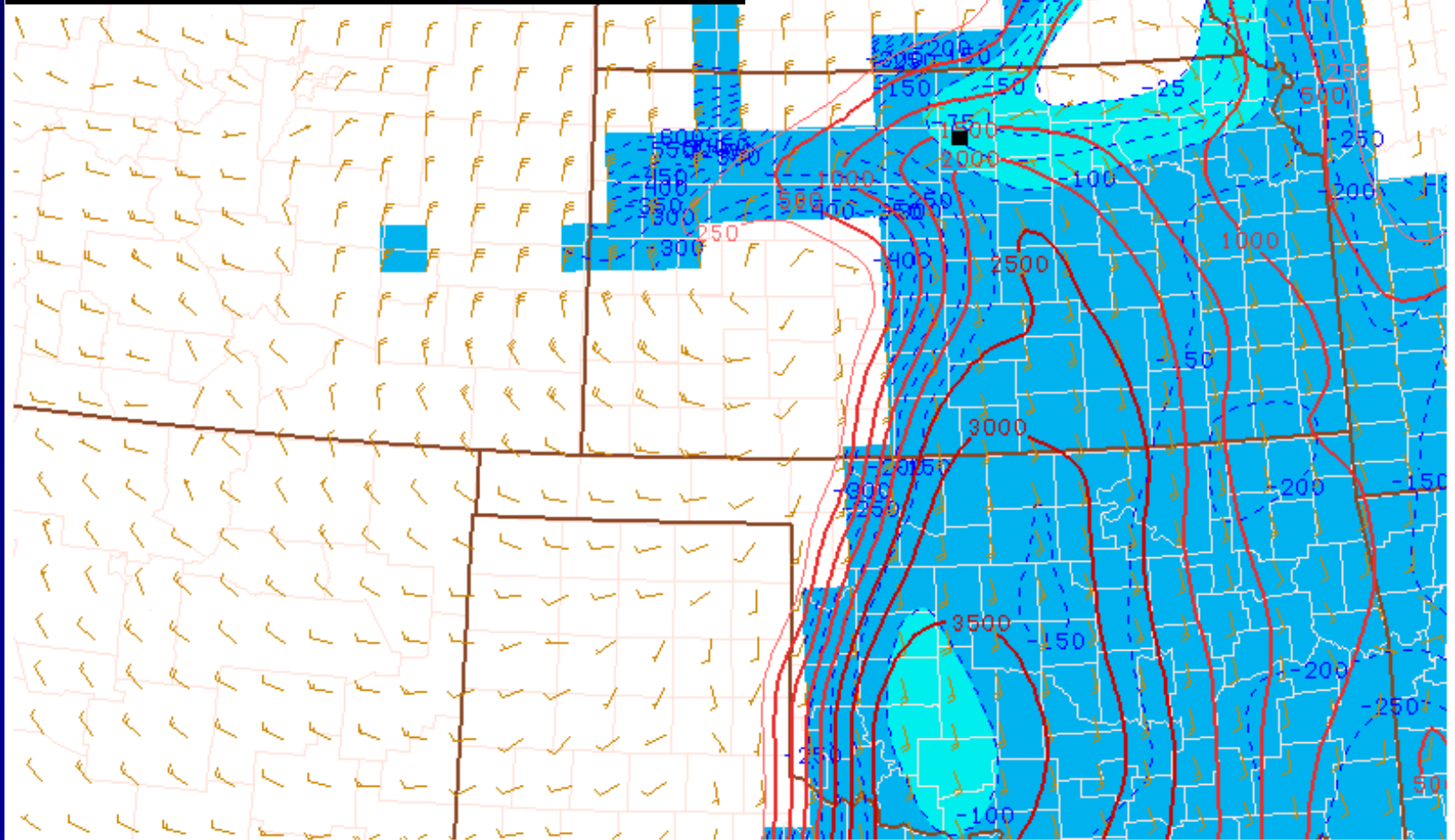


100 mb MLCAPE/MLCIN (J/kg)

05Z: MLCAPE = 1600 J/kg

MLCIN = -80 J/kg

(Tornadogenesis: $-75 \text{ J/kg} < \text{MLCIN} < -50 \text{ J/kg}$)

