

Homework #4 Key

100 points total

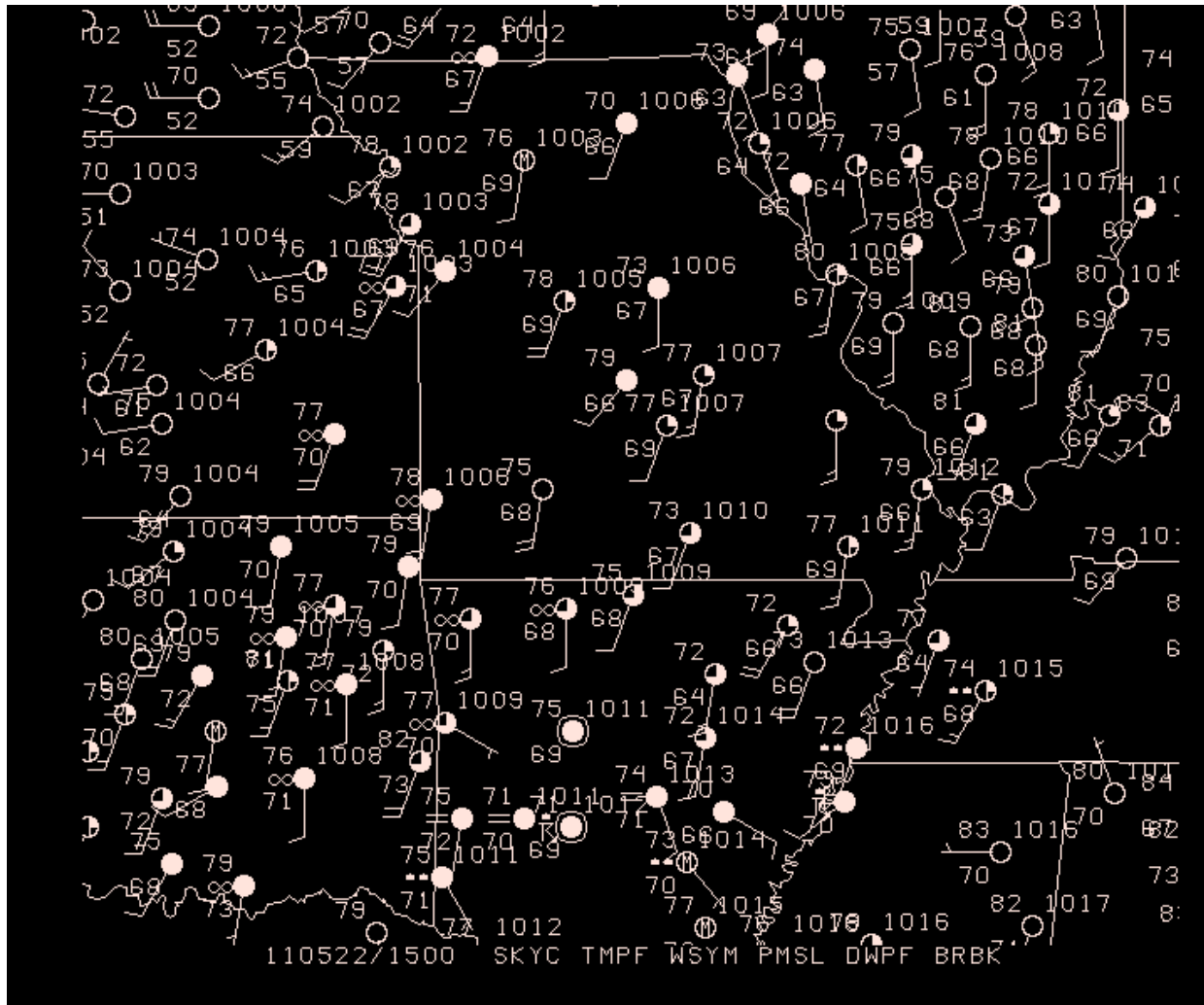
Part I

Surface and upper-air analyses

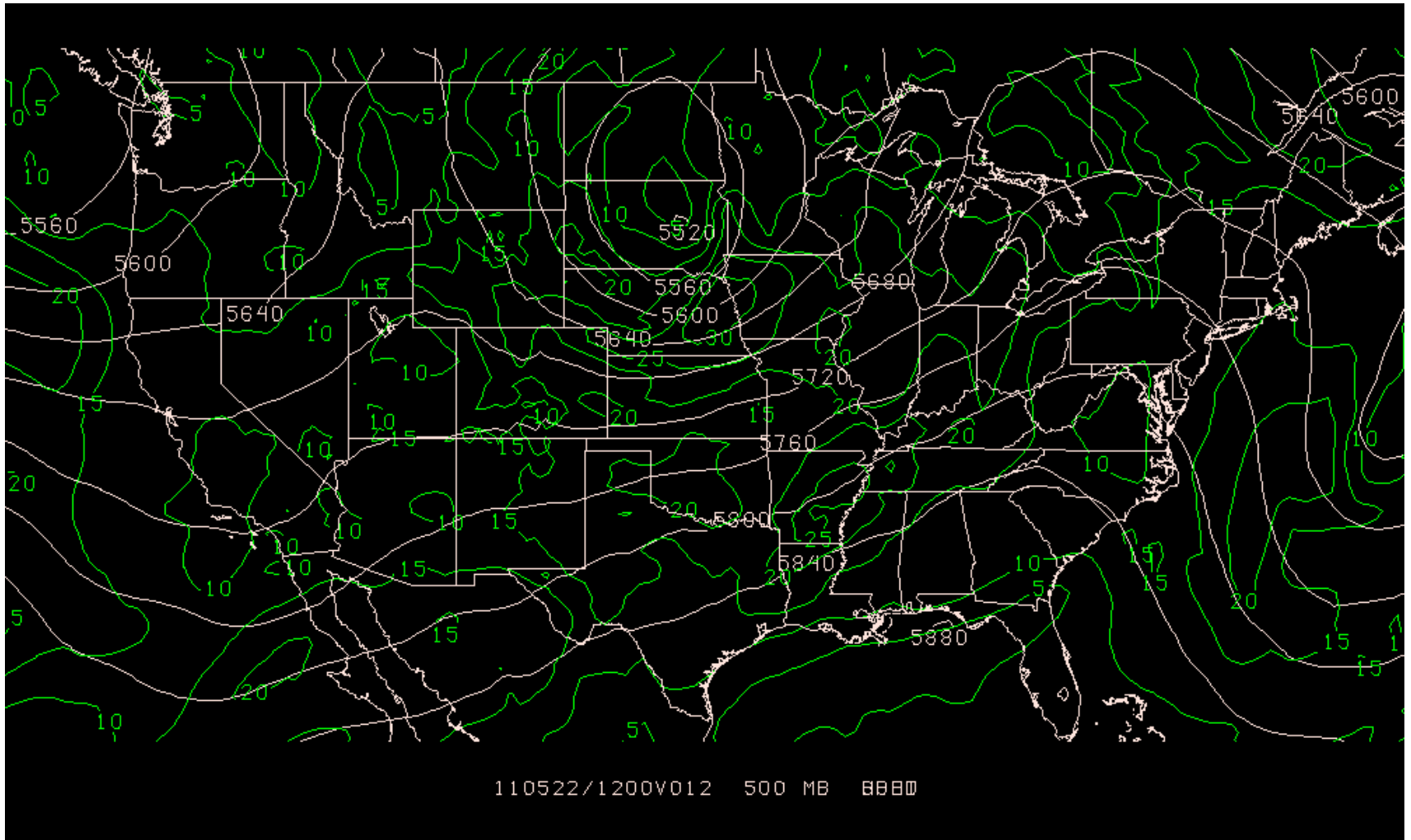
40 points

Where 12 UTC data were unavailable for surface data, I used the next closest analysis time.

