MPEX Analyses with Dropsondes

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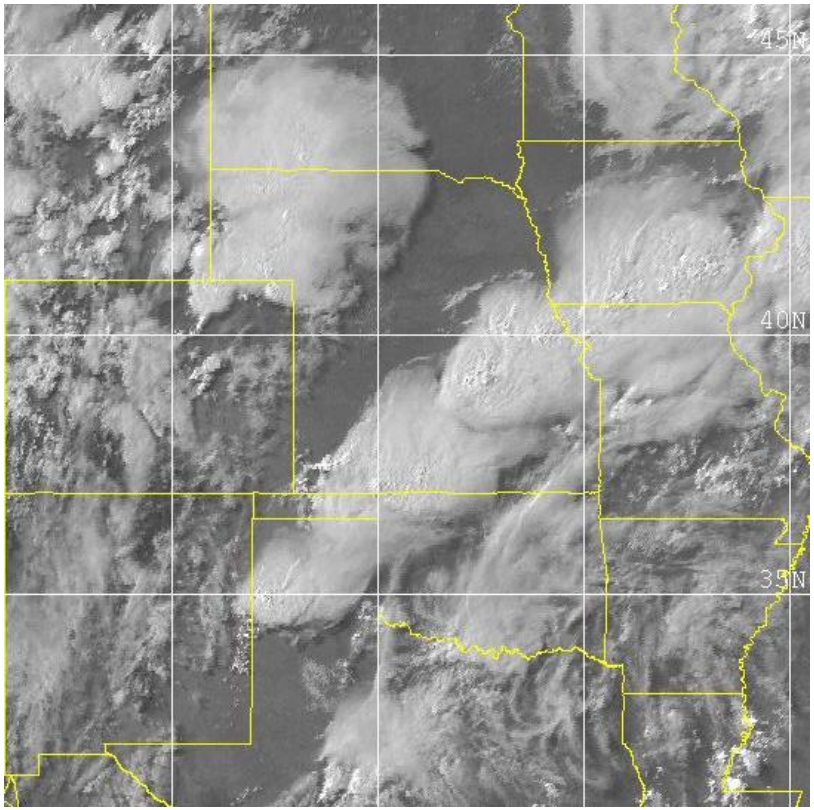
MPEX Workshop 19 November 2013

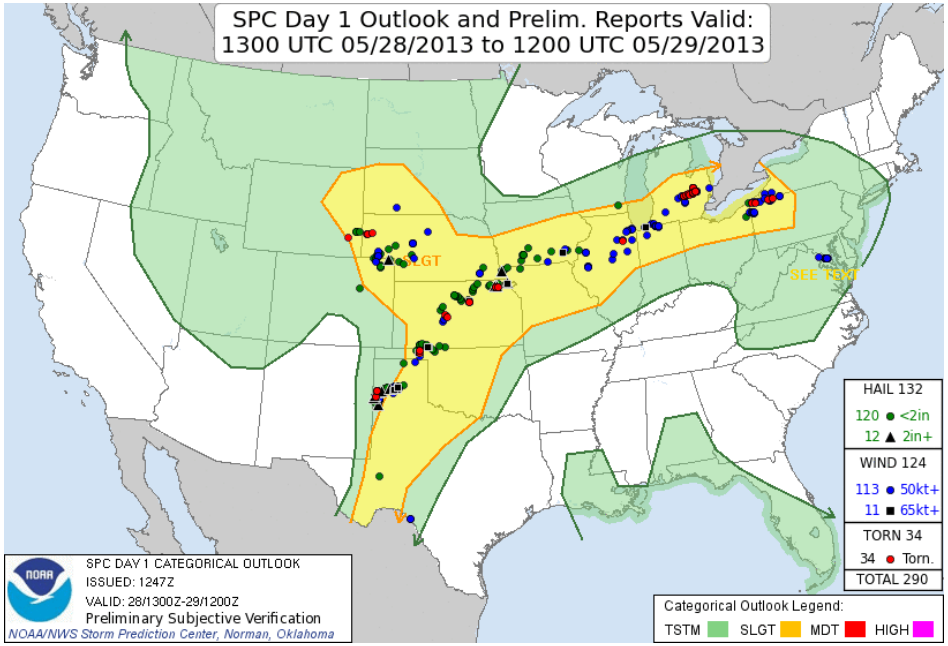
Purpose

- Use MPEX observations for comparison with operational model analyses at 1200 UTC
  - Dropsondes, flight level data, MTP(?)
- Examine "triggering" disturbances and air mass stratification
- Identify persistent biases/errors in operational model analyses
- Investigate how these errors may impact convective forecasts for 6–24 h lead times

Example Case: 28 May 2013

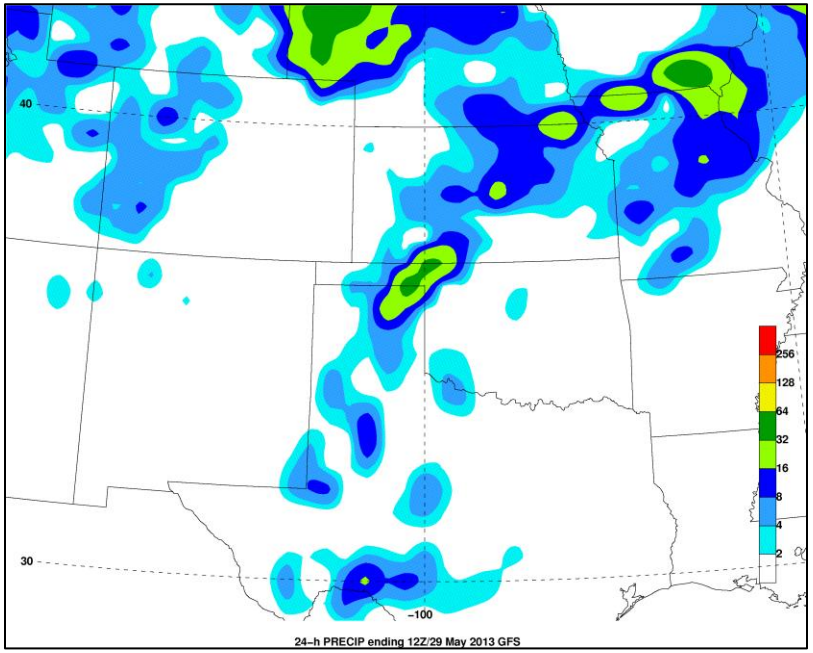
GOES-15 VIS: 00Z/29 May 2013



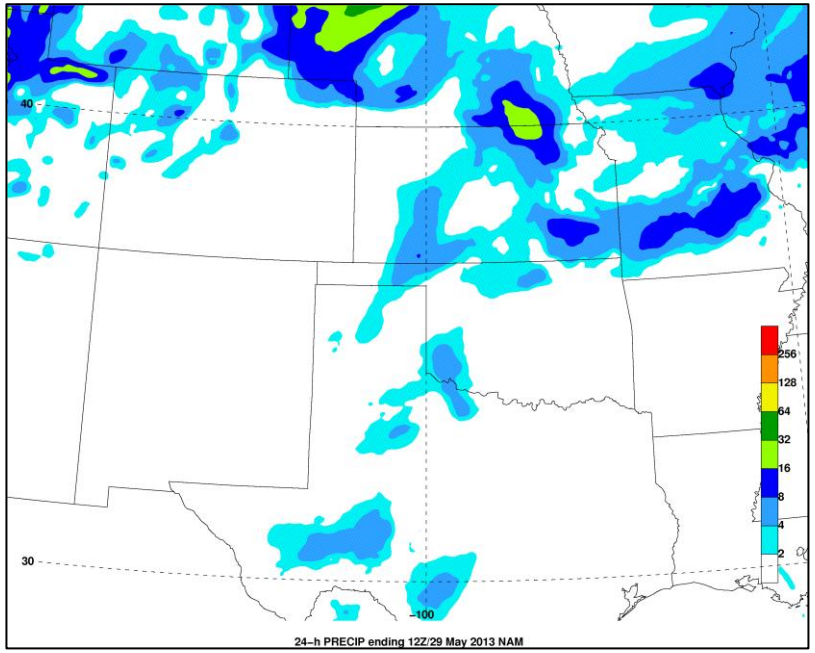


- **Severe convection developed from Iowa to Texas Panhandle along front and dryline as upper-level features emerged from the Intermountain West**

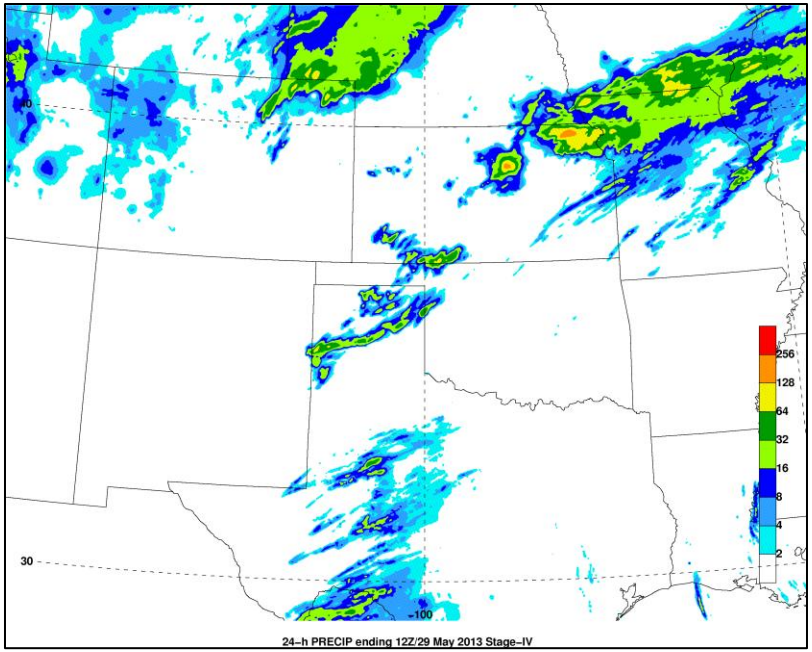
NCEP GFS



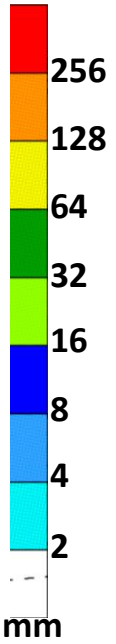
NCEP NAM



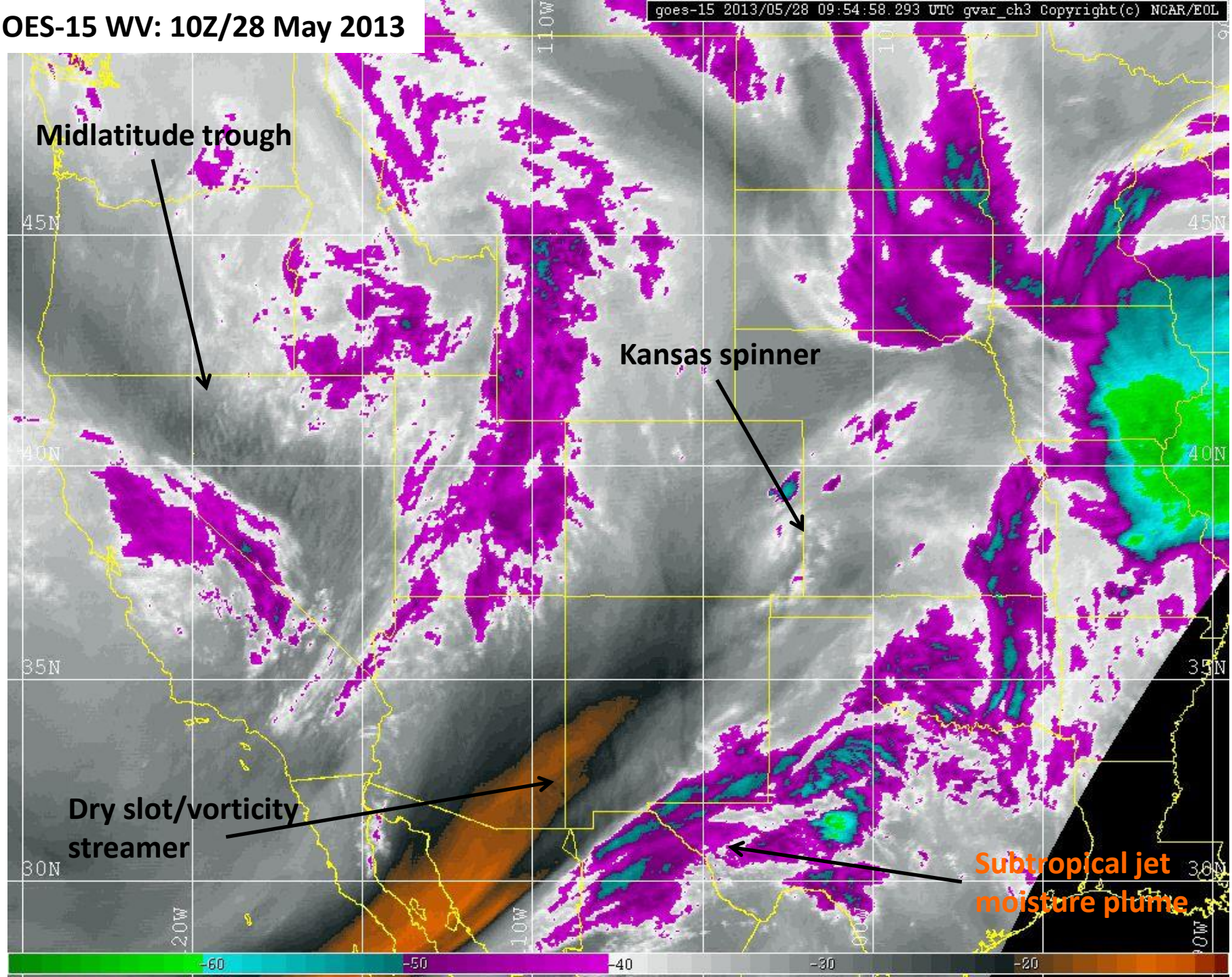
Stage-IV



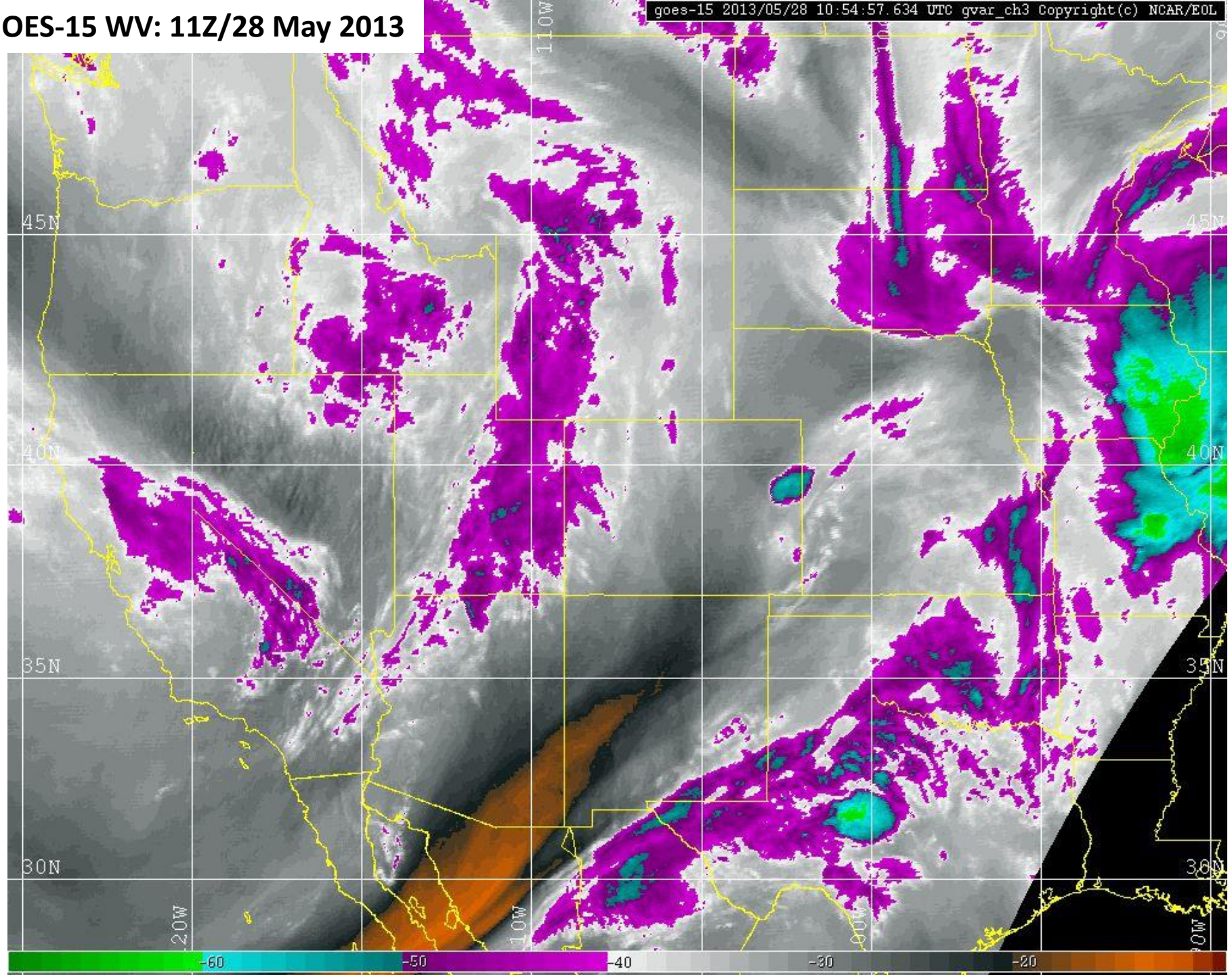
24-h total rainfall (mm)
12Z/28–29 May 2013



