

An Overview of the Environmental Conditions and Radar Analysis of the 22-23 May 2008 Tornadoes in Southeast Wyoming



Horse Creek Road, WY on May 23, 2008

Melissa Goering

NWS Cheyenne, WY

12th Annual High Plains Conference, September 4-5, 2008

Introduction

- Tornado Events on the 22-23 May 2008
 - SREF probabilistic forecast from SPC
 - Overview of environmental conditions (SPC Mesoscale Analysis)
 - Storm tracks and damage images
- Very brief remarks on following:
 - Geographical comparison of severe weather parameters
 - Examination radar-hail technique

May 22, 2008

SPC Storm Reports for 05/22/08

Map updated at 1207Z on 05/24/08



TORNADO REPORTS.. (48)
WIND REPORTS/HI..... (57/1)
HAIL REPORTS/LG..... (144/12)
TOTAL REPORTS..... (249)

National Weather Service
Storm Prediction Center Norman, Oklahoma

- High Wind Report (65KT +)
- ▲ Large Hail Report (2" dia. +)

PRELIMINARY DATA ONLY

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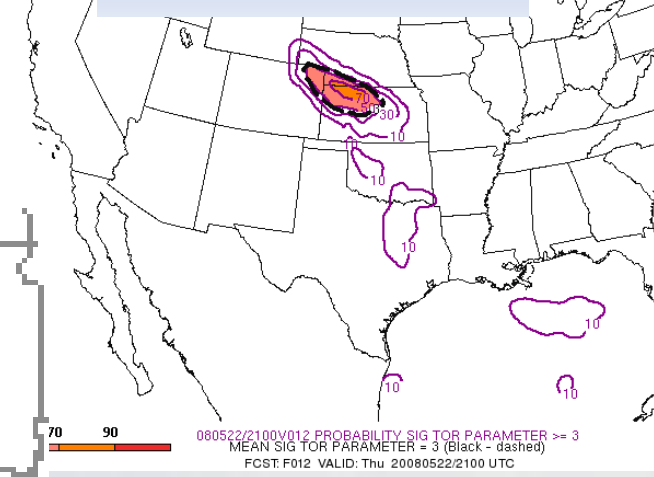
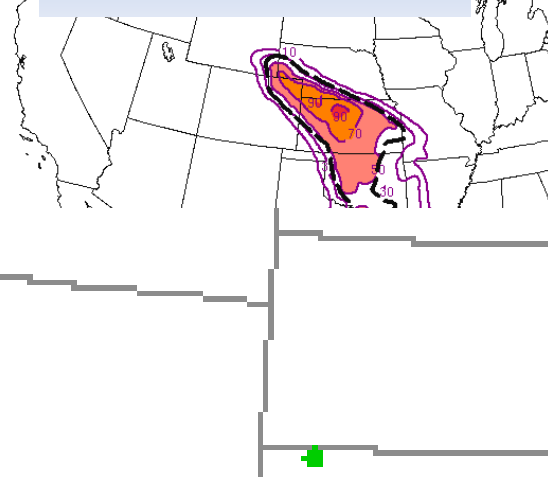
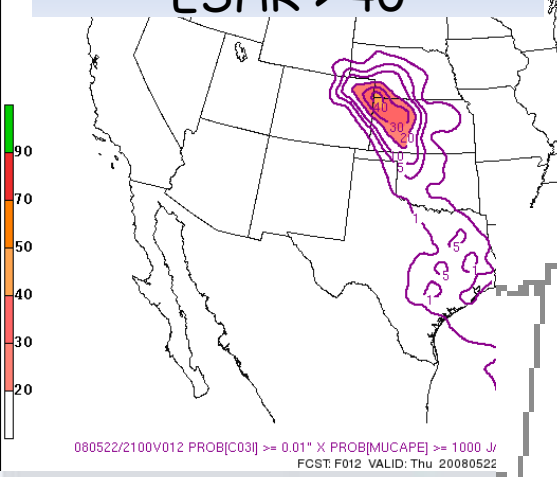
SPC DAY1 CONV OUTL
ISSUED: 1225Z 05/22/08
VALID: 22/1300Z-23/120
FORECASTER: EVANS/E

SPC DAY1 WIND OUTLOOK
ISSUED: 1225Z 05/22/2008
VALID: 22/1300Z-23/1200Z
FORECASTER: EVANS/EDWARDS/SMITH

Prob CP > .01 x Prob
 MUCAPE > 1000 x
 ESHR > 40

Probability
 STP > 1

Probability
 STP > 3

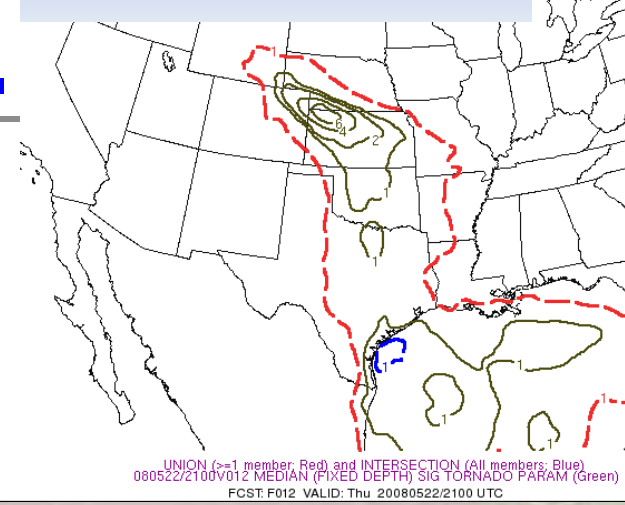
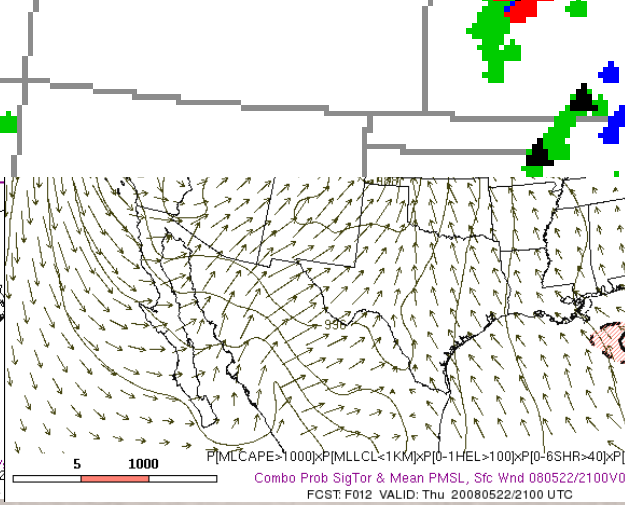
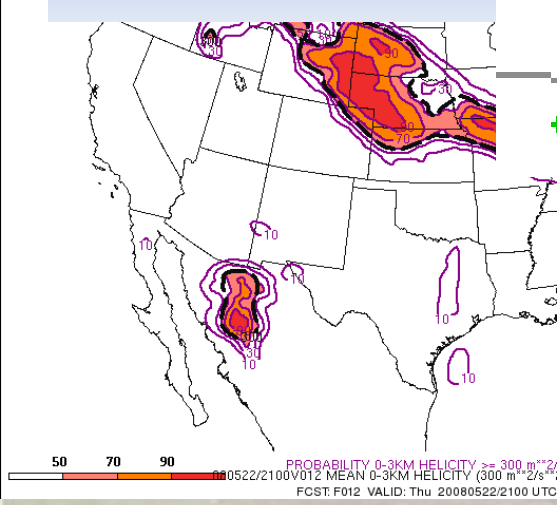


SREF 0522/0

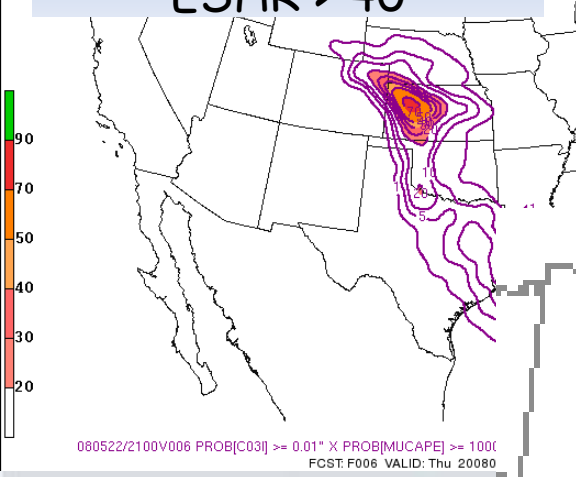
0522/2100 UTC

Probability
 0-3km SRH > 300

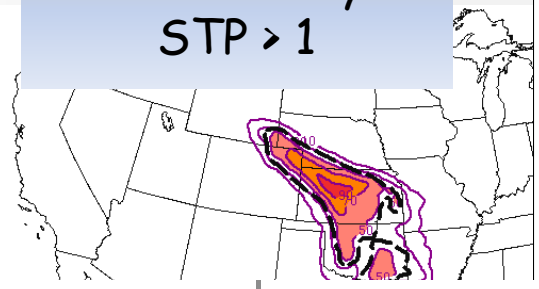
[MDXN] STP



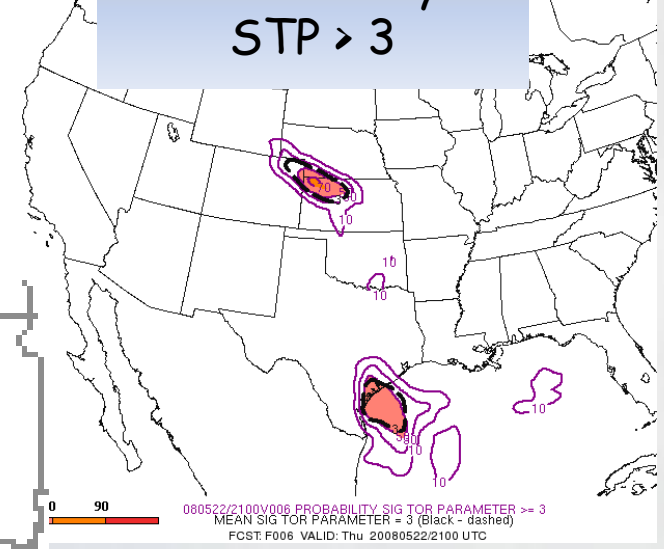
Prob CP > .01 x Prob
 MUCAPE > 1000 x
 ESHR > 40