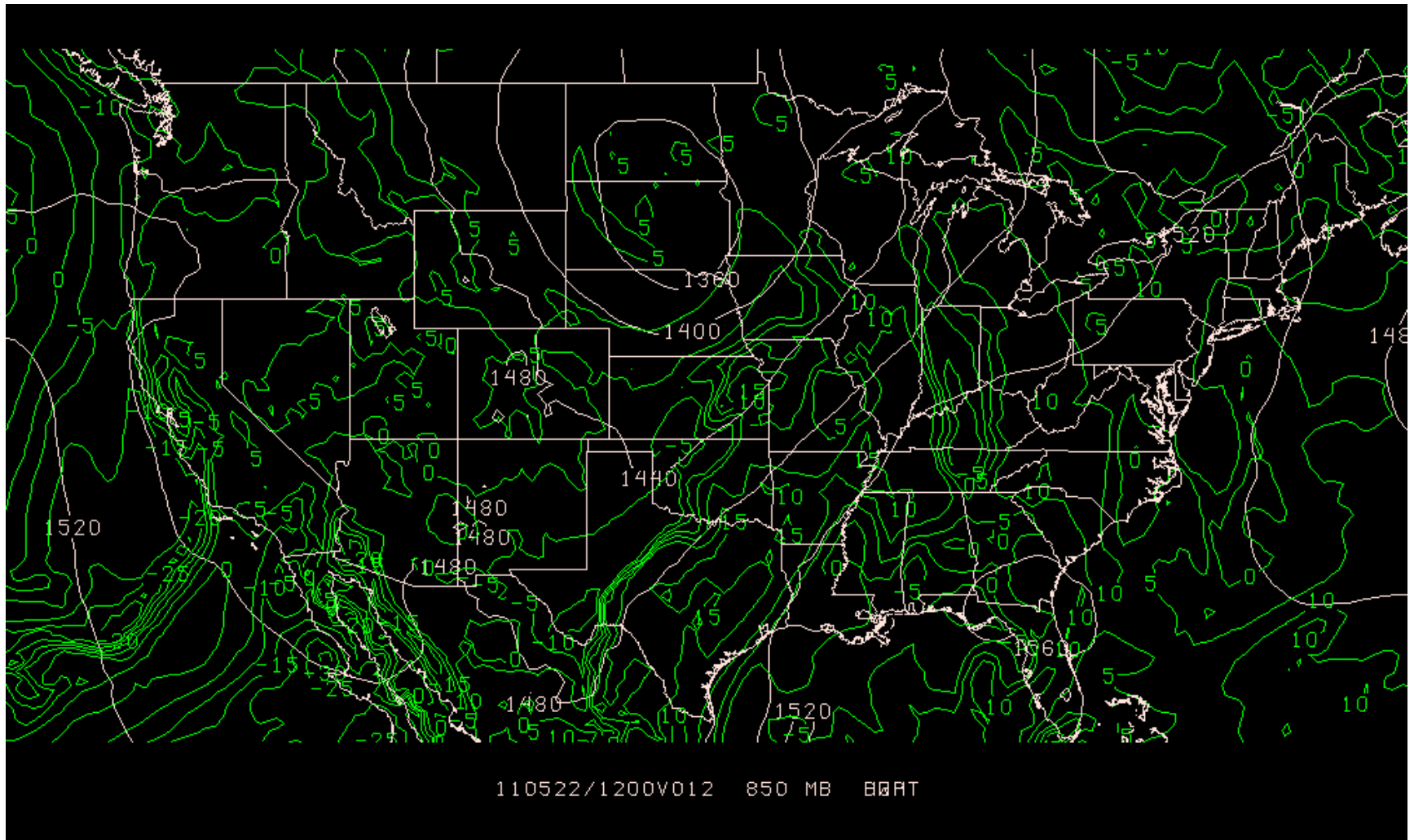
Surface analysis: 15 UTC 22 May 2011



500-mb Heights (m) and Winds (m s⁻¹) From NAM 12h forecast



850-mb Heights (m) and Dewpt ($^{\circ}\text{C}$) From NAM 12h forecast



Surface

In southern Missouri, conditions are very humid. Dewpoints are in the high 60s and even in the 70s further south into Arkansas, and that is about the maximum they ever get for this part of the country. Moist air is being advected directly from the Gulf of Mexico on southerly winds at the surface of 20 kts.