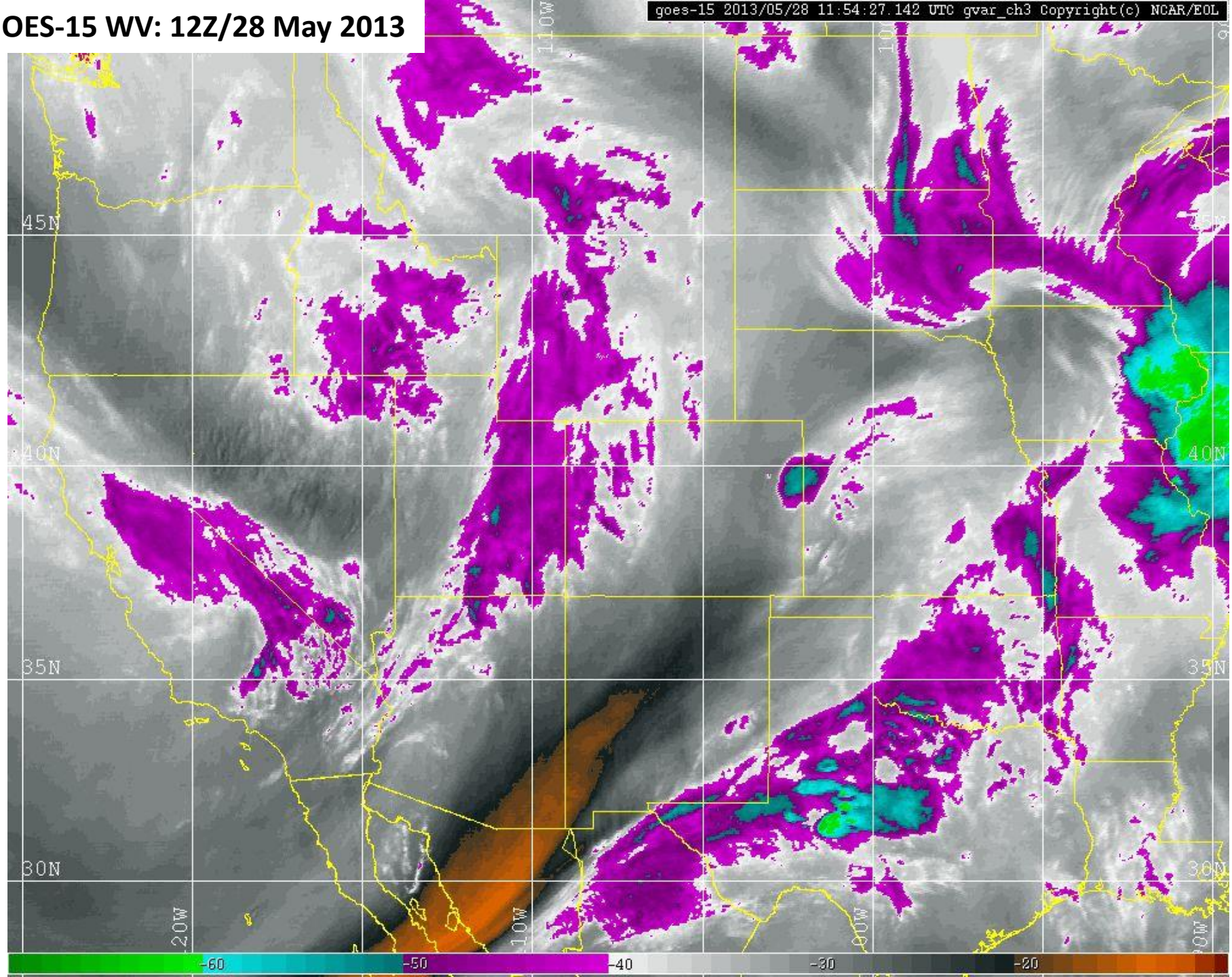
GOES-15 WV: 10Z/28 May 2013



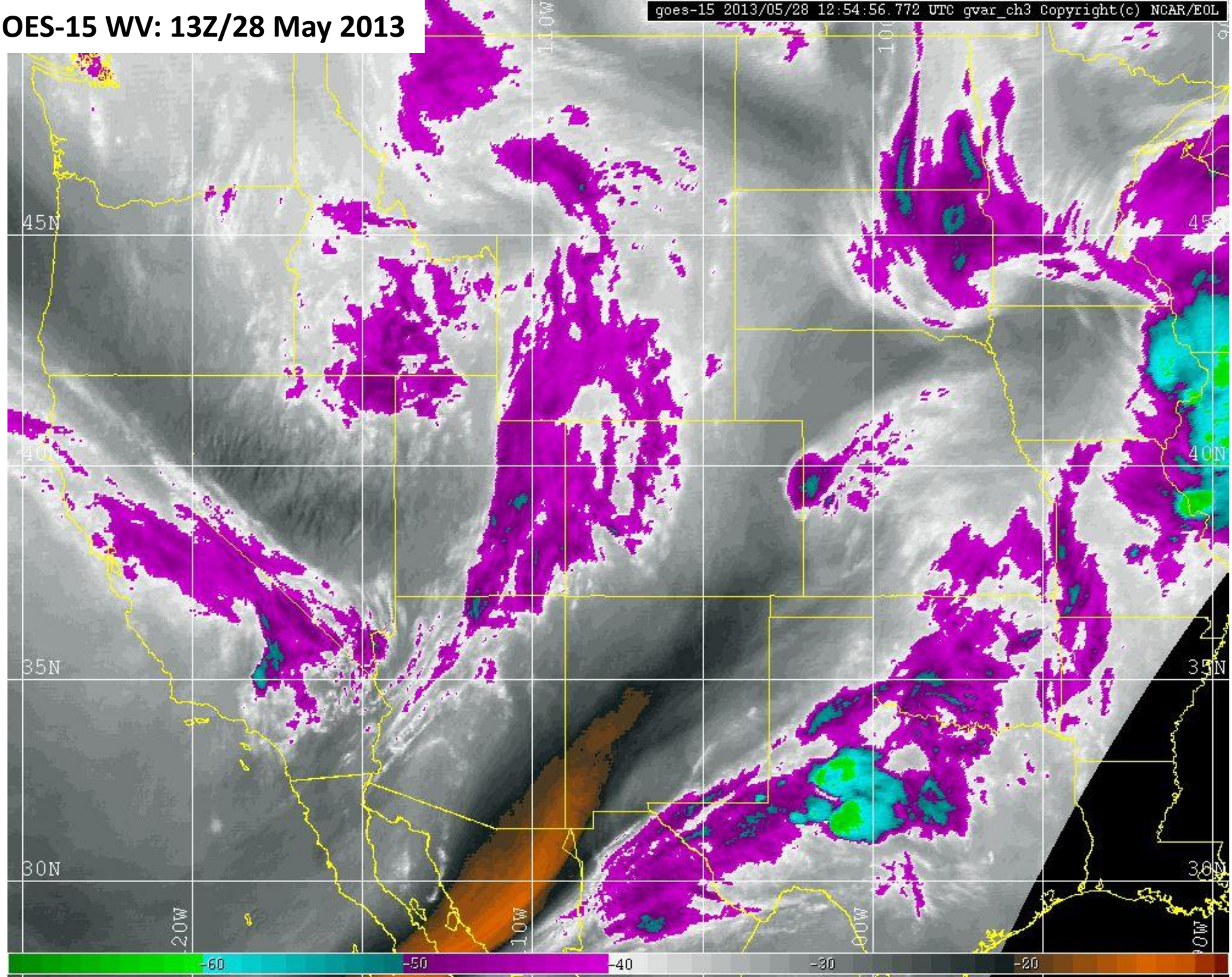
GOES-15 WV: 11Z/28 May 2013



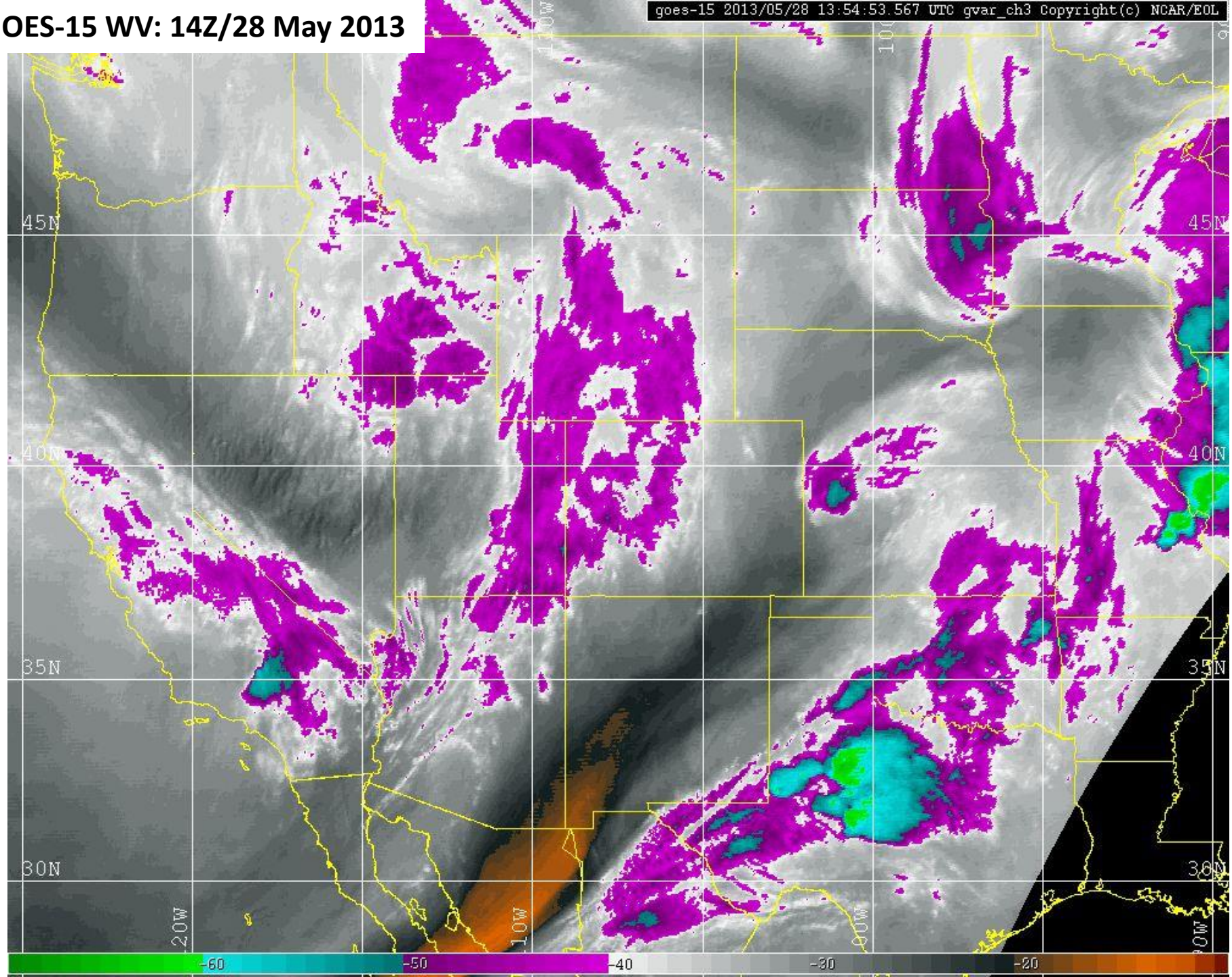
GOES-15 WV: 12Z/28 May 2013



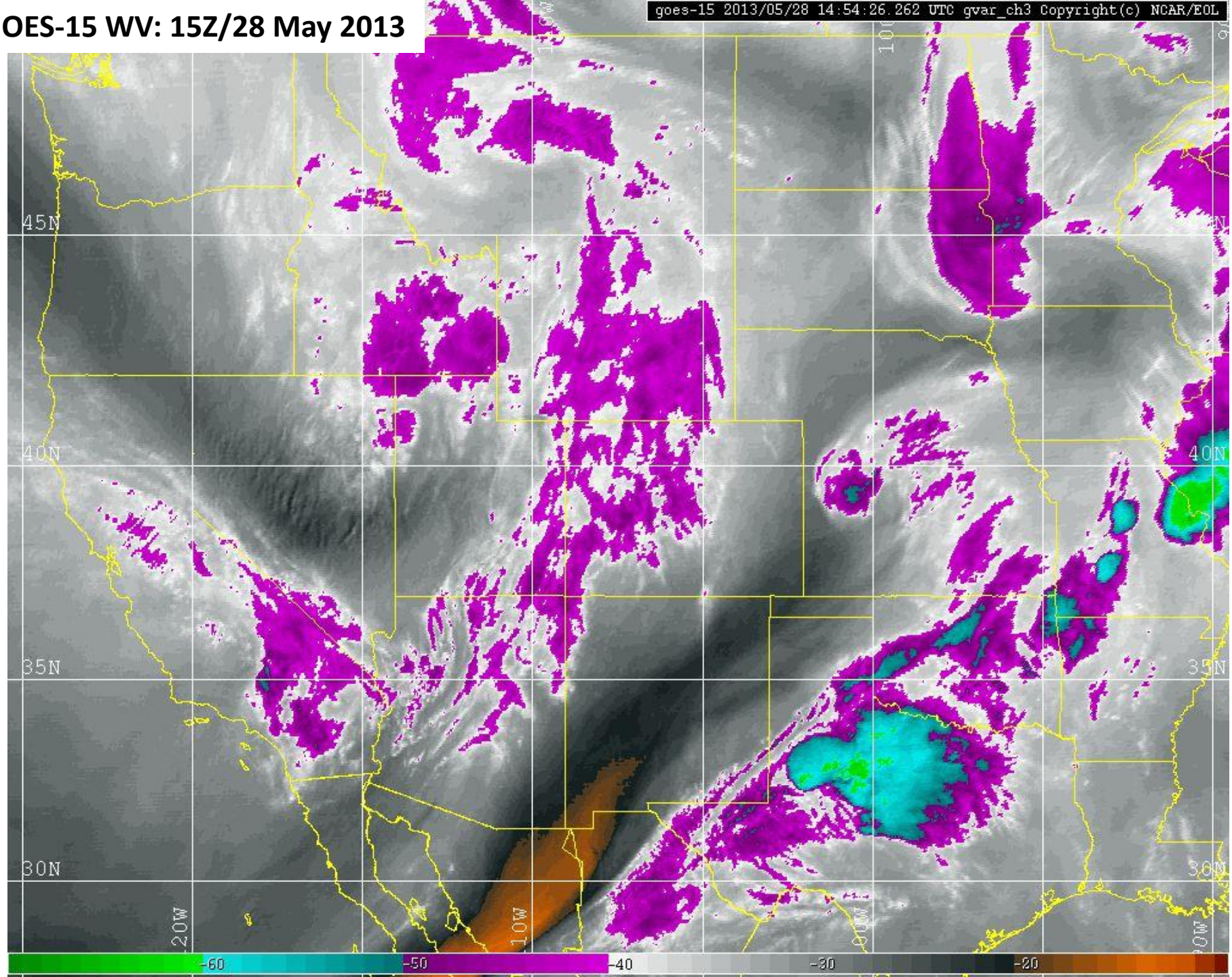
GOES-15 WV: 13Z/28 May 2013



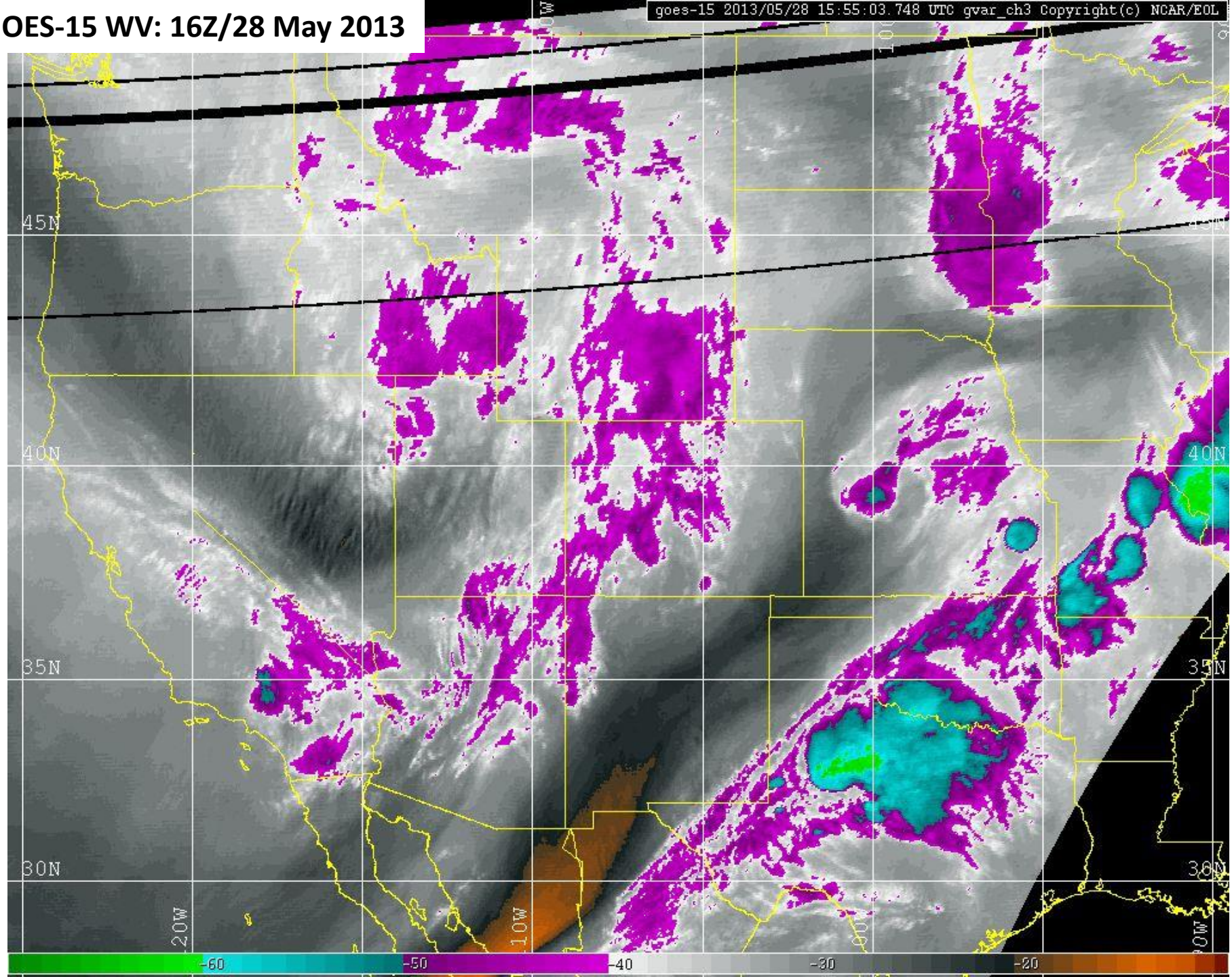
GOES-15 WV: 14Z/28 May 2013



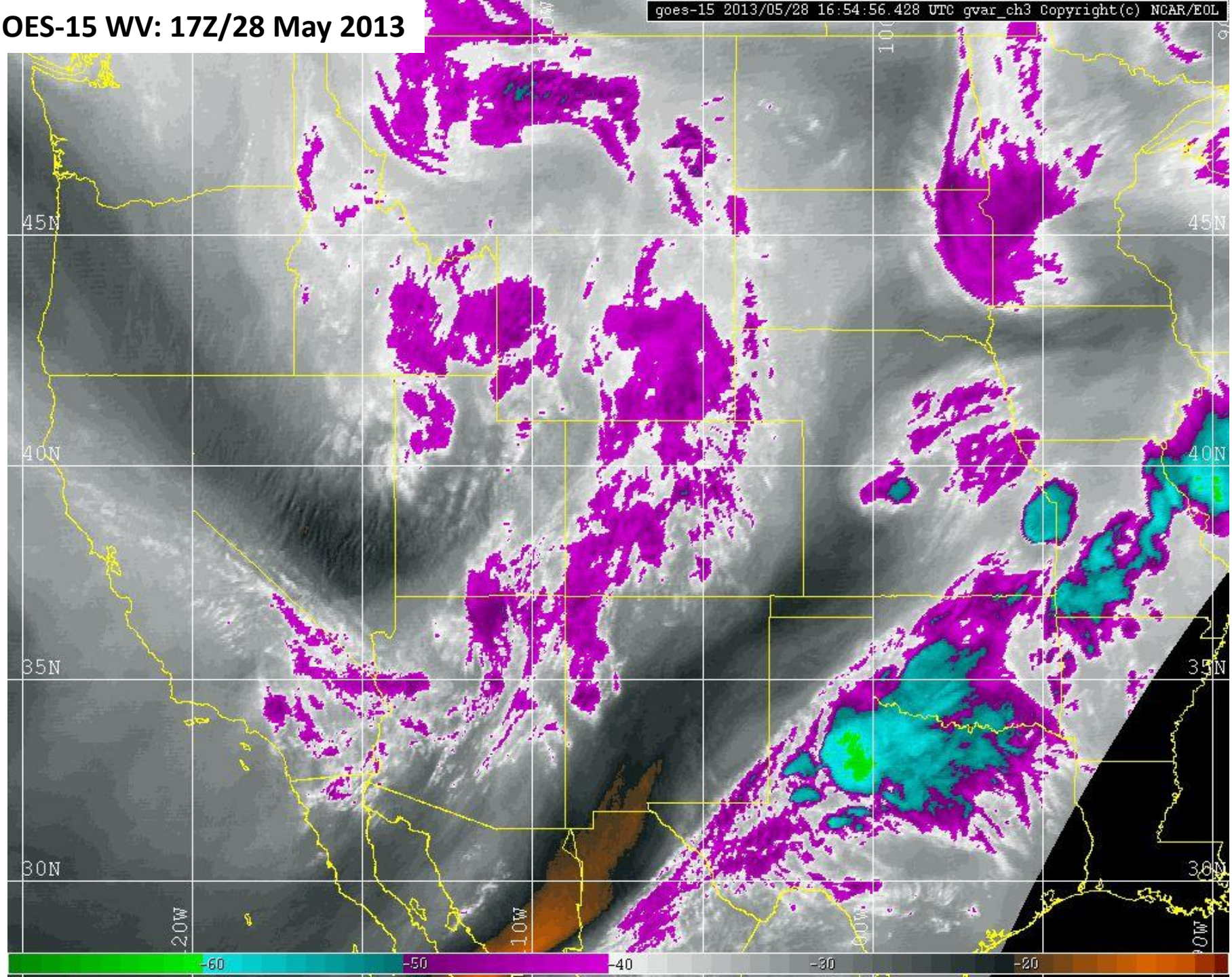
GOES-15 WV: 15Z/28 May 2013



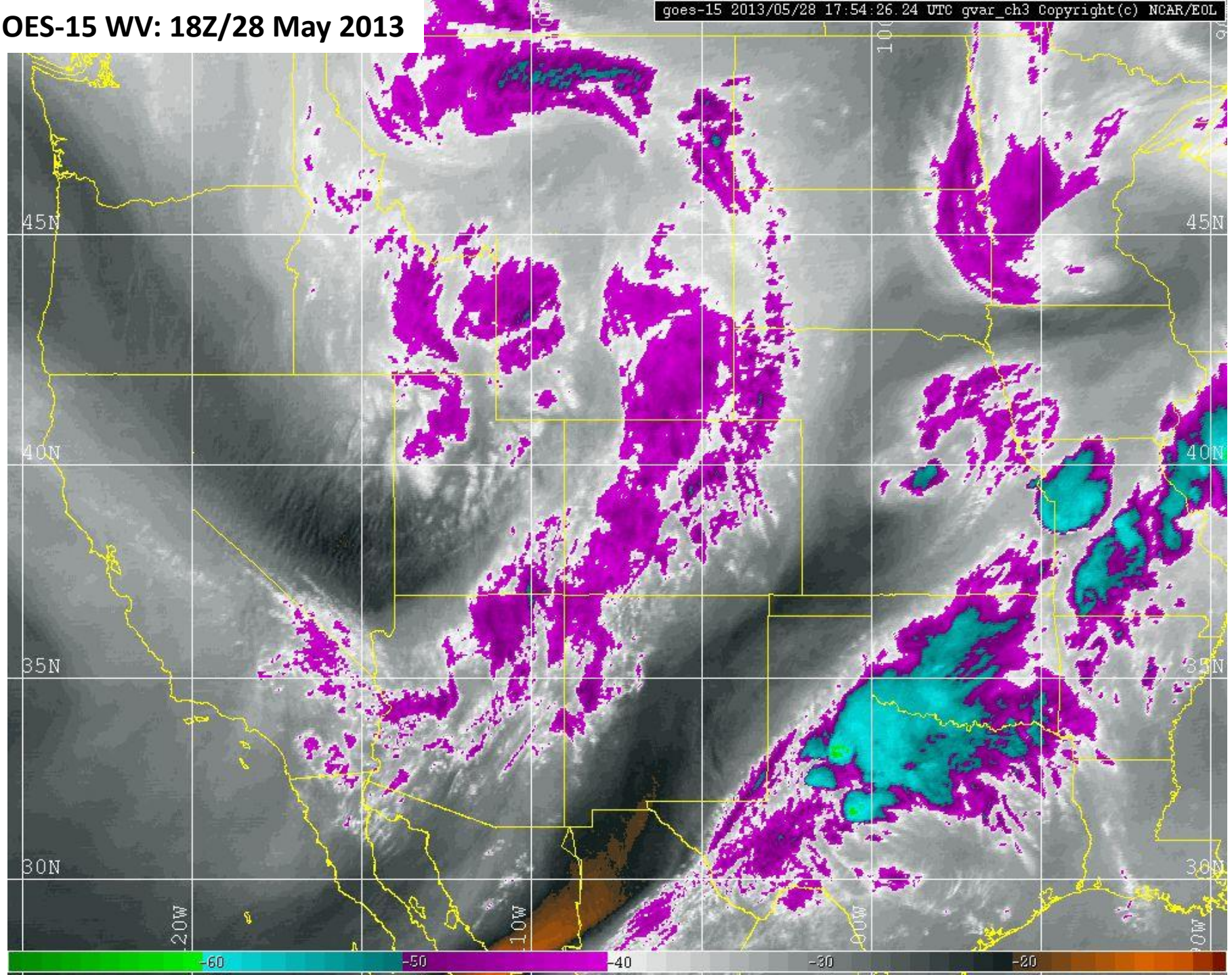
GOES-15 WV: 16Z/28 May 2013