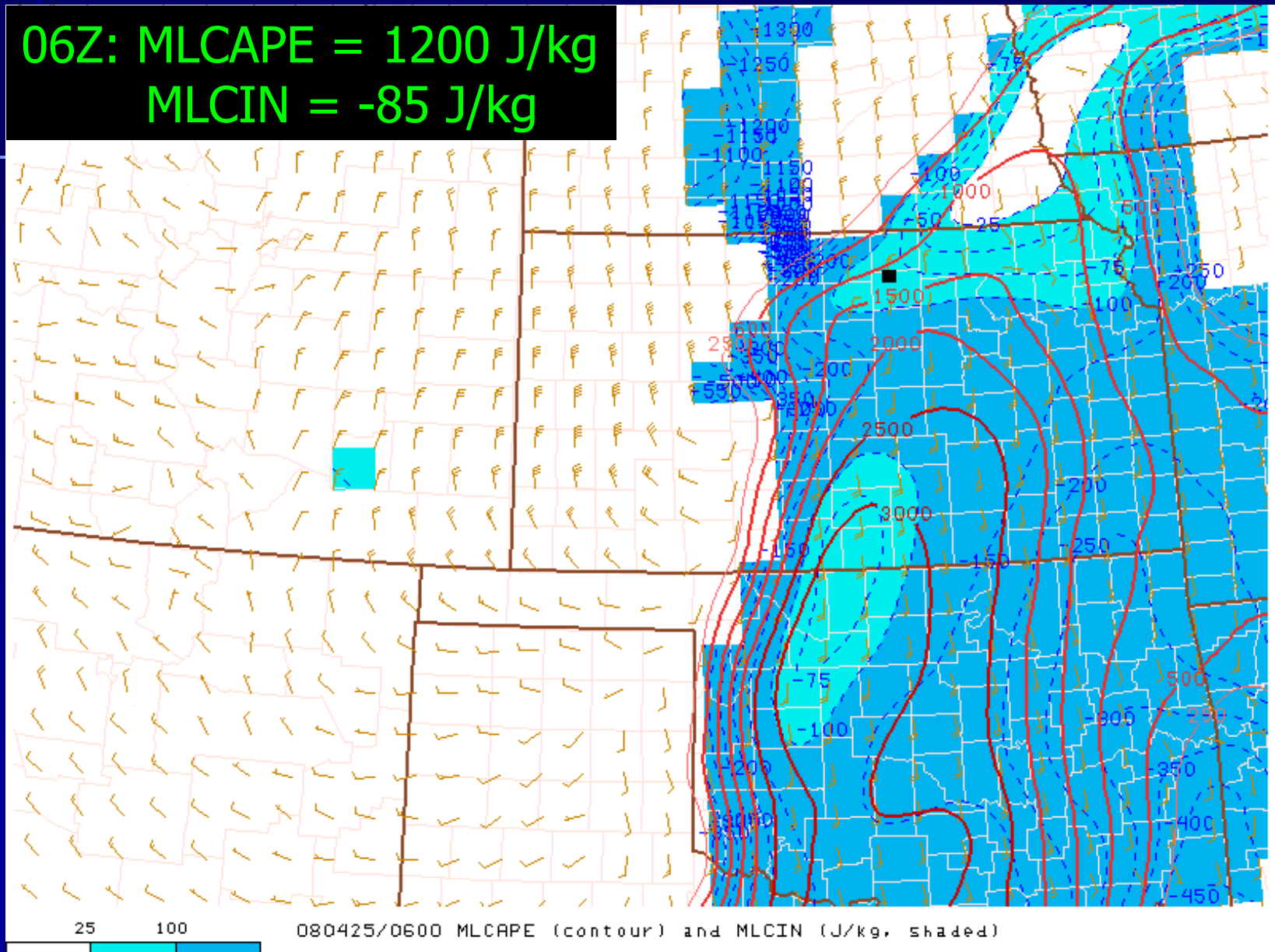


25 100

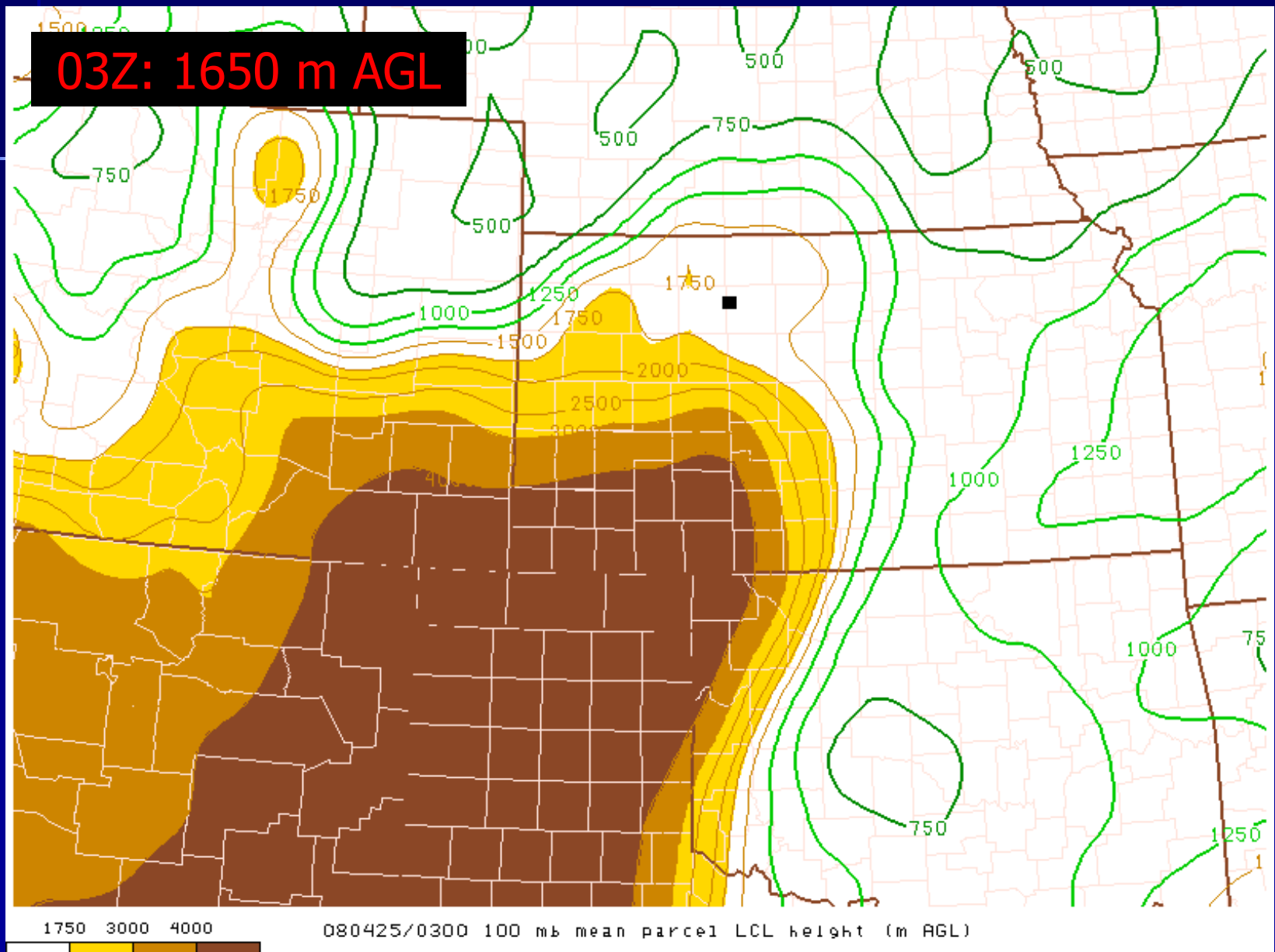
080425/0500 MLCAPE (contour) and MLCIN (J/kg, shaded)

100 mb MLCAPE/MLCIN (J/kg)

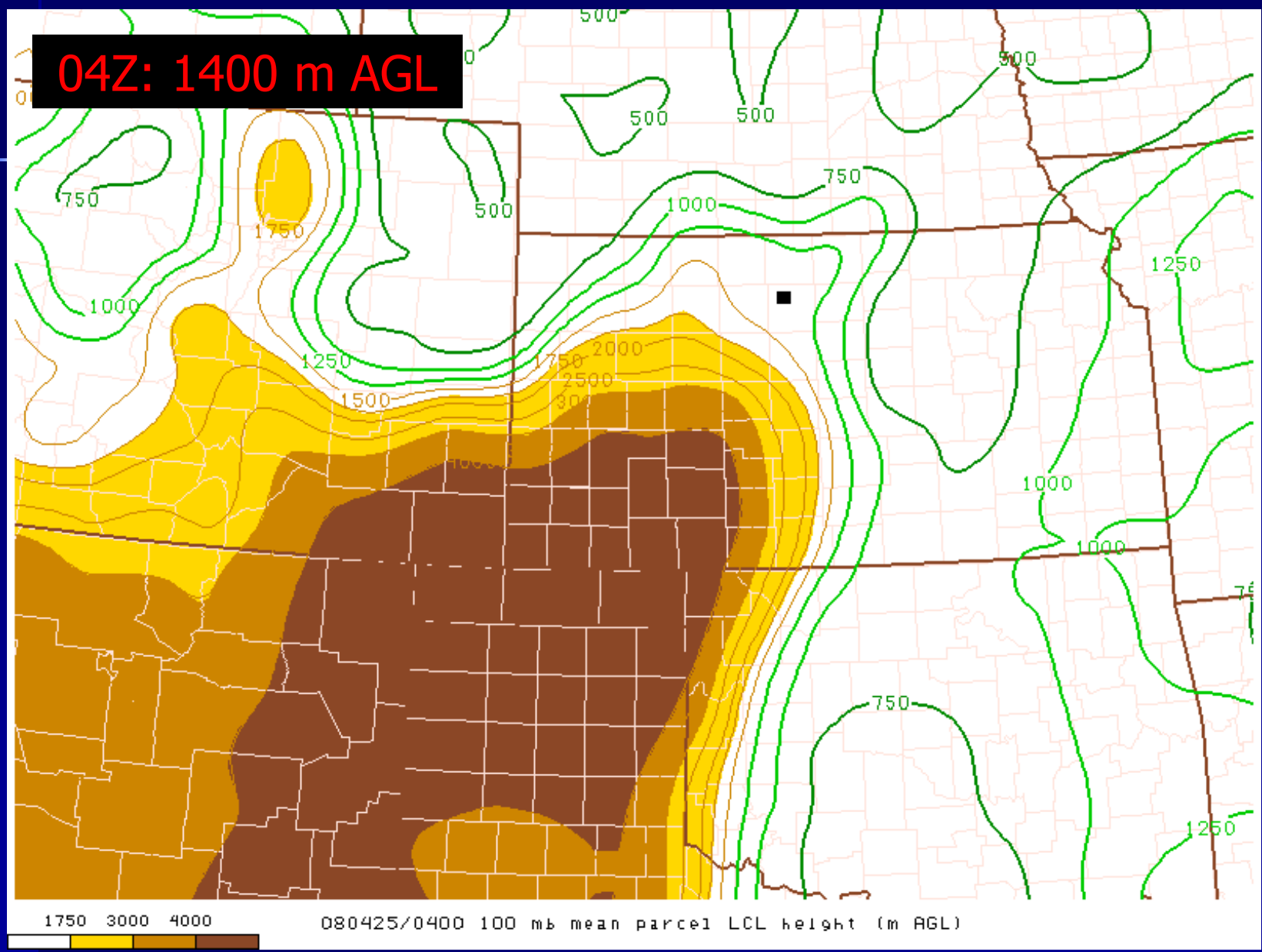
06Z: MLCAPE = 1200 J/kg
MLCIN = -85 J/kg



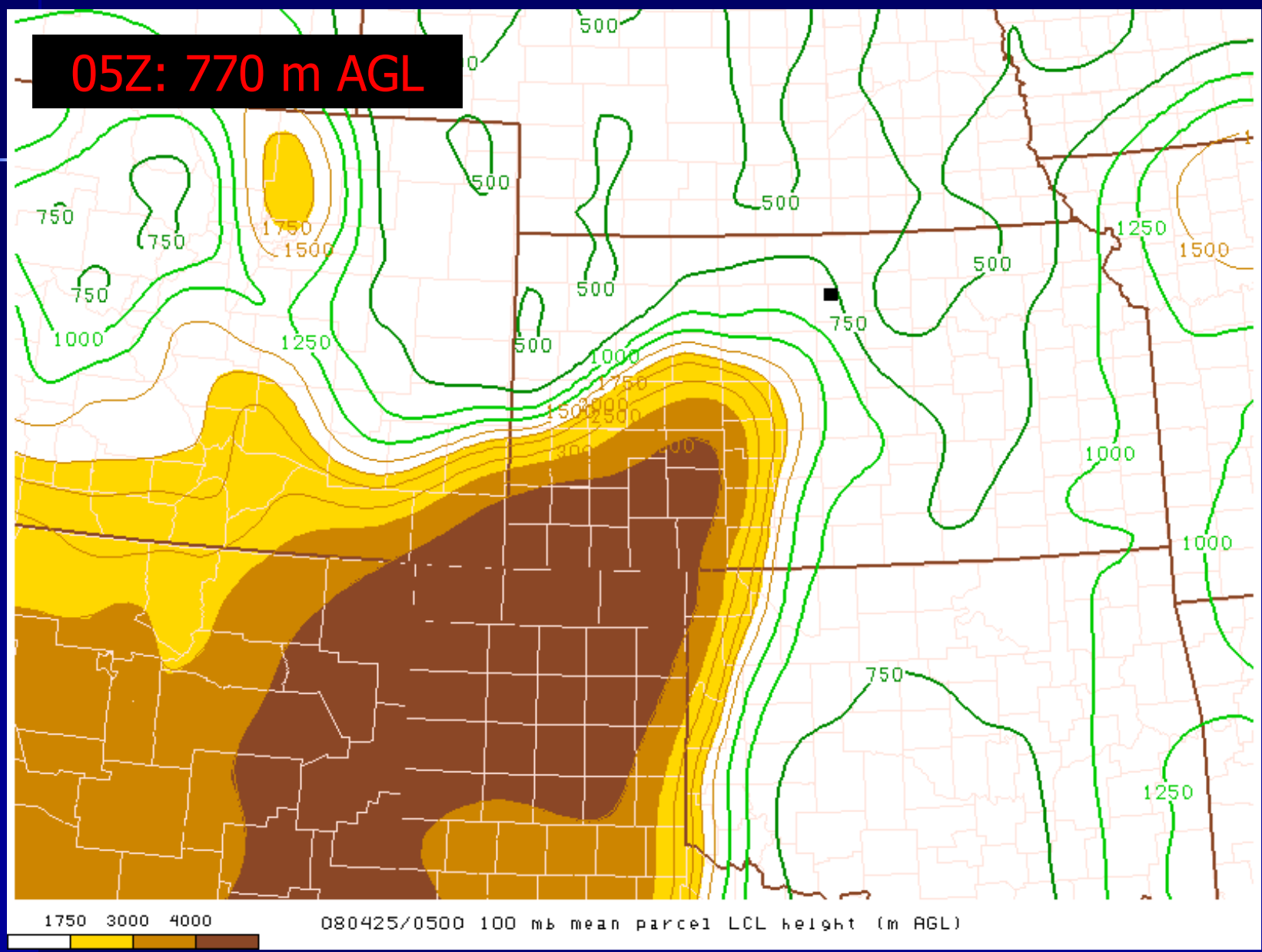
LCL Height (100 mb mean parcel; m AGL)