Probability
 STP > 1



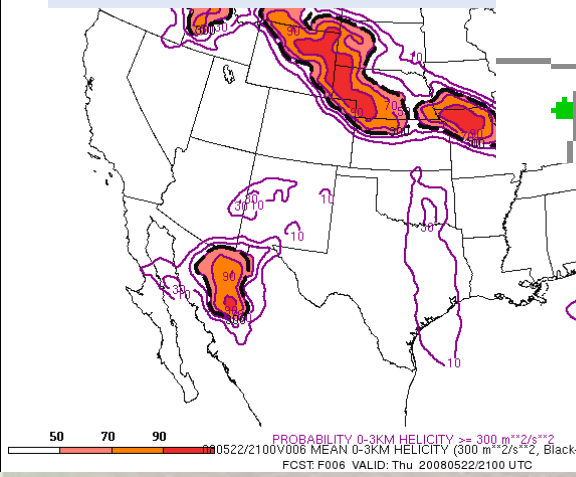
Probability
 STP > 3



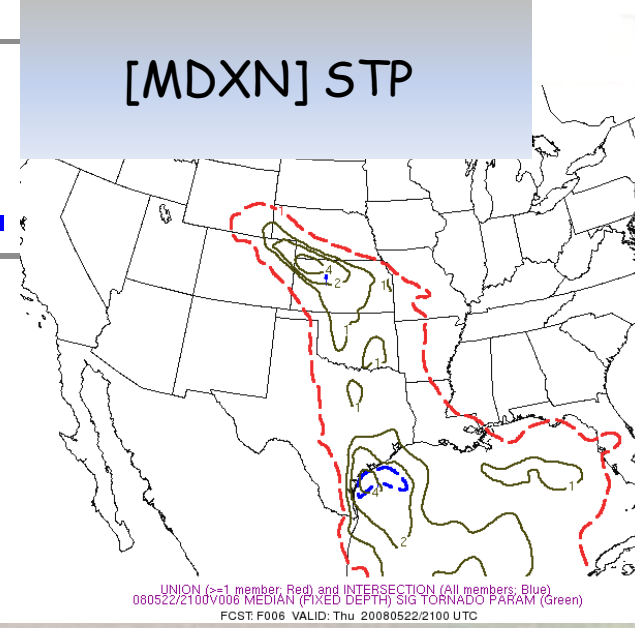
SREF 0522/2100 UTC

0522/2100 UTC

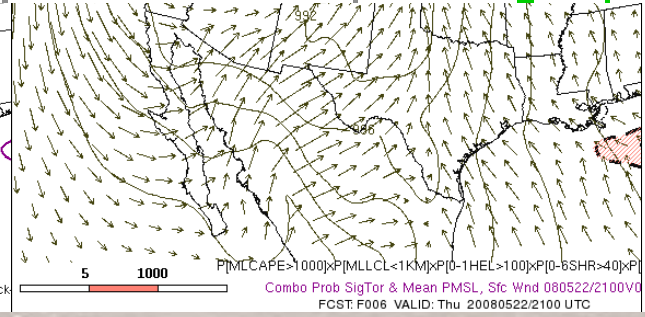
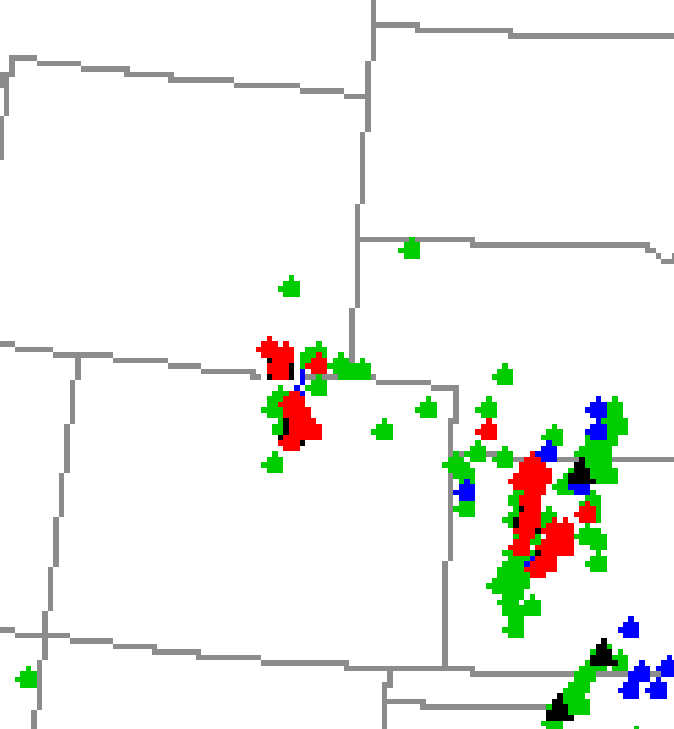
Probability
 0-3km SRH > 300



[MDXN] STP

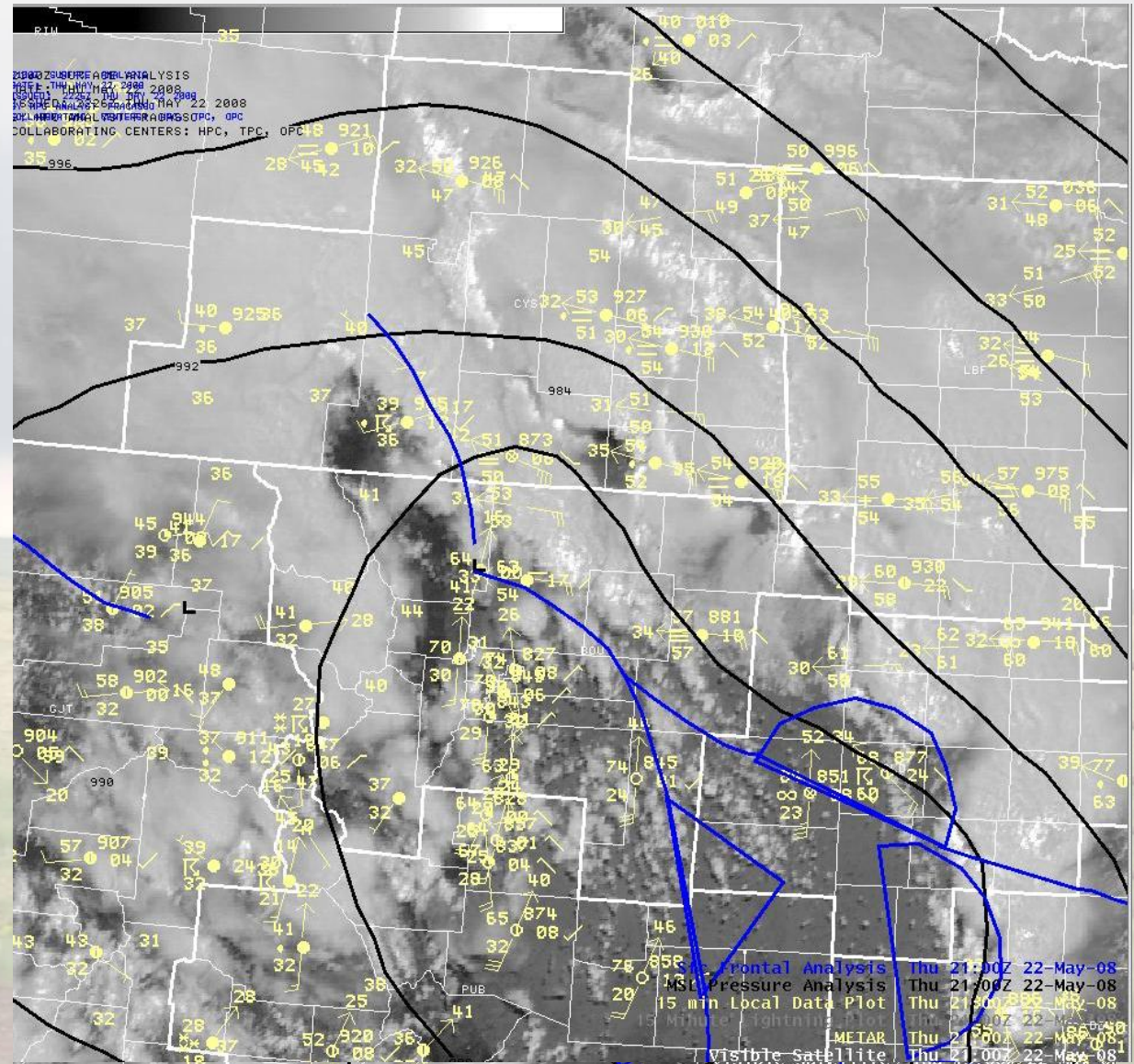


P[MUCAPE>1000]xP[MUCAPE<1KM]xP[0-1HEL>100]xP[0-6SHR>40]xP[0-3SRH>300]
 Combo Prob SigTor & Mean PMSL, Sig Wnd 080522/2100V006
 FCST.F006 VALID: Thu 20080522/2100 UTC



Overview Environmental Conditions

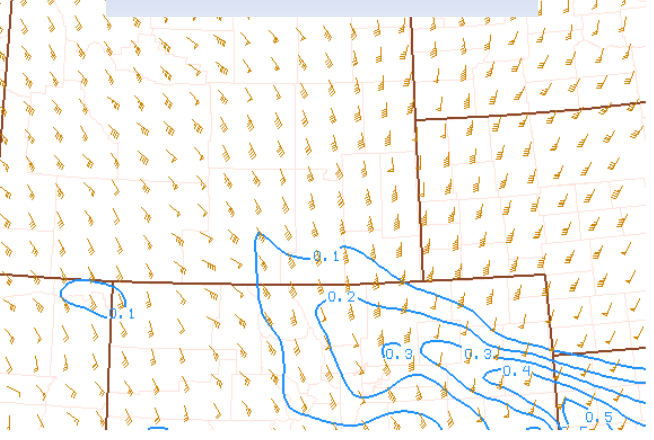
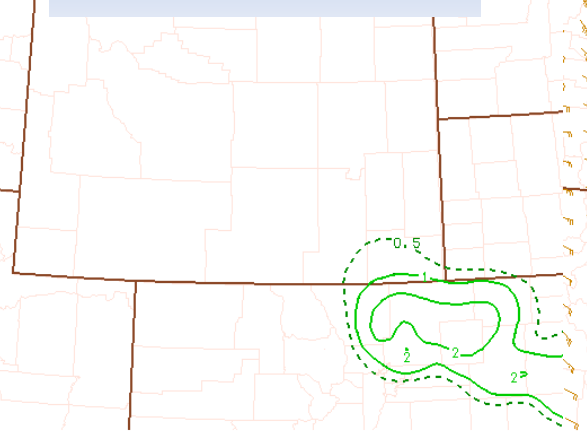
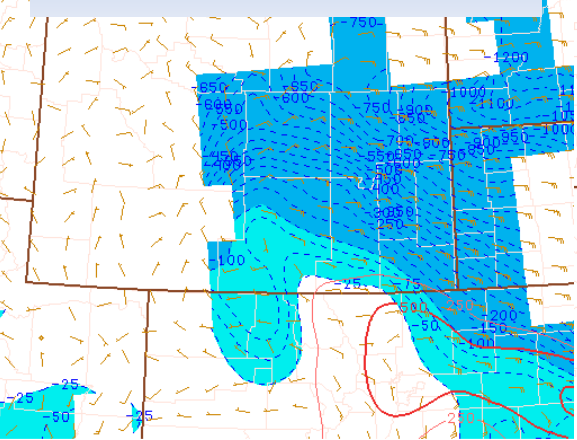
- Surface low located over northern CO
- Warm front extending east from low
 - Temperatures in the 70s in Denver
- Dense fog extending across Cheyenne through Laramie
- Easterly upslope flow
 - Dew point temperatures in the 50s



MLCAPE and MLCIN

0-1km EHI

0-1km VGP



080522/1800 MLCAPE (contour) and MLCIN (J/kg, shaded)

