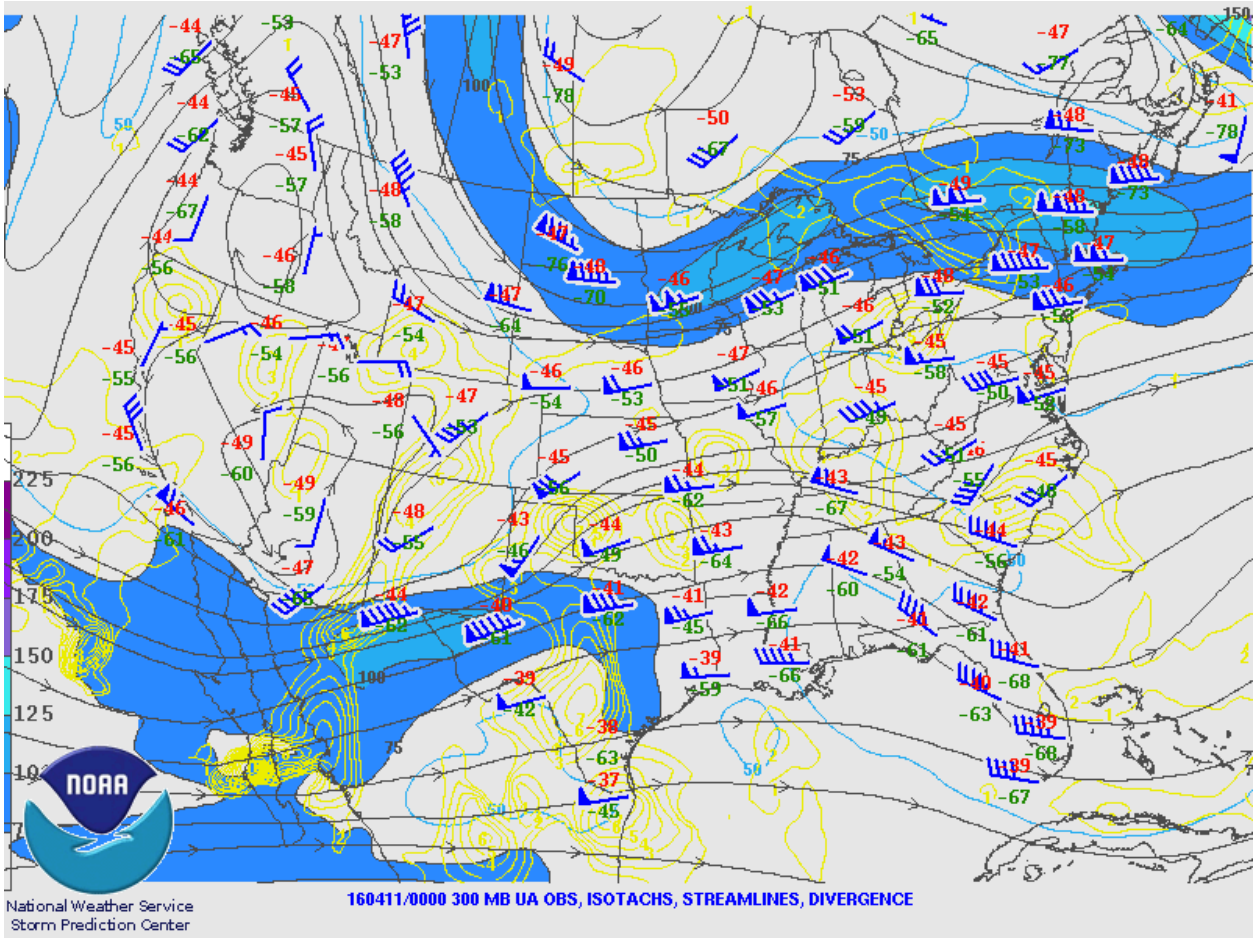
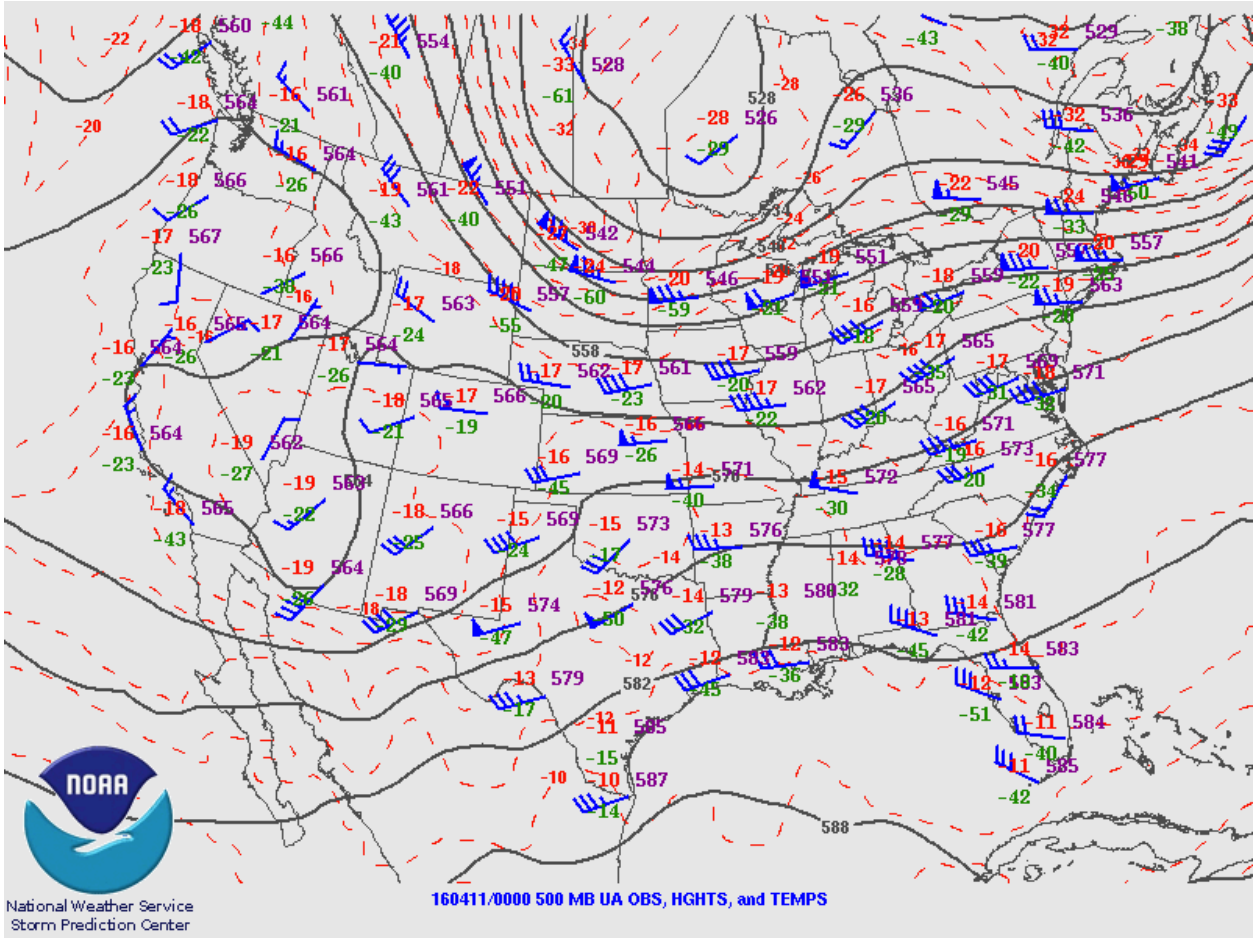
Weather Journal 1 – Due 18 April