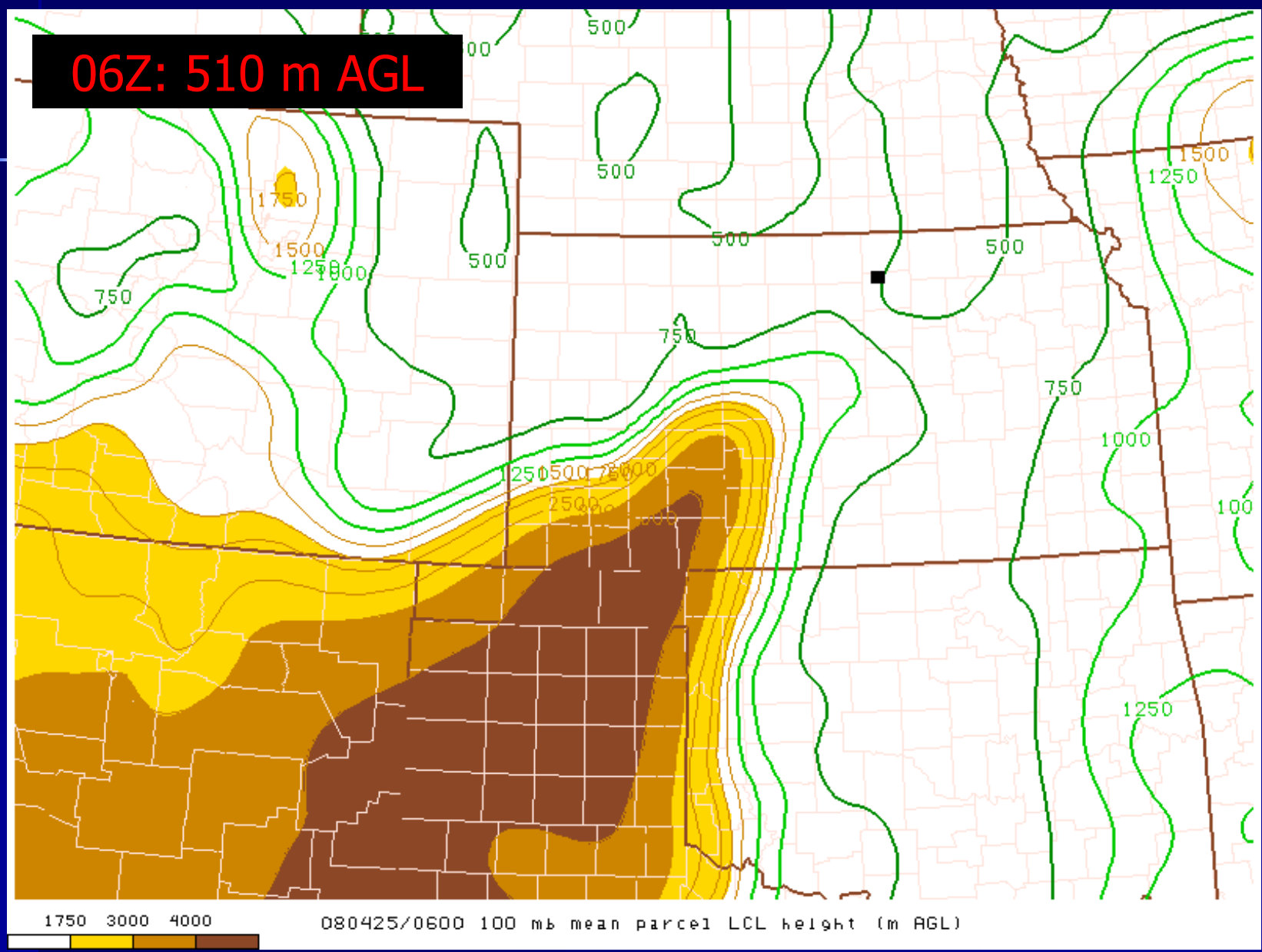
LCL Height (100 mb mean parcel; m AGL)



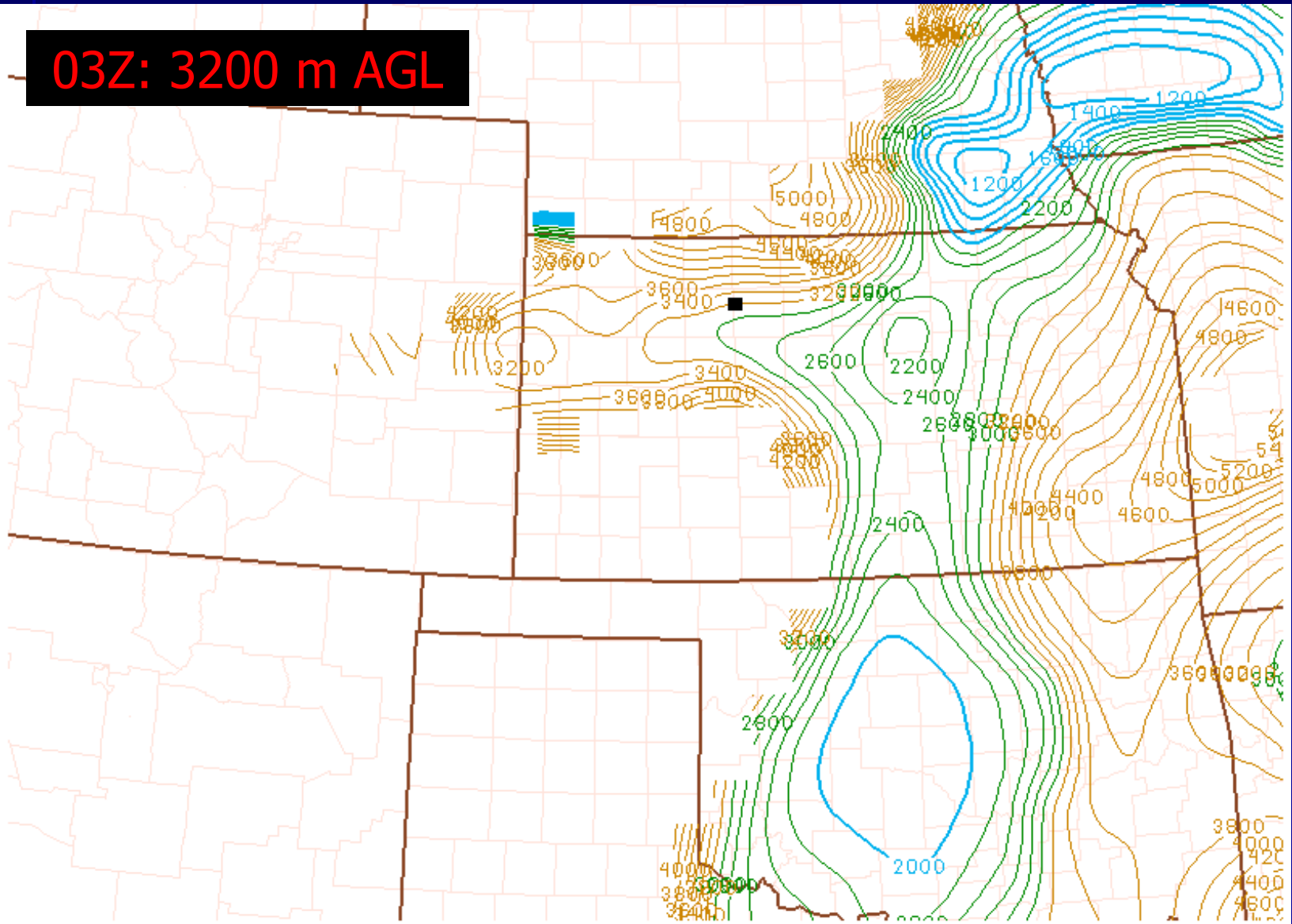
LCL Height (100 mb mean parcel; m AGL)