080522/2000 1km EHI

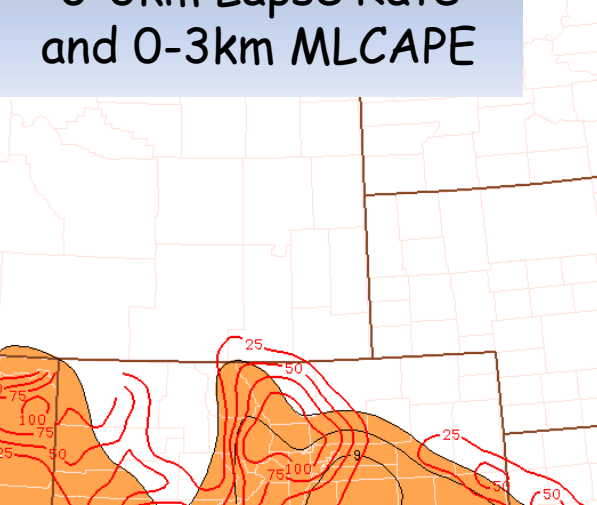
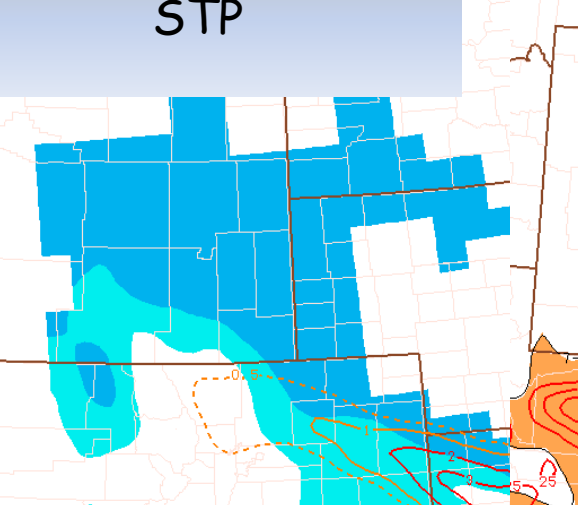
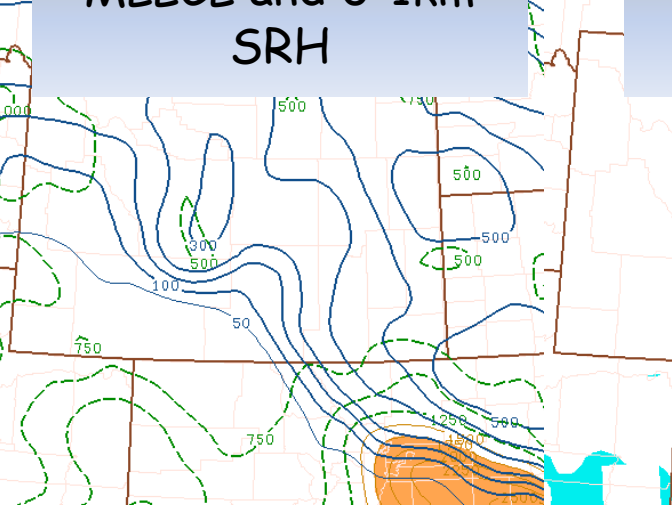
080522/1800 3km VGP, Shear Vector

Environmental Conditions: 20080522 at 18z

MLLCL and 0-1km SRH

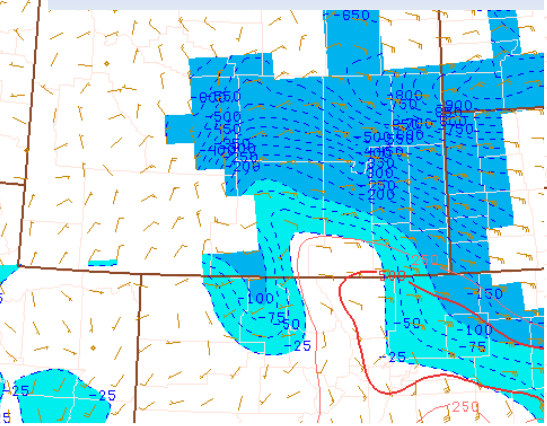
STP

0-3km Lapse Rate and 0-3km MLCAPE

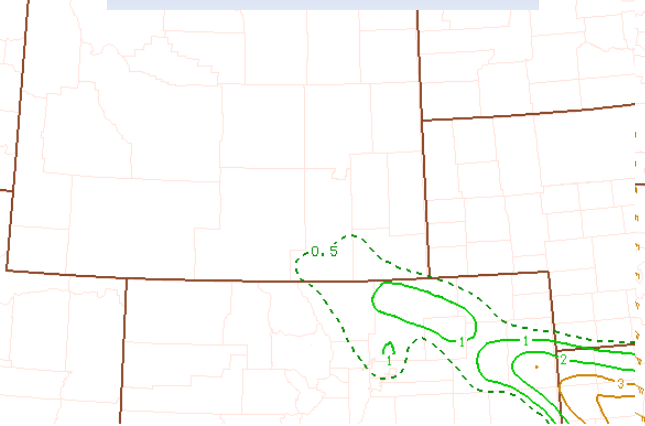


0522/2000 100 mb mean LCL (f111 > 1750 m) and 0-1 km SRH ant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded at 25 and 0522/1800 0-3 km lapse rate (f111) and 0-3 km MLCAPE (red)

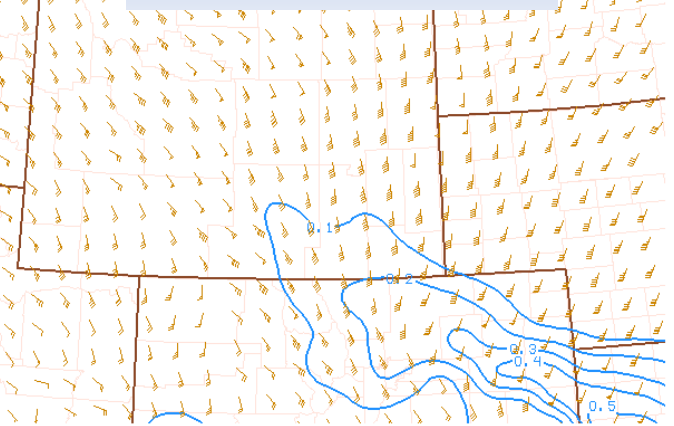
MLCAPE and MLCIN



0-1km EHI



0-1km VGP



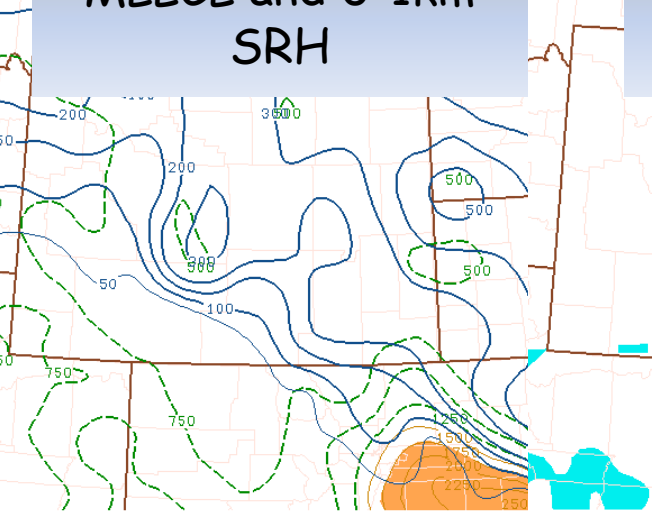
080522/1900 MLCAPE (contour) and MLCIN (J/kg, shaded)

080522/1900 1km EHI

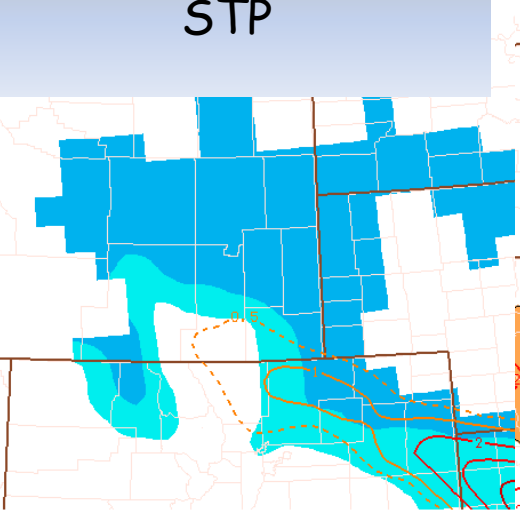
080522/1900 3km VGP, Shear Vector

Environmental Conditions: 20080522 at 19z

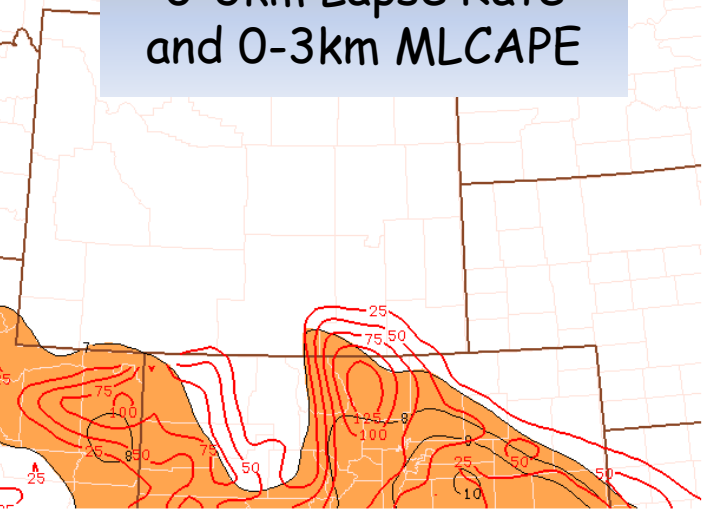
MLLCL and 0-1km SRH



STP



0-3km Lapse Rate and 0-3km MLCAPE

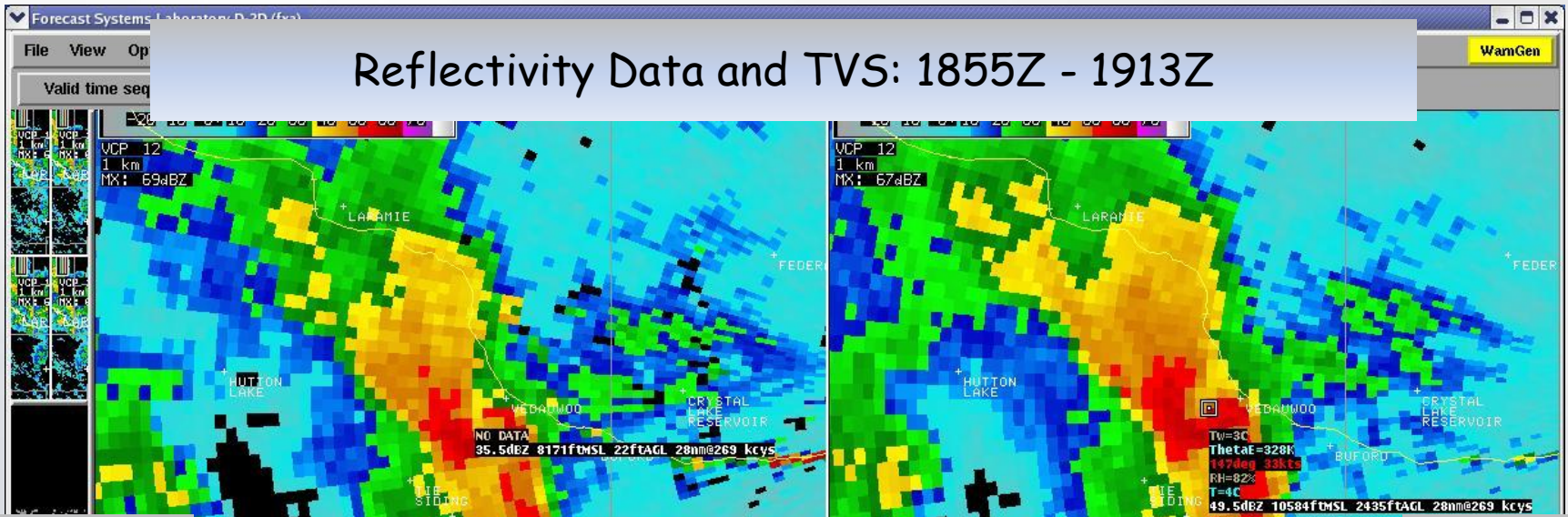


0522/1900 100 mb mean LCL (f111 > 1750 m) and 0-1 km SRHcant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded at 25 :0522/1900 0-3 km lapse rate (f111) and 0-3 km MLCAPE (red)