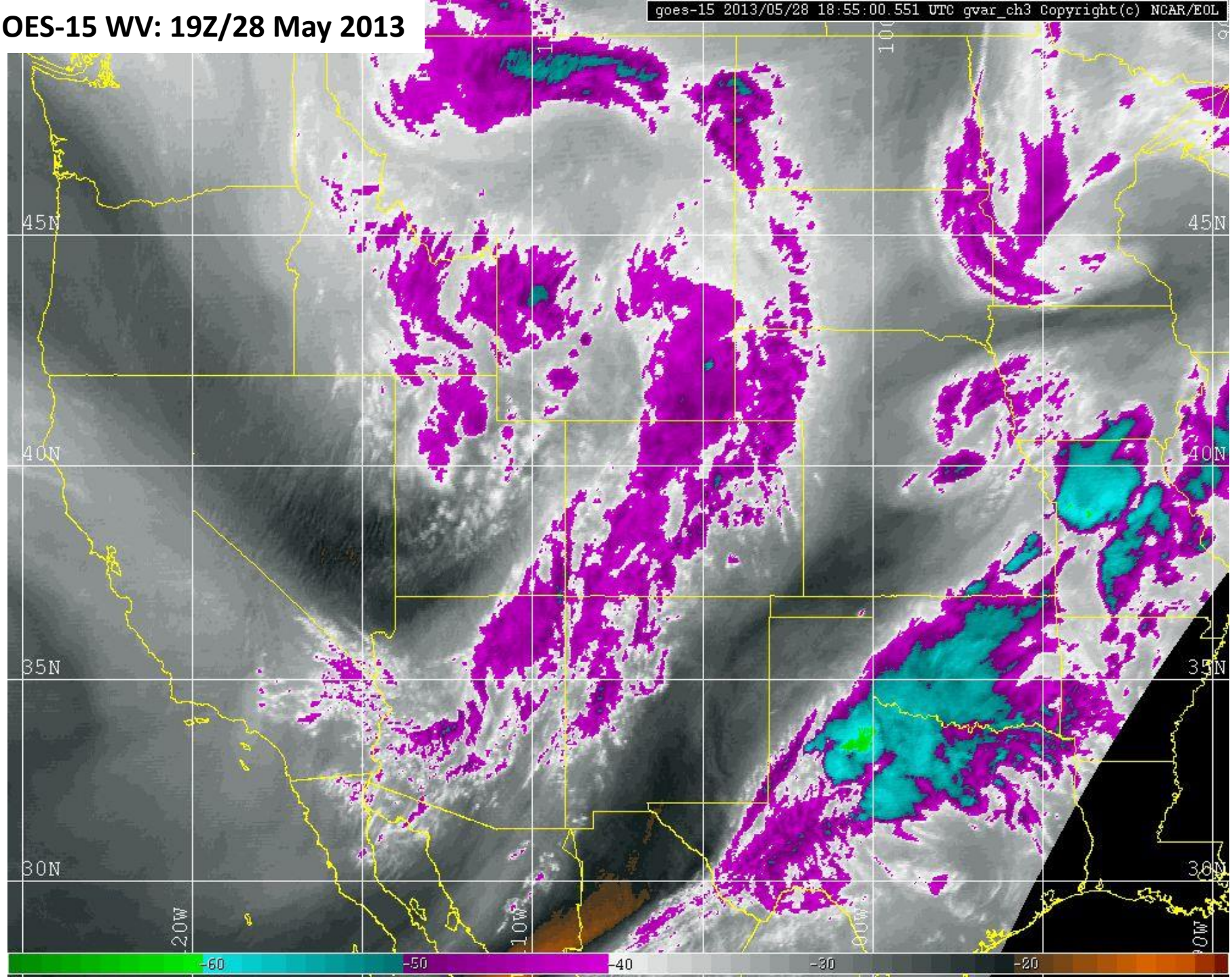
GOES-15 WV: 17Z/28 May 2013



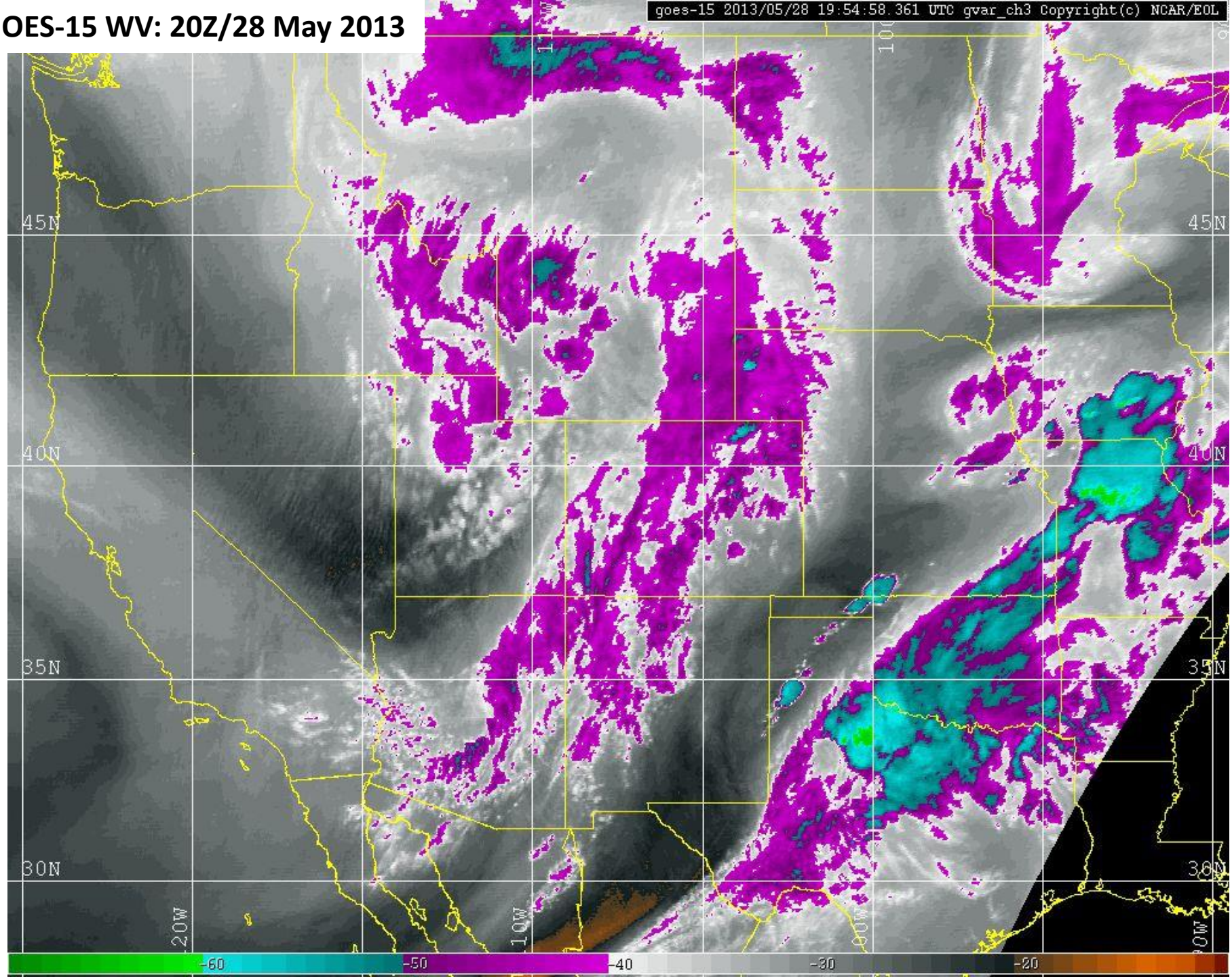
GOES-15 WV: 18Z/28 May 2013



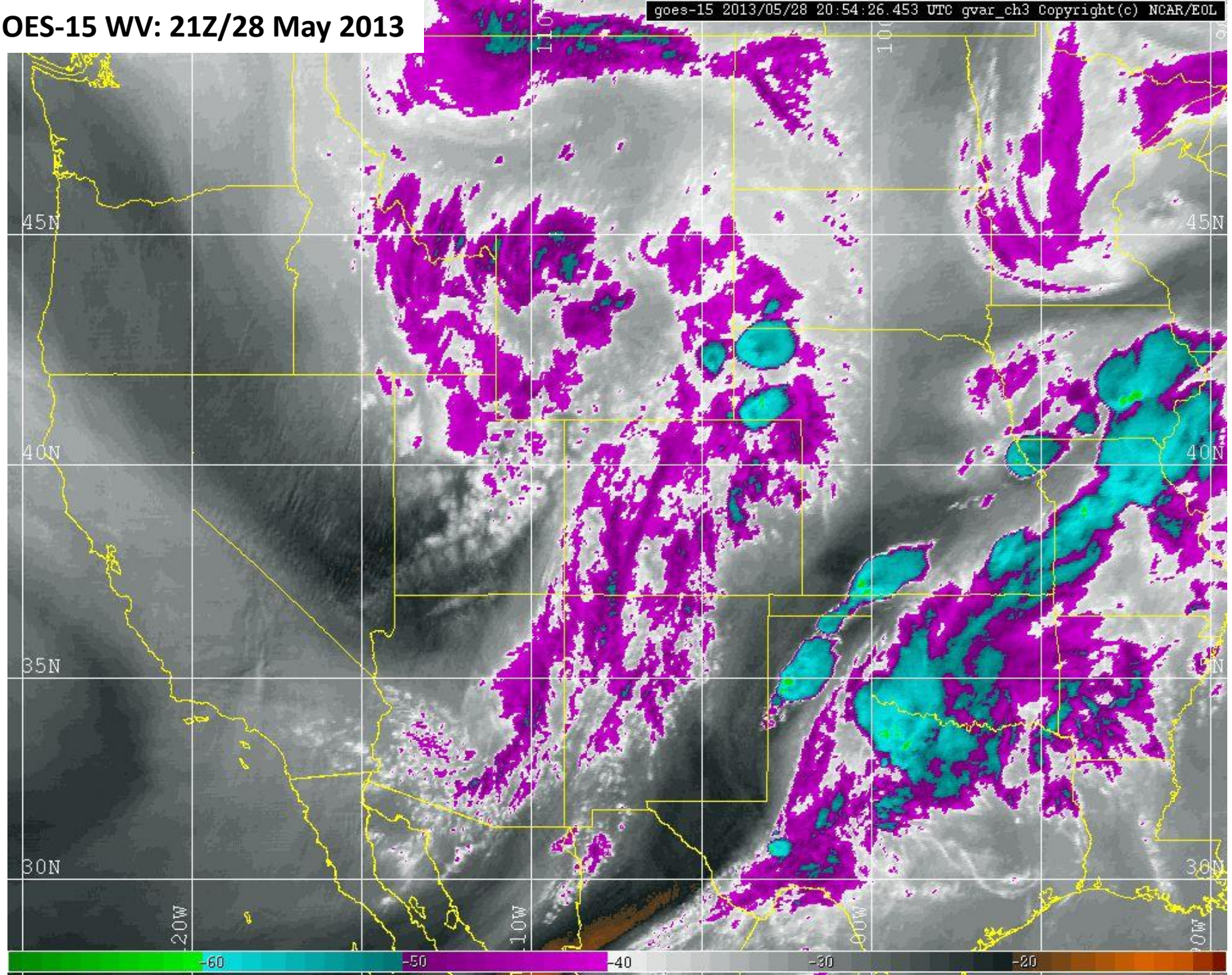
GOES-15 WV: 19Z/28 May 2013



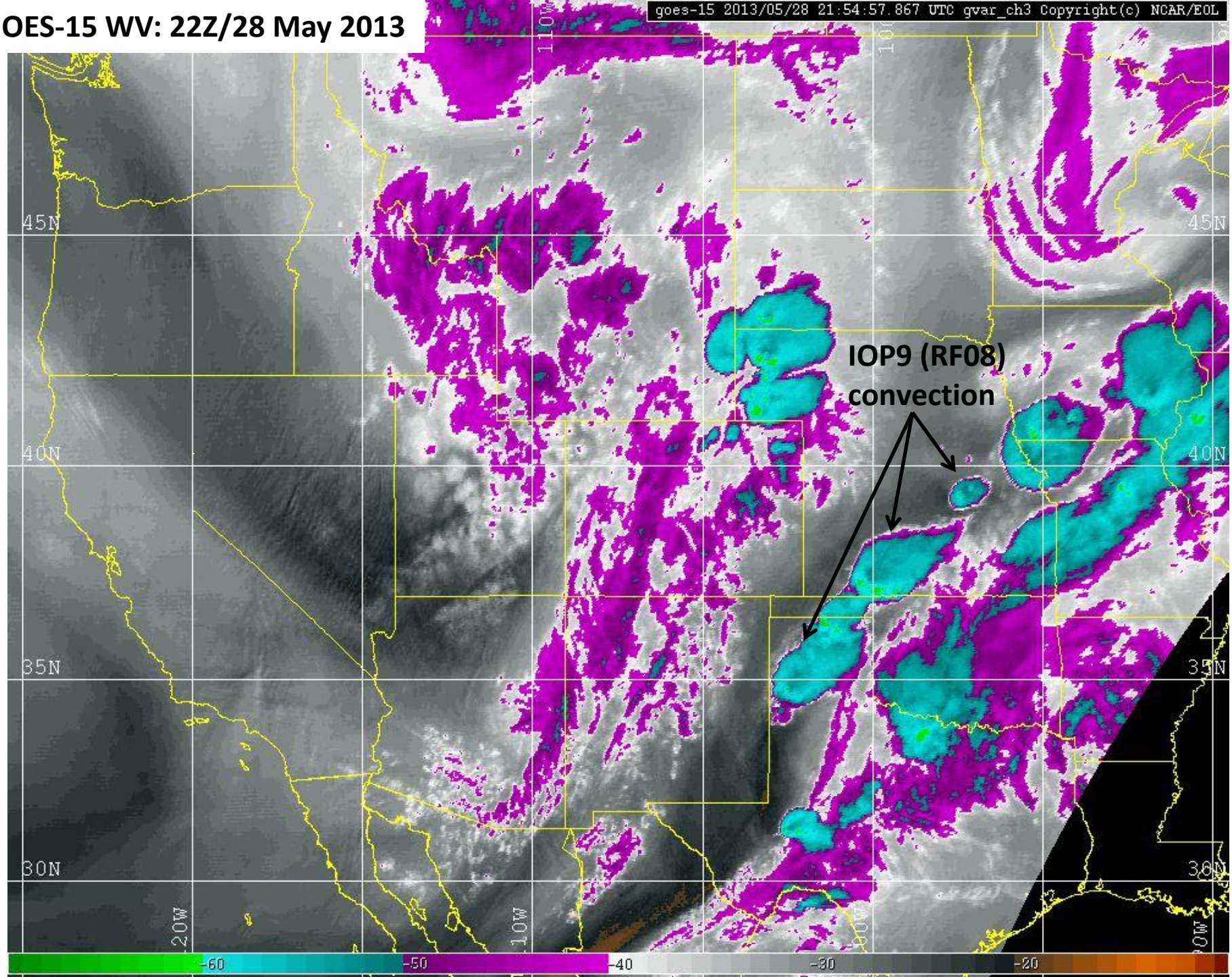
GOES-15 WV: 20Z/28 May 2013



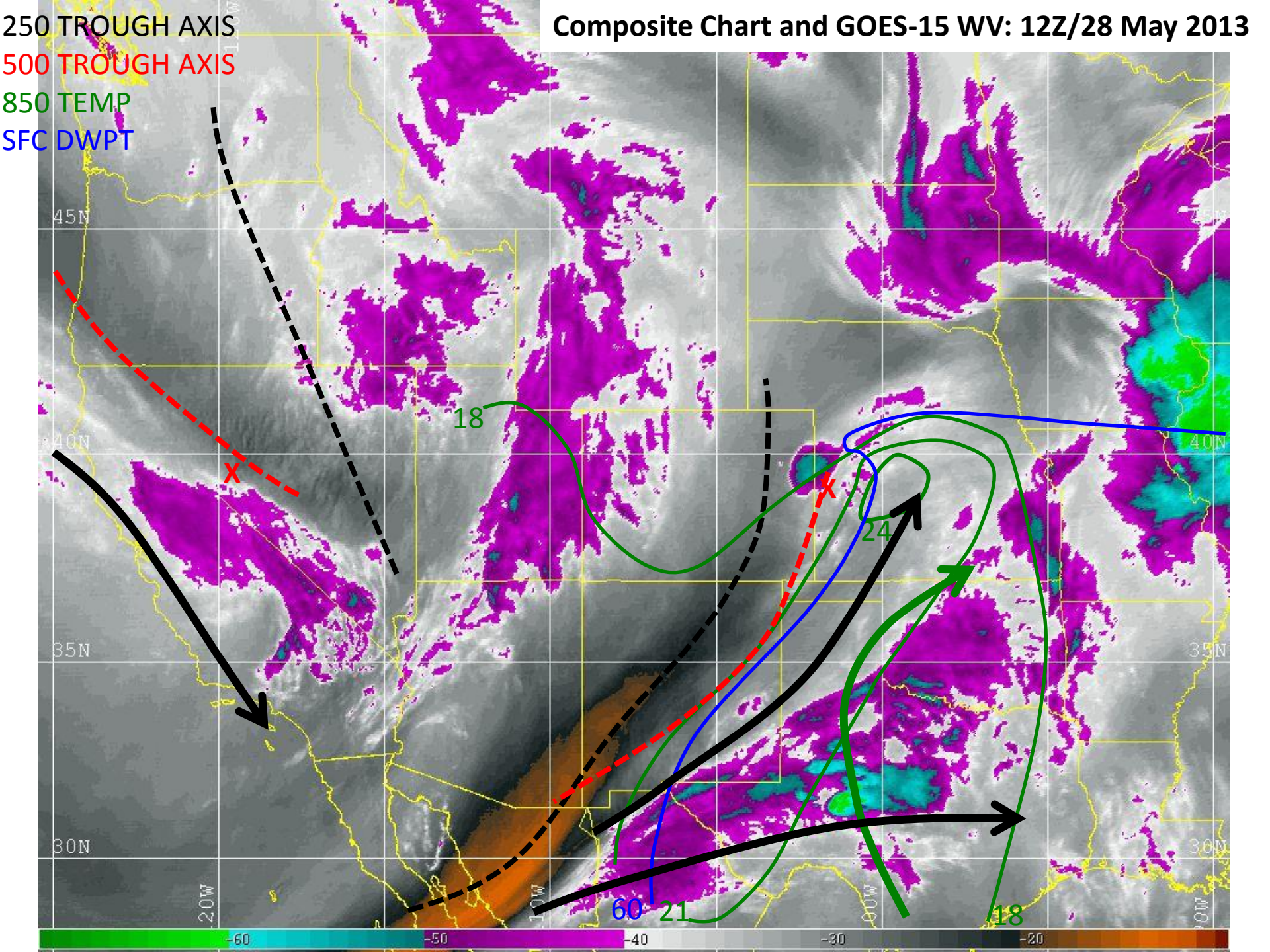
GOES-15 WV: 21Z/28 May 2013



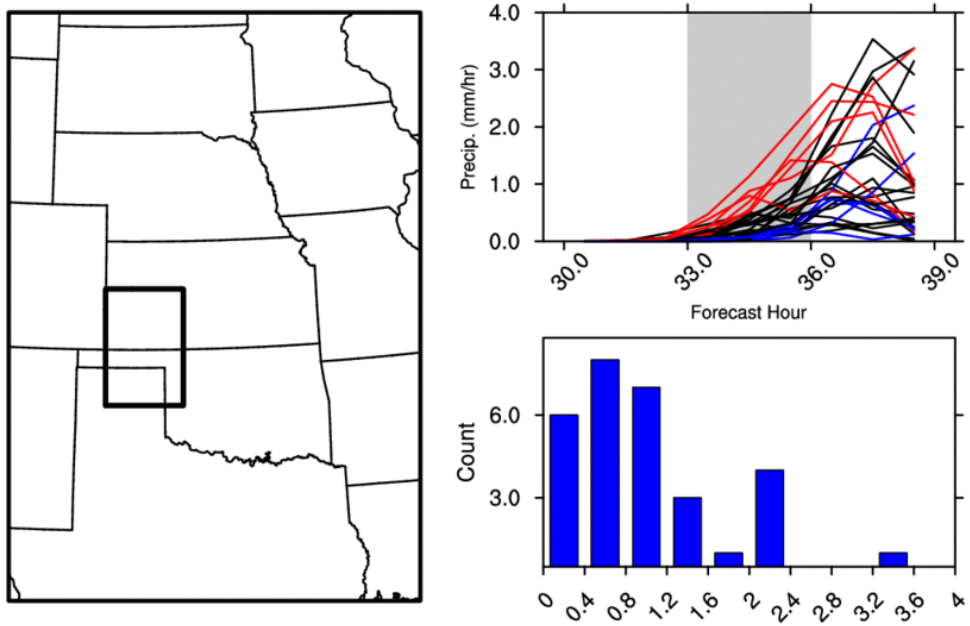
GOES-15 WV: 22Z/28 May 2013

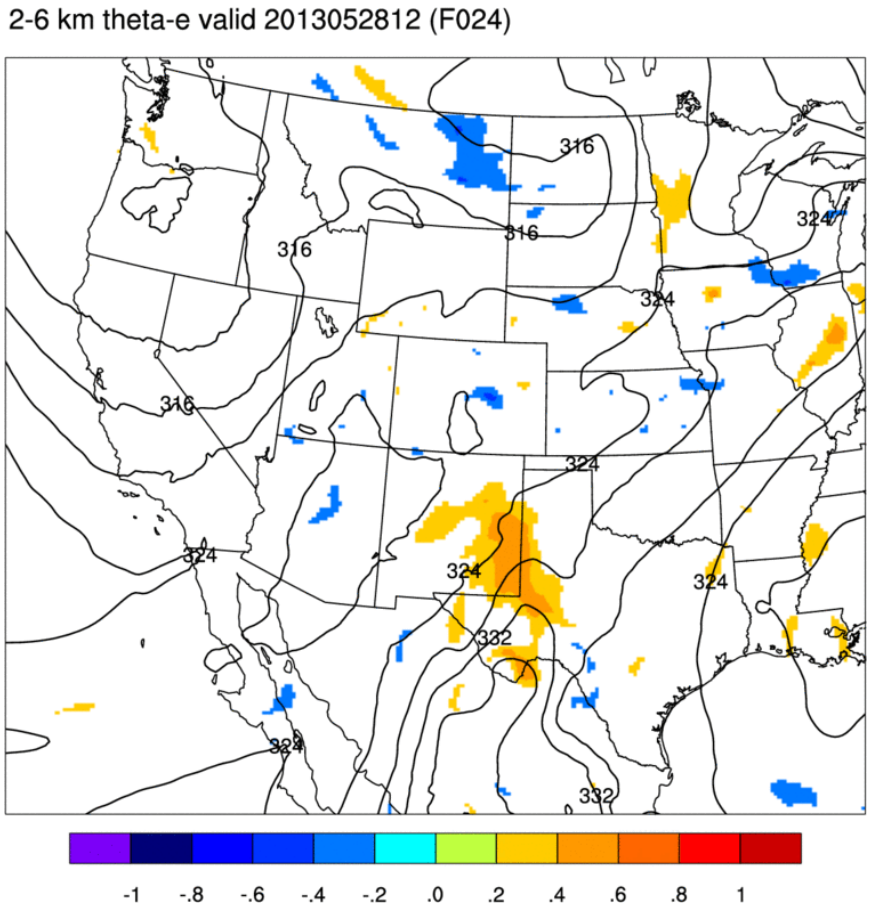


Composite Chart and GOES-15 WV: 12Z/28 May 2013