LCL Height (100 mb mean parcel; m AGL)



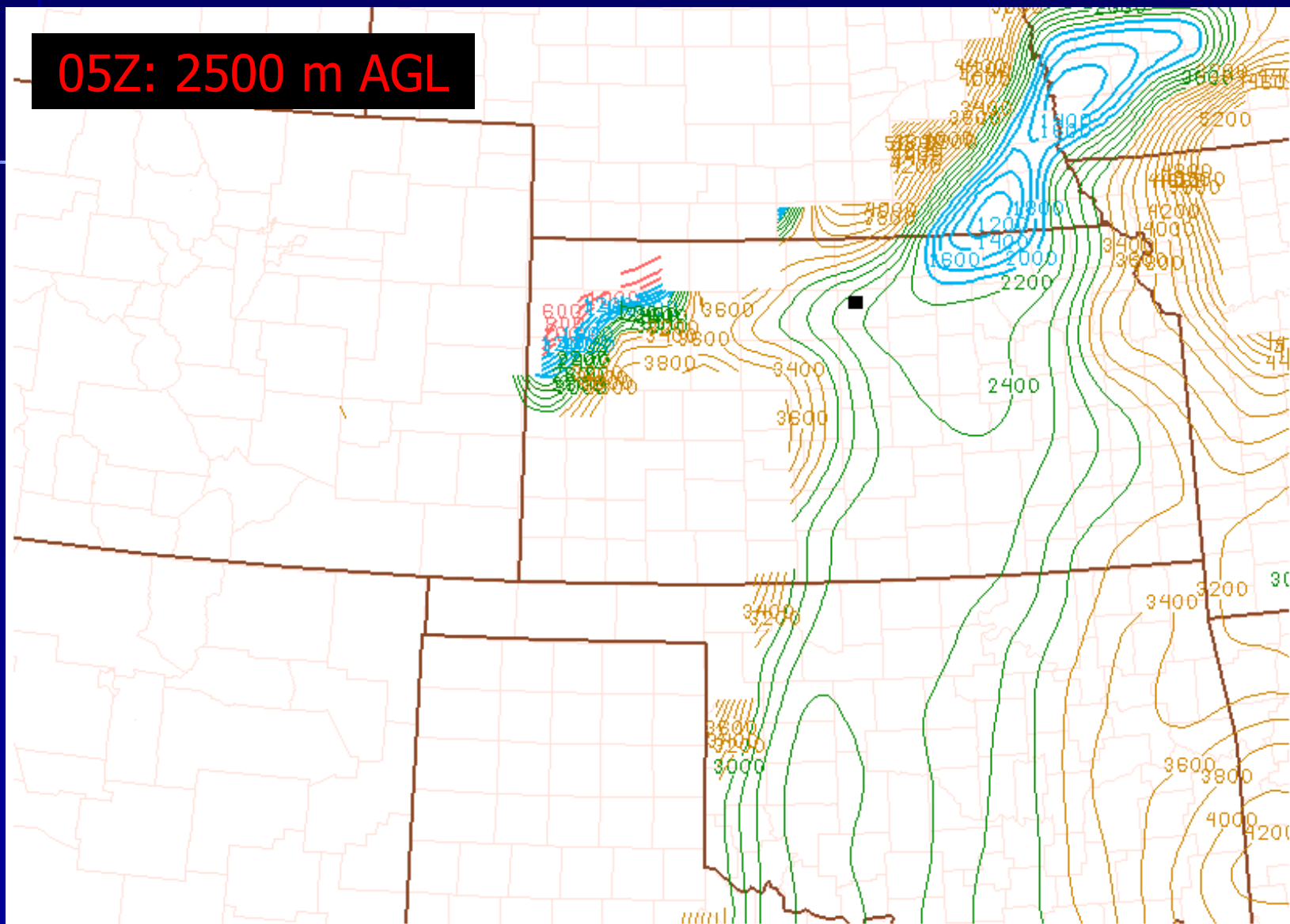
LFC Height (100 mb mean parcel; m AGL)



080425/0300 100 mb mean parcel LFC height (m AGL)

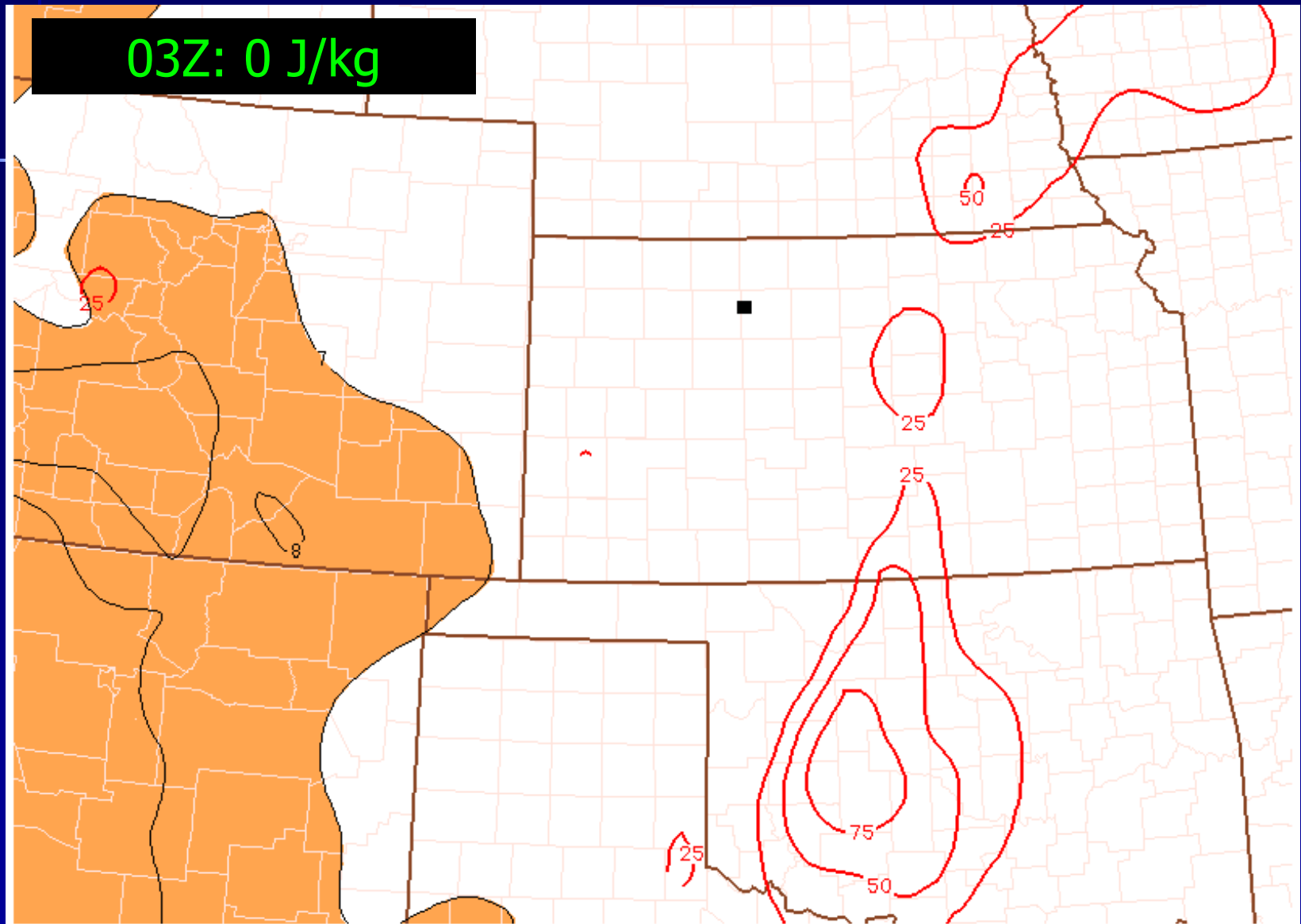
LFC Height (100 mb mean parcel; m AGL)