Tornado Tracks: May 22, 2008

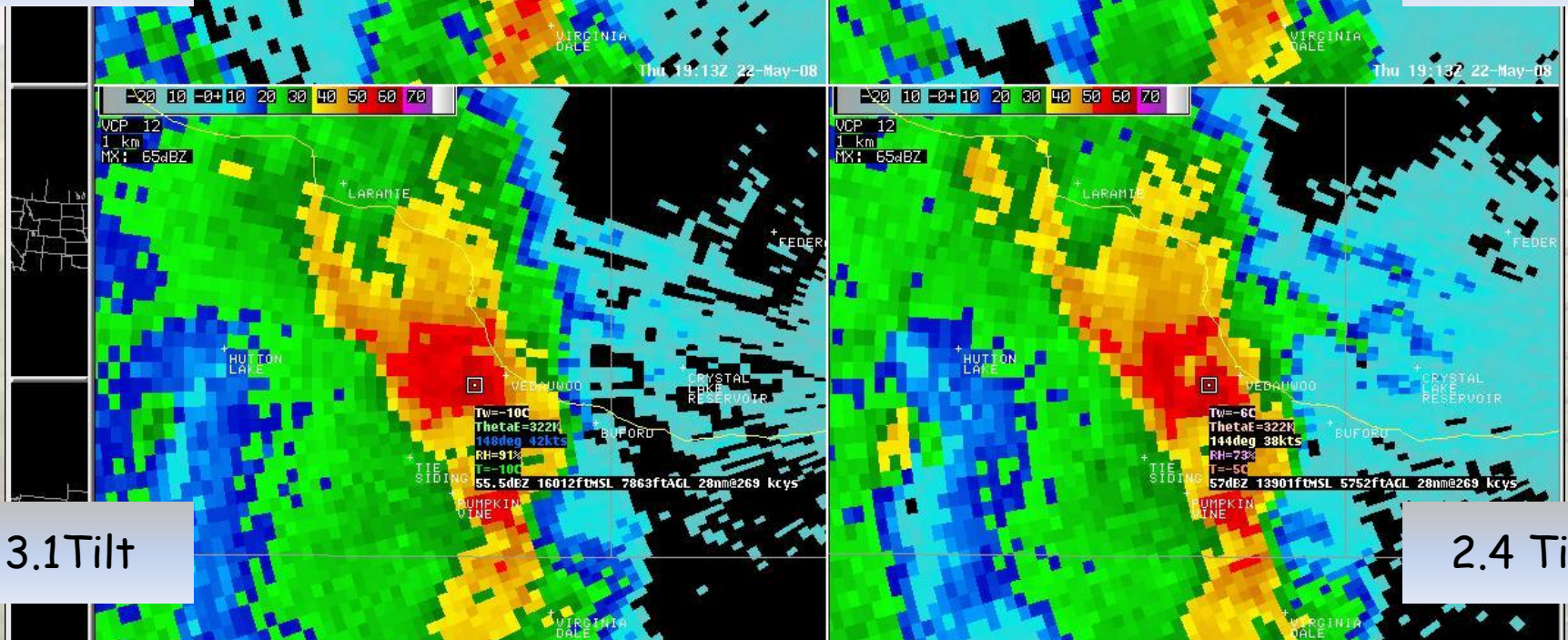


Reflectivity Data and TVS: 1855Z - 1913Z



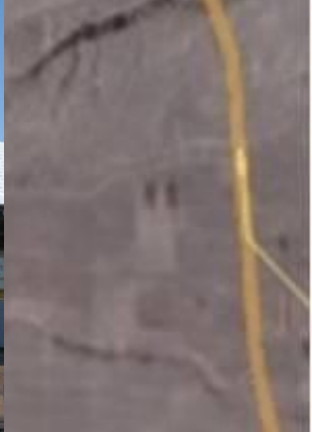
0.5 Tilt

1.3 Tilt



3.1 Tilt

2.4 Tilt



Courtesy of Jeff Mitros

May 23, 2008

- Upper level jet (~150 around over s and ea by

SPC Storm Reports for 05/23/08

Map updated at 1707Z on 05/24/08



TORNADO REPORTS.. (63)
WIND REPORTS/HI..... (38/4)
HAIL REPORTS/LG..... (102/12)
TOTAL REPORTS..... (203)

National Weather Service
Storm Prediction Center Norman, Oklahoma

- High Wind Report (65KT +)
- ▲ Large Hail Report (2" dia. +)

PRELIMINARY DATA ONLY

boundary moving northward

SPC DAY1 CONV OUTLOOK
ISSUED: 1242Z 05/23/2008
VALID: 23/1300Z-24/1200Z
FORECASTER: HART/SMITH
National Weather Service
Storm Prediction Center Norman, Oklahoma

SP

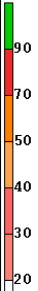
FORECASTER: HART
National Weather Service
Storm Prediction Center Norman, Oklahoma

SPC DAY1 WIND OUTLOOK
ISSUED: 1242Z 05/23/2008
VALID: 23/1300Z-24/1200Z
FORECASTER: HART
National Weather Service
Storm Prediction Center Norman, Oklahoma

Prob CP > .01 x Prob
 MUCAPE > 1000 x
 ESHR > 40

Probability
 STP > 1

Probability
 STP > 3



080523/2100V036 PROB[C03] >= 0.01 * PROB[MUCAPE] >= 1000 J
 FCST: F036 VALID: Fri 20080523

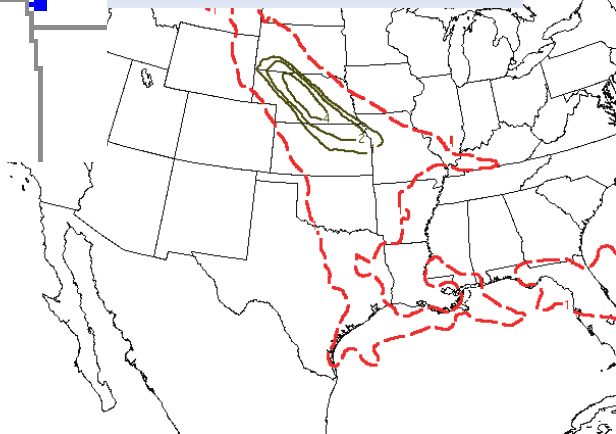
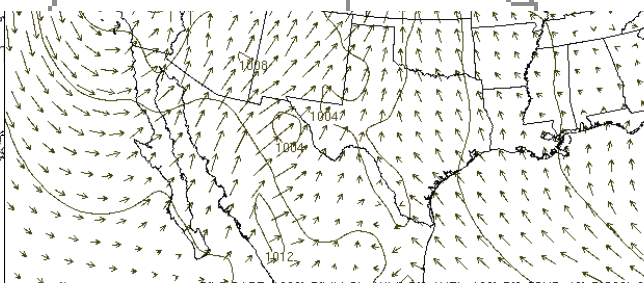
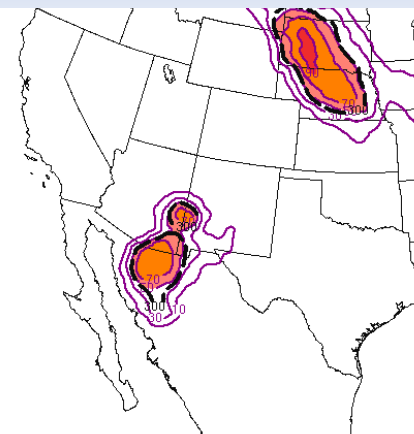
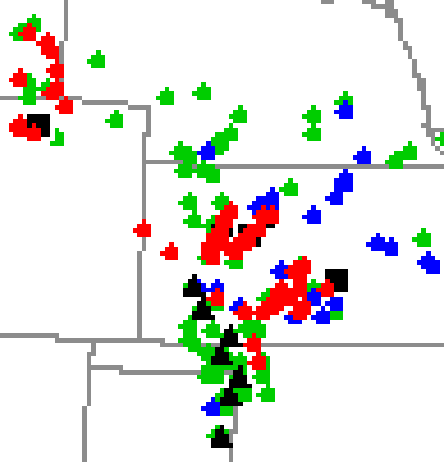
90 080523/2100V036 PROBABILITY SIG TOR PARAMETER >= 3
 MEAN SIG TOR PARAMETER = 3 (Black - dashed)
 FCST: F036 VALID: Fri 20080523/2100 UTC

SREF 0522/

0523/2100 UTC

Probability
 0-3km SRH > 300

[MDXN] STP



50 70 90 080523/2100V036 PROBABILITY 0-3KM HELICITY >= 300 m²/s²
 MEAN 0-3KM HELICITY (300 m²/s²)
 FCST: F036 VALID: Fri 20080523/2100 UTC

5 1000 P[MCAPE>1000]*P[MLLCL<1KM]*P[0-1HEL>100]*P[0-6SHR>40]*P[C03]>0
 Combo Prob SigTor & Mean PMSL, Stc Wnd 080523/2100V036
 FCST: F036 VALID: Fri 20080523/2100 UTC

UNION (>=1 member, Red) and INTERSECTION (All members, Blue)
 080523/2100V036 MEDIAN (FIXED DEPTH) SIG TORNO PARAM (Green)
 FCST: F036 VALID: Fri 20080523/2100 UTC

Prob CP > .01 x Prob
MUCAPE > 1000 x
ESHR > 40

Probability
STP > 1

Probability
STP > 3



080523/2100V012 PROB[C03] >= 0.01 * PROB[MUCAPE] >= 10
FCST.F012 VALID: Fri 20080523/2100 UTC

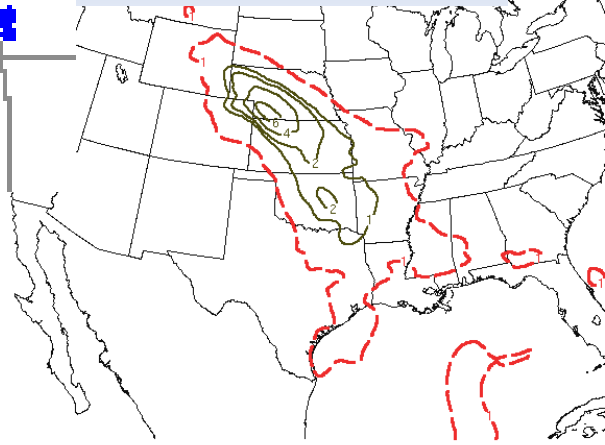
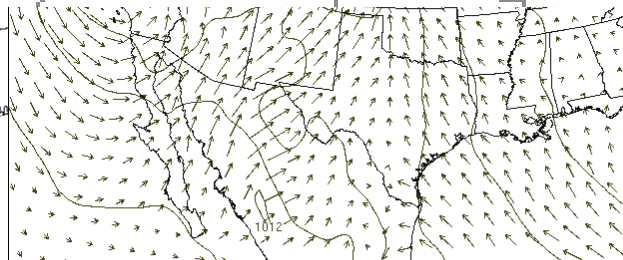
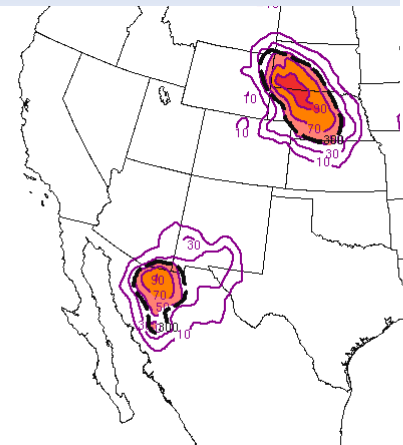
080523/2100V012 PROBABILITY SIG TOR PARAMETER >= 3
MEAN SIG TOR PARAMETER = 3 (Black - dashed)
FCST.F012 VALID: Fri 20080523/2100 UTC