Even in the morning hours there is already precipitation occurring in Arkansas, in the form of showers and thunderstorms ahead of a surface cold front

Upper-air

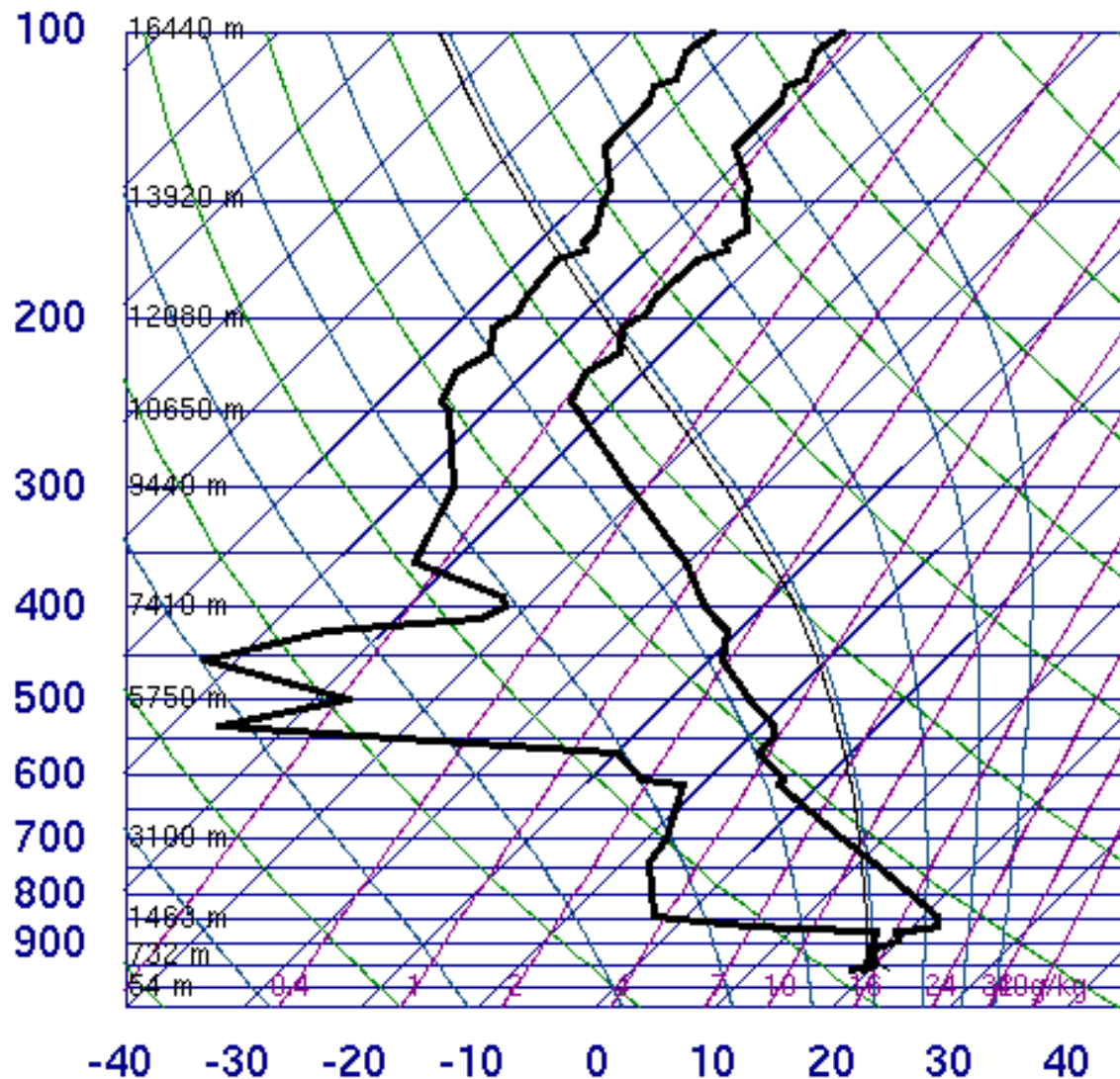
Upper-level trough is located over the Dakotas. The jet max associated with this disturbance is located over western Nebraska, and that is where the strongest PVA is occurring. The system is probably nearing maximum intensity as a mature to occluded mid-latitude cyclone. as it is nearly vertically stacked. Though there is some PVA over southern Missouri, probably the more important factor for synoptic-scale vertical motion is WAA.