05Z: 2500 m AGL



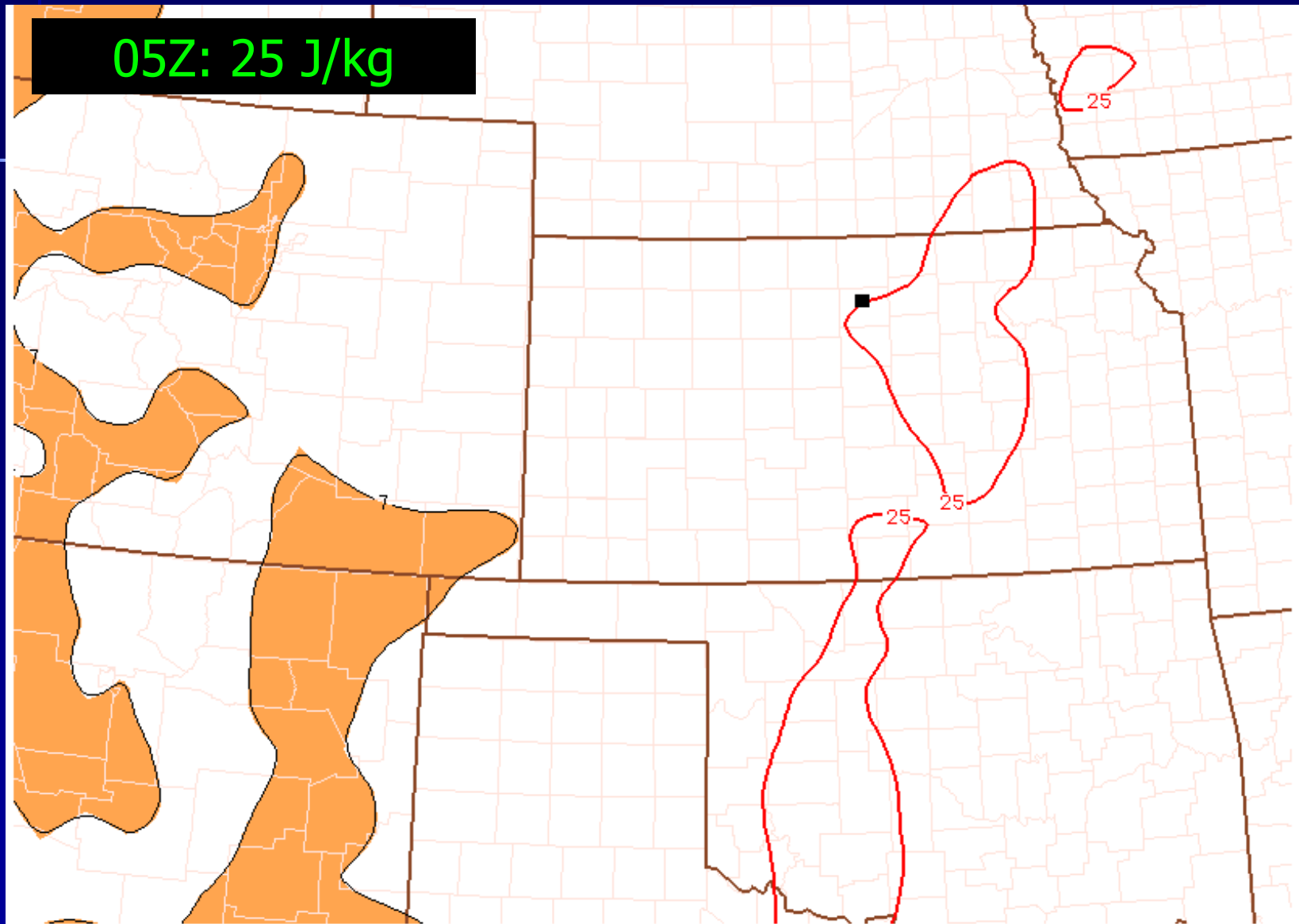
080425/0500 100 mb mean parcel LFC height (m AGL)

0-3 km AGL MLCAPE (J/kg)



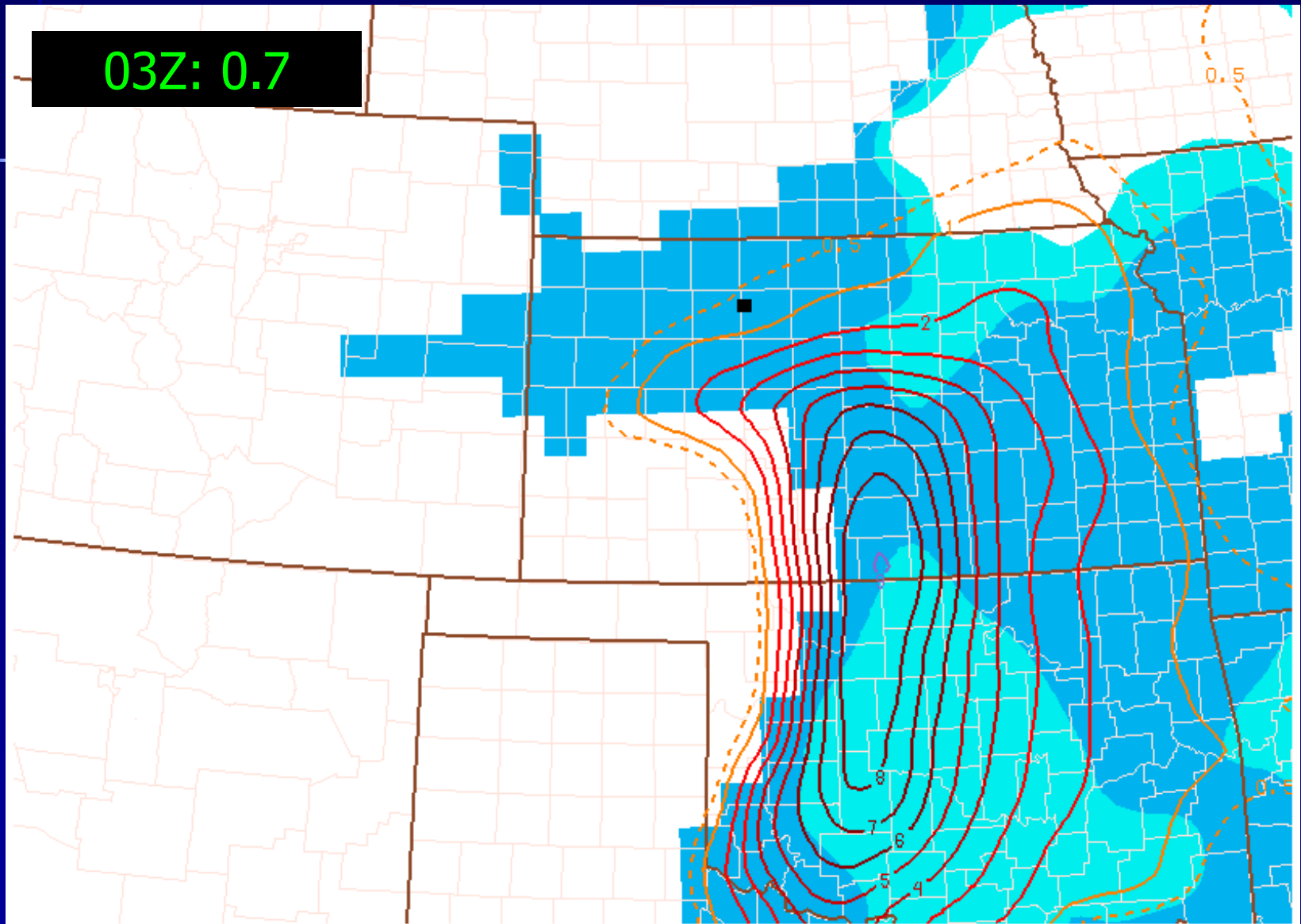
080425/0300 0-3 km lapse rate (fill) and 0-3 km MLCAPE (red)

0-3 km AGL MLCAPE (J/kg)