SREF 0523/

Probability
0-3km SRH > 30

0523/2100 UTC

[MDXN] STP

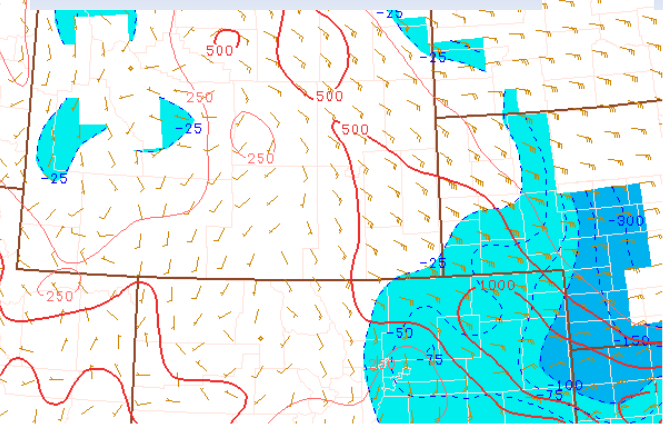


50 70 90
080523/2100V012 PROBABILITY 0-3KM HELICITY >= 300 m**2/s**2
FCST.F012 VALID: Fri 20080523/2100 UTC

5 1000
P[MUCAPE>1000]*P[MLLCL<1KM]*P[0-1HEL>100]*P[0-6SHR>40]*P[C03]>0.0
Combo Prob SigTor & Mean PMSL, Stc Wnd 080523/2100V012
FCST.F012 VALID: Fri 20080523/2100 UTC

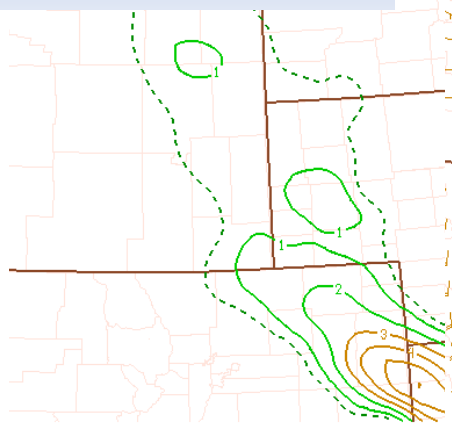
UNION (>=1 member, Red) and INTERSECTION (All members, Blue)
080523/2100V012 MEDIAN (FIXED DEPTH) SIG TORNADO PARAM (Green)
FCST.F012 VALID: Fri 20080523/2100 UTC

MLCAPE and MLCIN



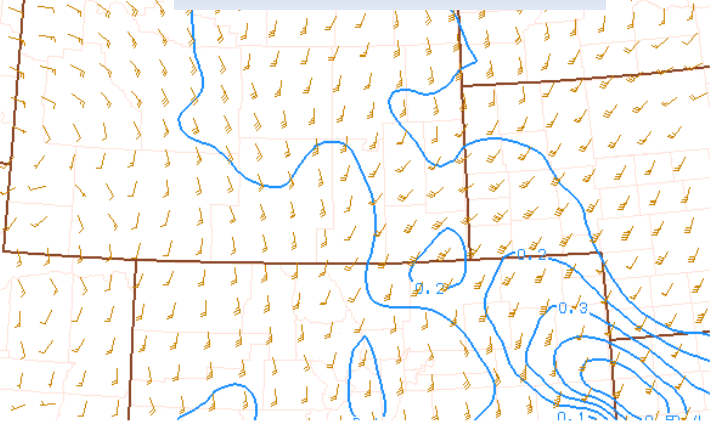
080523/2200 MLCAPE (contour) and MLCIN (J/kg, shaded)

0-1km EHI



:080523/2200 1km EHI

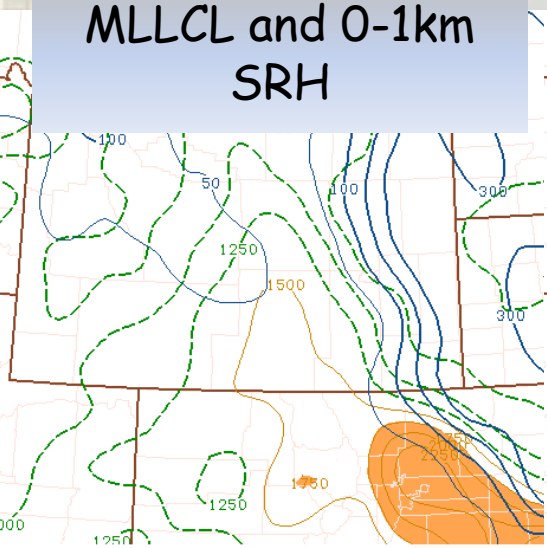
0-1km VGP



080523/2200 3km VGP, Shear Vector

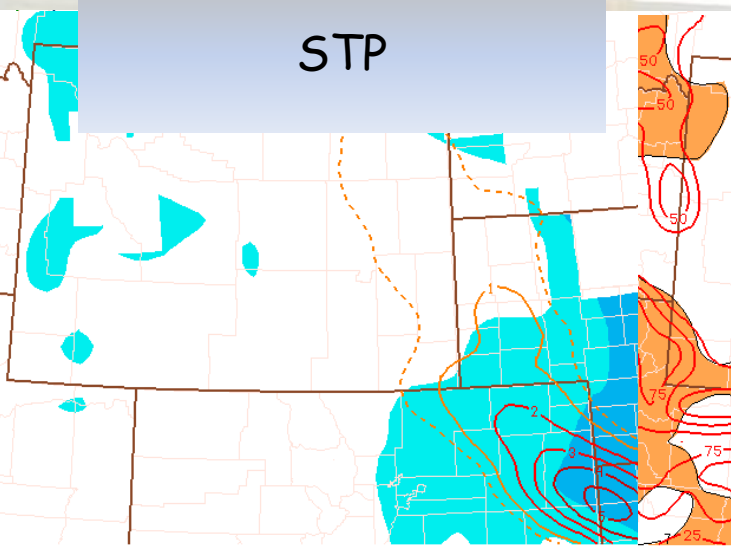
Environmental Conditions: 20080523 at 22z

MLLCL and 0-1km SRH

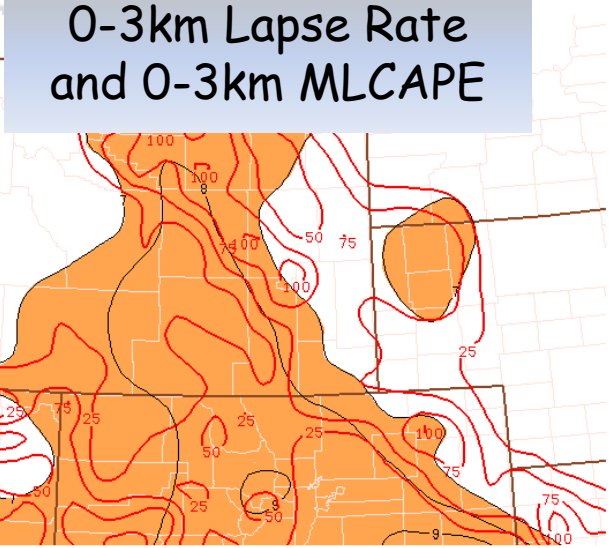


080523/2200 100 mb mean LCL (fill > 1750 m) and 0-1 km SFant Tornado Parameter (fixed layer) and MLCIN (J/kg, shaded)

STP

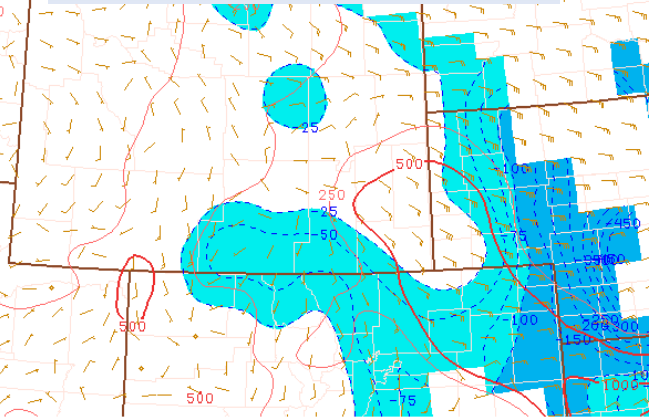


0-3km Lapse Rate and 0-3km MLCAPE



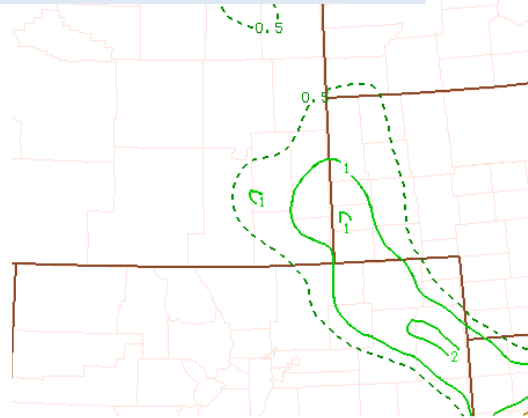
080523/2200 0-3 km lapse rate (fill) and 0-3 km MLCAPE (red)

MLCAPE and MLCIN



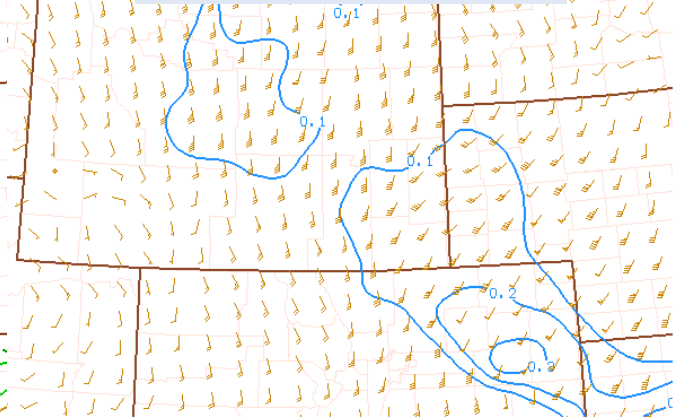
080524/0000 MLCAPE (contour) and MLCIN (J/kg, shaded)