The surface cold front is located approximately in eastern KS (extending south and west into OK and TX) during the morning of the event, as clearly indicated by the large moisture gradient there. Supercell thunderstorms would be more favored to develop on the tail end of the front, to the south and west of the surface low, because of the high directional shear. This would certainly include southern Missouri.

Part II
Sounding analysis
20 points

Used data from Wyoming site

72440 SGF Springfield



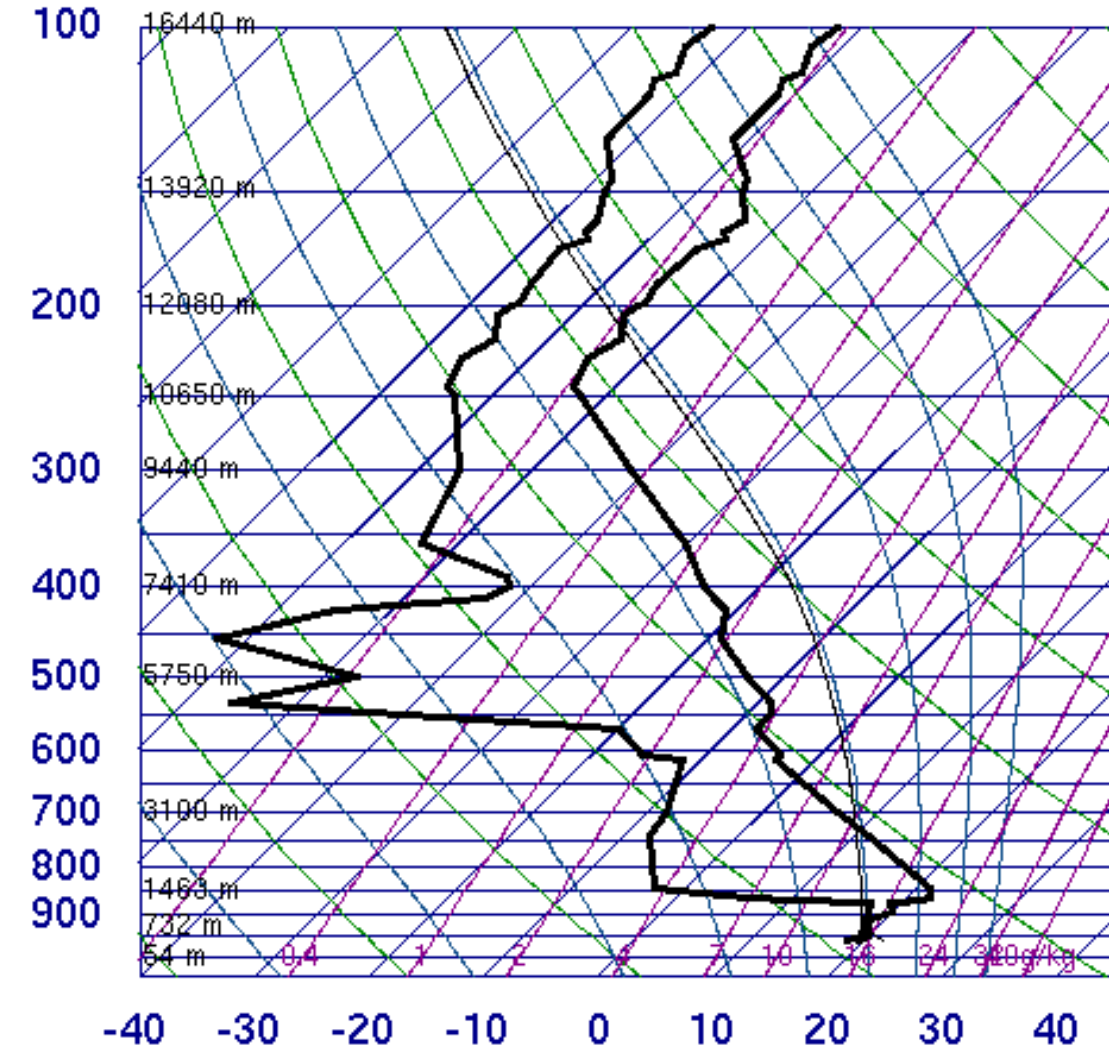
SLAT	37.23
SLON	-93.38
SELV	387.0
SHOW	1.90
LIFT	-6.80
LFTV	-7.56
SWET	156.7
KINX	19.30
CTOT	12.70
VTOT	34.70
TOTL	47.40
CAPE	2267.
CAPV	2431.
CINS	-212.
CINV	-145.
EQLV	211.1
EQTV	211.0
LFCT	724.2
LFCV	748.7
BRCH	36.53
BRCV	39.18
LCLT	291.8
LCLP	928.1
MLTH	298.1
MLMR	14.86
THCK	5696.
PWAT	23.91