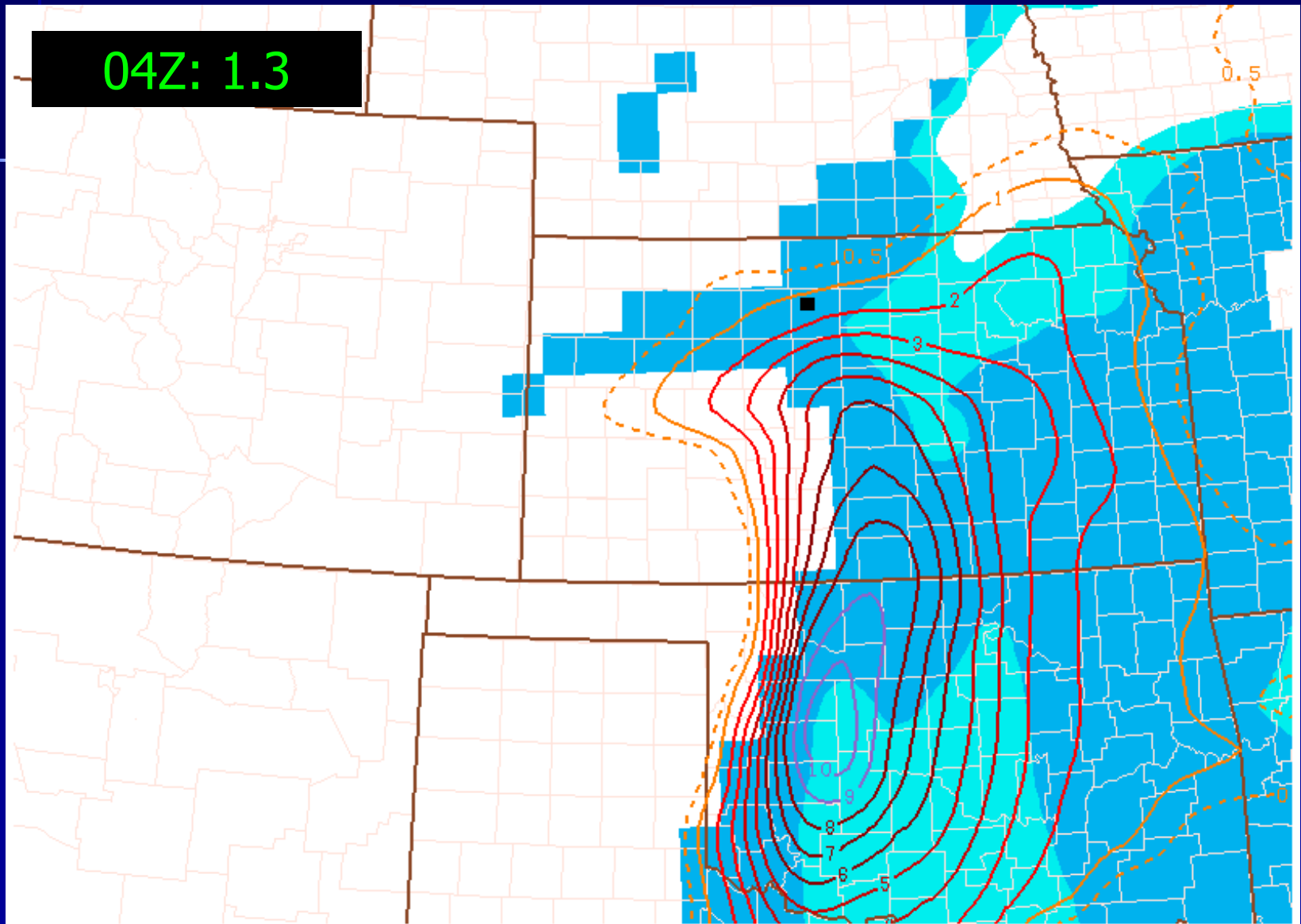
080425/0500 0-3 km lapse rate (f111) and 0-3 km MLCAPE (red)

Significant Tornado Parameter (Fixed Layer)



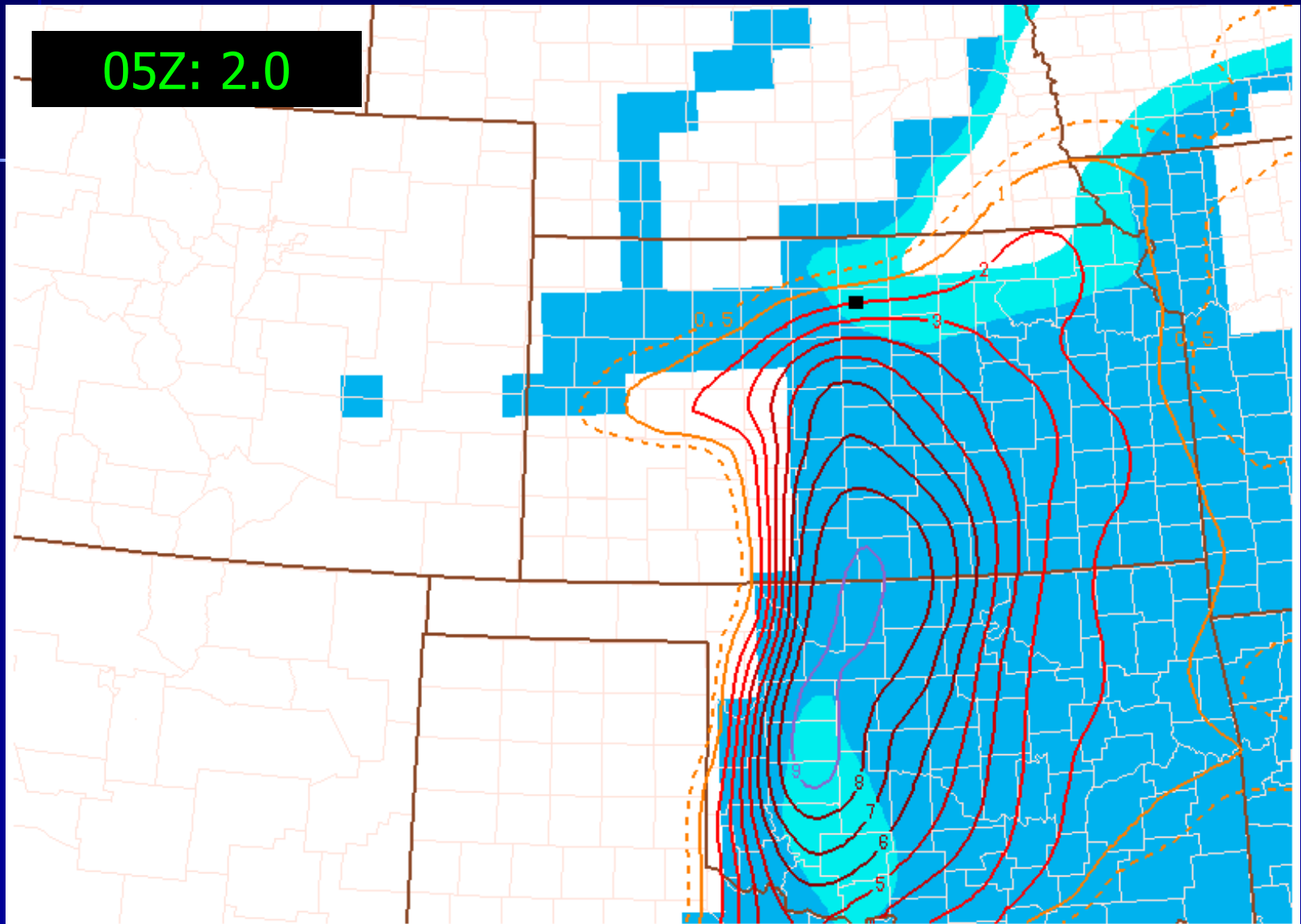
080425/0300 Significant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded at 25 and 100)

Significant Tornado Parameter (Fixed Layer)



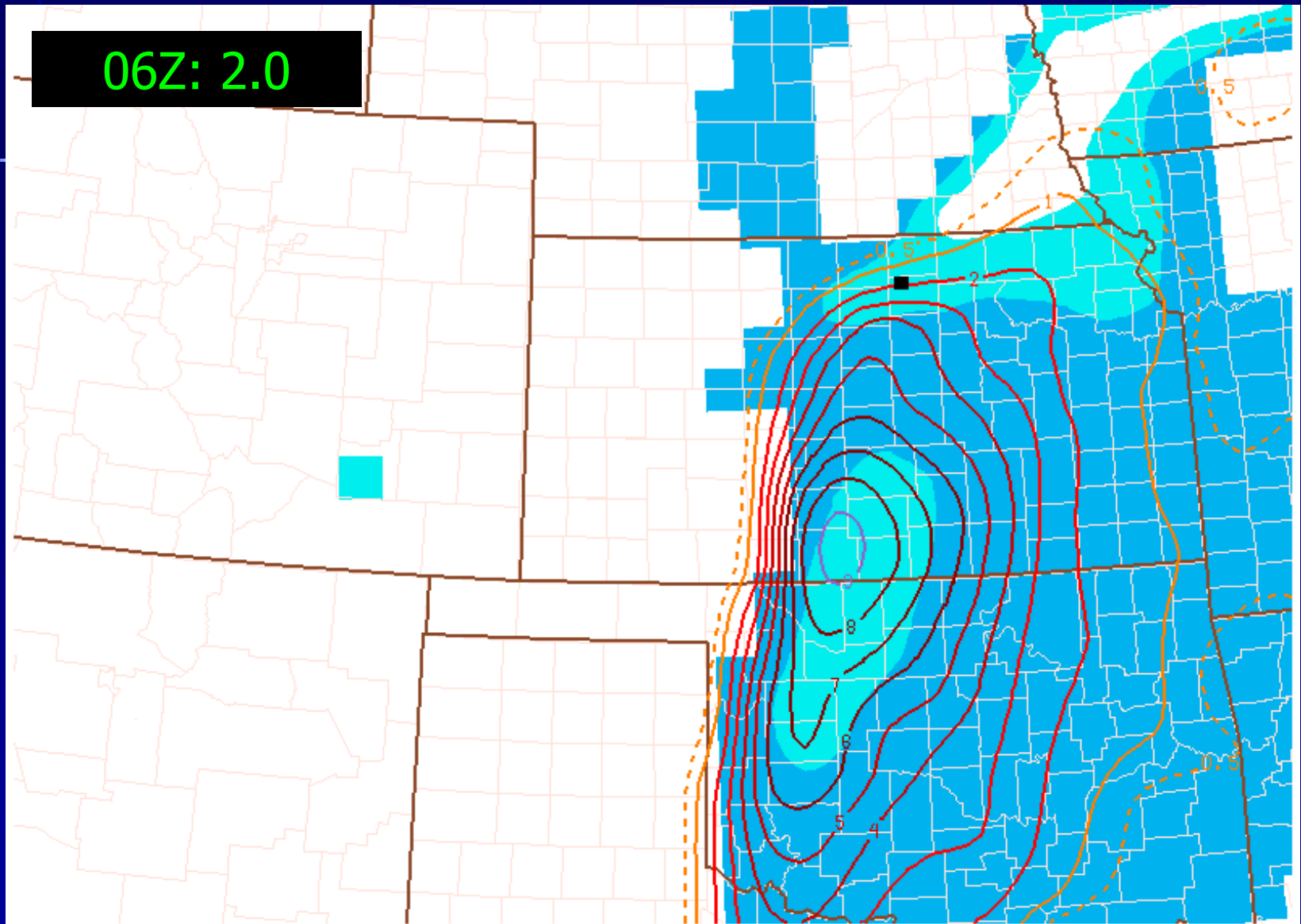
080425/0400 Significant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded at 25 and 100)