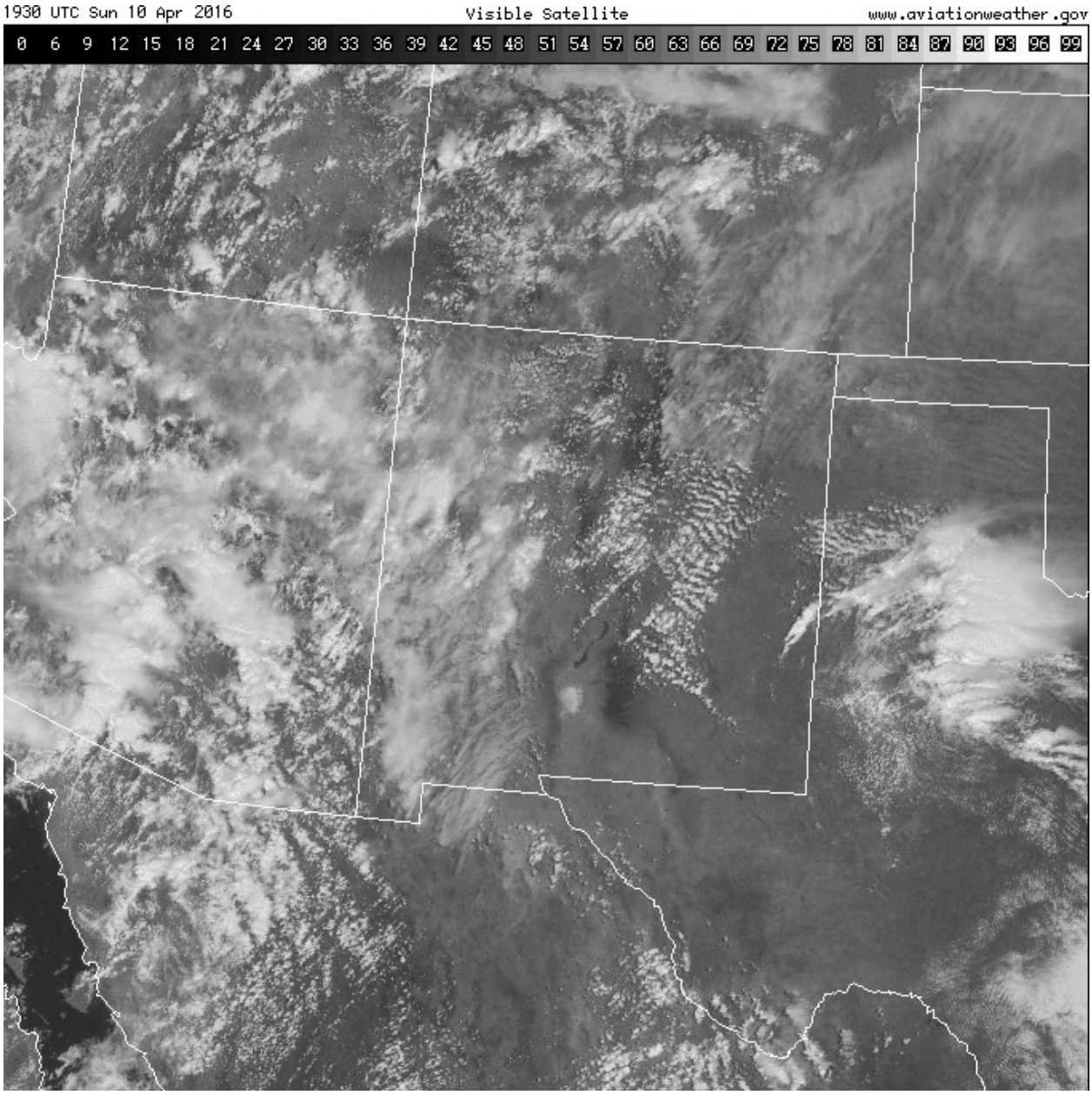
Sunday night - 10 April 2016/11 April 2016

At 12 UTC on 10 April, an upper level/midlevel trough and associated closed low were present off the far southern coast of California. Through time, this trough transitioned into more of an open wave as it progressed eastward. Differential cyclonic vorticity advection and thus quasi-geostrophic ascent associated with this upper and midlevel flow pattern will likely result in the strongest ascent located somewhere near the Texas panhandle and southwestern Oklahoma as this region is downstream from the greatest overlap between shear and curvature vorticity. This ascent will act to steepen midlevel lapse rates via stretching, with associated height falls owing to cooling aloft as the trough and jet max continue eastward.