0-1km EHI



080524/0000 1km EHI

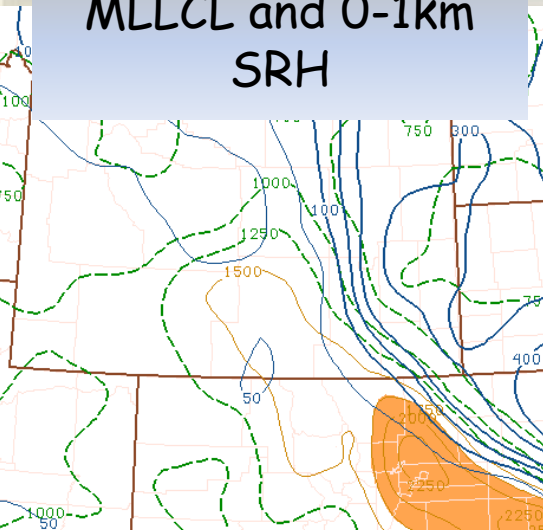
0-1km VGP



080524/0000 3km VGP, Shear Vector

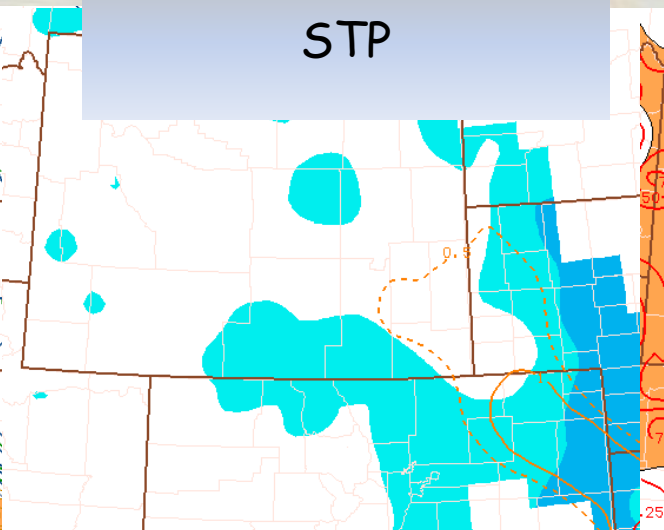
Environmental Conditions: 20080524 at 00z

MLLCL and 0-1km SRH

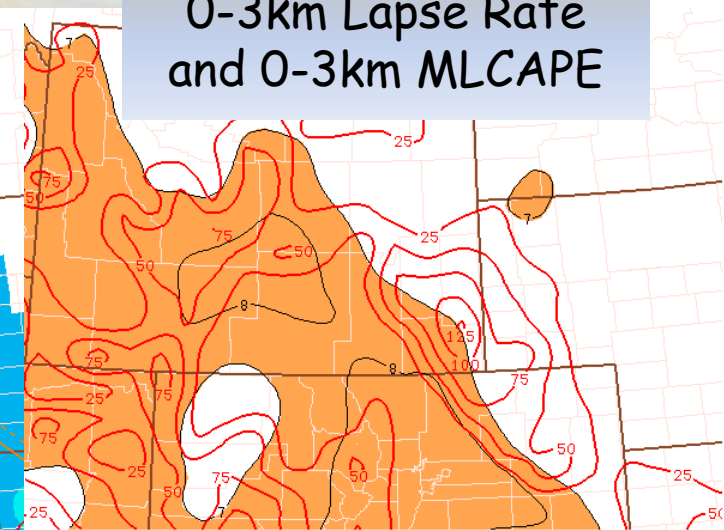


0524/0000 100 mb mean LCL (f111 > 1750 m) and 0-1 km SRcant Tornado Parameter (f1ixed layer) and MLCIN (J/kg, shaded) at 024/0000 0-3 km lapse rate (f111) and 0-3 km MLCAPE (red)