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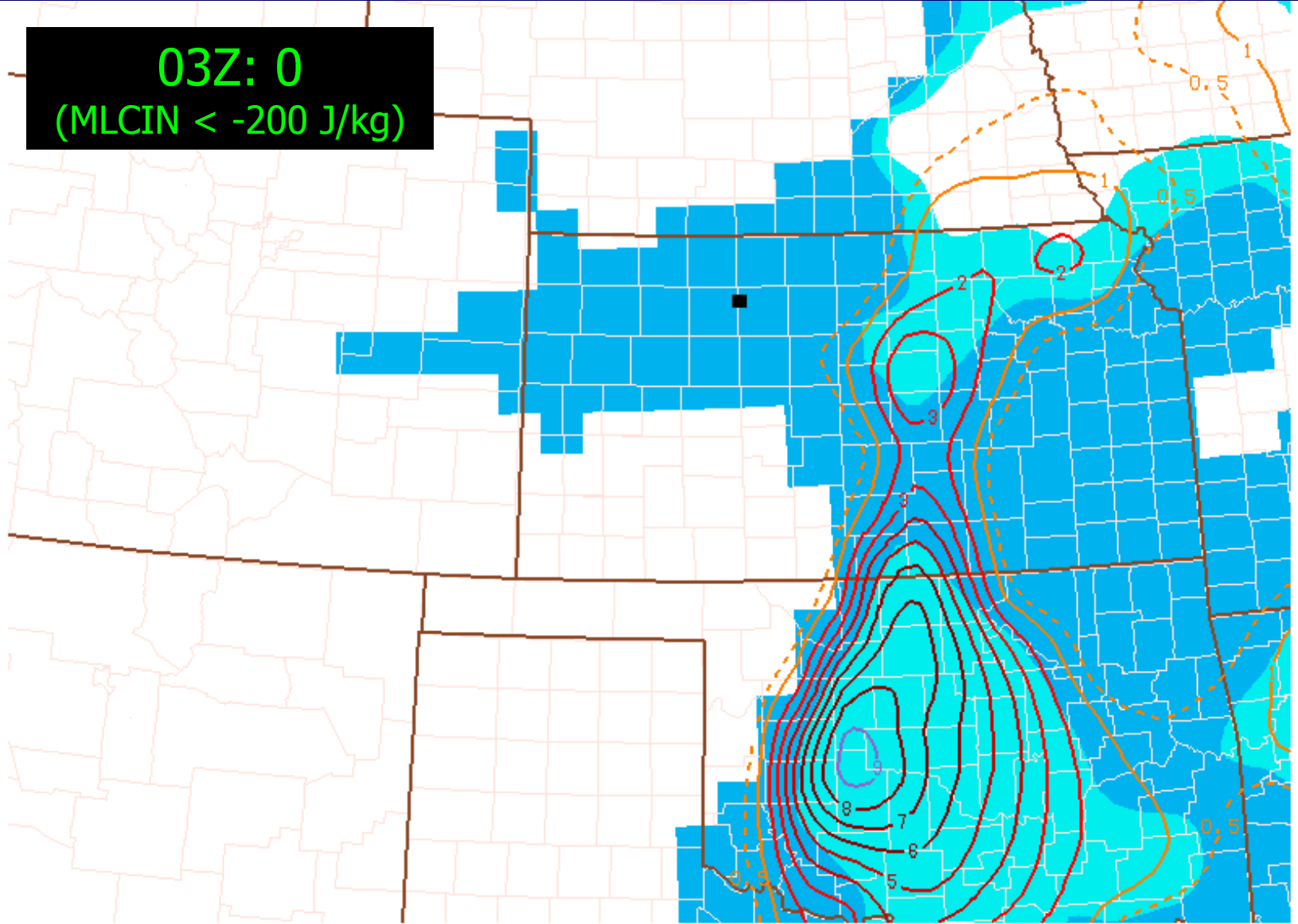
080425/0500 Significant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded at 25 and 100)

Significant Tornado Parameter (Fixed Layer)



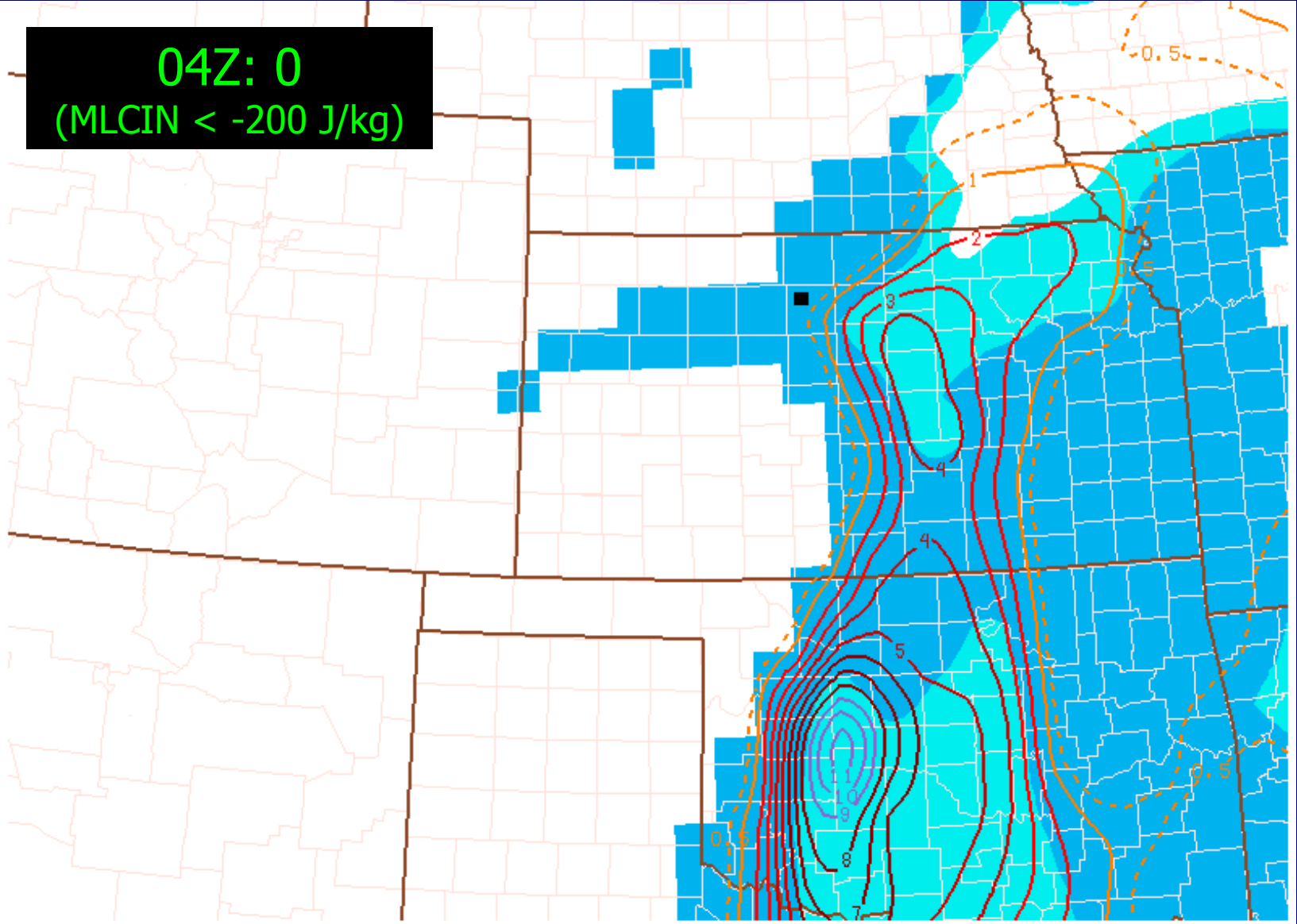
080425/0600 Significant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded at 25 and 100)