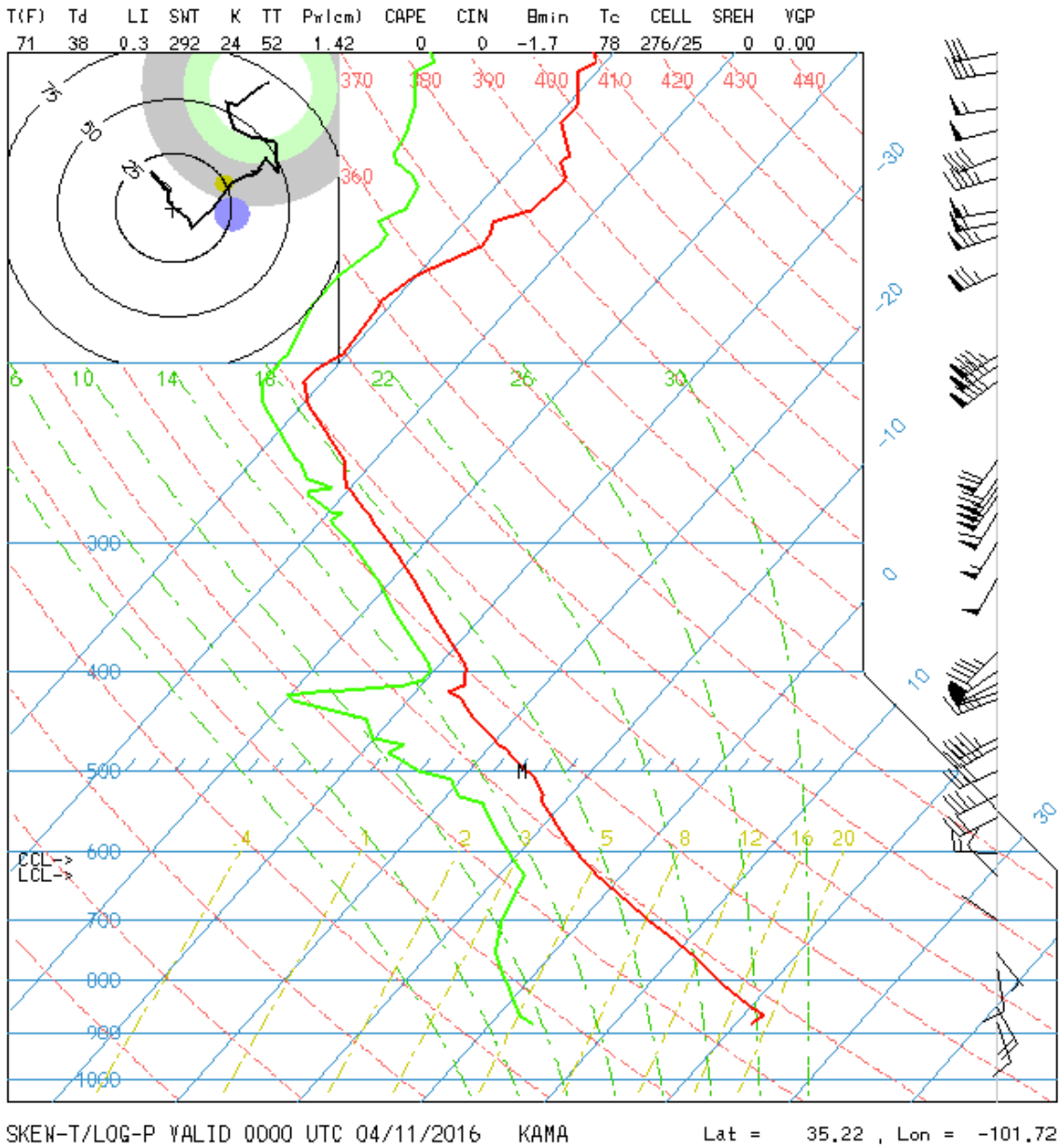




By 00 UTC on 11 April, a midlevel speed max had progressed through the trough base and moved into western and central Texas. Shortwave ridging and associated subsidence existed during the afternoon over central Oklahoma, but as height falls occurred ahead of the mid and upper level vorticity maxima, midlevel winds backed from westerly to southwesterly.

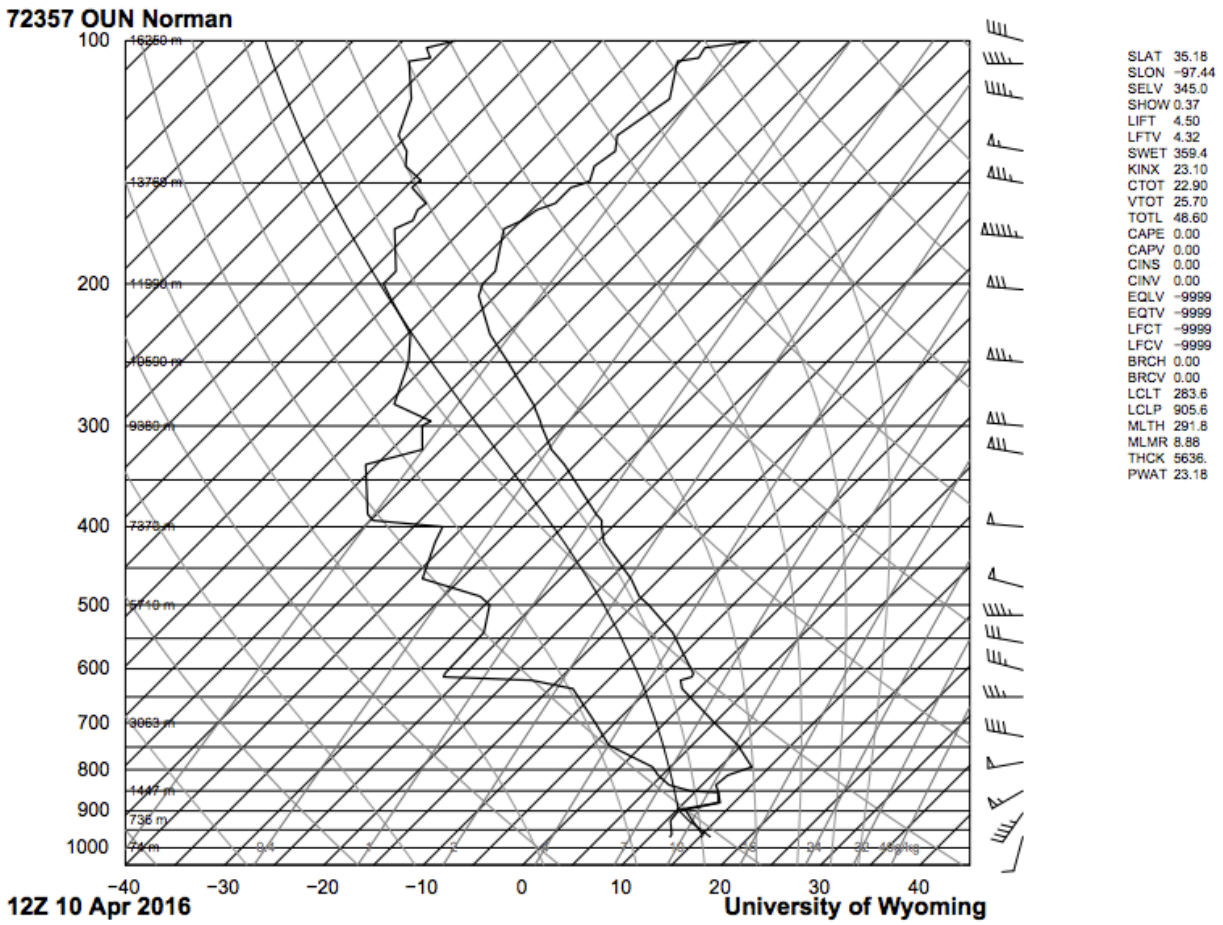


Clear skies and fair weather cumulus over New Mexico as shown in the visible satellite imagery indicate strong surface heating over higher western terrain. Southwesterly midlevel flow over this region is favorable for the development of an elevated mixed layer as this daytime well-mixed boundary is advected downstream over west/central Texas and southwestern Oklahoma.