12Z 22 May 2011

University of Wyoming

Why is this a Miller type I, loaded gun sounding?

72440 SGF Springfield



Warm, moist at surface

Capping inversion at 800-mb

Cold, dry aloft

High directional wind shear in the vertical

Right moving Supercells will develop provided there is sufficient heating to reach the convective T.

12Z 22 May 2011

University of Wyoming

SLAT 37.23
SLON -93.38
SELV 387.0
SHOW 1.90
LIFT -6.80
LFTV -7.56
SWET 156.7
KINX 19.30
CTOT 12.70
VTOT 34.70
TOTL 47.40
CAPE 2267.
CAPV 2431.
CINS -212.
CINV -145.
EQLV 211.1
EQTV 211.0
LFCT 724.2
LFCV 748.7
BRCH 36.53
BRCV 39.18
LCLT 291.8
LCLP 928.1
MLTH 298.1
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THCK 5696.
PWAT 23.91

Lifted index = -6.80

Very unstable- heavy to strong thunderstorms: RIGHT

Cross totals = 12.7

Vertical totals = 34.7

Totals-totals = 47.4

Thunderstorms, some severe with scattered tornadoes: RIGHT for TT and VT, **WRONG** for CT

Showalter: 1.9 (probably too low because its morning sounding)

Thunderstorms possible—strong trigger needed: **WRONG**

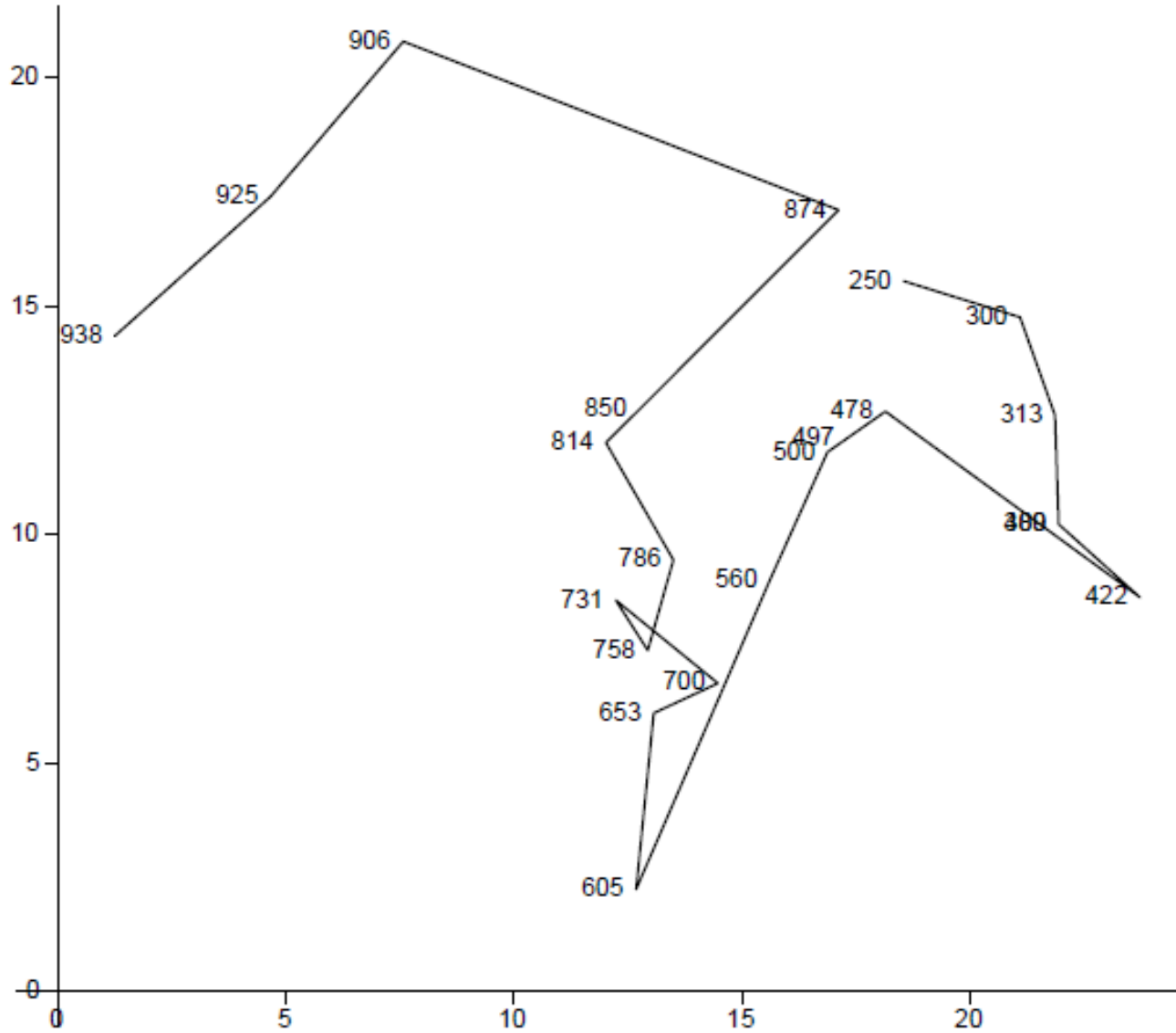
K-index: 19.30

No probability for thunderstorms: REALLY WRONG

→ Only the first two of these indices are giving an accurate picture of potential for tornadic thunderstorms, even for a very obvious case of strong tornadoes. So one index alone should never be considered in isolation for forecasting purposes!

CAPE of 2267 J kg^{-1} yields a maximum updraft velocity in a thunderstorm cell of 67 m s^{-1} . CAPE value is definitely indicative of strong convection! Moreover, strong CIN of -212 J kg^{-1} will facilitate only the strongest updrafts to develop into a few strong supercells.