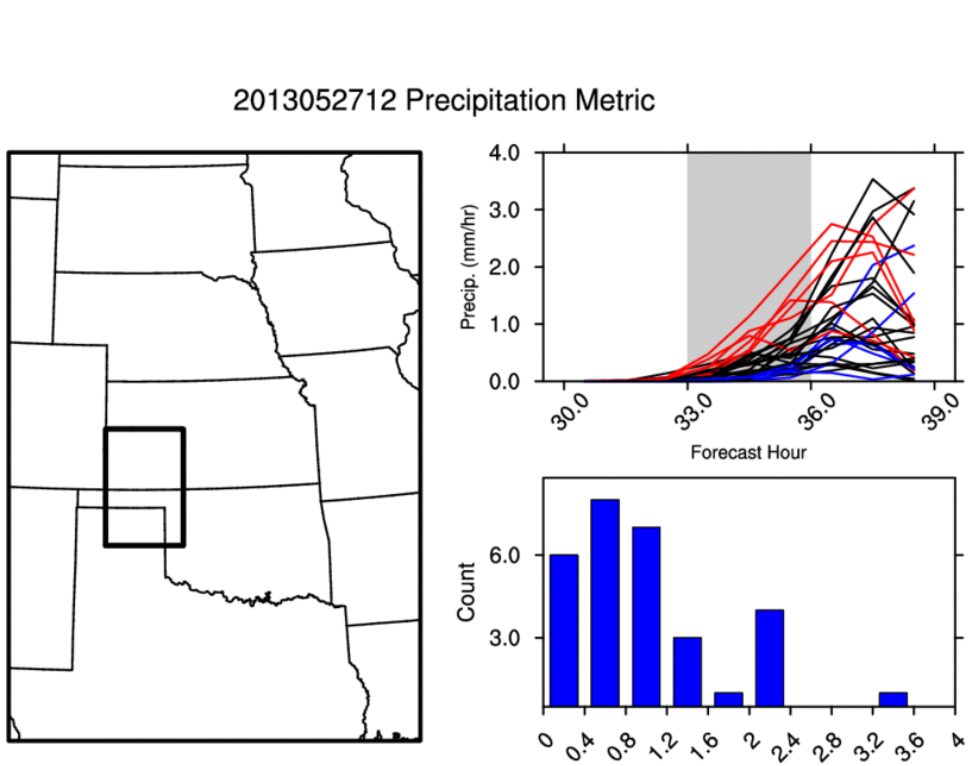
Ensemble Sensitivity: 12Z/27 May Init

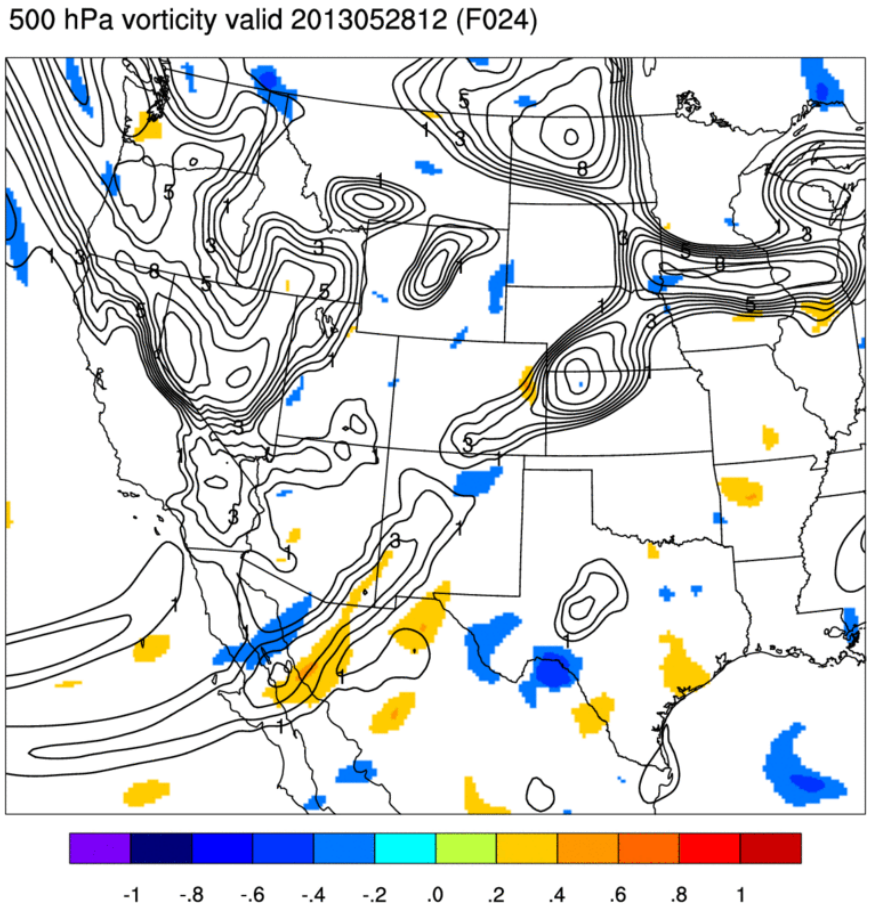




- **Goal of morning mission was to sample upper-level vorticity features and mid-tropospheric moisture over New Mexico**

Ensemble Sensitivity: 12Z/27 May Init

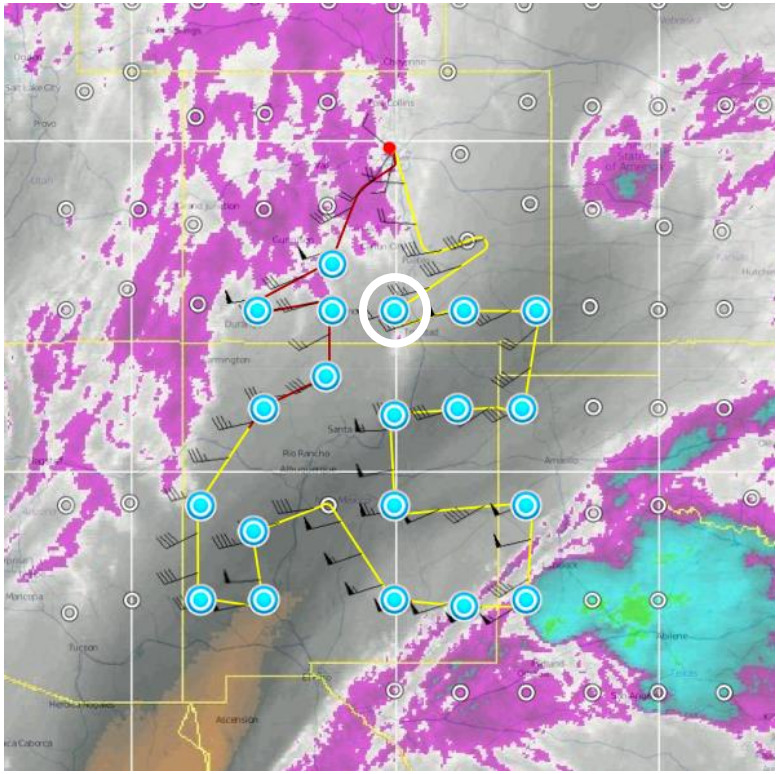




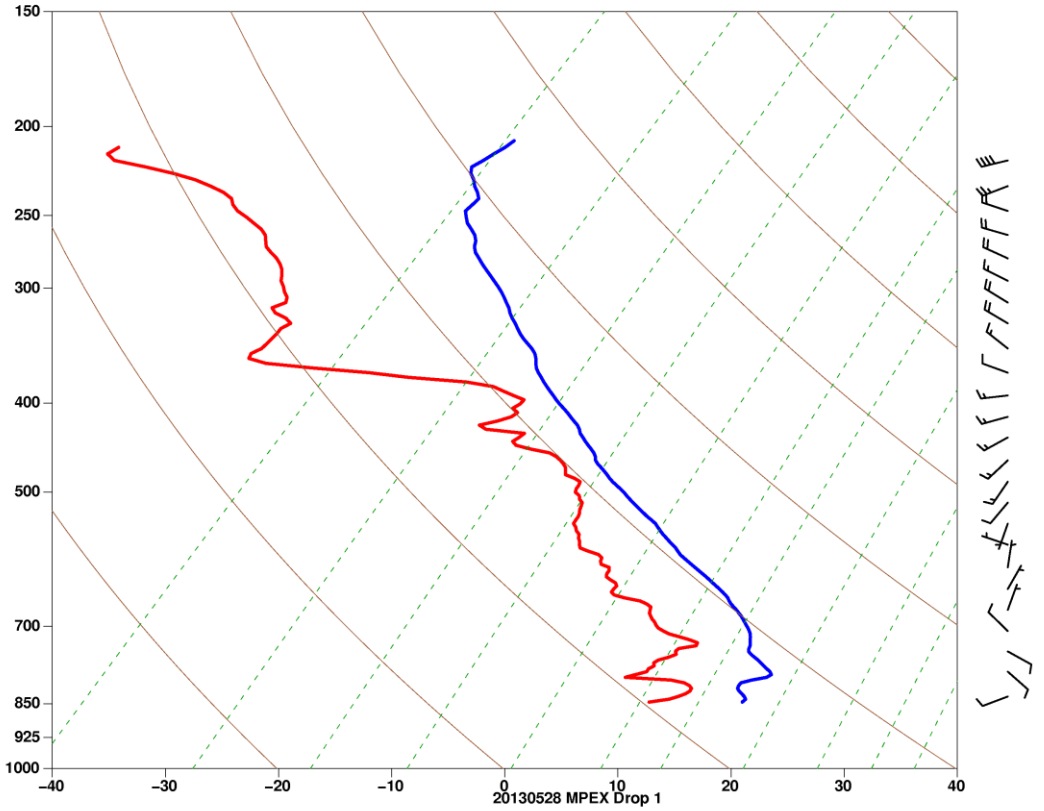
- **Goal of morning mission was to sample upper-level vorticity features and mid-tropospheric moisture over New Mexico**