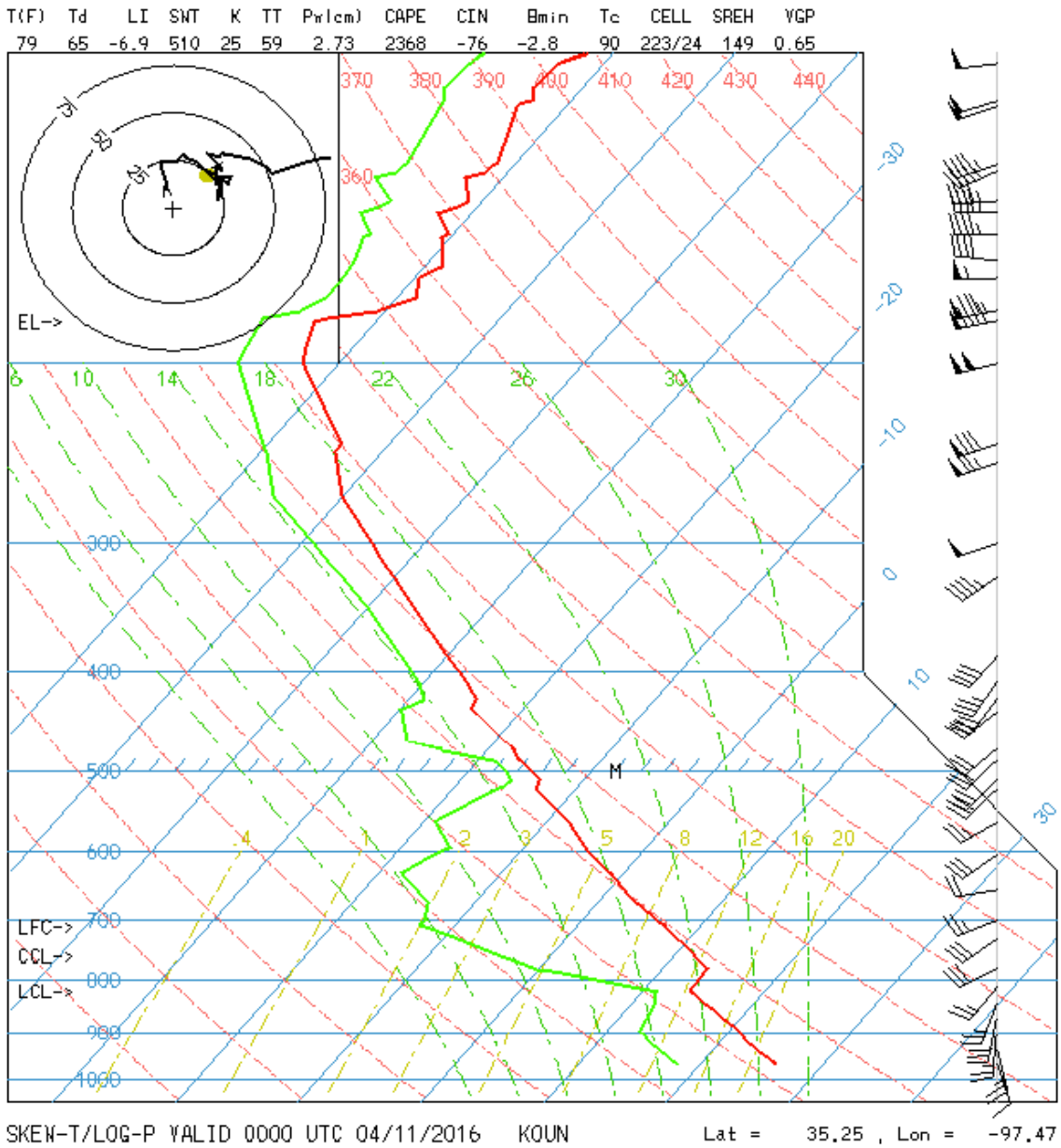


Southwesterly/westerly (cross-barrier) midlevel flow should promote troughing and downsloping in the lee of the Rockies, which would promote dryline formation with the onset of boundary layer mixing. This deep mixing west of the dryline is shown in the 00 UTC Amarillo sounding, with nearly dry adiabatic lapse rates up to 600 mb.

Thus, deep synoptic ascent, a localized forcing mechanism, and steep midlevel lapse rates should exist, aiding in an environment potentially supportive of convective development east of the dryline, assuming favorable low-level conditions.

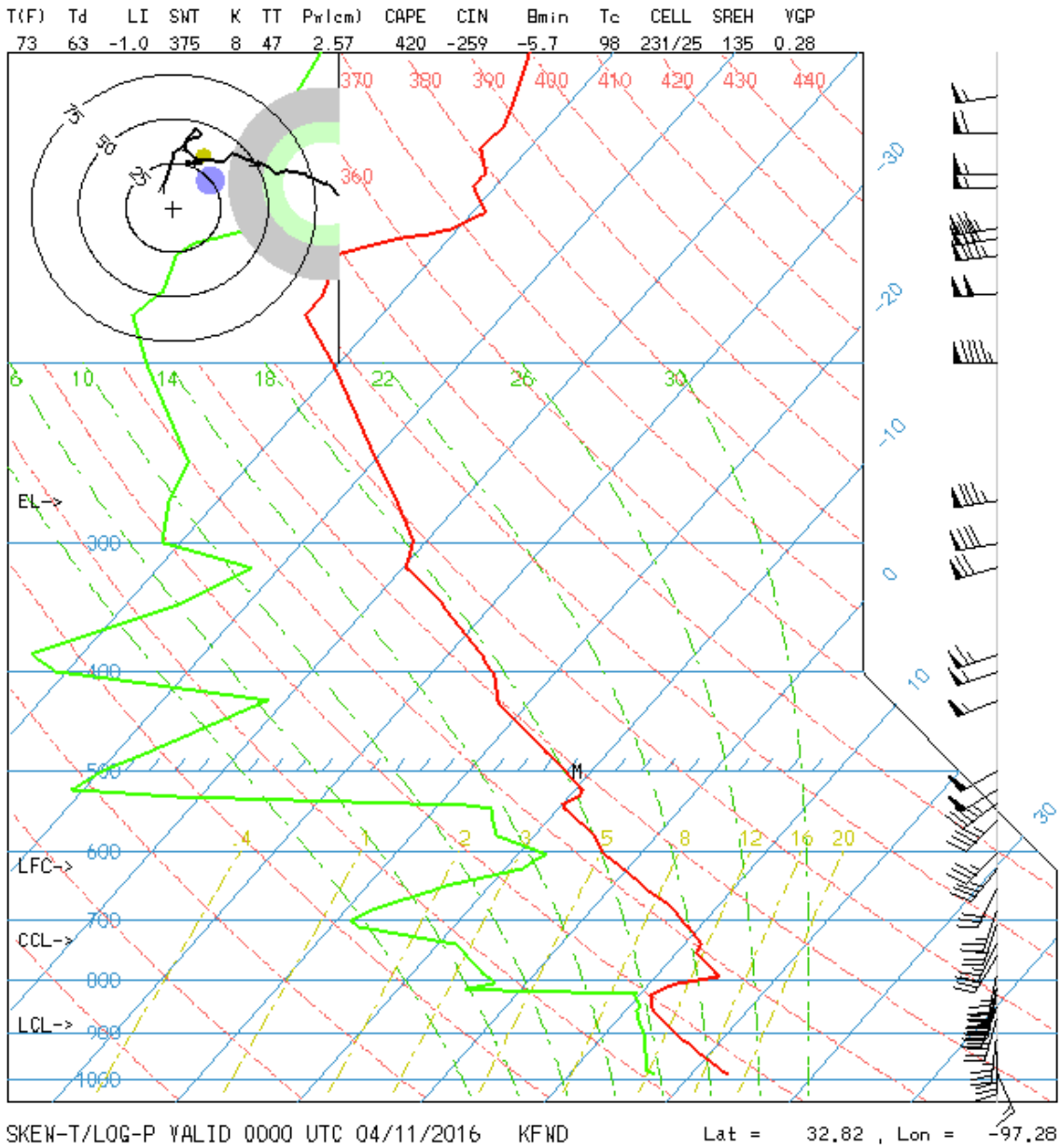


At 12 UTC, the Norman sounding did not exhibit an environmental profile favorable for deep convection. Thus, modification of this profile by upper-level dynamics, advection, and low-level warming and moistening is necessary in order to be conditionally unstable.