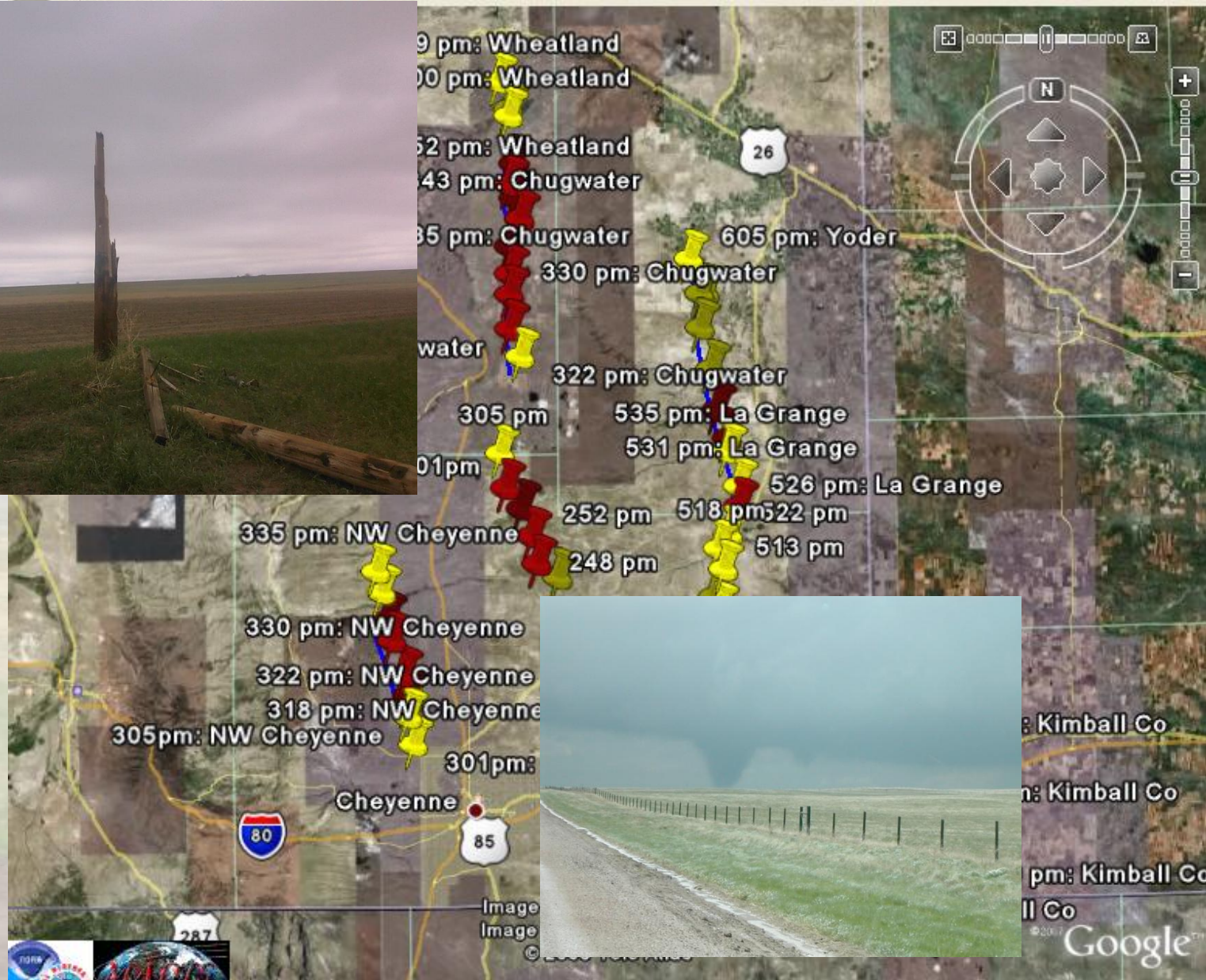
STP



0-3km Lapse Rate and 0-3km MLCAPE



Tornado Tracks: May 23, 2008



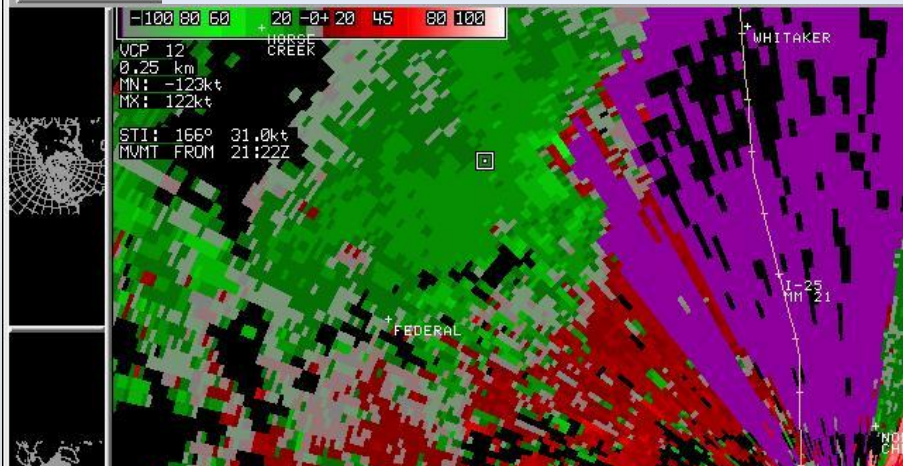
SRM8 Velocity Data and TVS: 2122Z

Forecast Systems

File View Op

Valid time seq

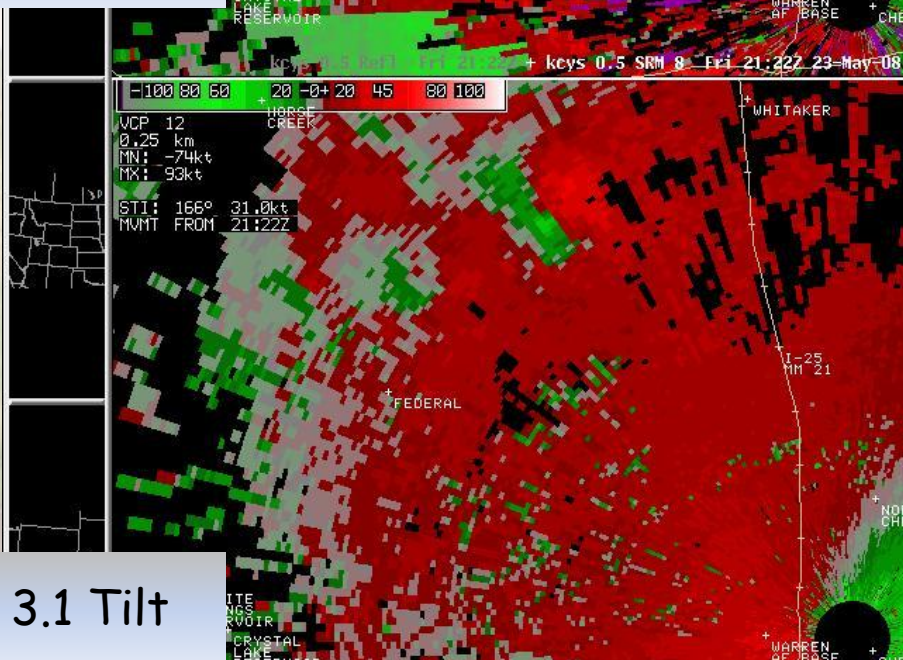
WamGen



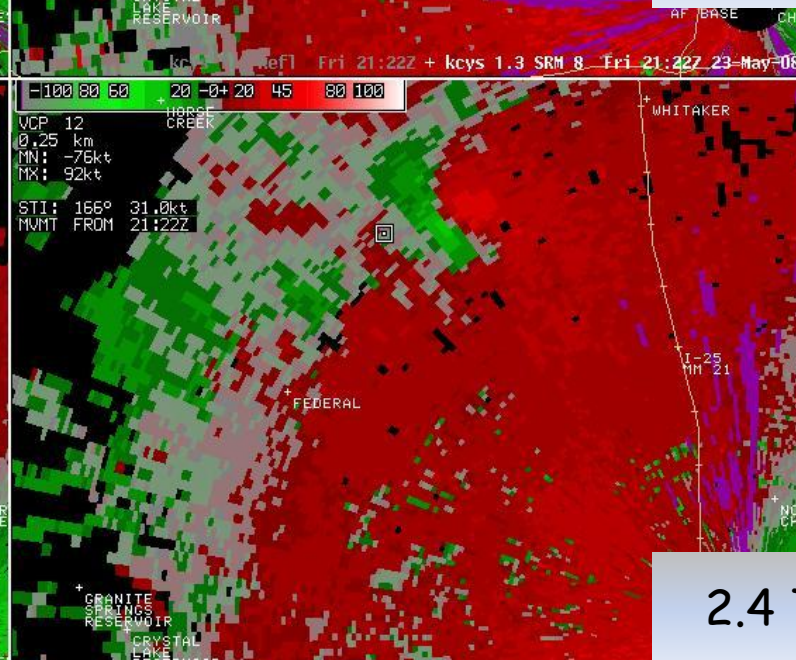
0.5 Tilt



1.3 Tilt



3.1 Tilt



2.4 Tilt

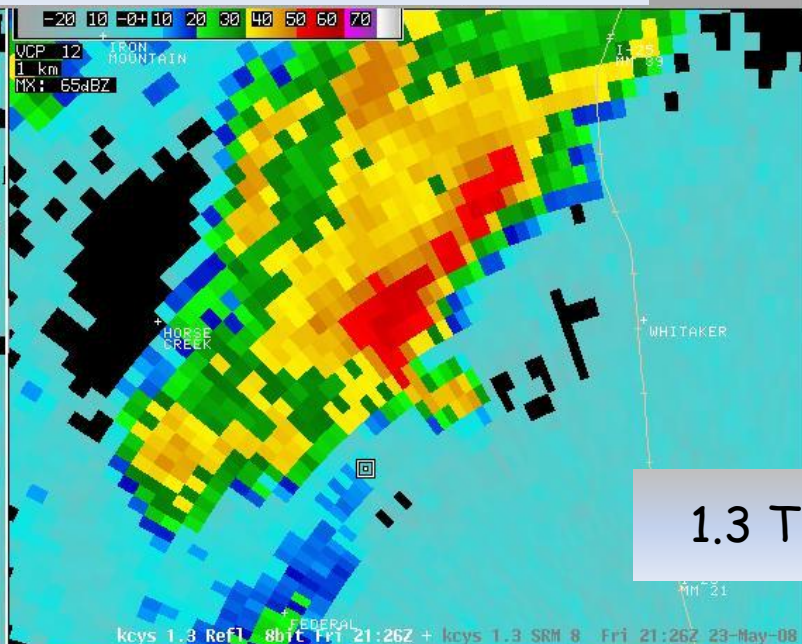
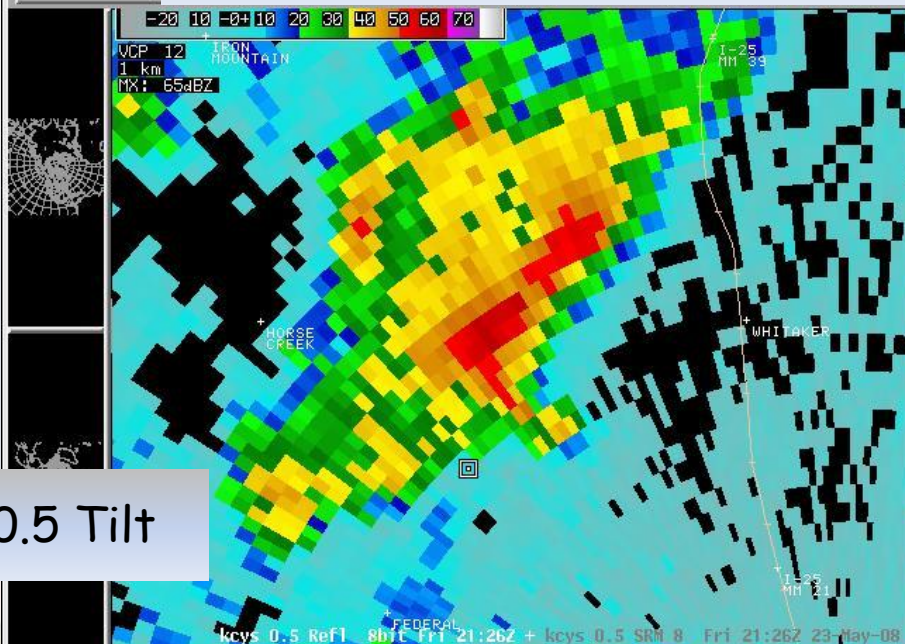
Reflectivity Data and TVS: 2122Z