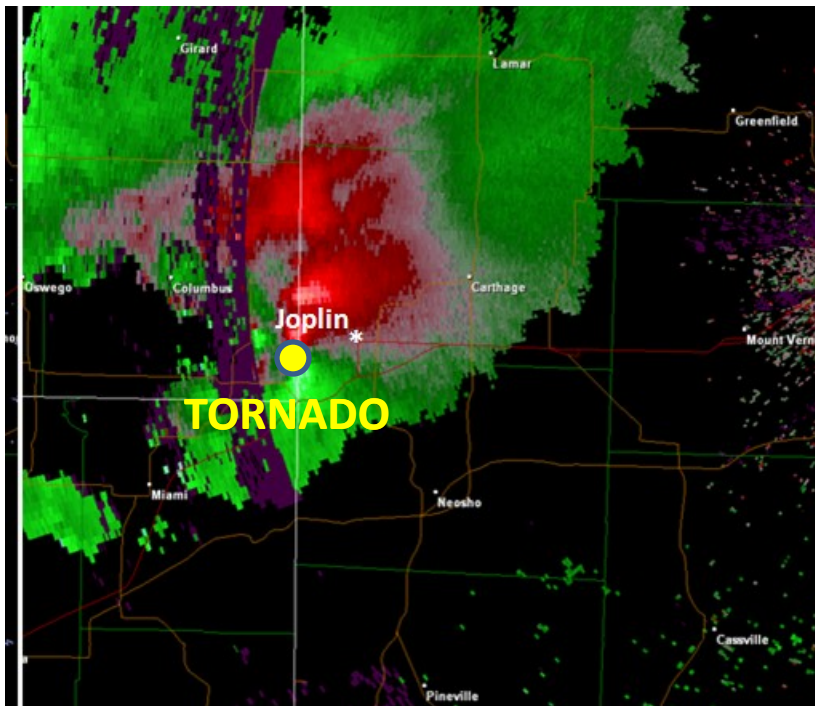
Part III
Hodograph Analysis
40 points



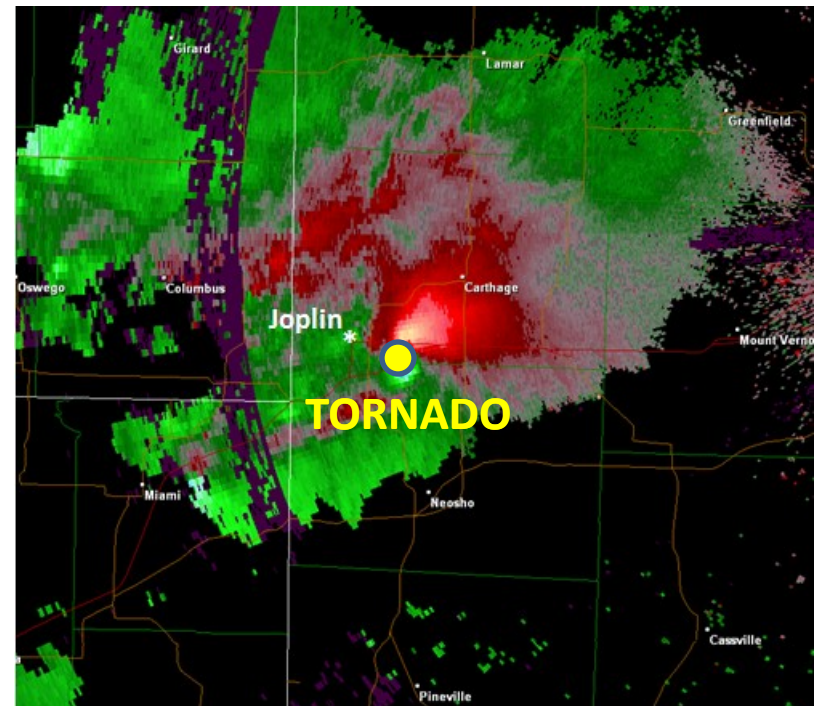