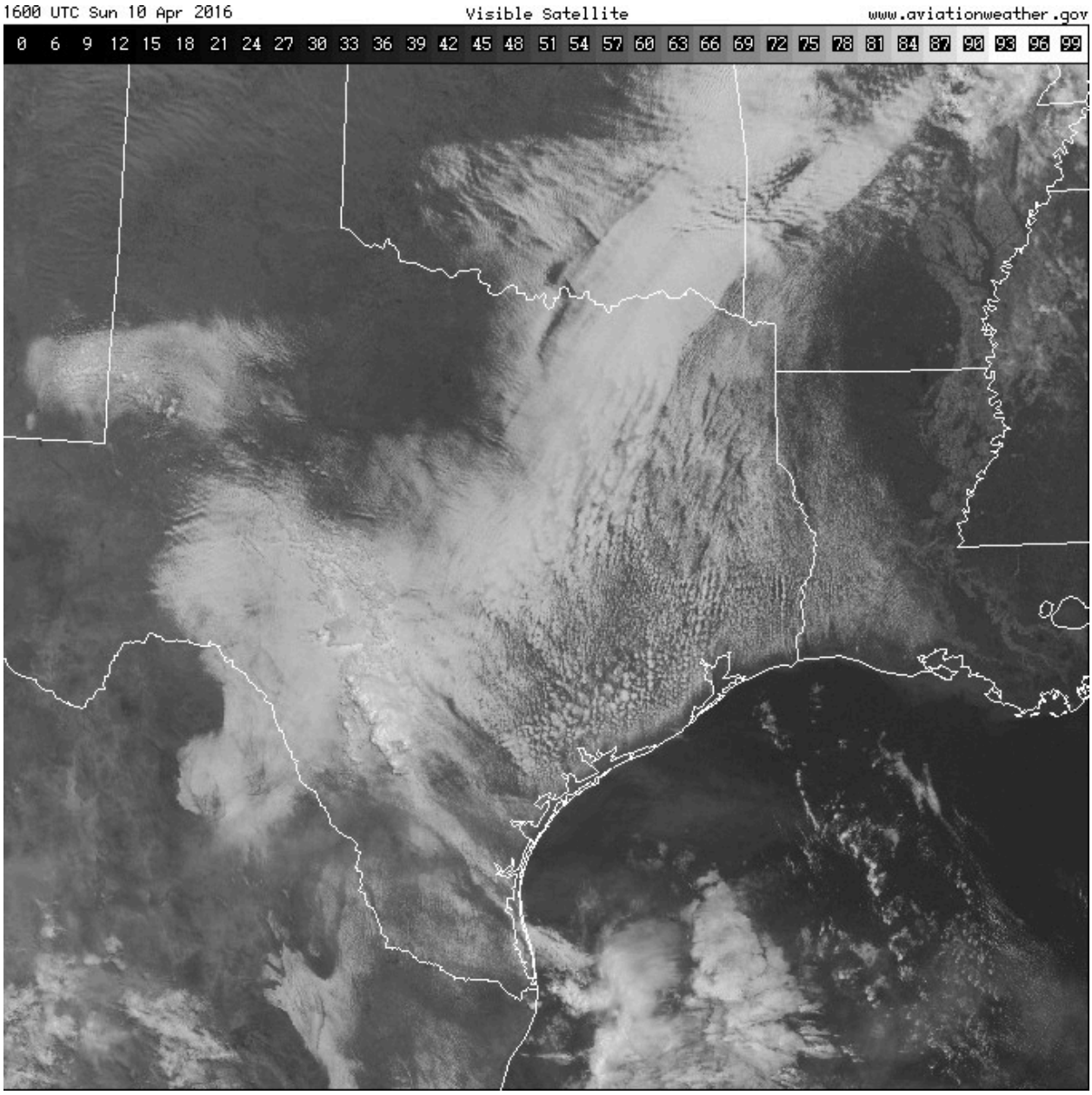


The 00 UTC Norman sounding east of the dryline reflects the steepening lapse rates anticipated by the synoptic ascent and eastward midlevel advection of the deep mixed layer off the higher terrain. By this time, much of the capping that likely occurred earlier in the afternoon owing to midlevel ridging had eroded, and the low-level winds had backed substantially from 12 UTC.

Fairly weak 0-6 km shear existed at 00 UTC on the Norman sounding. Additionally, there is a veer-back-veer profile in the winds, which is unfavorable for strong, long-lived supercells.



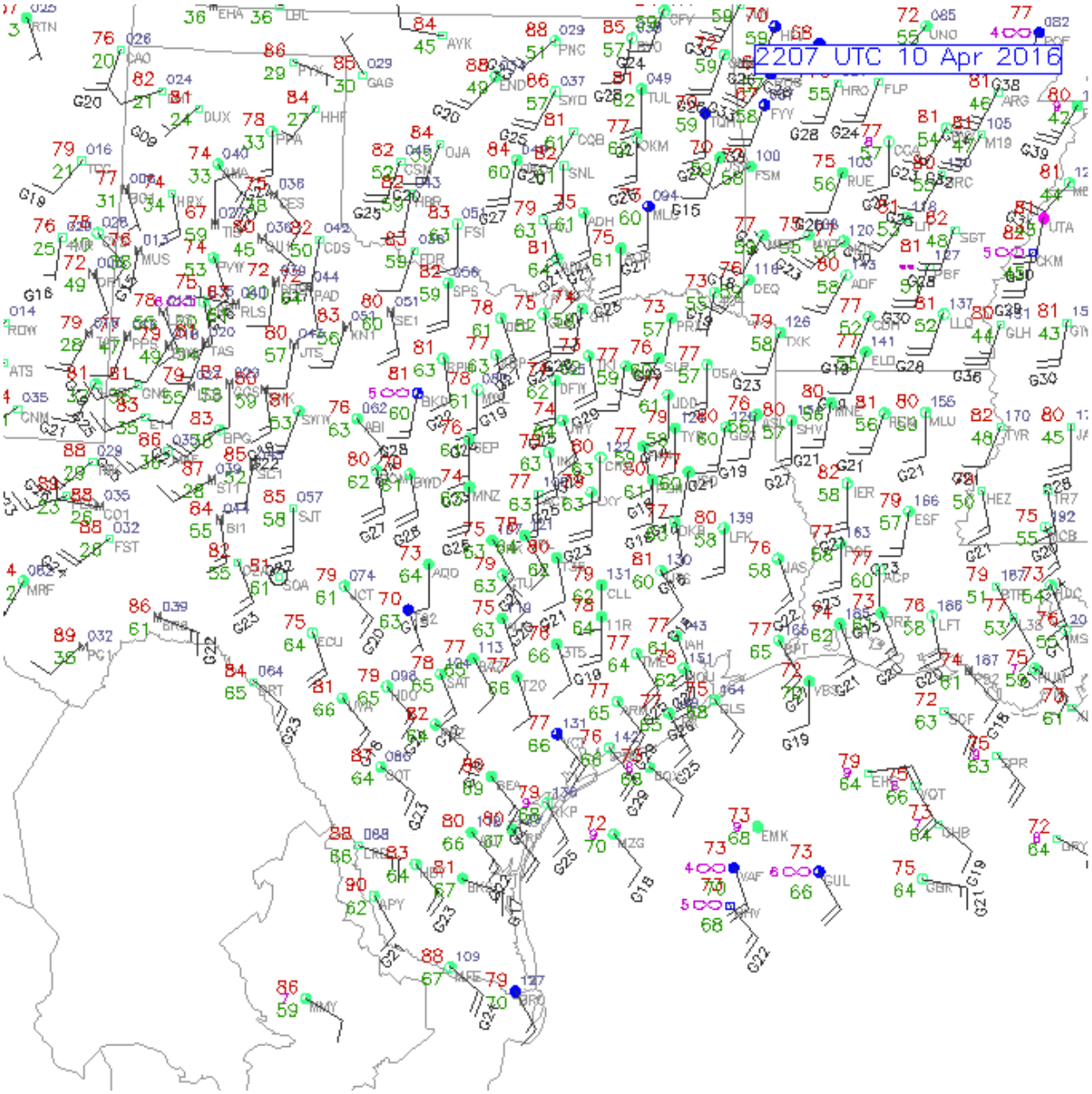
Greater capping is present in the Fort Worth area owing to persistent cloud cover throughout the daytime and weaker QG forcing for ascent, inhibiting convection in this region. However, greater shear (>40 kts) is present to the south on the Fort Worth sounding owing to closer proximity to the midlevel jet streak. Additionally, the hodograph possesses some low level curvature, but is mostly straight, likely favoring storm mergers and inhibiting the ability for the convection to remain isolated. Farther northwest, the upper level charts show more of a southwesterly component of the flow, perhaps resulting in an environment more favorable for discrete convection.