Flight and Selected Drops

GOES-15 WV at 1454 UTC 28 May 2013

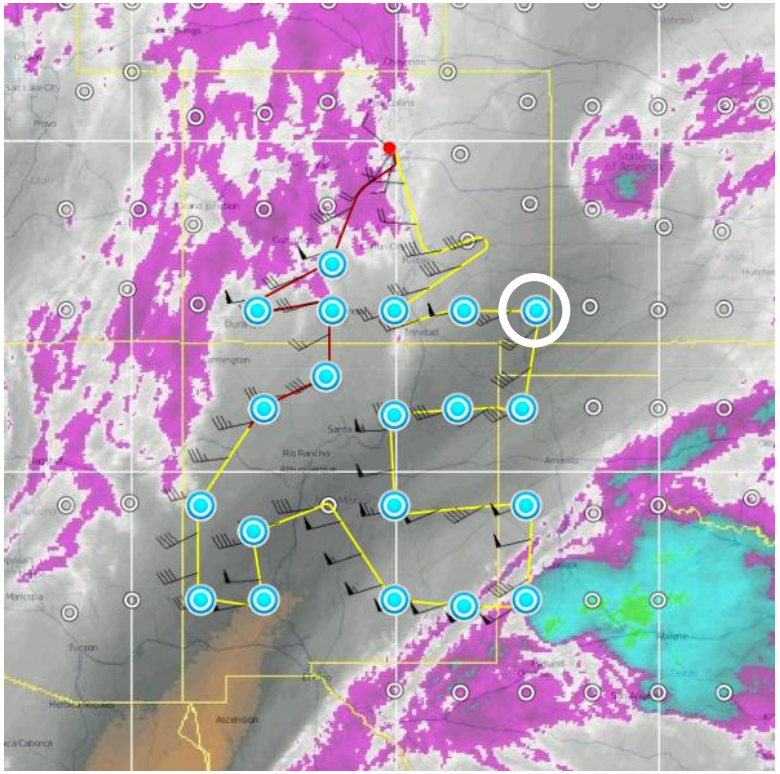


130528/1200 700011 DROP11 CAPE: 652 SLAT: 39 SLON: -104 **Drop 1**

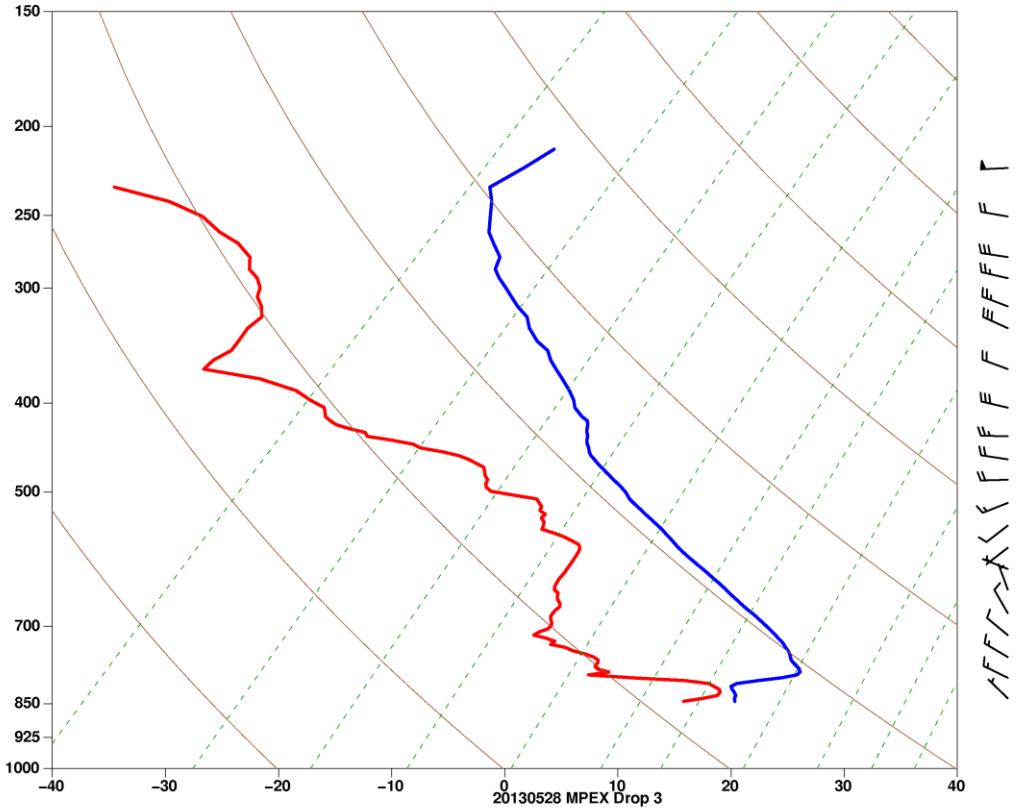


Flight and Selected Drops

GOES-15 WV at 1454 UTC 28 May 2013

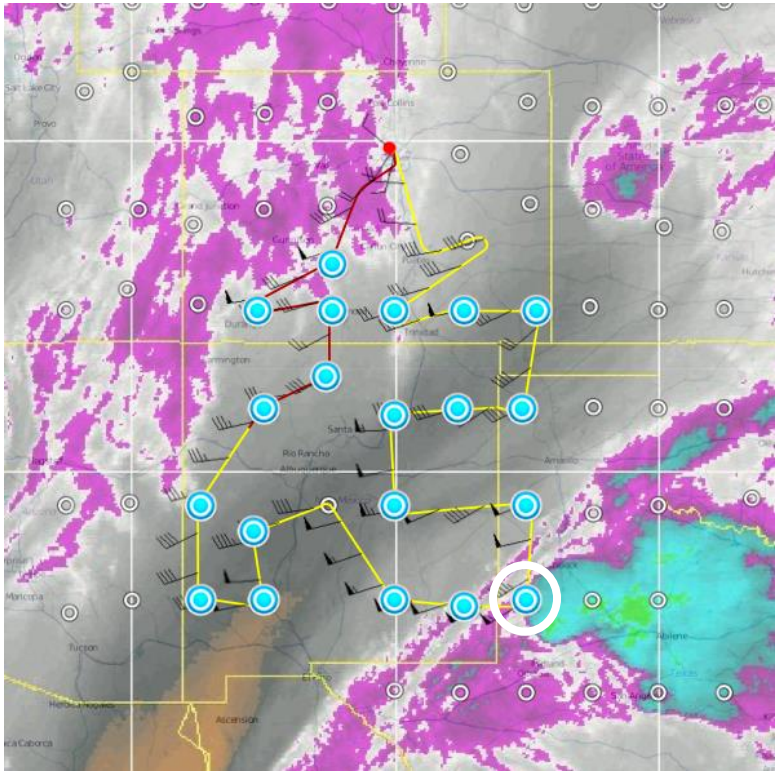


Drop 3

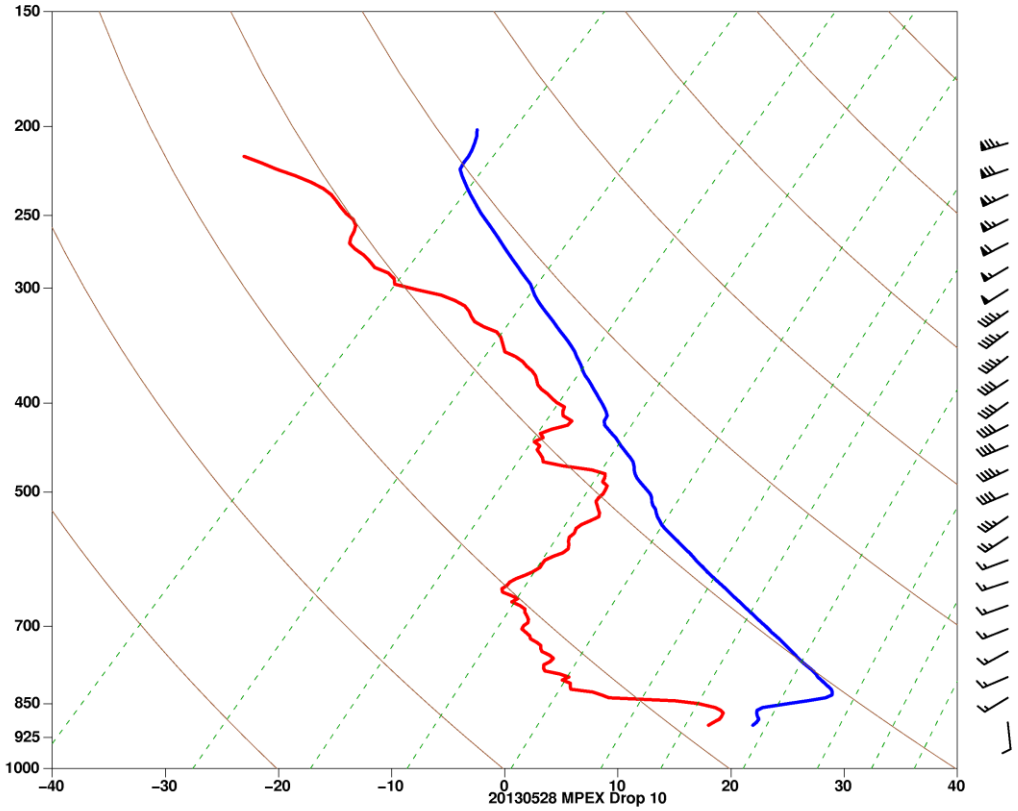


Flight and Selected Drops

GOES-15 WV at 1454 UTC 28 May 2013

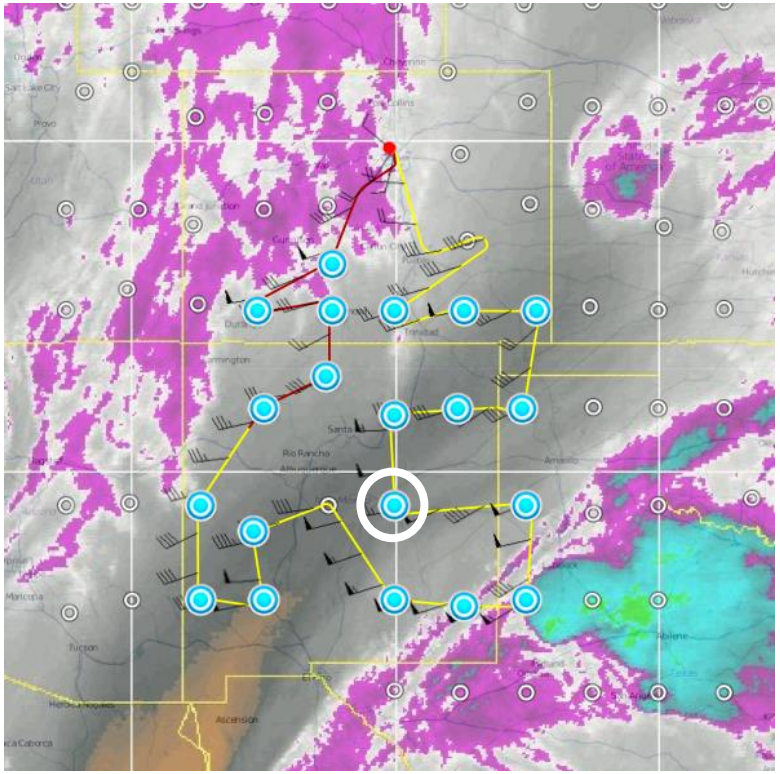


130528/1200 700020 DROP20 CAPE: 1102 SLAT: 33 SLON: -102 **Drop 10**

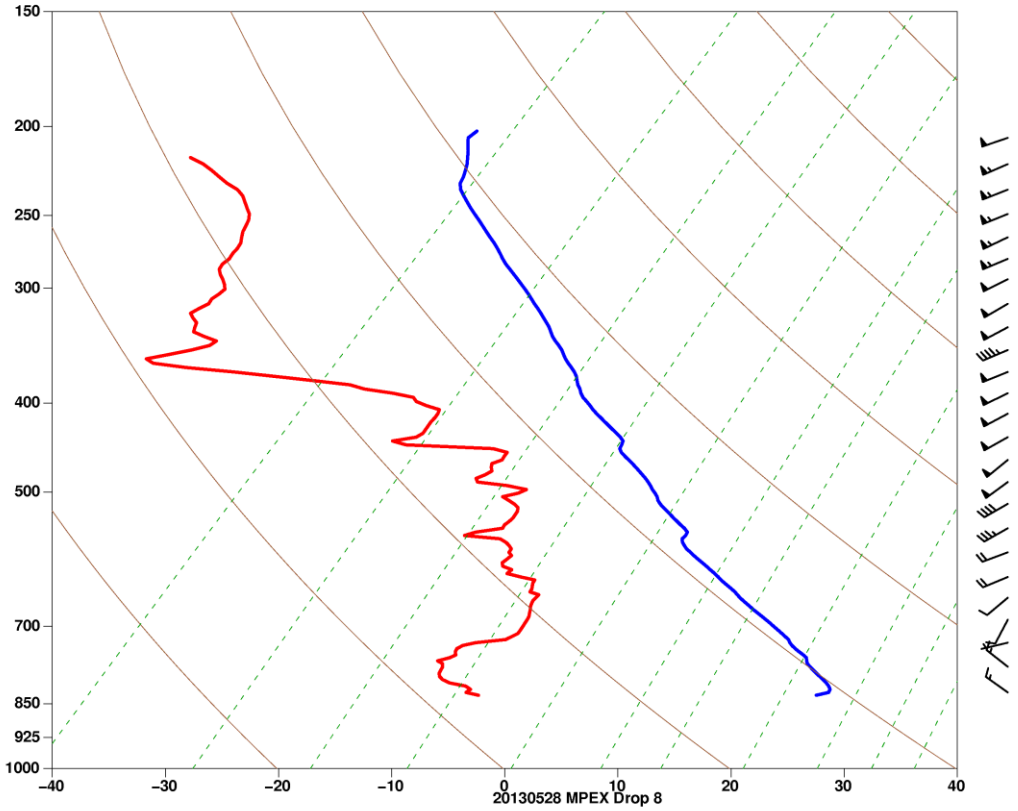


Flight and Selected Drops

GOES-15 WV at 1454 UTC 28 May 2013

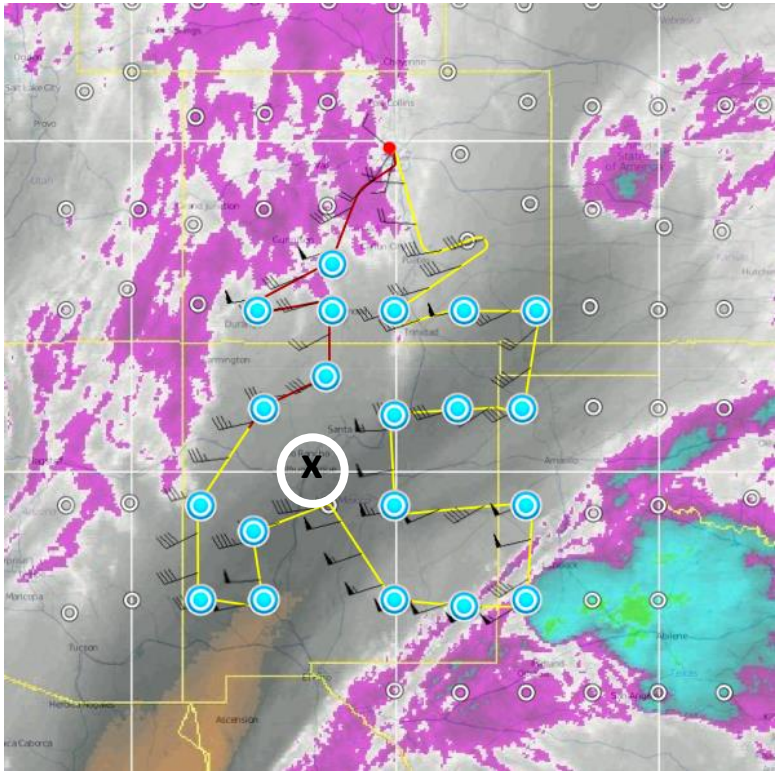


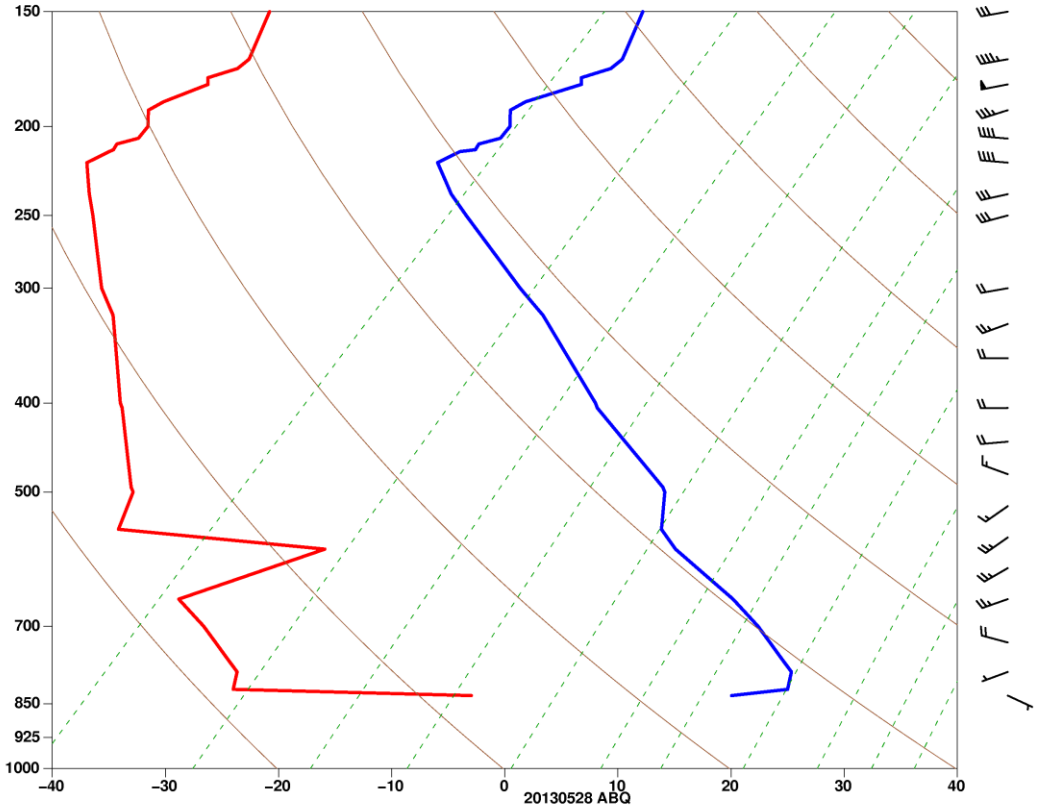
Drop 8



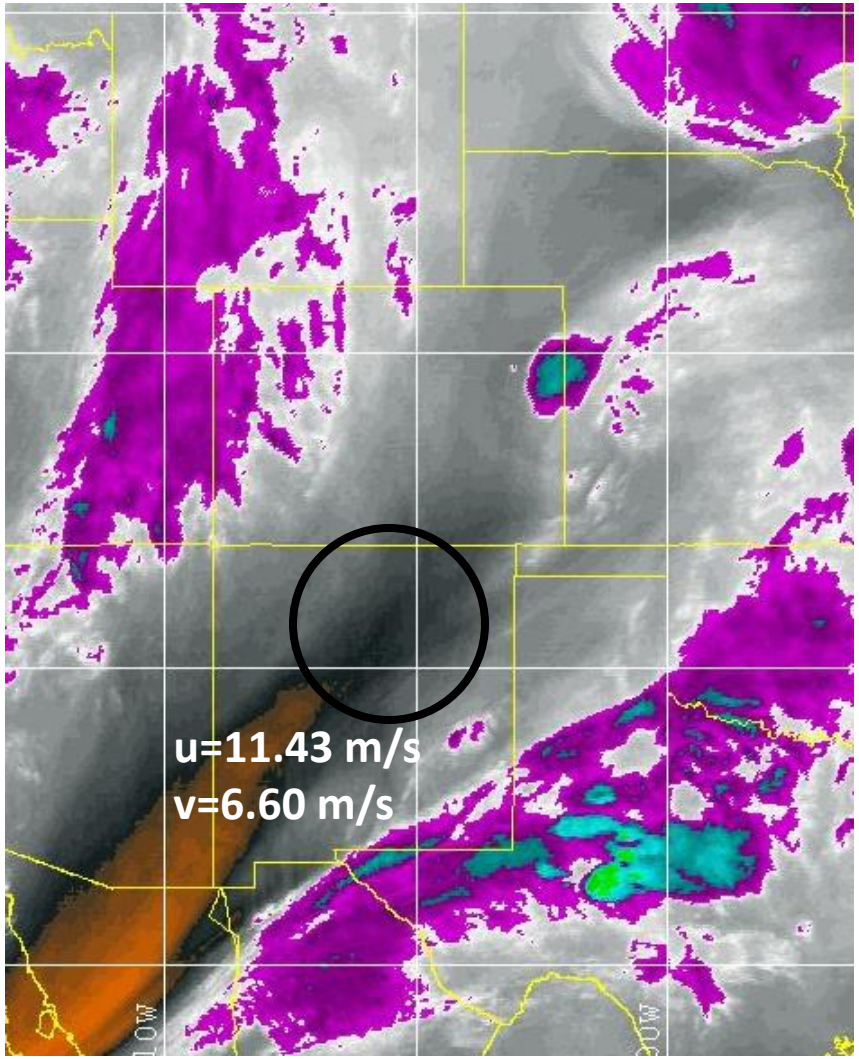
Flight and Selected Drops

GOES-15 WV at 1454 UTC 28 May 2013



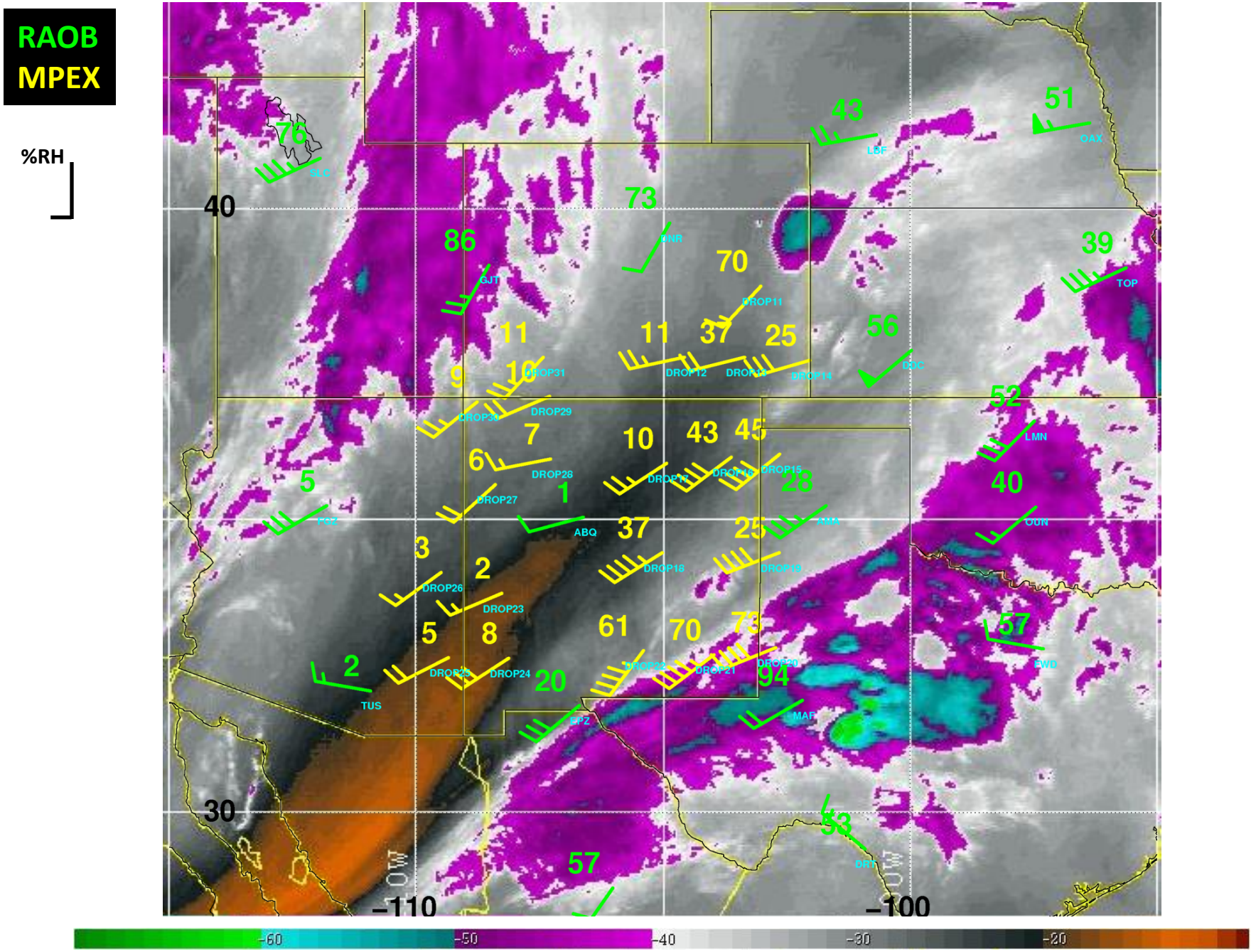


Time-Space Correction

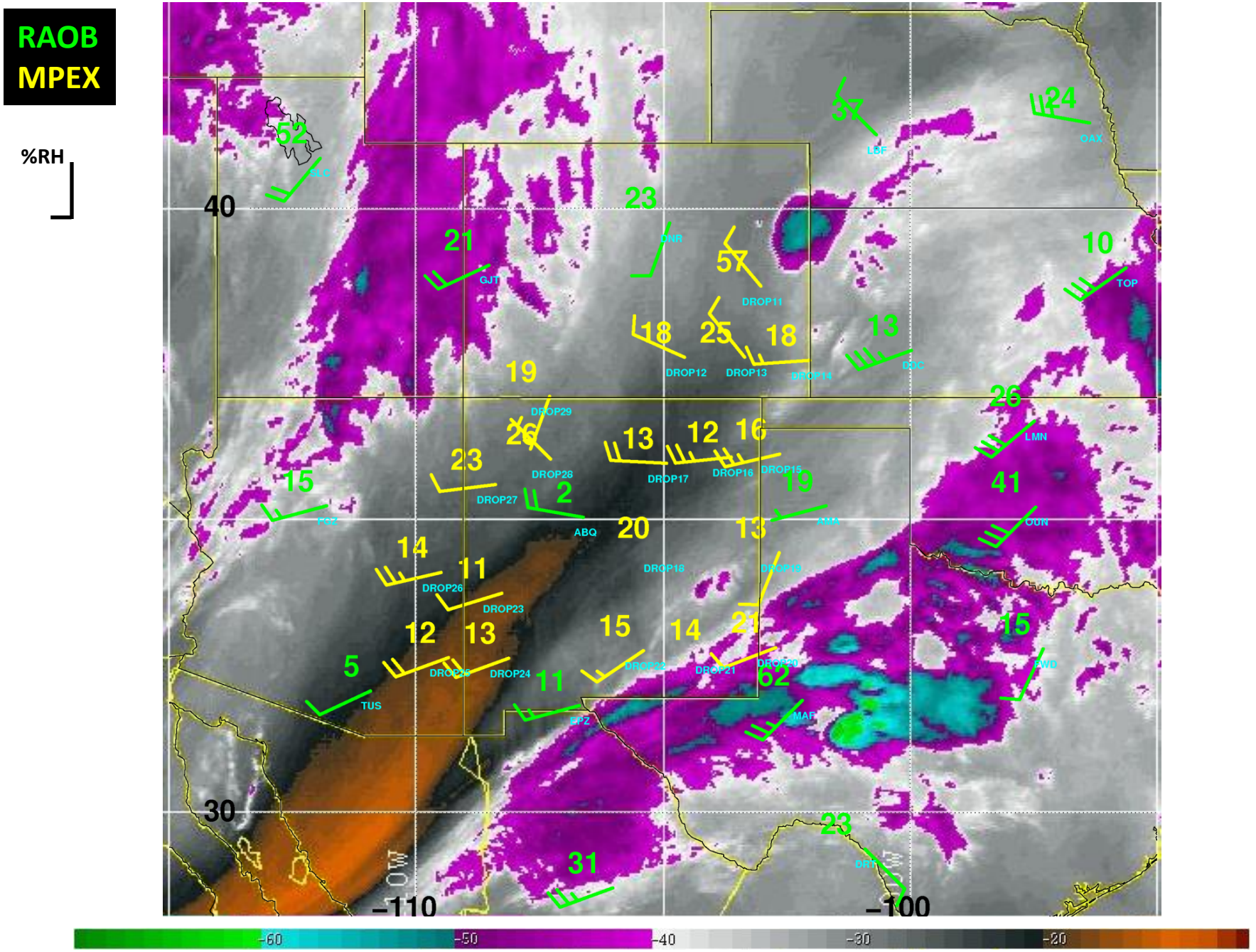


- Time-space correct dropsonde locations to 1200 UTC 28 May
- Use motion of leading nose of dry slot
  - ENE 190.1 km in 4 hours (10–14 UTC)
  - Motion 13.2 m/s at 60°
- Motion of Kansas spinner yields same result