Significant Tornado Parameter (Effective Layer)



080425/0300 Significant Tornado Parameter (eff layer) and MLCIN (J/kg, shaded at 25 and 100)

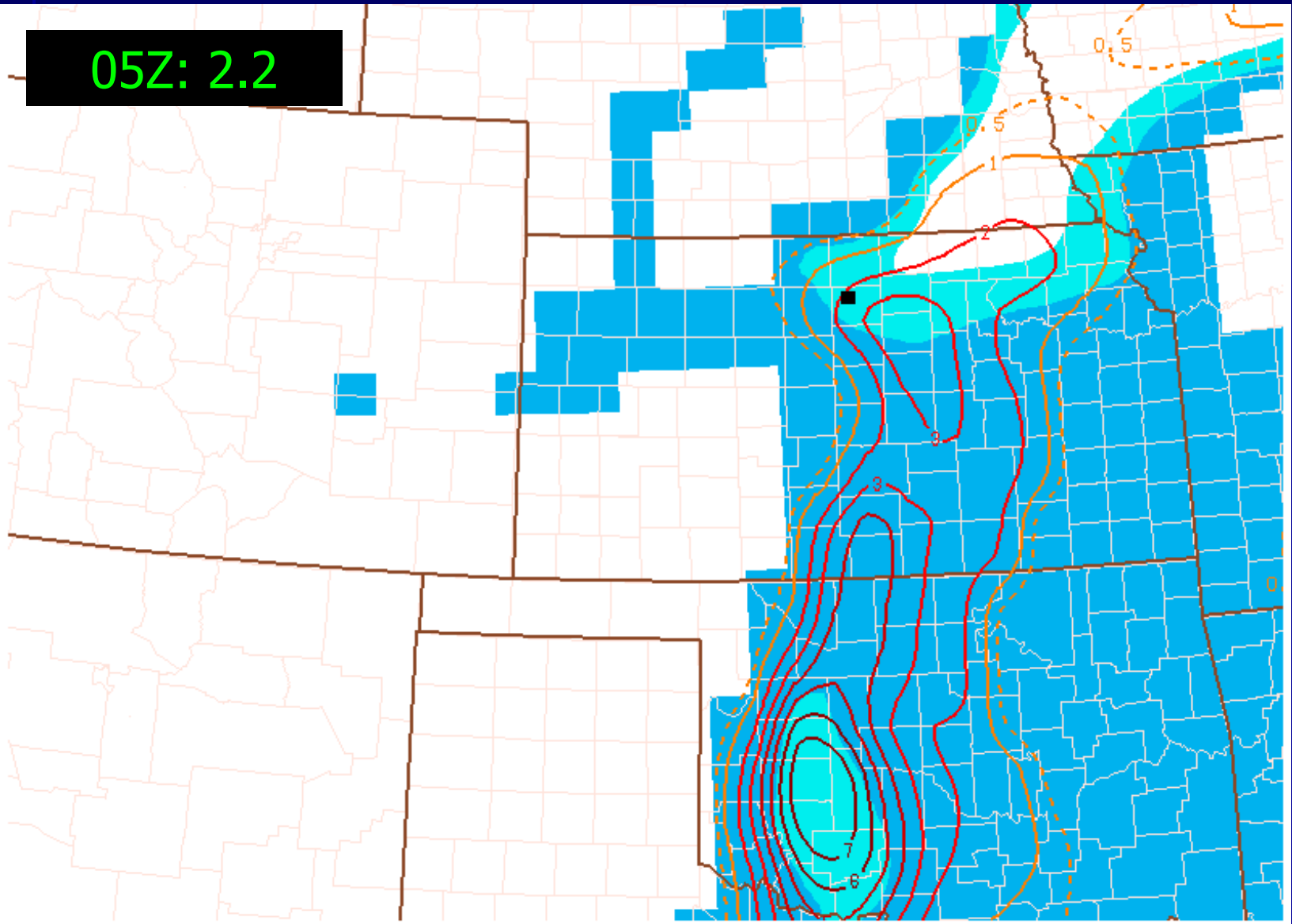
Significant Tornado Parameter (Effective Layer)



080425/0400 Significant Tornado Parameter (eff layer) and MLCIN (J/kg, shaded at 25 and 100)

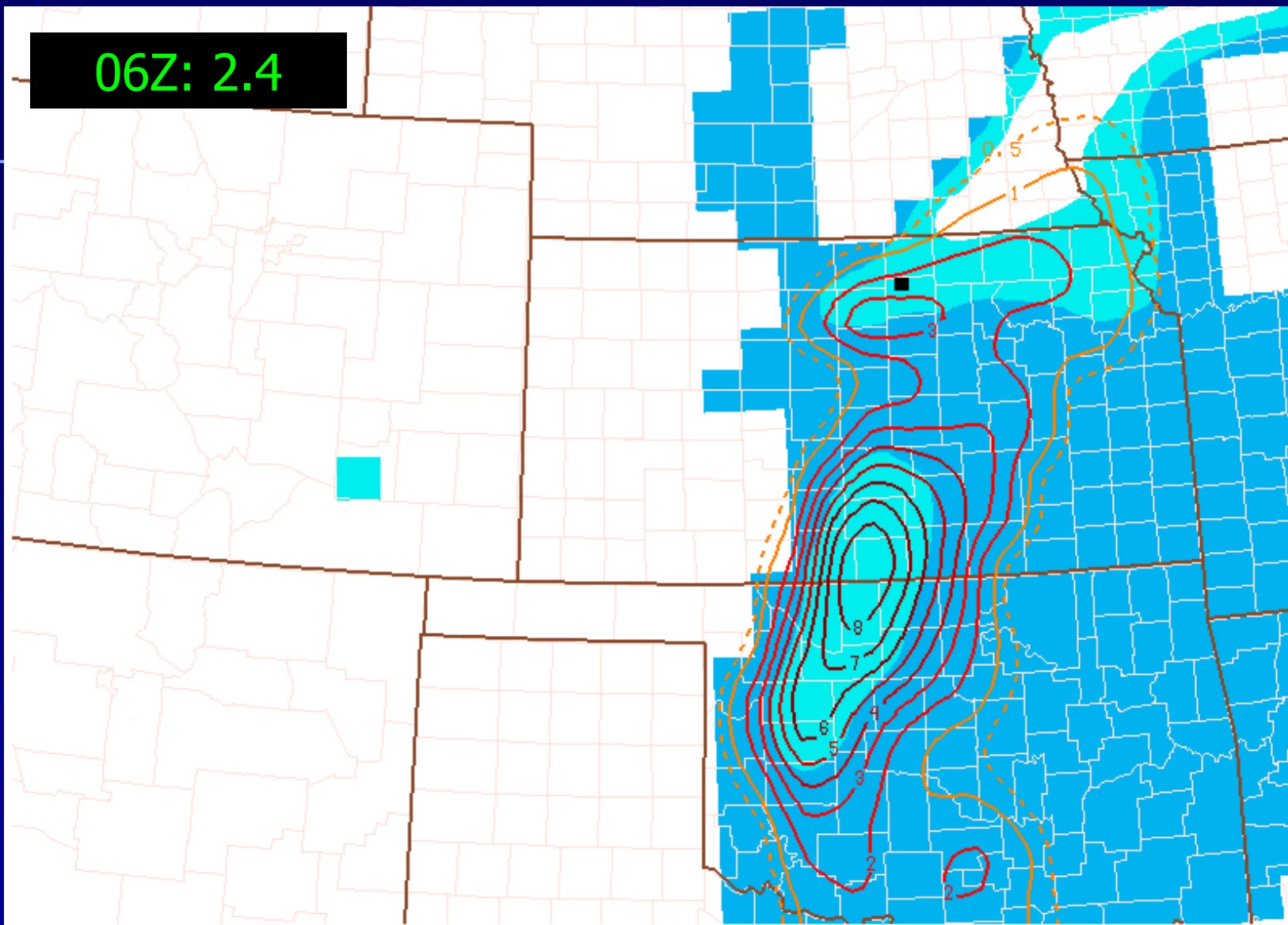
Significant Tornado Parameter (Effective Layer)

05Z: 2.2



080425/0500 Significant Tornado Parameter (eff layer) and MLCIN (J/kg, shaded at 25 and 100)

Significant Tornado Parameter (Effective Layer)



080425/0600 Significant Tornado Parameter (eff layer) and MLCIN (J/kg, shaded at 25 and 100)

Summary

- Moderate to strong BL moisture advection proved critical in decreasing BL convective inhibition to allow the long-lived supercell to tap into the BL despite the late night timing favoring a trend toward elevated convection
 - BL moisture advection also produced increased instability (including low-level instability)
 - BL moisture advection contributed to lowering LCL heights as well
- Development of an intense LLJ produced strong low-level shear/SRH for the surface-based convection to ingest
- SPC mesoanalysis plots/other RUC analysis data did a good job of capturing the evolution of the mesoscale environment into one more favorable for tornadic development