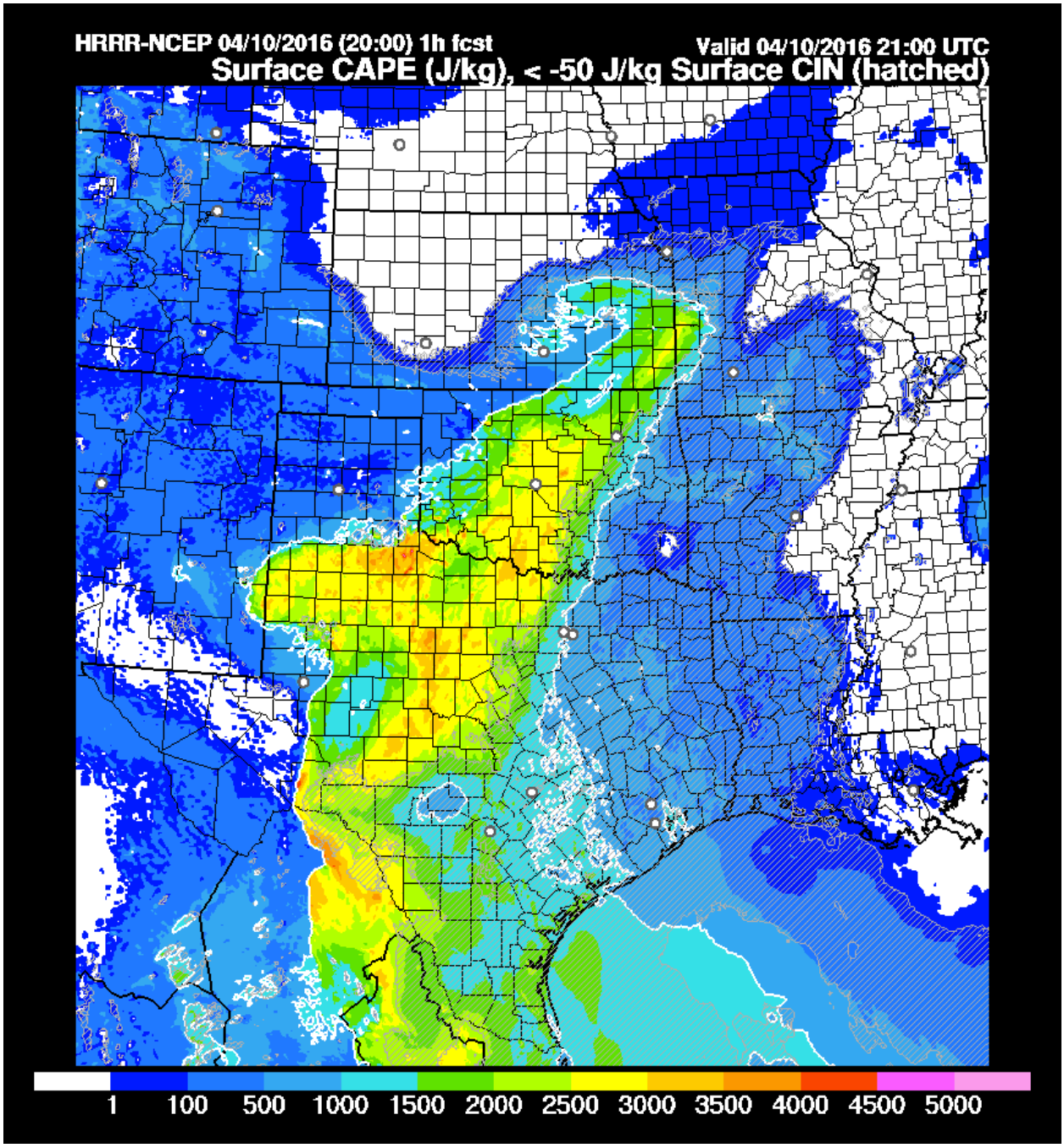
Also, the onset of boundary layer stabilization would be expected to enhance the vertical shear via the nocturnal low-level jet, so I would imagine the greatest chance of storms would be somewhere southwest of Norman, closer to the strongest midlevel flow and thus vertical shear, but in a region of greater destabilization (QG effects plus less persistent cloud cover) and near the forcing for ascent (the dryline).

Looking at the surface charts, the greatest surface heating in proximity to the dryline and favorable upper level dynamics had occurred in southwestern Oklahoma to north central Texas. However, dewpoints are rather low, with surface dewpoint depressions at this time of approximately 20 degrees F. This would support high LCL heights, which are present in the OUN sounding at 00 UTC. Thus, the environment likely would not be particularly favorable for

tornadogenesis as there is potential for substantial evaporative cooling within the storm outflow. Although the shear vector in this region has a component mostly orthogonal to the dryline, the potential for strong cold pools could promote relatively fast upscale growth into a linear mode.



Looking at the HRRR forecasts for CAPE at 21 UTC, the greatest CAPE values match up well with the greatest surface heating east of the dryline as shown in the surface chart and the visible satellite imagery.