GOES-15 Water Vapor and 500 mb Upper-Air Observations: 12Z/28 May 2013

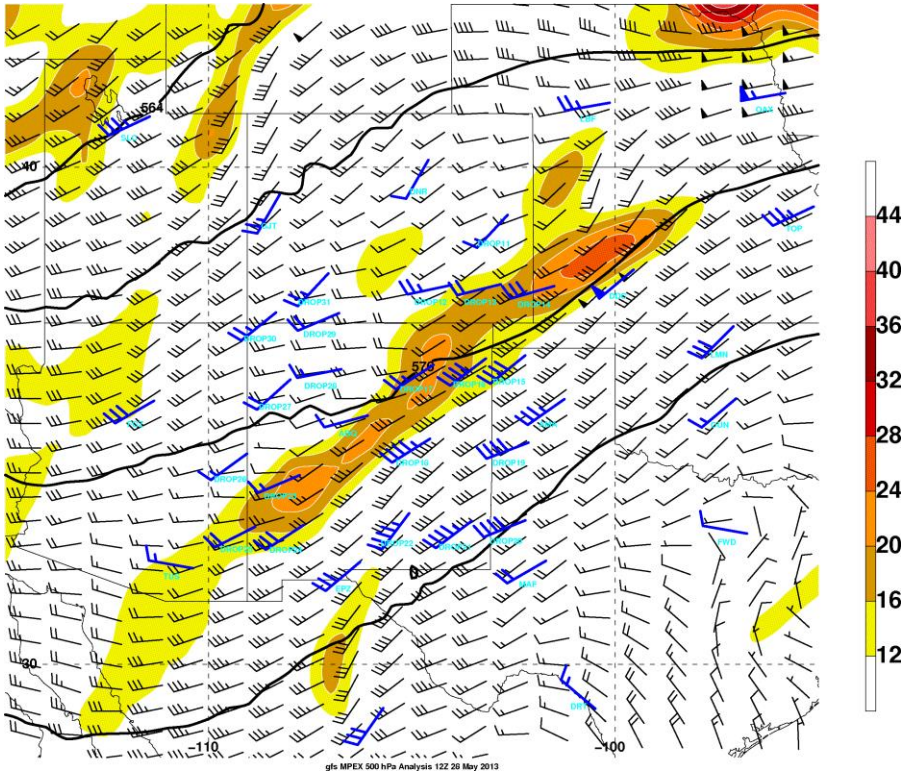


GOES-15 Water Vapor and 700 mb Upper-Air Observations: 12Z/28 May 2013

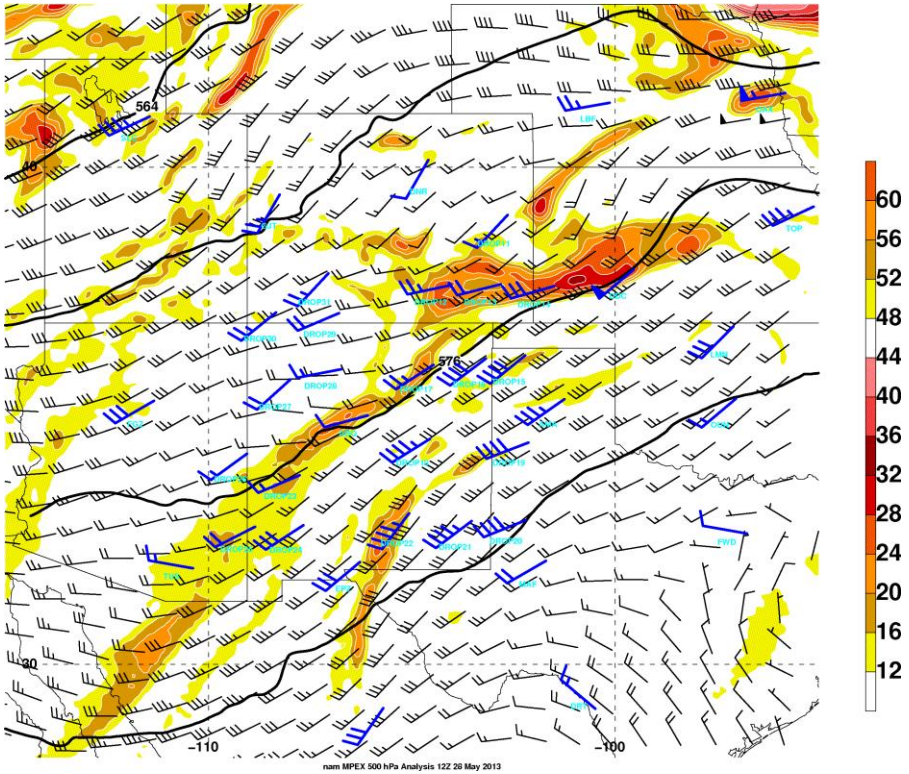


Dropsondes and Model Analyses

500 hPa Absolute Vorticity and Wind at 1200 UTC 28 May 2013



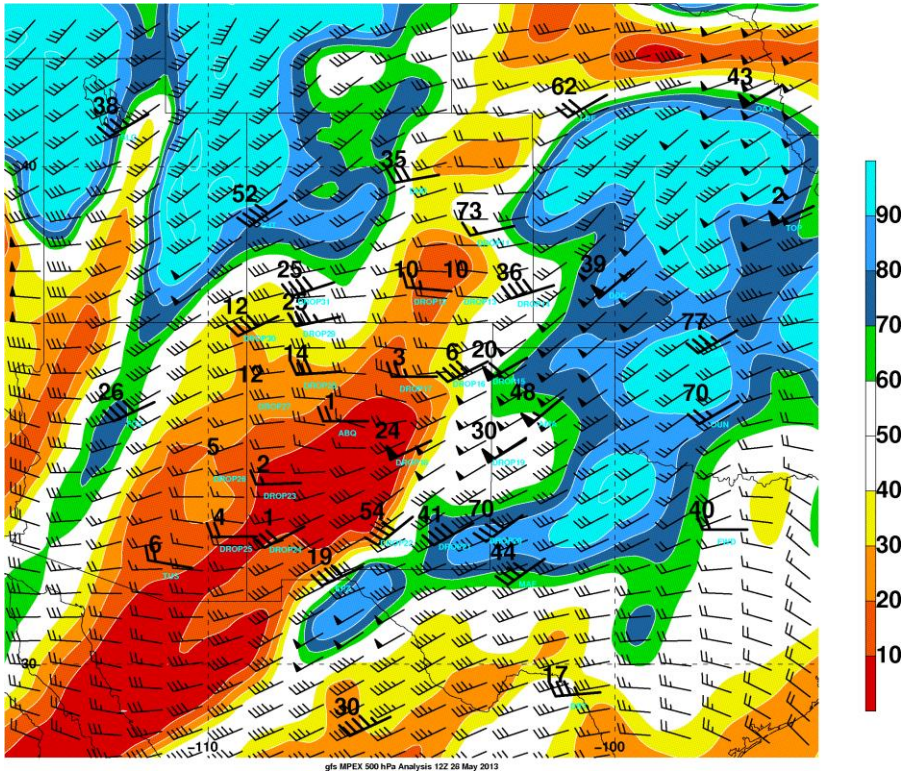
0.5° GFS Analysis



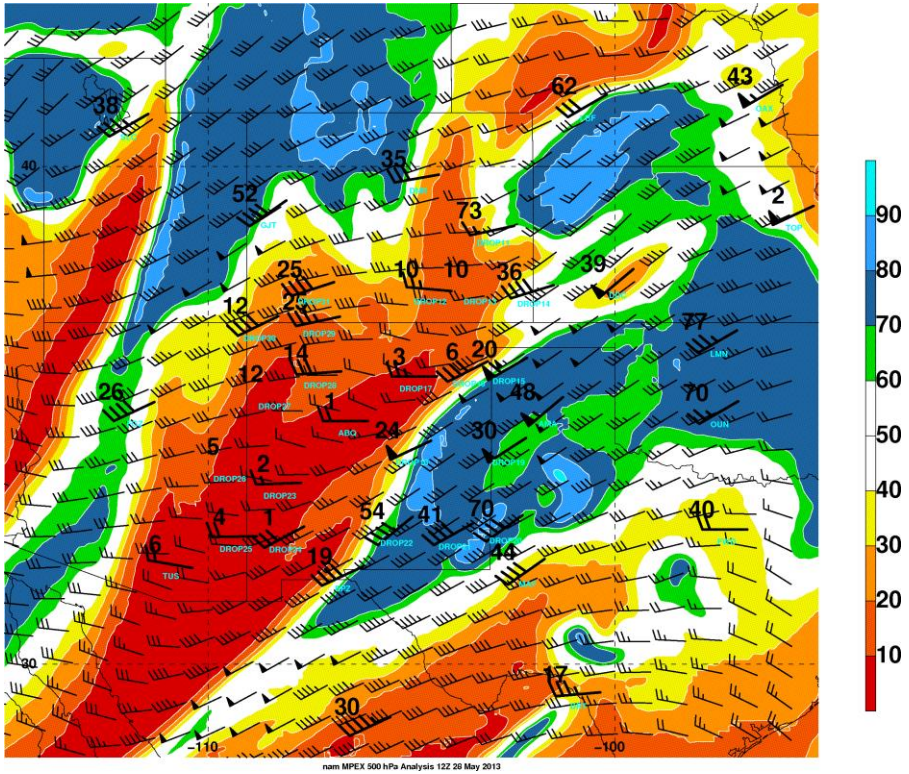
12 km NAM Analysis

Dropsondes and Model Analyses

400 hPa Relative Humidity and Wind at 1200 UTC 28 May 2013



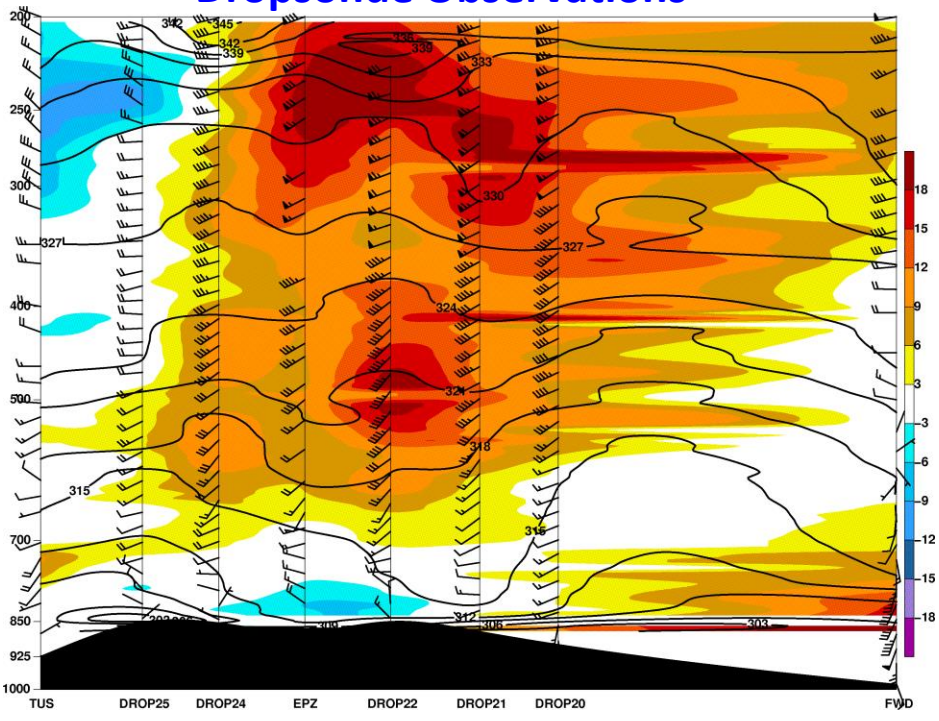
0.5° GFS Analysis



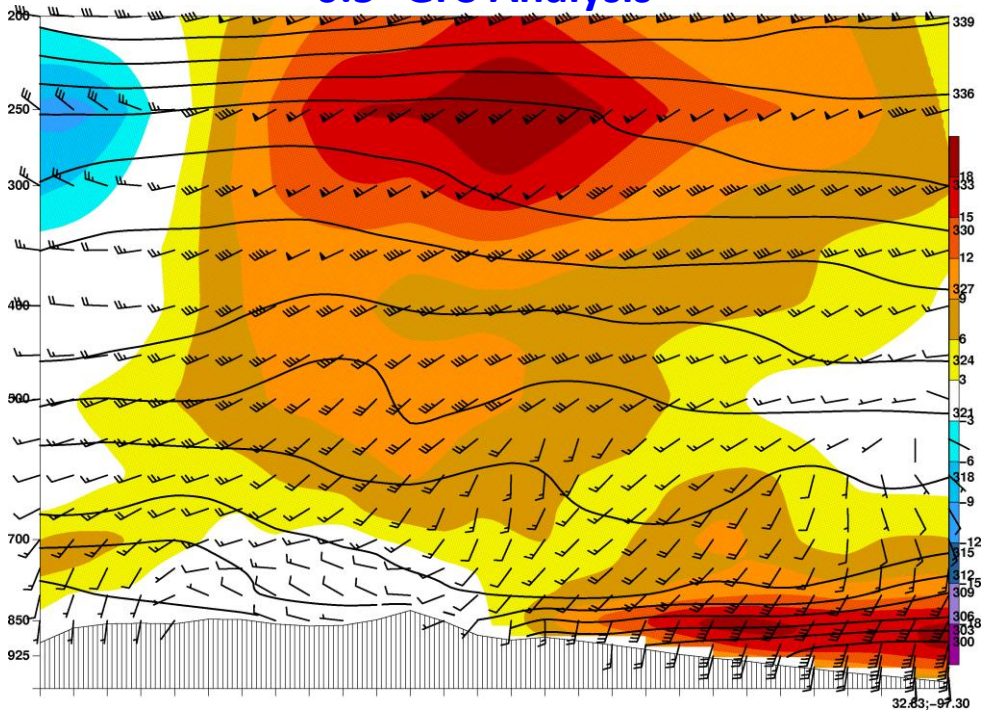
12 km NAM Analysis

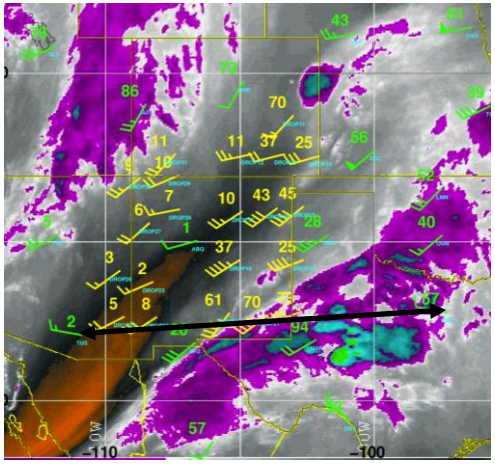
Cross Sections: θ and Wind at 12Z/28

Dropsonde Observations



0.5° GFS Analysis

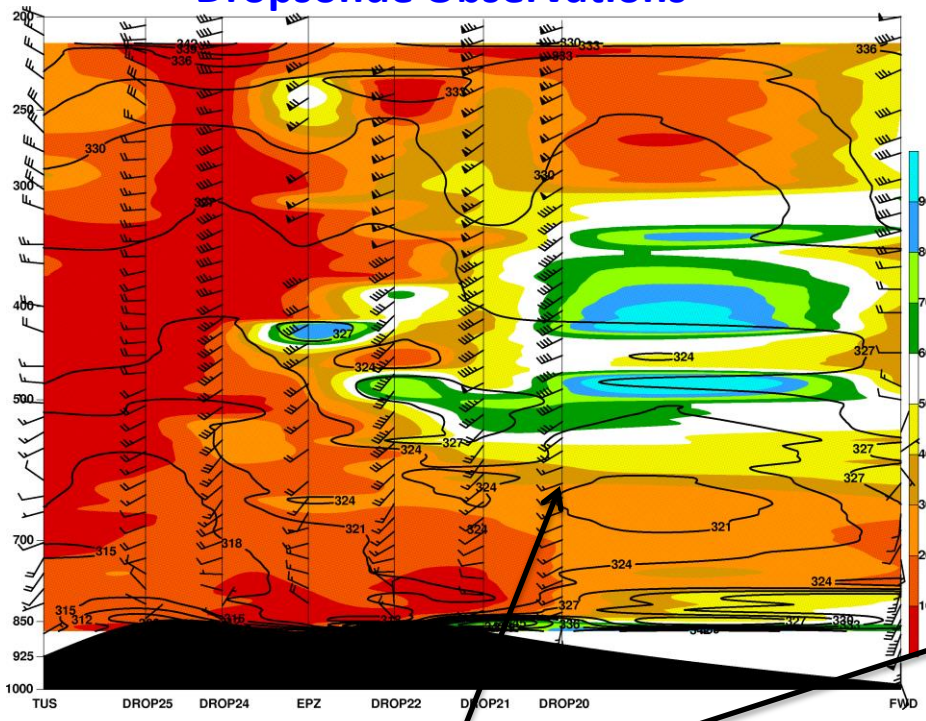




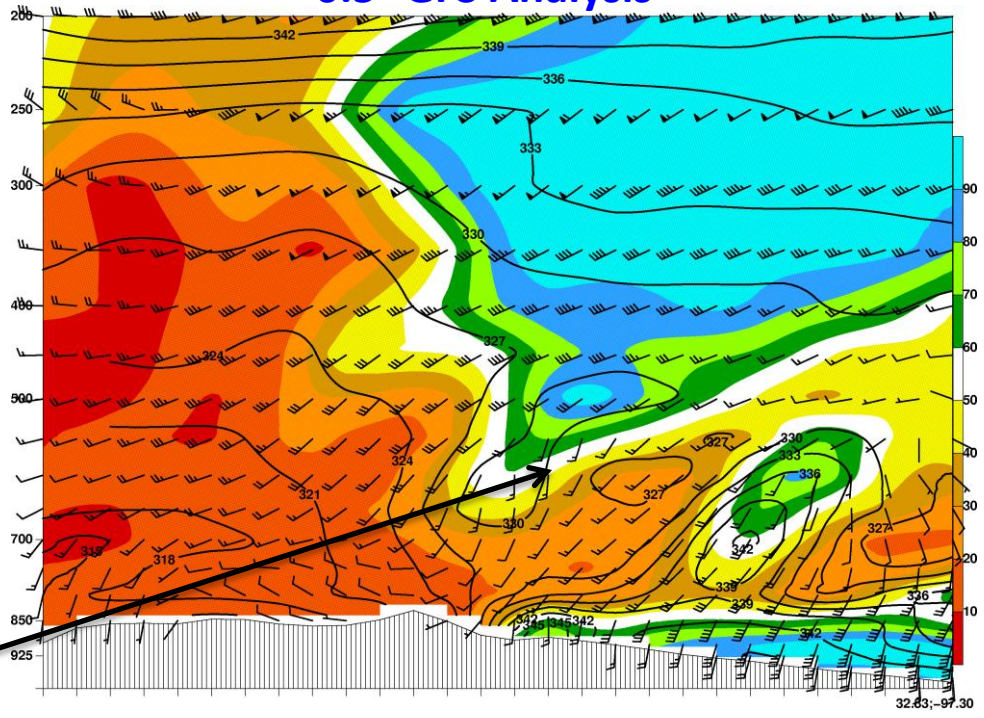
GOES-15 WV and
500 hPa RH and wind

Cross Sections: RH, θ_e and Wind at 12Z/28

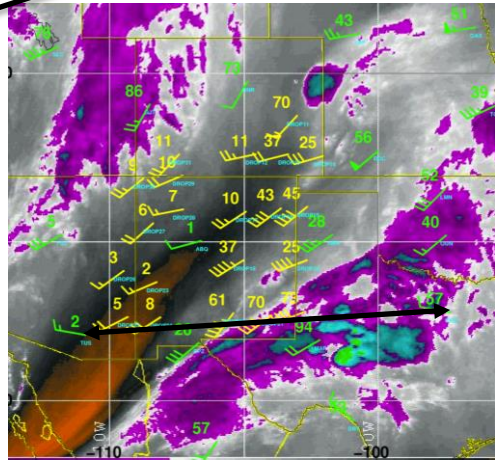
Dropsonde Observations



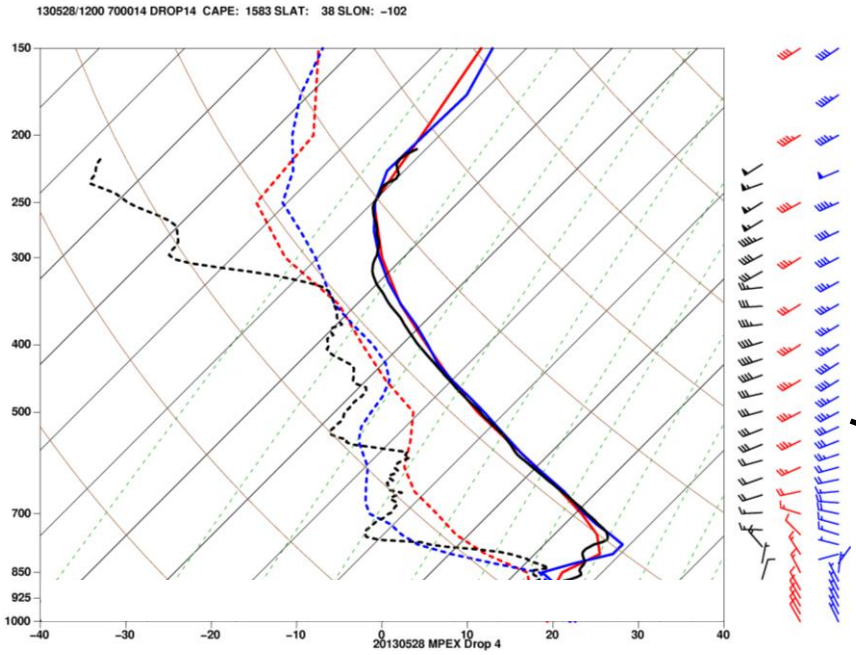
0.5° GFS Analysis

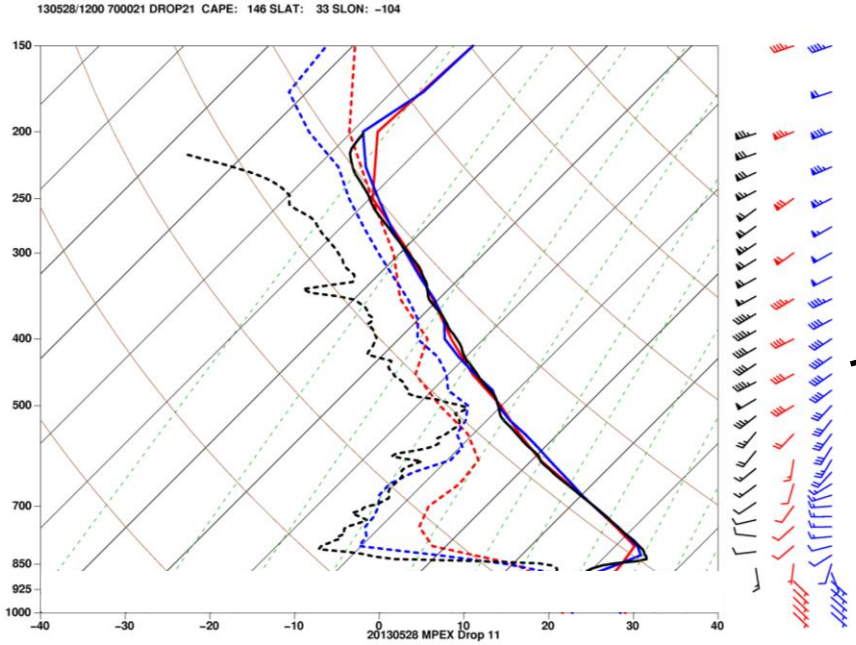


Mid-level θ_e 5-9 K warmer over eastern NM/western TX in GFS analysis compared to dropsondes