Storm relative vertical velocity

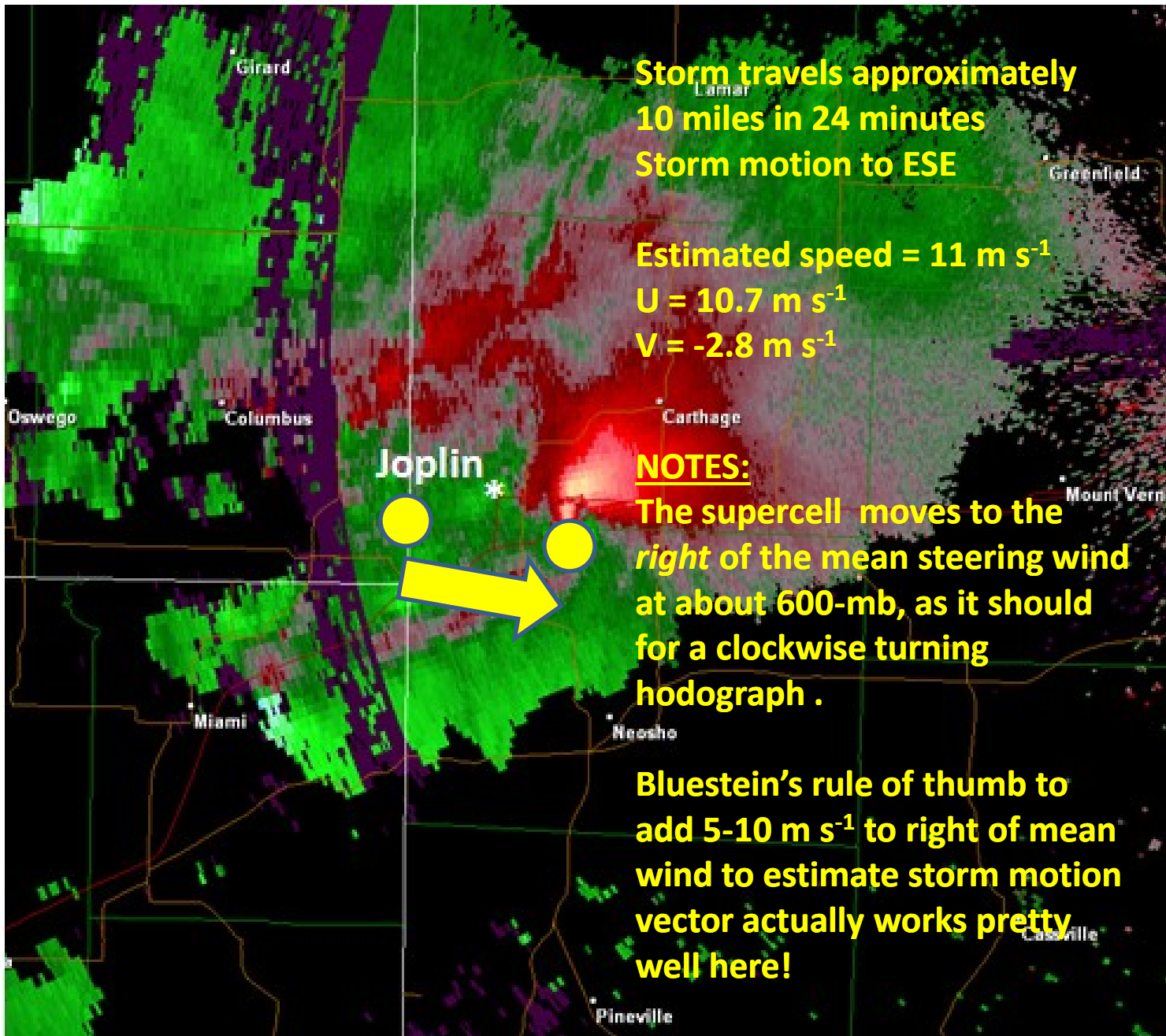
Tornadic signature can be used to track storm velocity