HRRR-NCEP 04/10/2016 (20:00) 1h fcst
Valid 04/10/2016 21:00 UTC
Surface CAPE (J/kg), < -50 J/kg Surface CIN (hatched)
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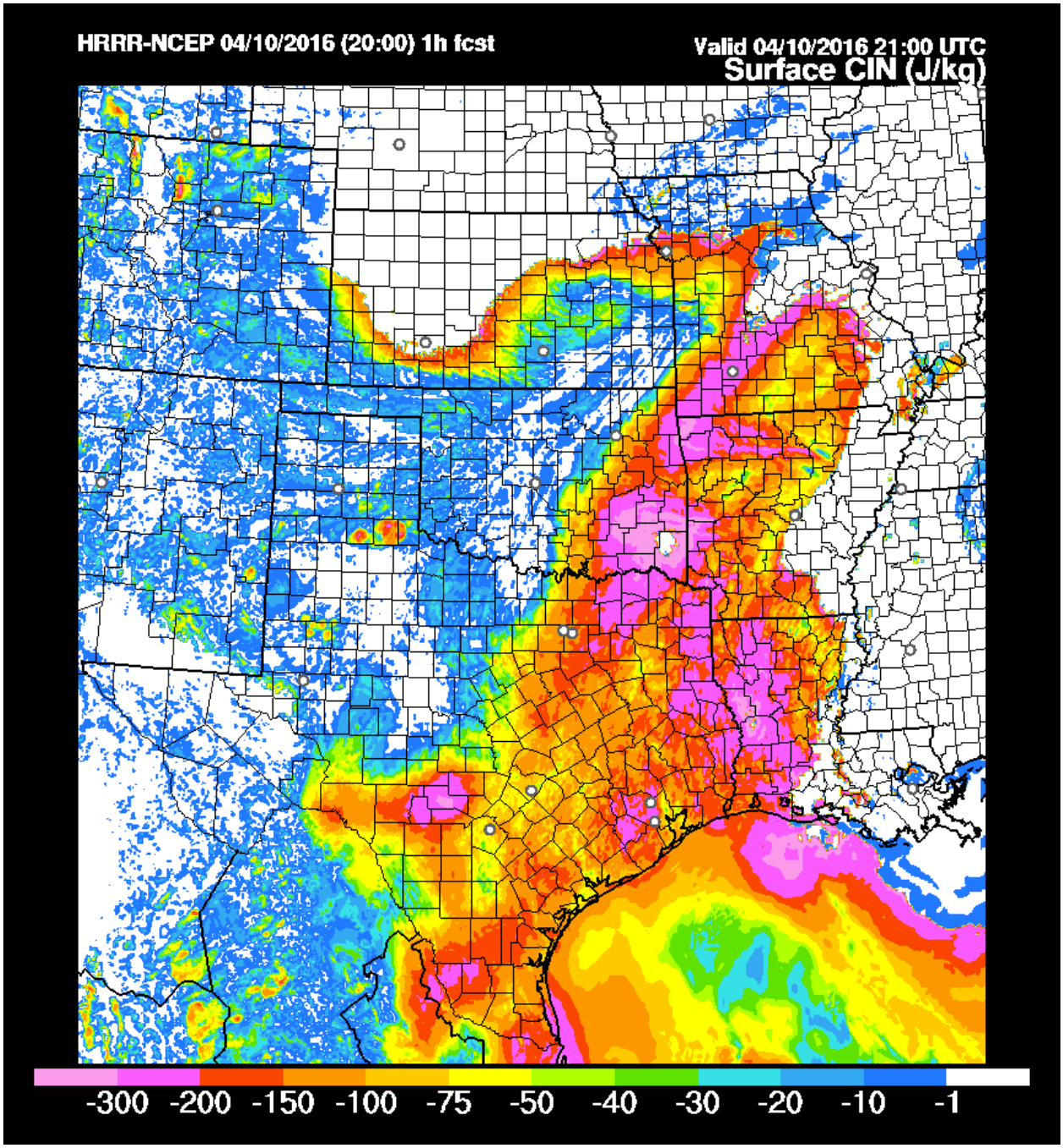
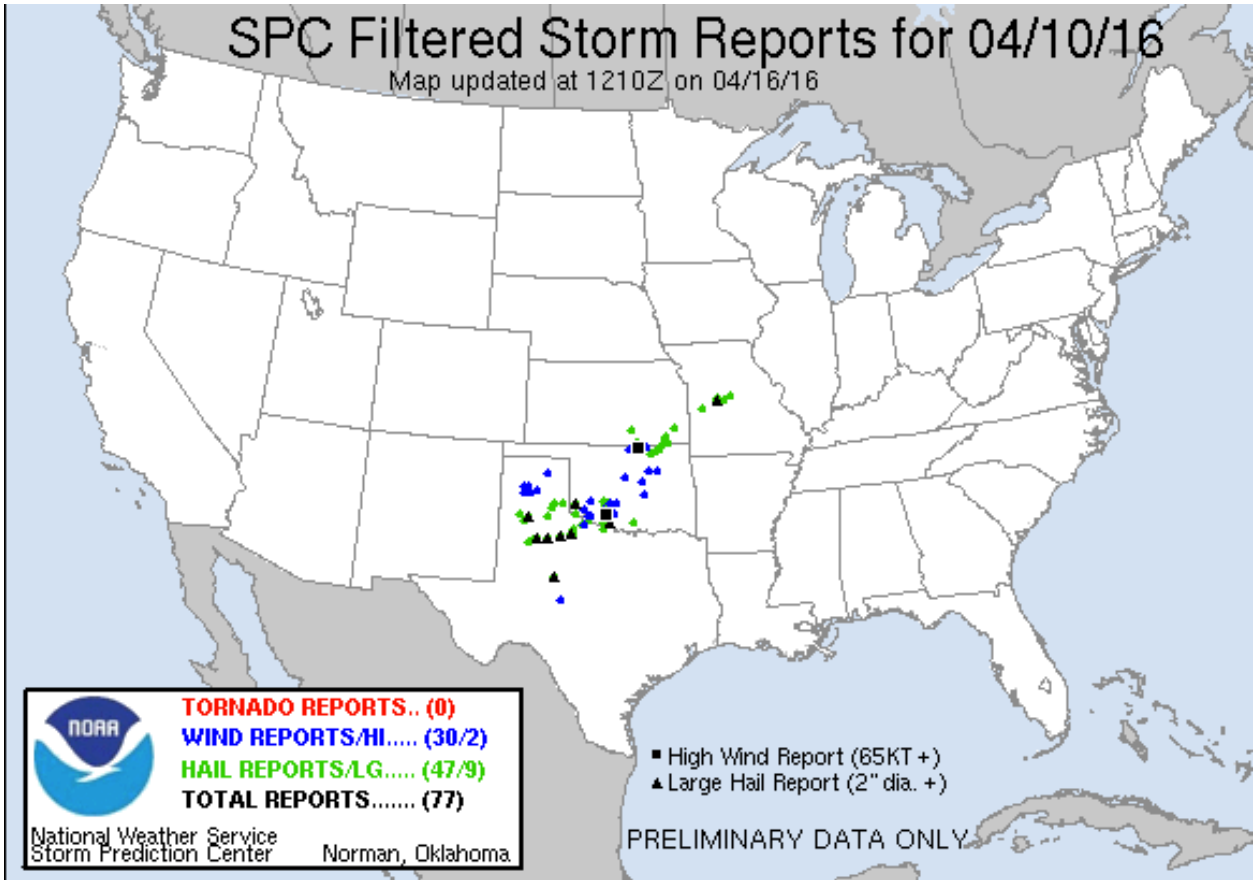