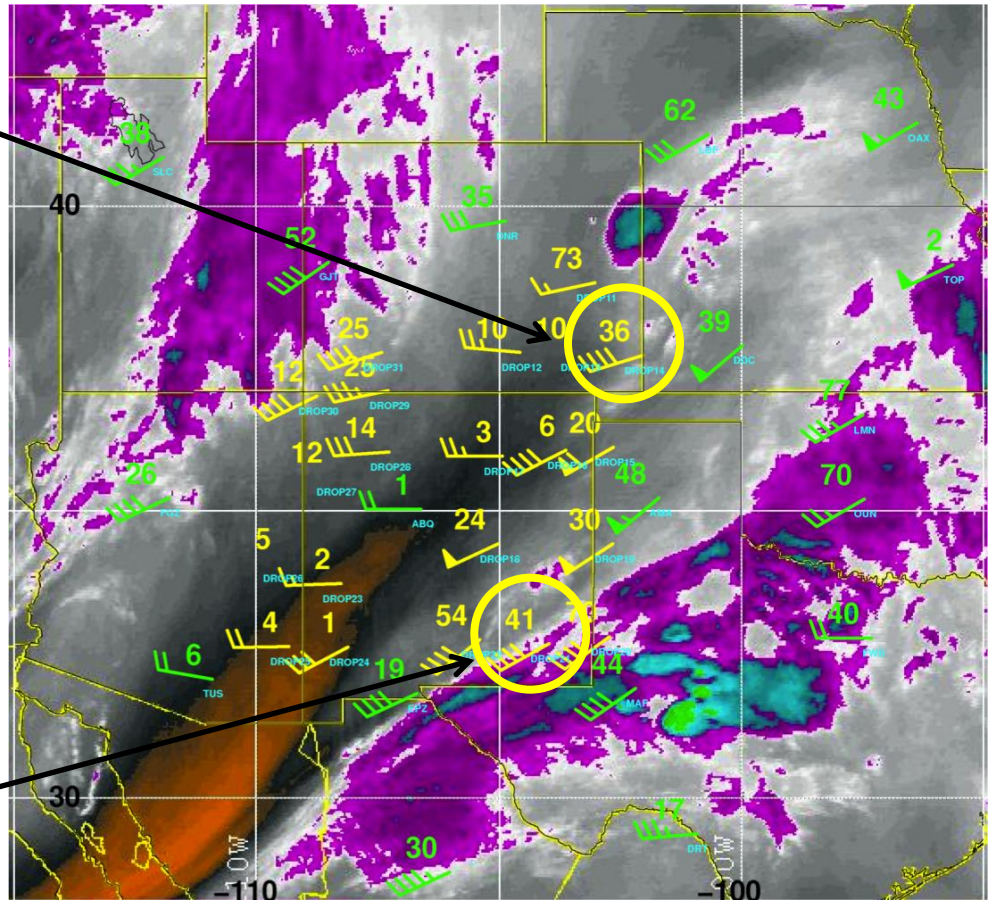


GOES-15 WV and 500 hPa RH and wind



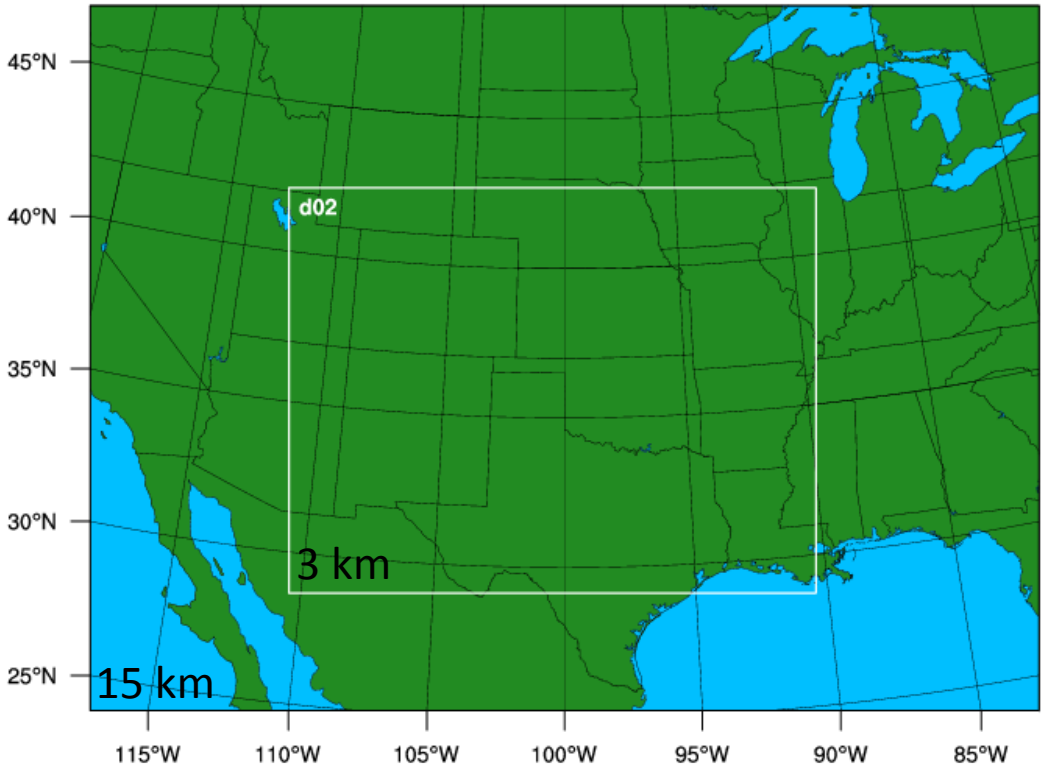


GOES-15 WV and 400 hPa RH and wind



ARW Simulations

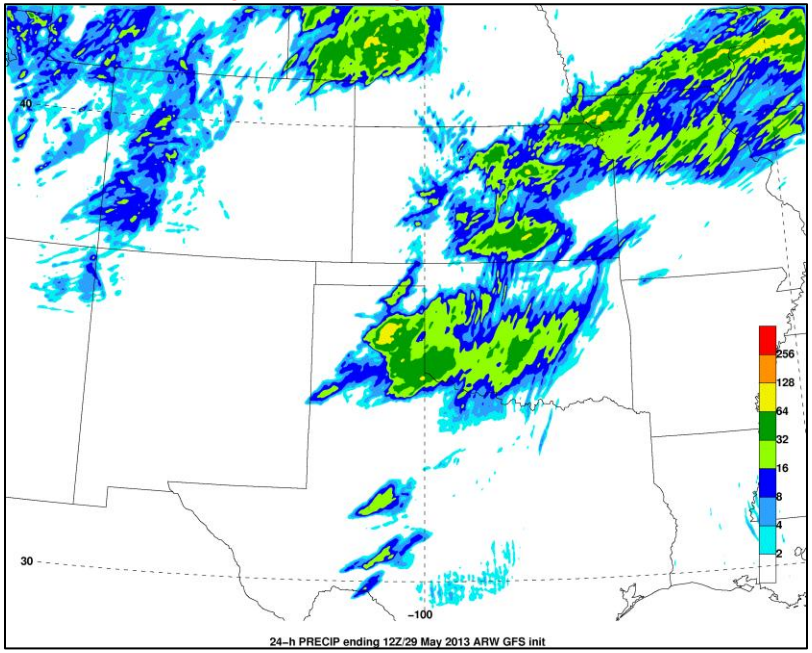
Initialized at 1200 UTC 28 May 2013



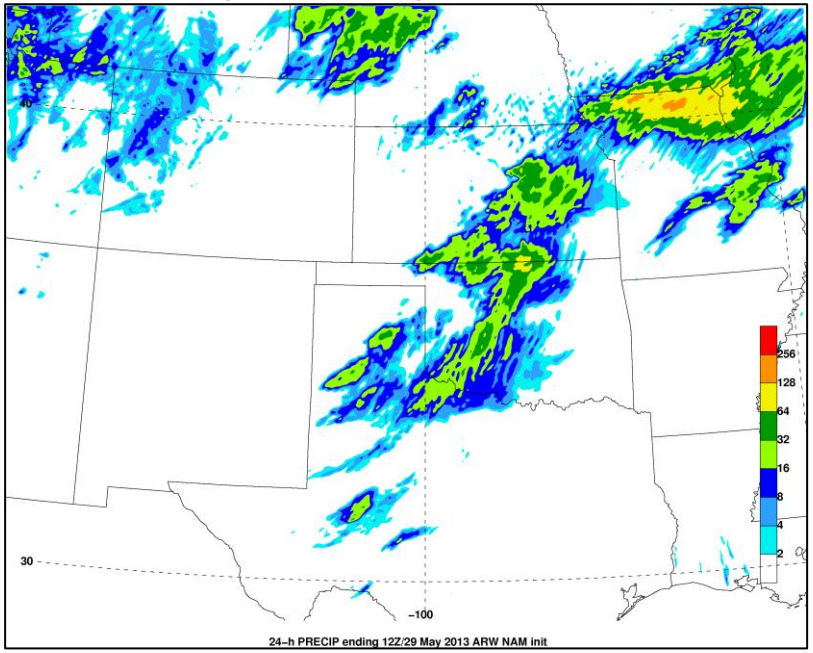
- WRF-ARW v3.5.1
- 15/3 km two-way nests
- 51 vertical levels
- 0.5° GFS Analyses BC
- Operational GFS or NAM IC
- Tiedtke cumulus on 15 km domain/explicit on 3 km
- YSU boundary layer
- WSM-6 microphysics
- Noah Land Surface
- RRTMG shortwave radiation
- RRTM longwave radiation
- 2D Smagorinsky turbulence
- Second order diffusion
- Positive definite scalar advection

How might differences in operational analyses contribute to departures in ARW simulations?

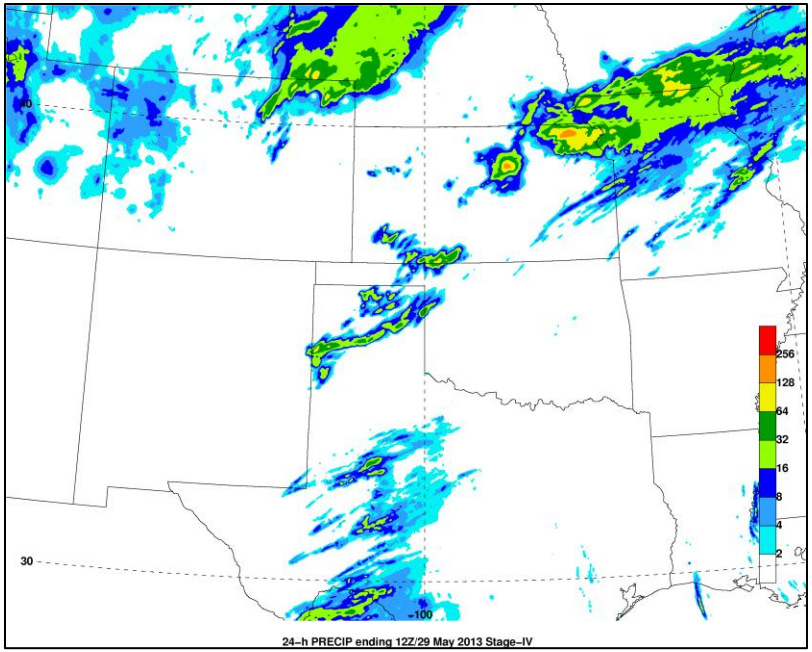
WRF-ARW (GFS Init)



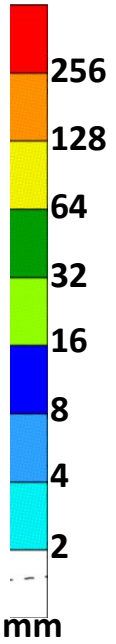
WRF-ARW (NAM Init)



Stage-IV

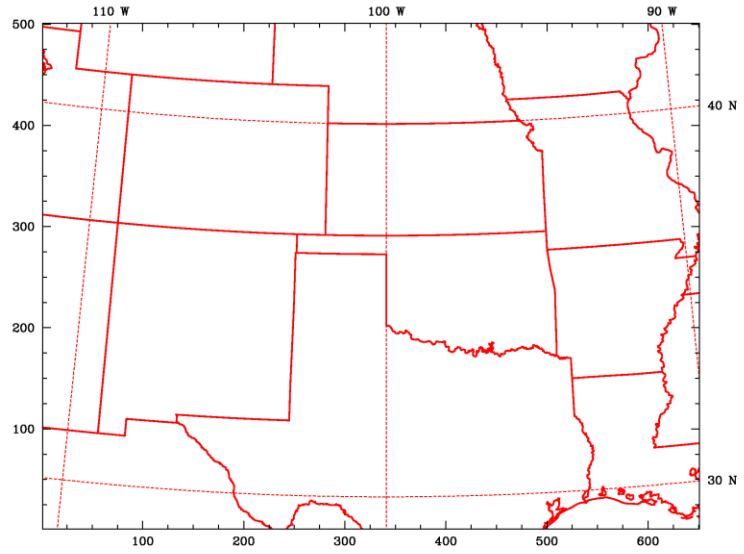


24-h total rainfall (mm)
12Z/28–29 May 2013



Dataset: gfs RIP: reflect
Fcst: 0.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1200 UTC Tue 28 May 13 (0700 CDT Tue 28 May 13)