Forecast Systems

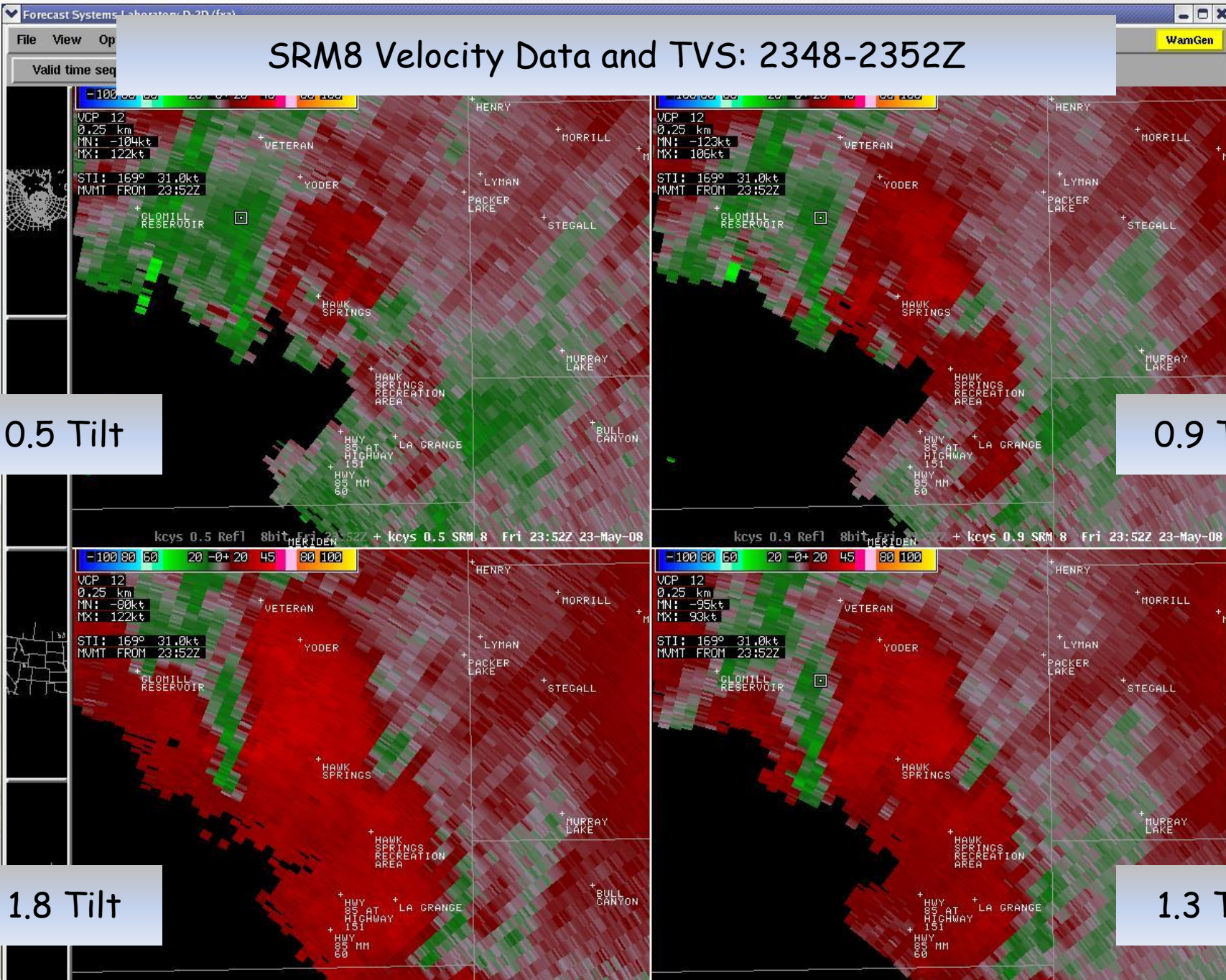
File View Op

Valid time seq

WamGen



SRM8 Velocity Data and TVS: 2348-2352Z



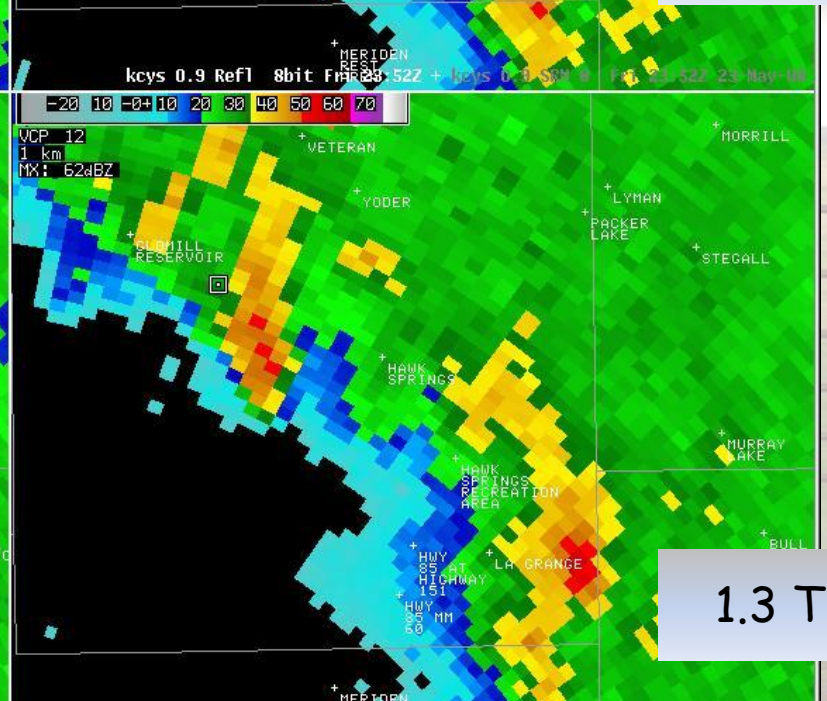
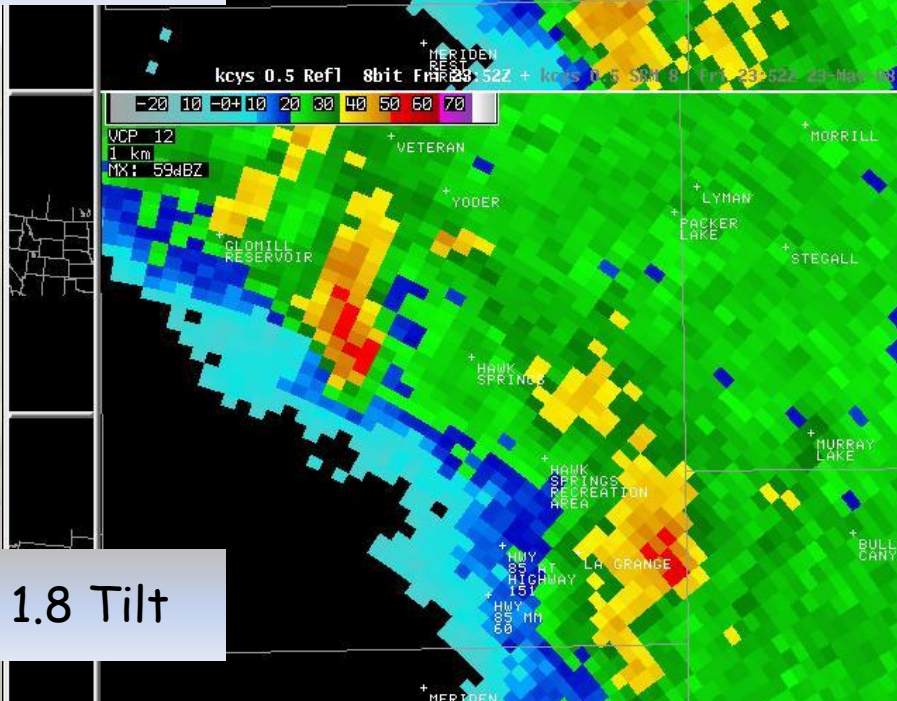
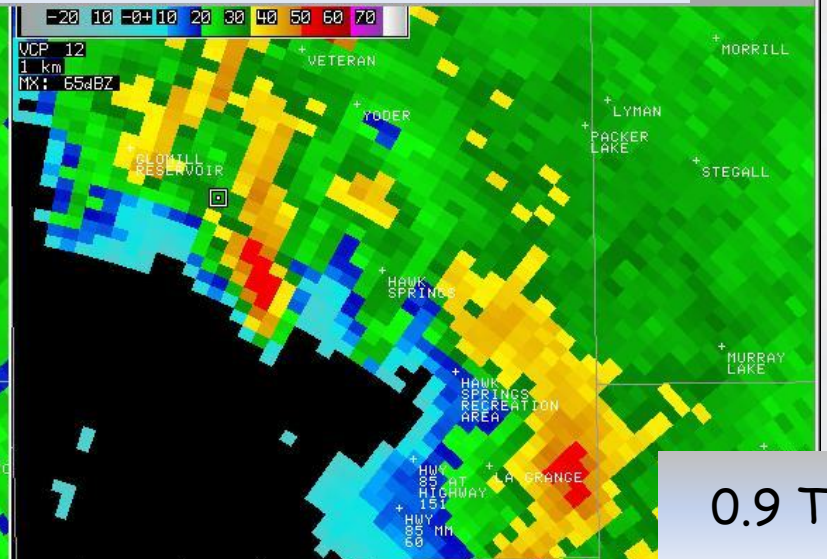
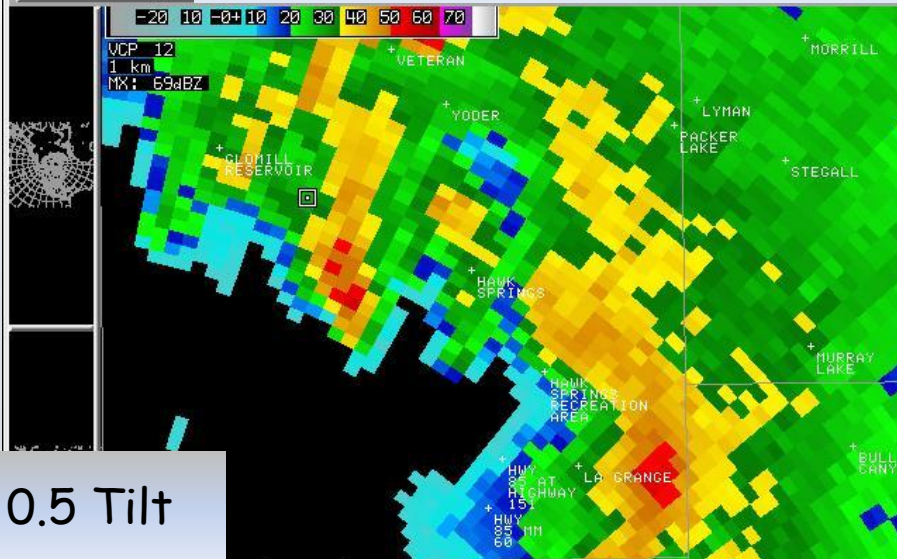
Reflectivity Data and TVS: 2348-2352Z

Forecast Systems Lab

File View Options

Valid time seq

WamGen

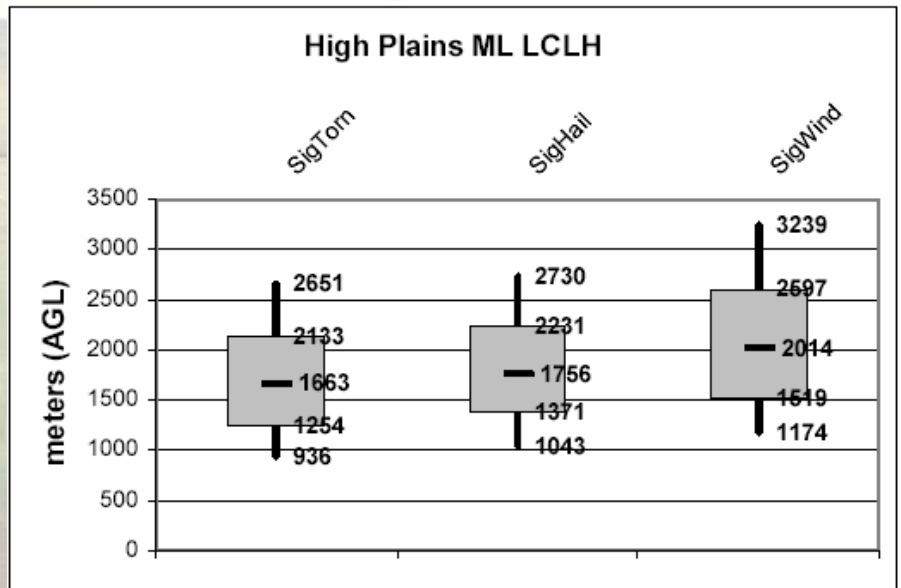
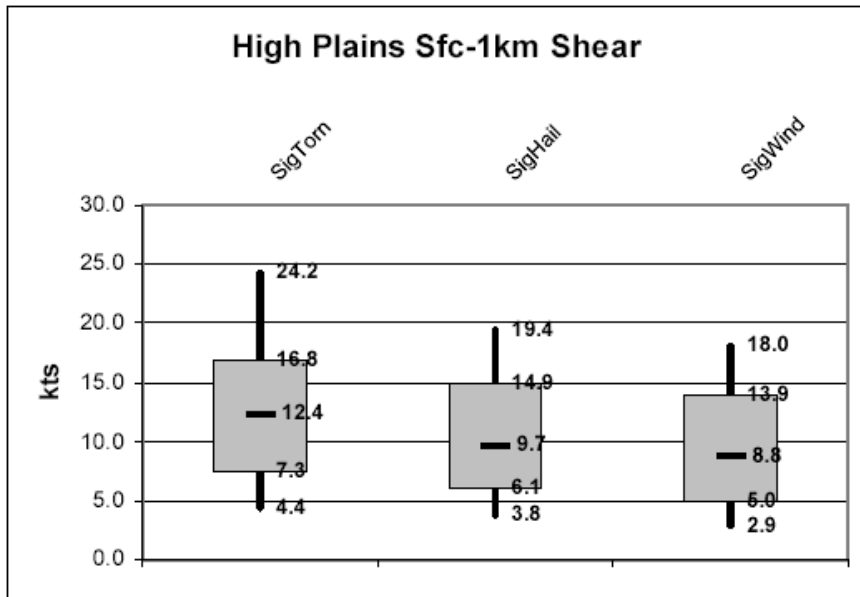
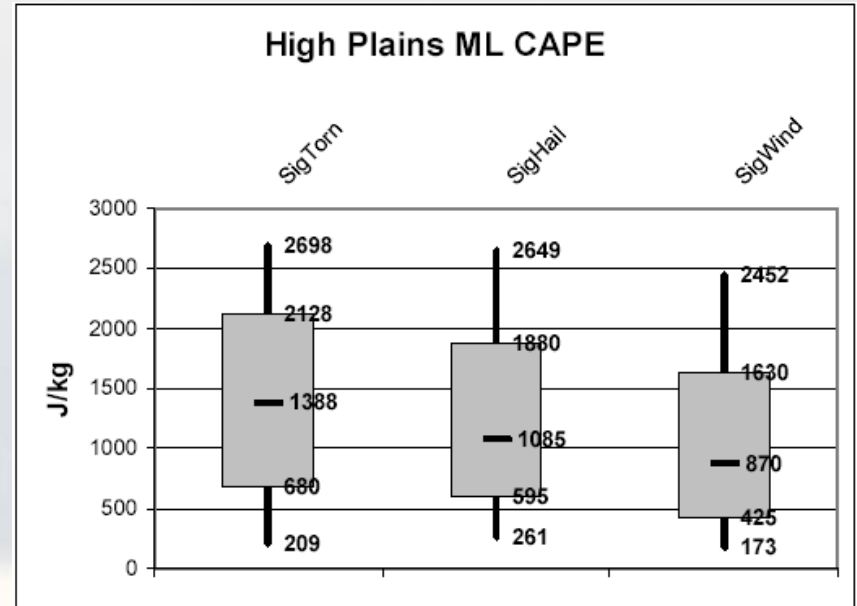
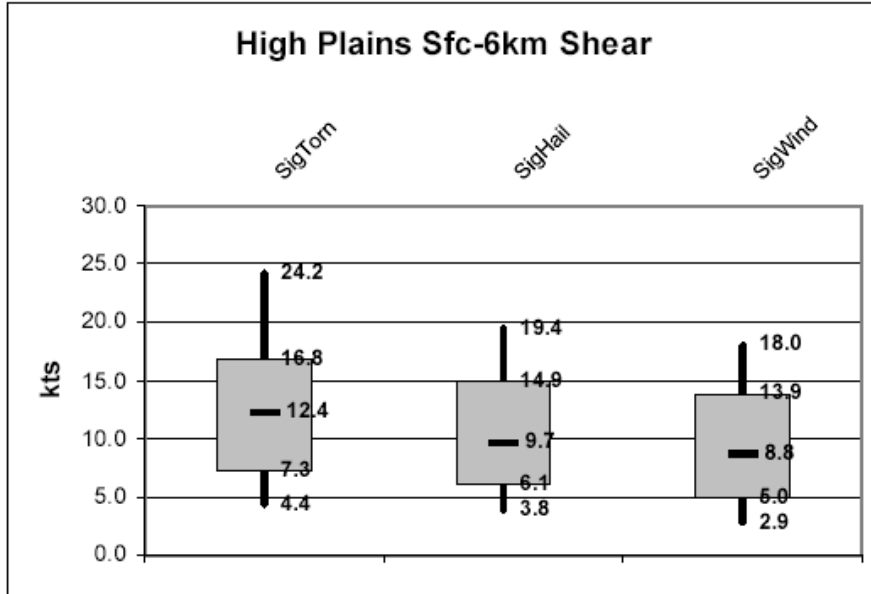




ings (Courtesy of Matt Bunkers)



Geographical Comparisons



Radar-Hail Technique

- Hail sizes ranged from nickel to golf ball on 22-23 May
 - Picture of hail damage indicates potential for baseball
- Strongly sheared environments does not necessarily favor the Donovan 1" hail technique
 - WER, meso



Hail Damage on May 22, 2008
(Courtesy of Jeff Mitros)

Summary

- SREF Probabilistic forecast provided guidance to forecasters for a potential severe weather outbreak
 - Main focus was slightly east of CWA
- SPC Mesoscale Analysis graphs showed hourly severe weather potential with such parameters as STP, VGP, etc
- Although low 0-1km shear/high ML LCLH environments typical for High Plains, it has been shown that significant outbreaks occur high 0-1km shear/low ML LCLH environments
 - Most forecasters were surprised about the strong tornadic supercells given the cool environment
- Futures projects
 - Examine the hail events across CYS CWA from 2007-2008 environments for close inspections of Donovan 1" hail technique