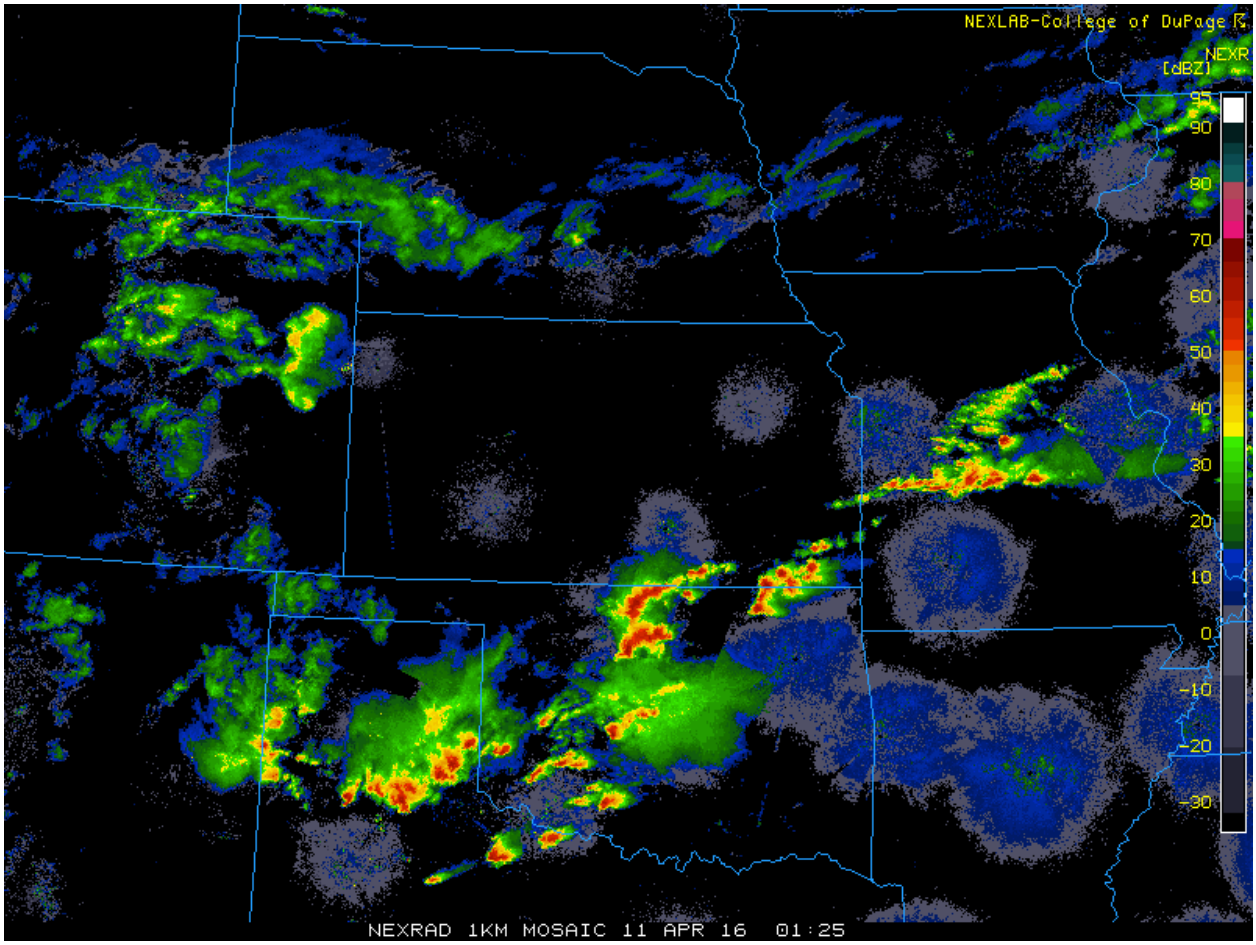
Additionally, minimal surface-based CIN exists in this region. Thus, I would expect convective development to occur somewhere along the dryline in southwestern Oklahoma to the southern portion of the Texas panhandle and then east. The primary area of strongest convection is likely somewhere in the vicinity of Childress, Texas, where the greatest CAPE is most collocated with the strongest shear. Owing to the large dewpoint depressions, I would expect a minimal tornado threat, at least until the low-level jet and some surface cooling occur, and a relatively high wind threat attributed to strong downdrafts. However, the main convective hazard is likely to be hail as CAPE values are large (~3000 J kg^{-1}) and the 0-6 km bulk shear is sufficient for rotating updrafts. Further, I would anticipate the hail threat to be higher down south nearer to the highest

CAPE, with a wind threat expanding farther north as dewpoint depressions are substantial throughout the region.

The storm reports for the day:



Some supercells formed ahead of the dryline in southwestern OK/the eastern TX panhandle. Additionally, storms formed along a surface boundary that extended through central Missouri, which I did not mention.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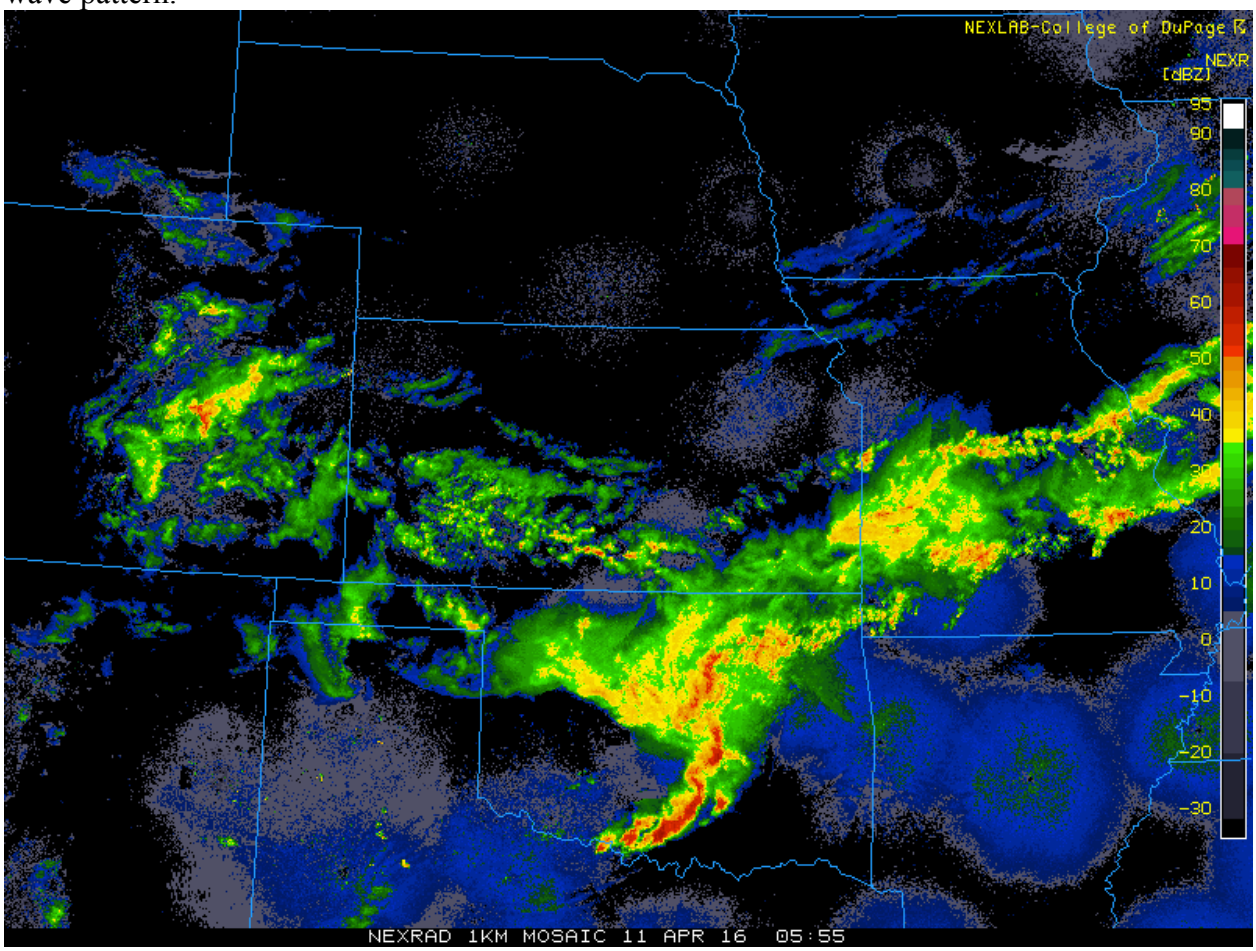
These storms grew upscale, and the cells in OK/TX developed into a quite remarkable line echo wave pattern.



As expected, this system was primarily responsible for wind damage, with winds on radar of approximately 100 knots in southern Oklahoma. The hail reports were mainly confined to far southwestern Oklahoma and Texas, but there is a second region of hail reports in northeastern Oklahoma into Missouri, which I did not anticipate. These are most likely due to the semi-discrete cells that formed along the northern boundary. Additionally, storms formed a bit more north in the Texas panhandle than I anticipated. Overall, the forecast was okay for TX/OK, but significant attention should have been given to the northern boundary.