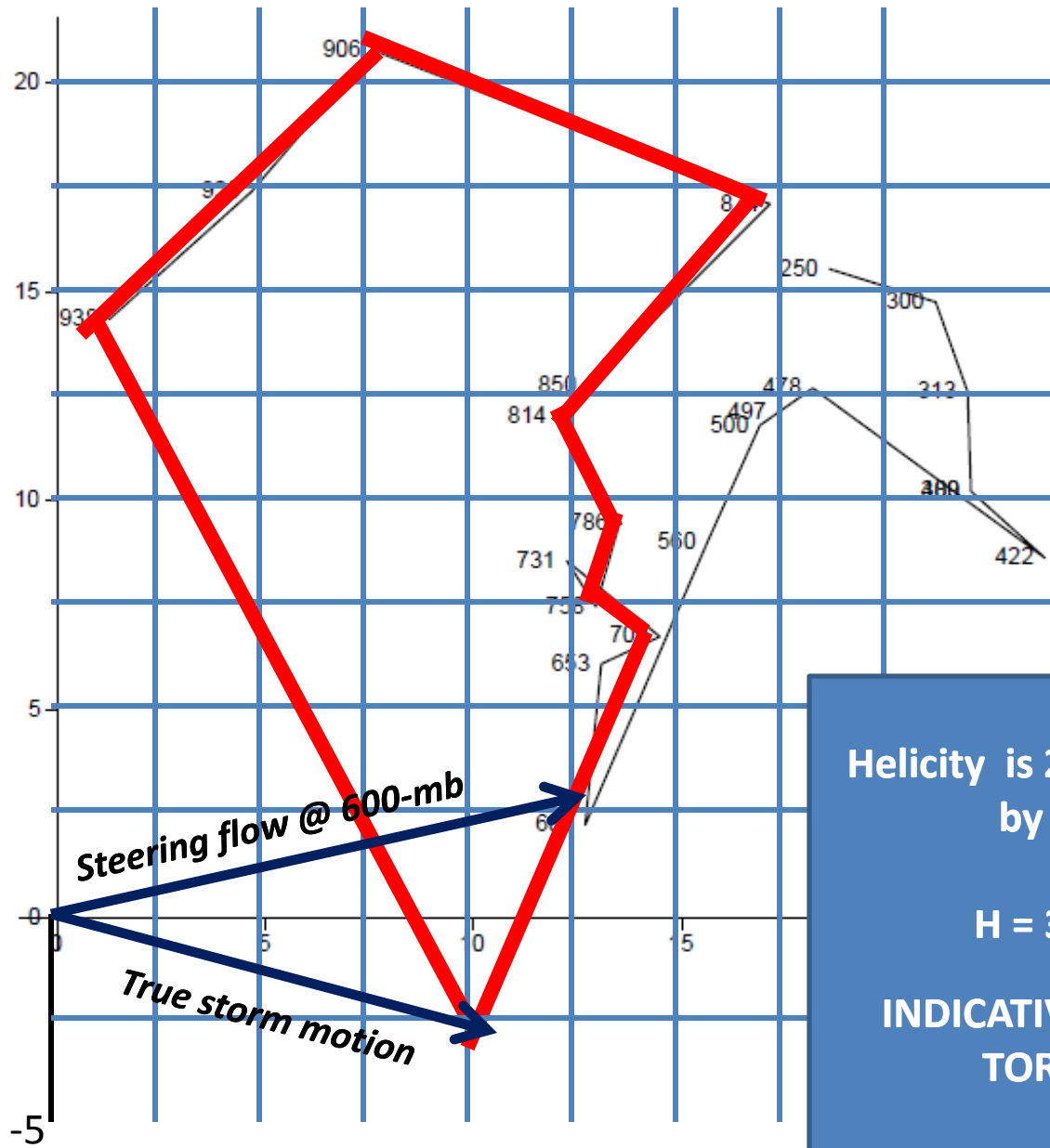
5:29 pm



5:53 pm







Helicity is 2x area enclosed
by polygon

$$H = 348 \text{ m}^2 \text{ s}^{-2}$$

**INDICATIVE OF STRONG
TORNADOES**