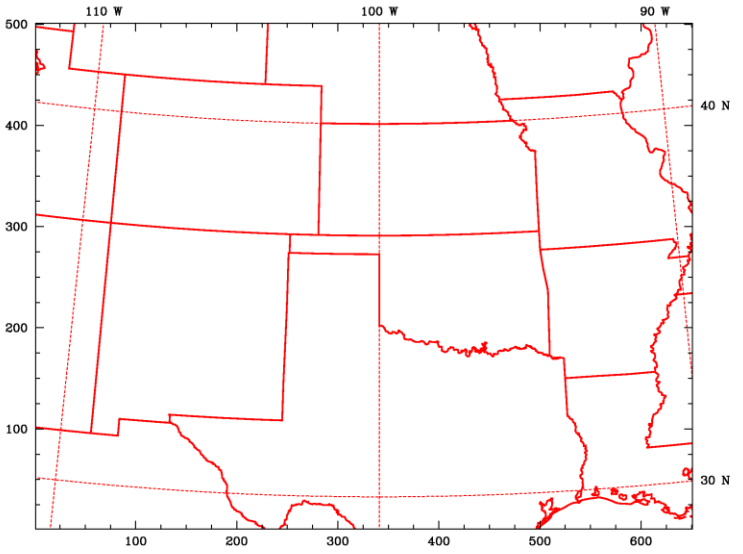
GFS initialization



Model Info: V3.5.1 No Cu YSU PBL WSM 6class Noah LSM 3.0 km, 50 levels, 15 sec
LW: RRTM SW: RRTMG DIFF: simple KM: 2D Smagor

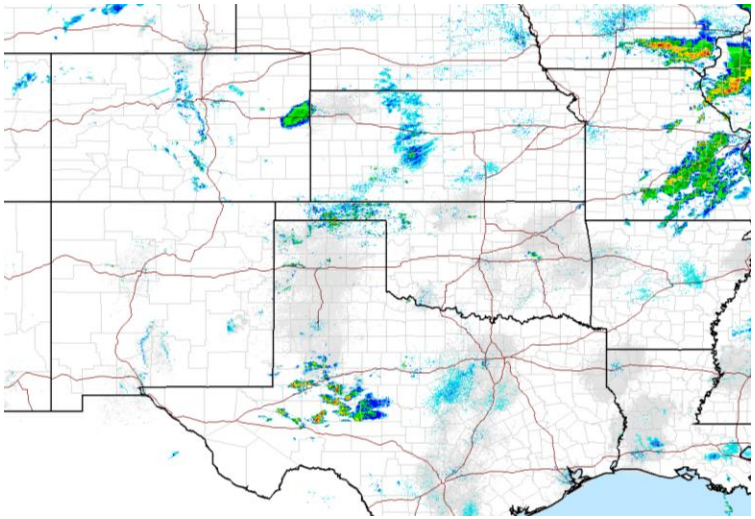
Dataset: nam RIP: reflect
Fcst: 0.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1200 UTC Tue 28 May 13 (0700 CDT Tue 28 May 13)

NAM initialization



Model Info: V3.5.1 No Cu YSU PBL WSM 6class Noah LSM 3.0 km, 50 levels, 15 sec
LW: RRTM SW: RRTMG DIFF: simple KM: 2D Smagor

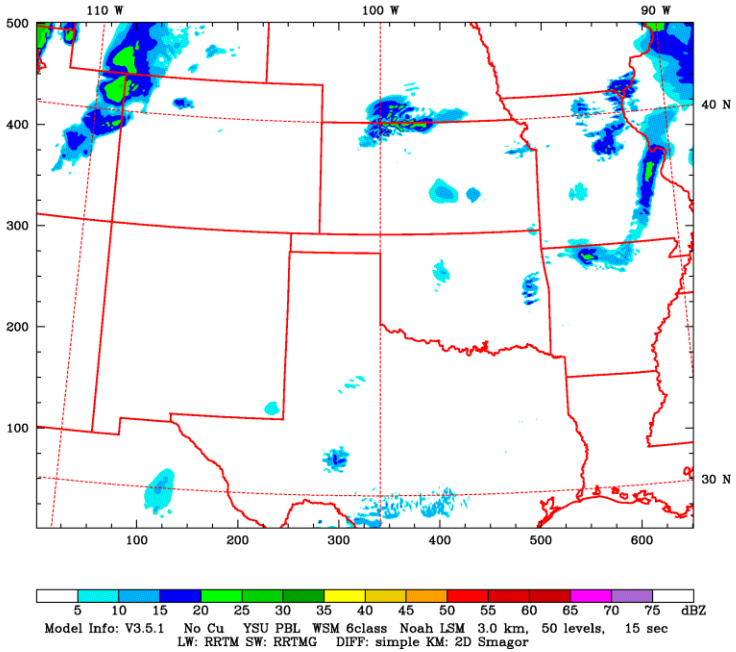
NEXRAD Mosaic



ARW 0-h forecast
v12Z/28 May 2013
i12Z/28 May 2013

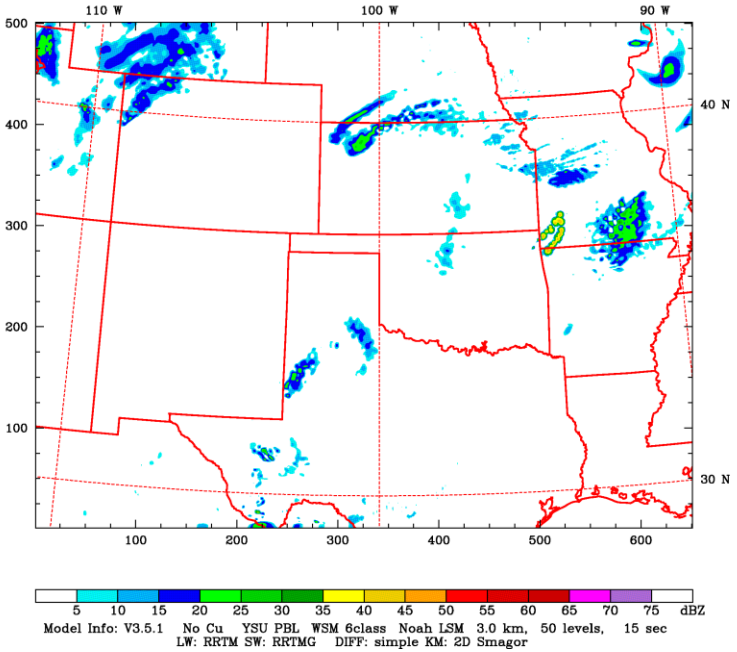
Dataset: gfs RIP: reflect
Fcst: 1.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1300 UTC Tue 28 May 13 (0800 CDT Tue 28 May 13)

GFS initialization

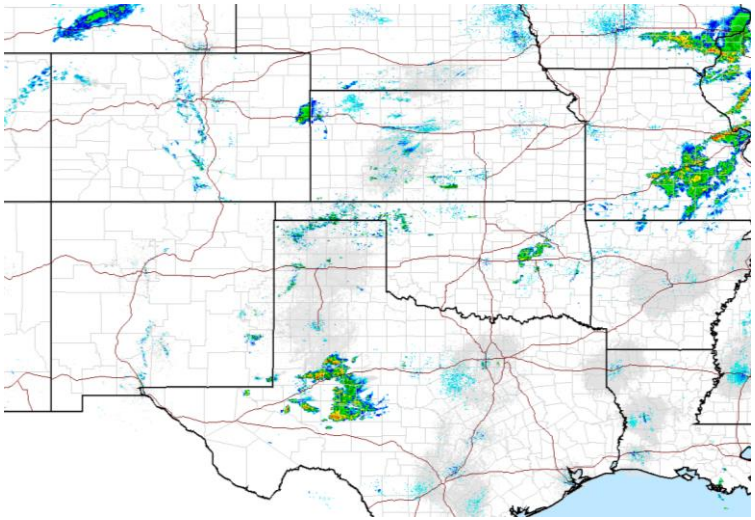


Dataset: nam RIP: reflect
Fcst: 1.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1300 UTC Tue 28 May 13 (0800 CDT Tue 28 May 13)

NAM initialization



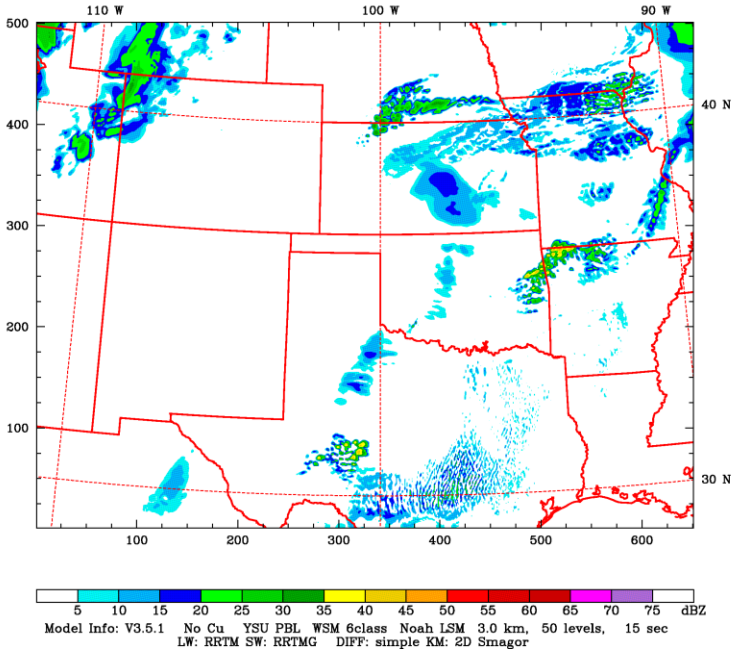
NEXRAD Mosaic



ARW 1-h forecast
v13Z/28 May 2013
i12Z/28 May 2013

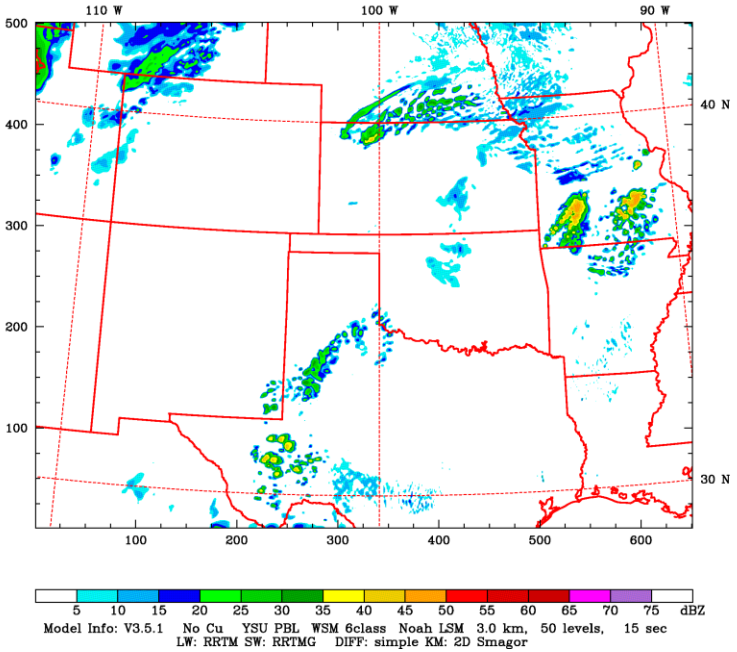
Dataset: gfs RIP: reflect
Fcst: 2.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1400 UTC Tue 28 May 13 (0900 CDT Tue 28 May 13)

GFS initialization

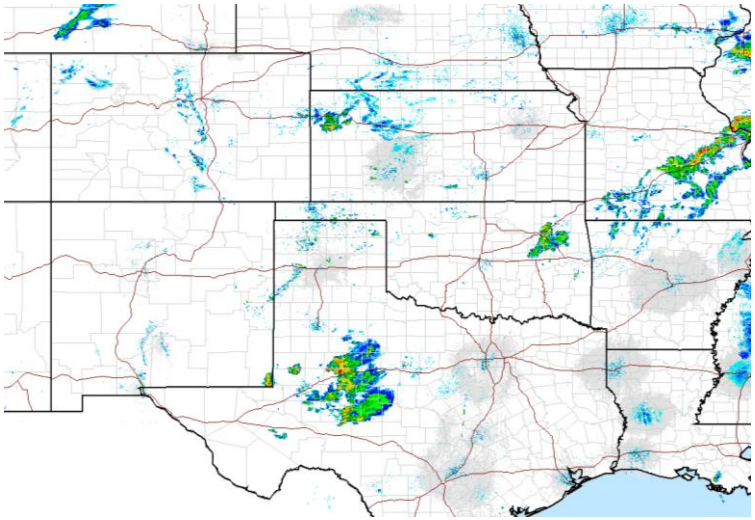


Dataset: nam RIP: reflect
Fcst: 2.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1400 UTC Tue 28 May 13 (0900 CDT Tue 28 May 13)

NAM initialization



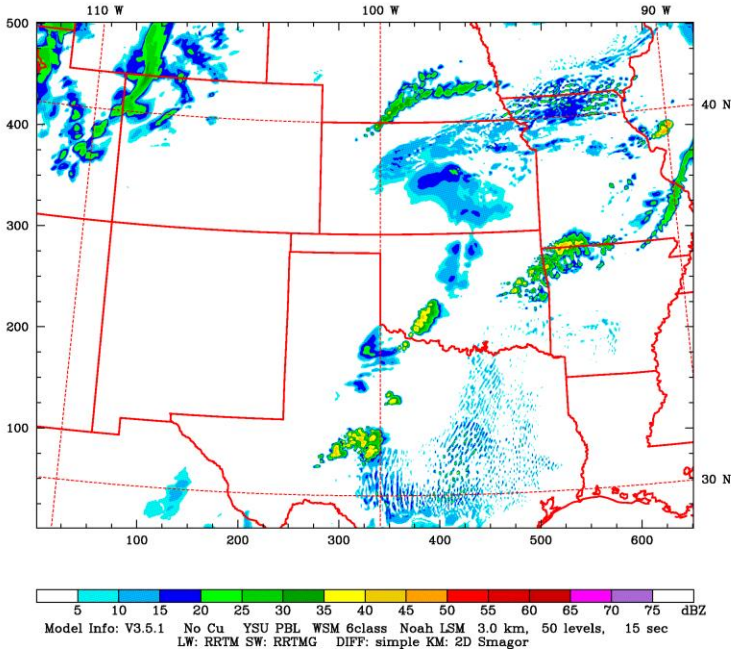
NEXRAD Mosaic



ARW 2-h forecast
v14Z/28 May 2013
i12Z/28 May 2013

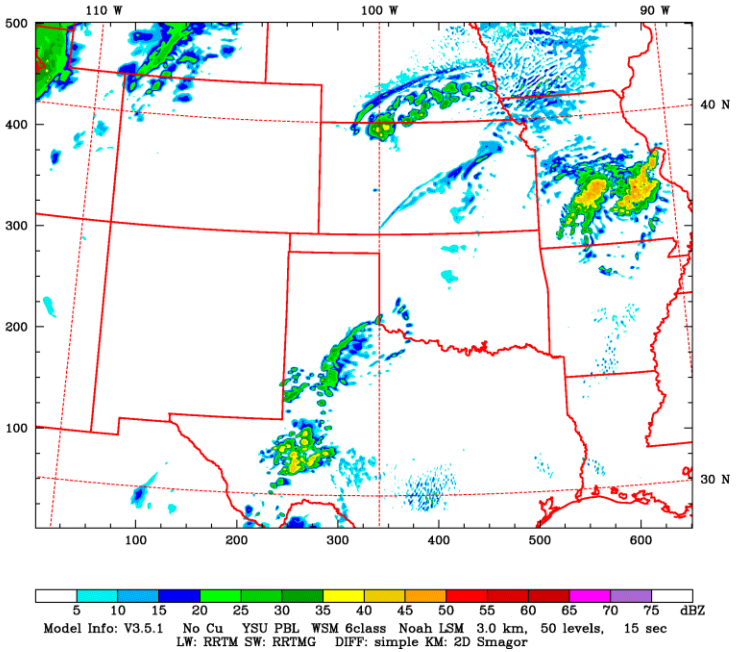
Dataset: gfs RIP: reflect
Fcst: 3.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1500 UTC Tue 28 May 13 (1000 CDT Tue 28 May 13)

GFS initialization

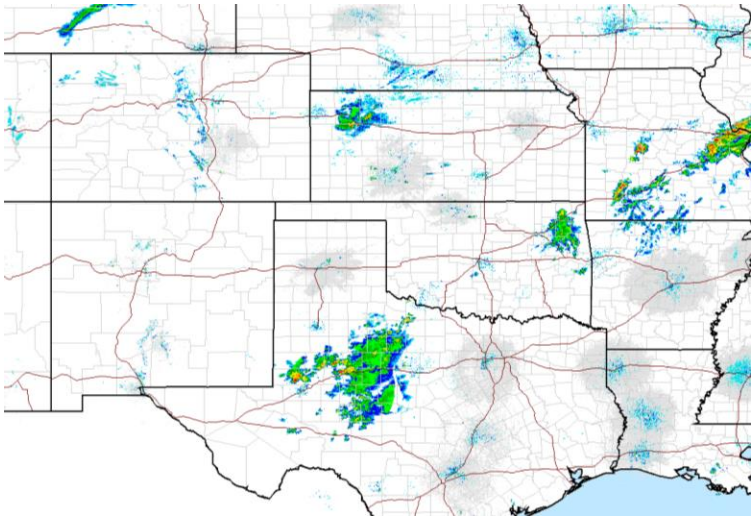


Dataset: nam RIP: reflect
Fcst: 3.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1500 UTC Tue 28 May 13 (1000 CDT Tue 28 May 13)

NAM initialization



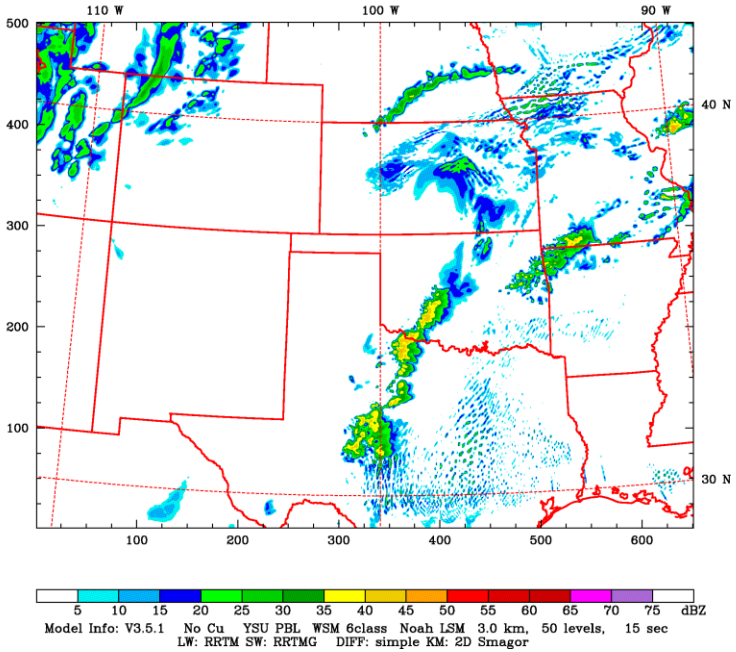
NEXRAD Mosaic



ARW 3-h forecast
v15Z/28 May 2013
i12Z/28 May 2013

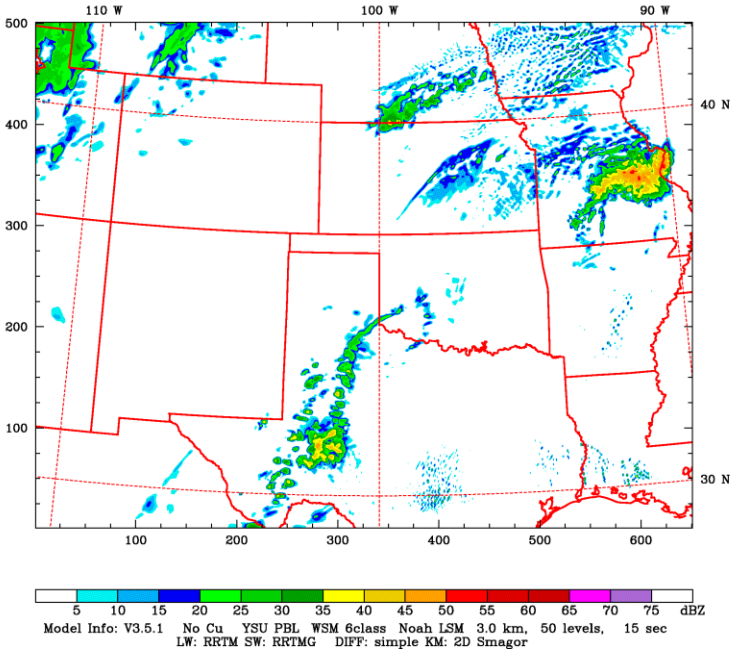
Dataset: gfs RIP: reflect
Fcst: 4.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1600 UTC Tue 28 May 13 (1100 CDT Tue 28 May 13)

GFS initialization

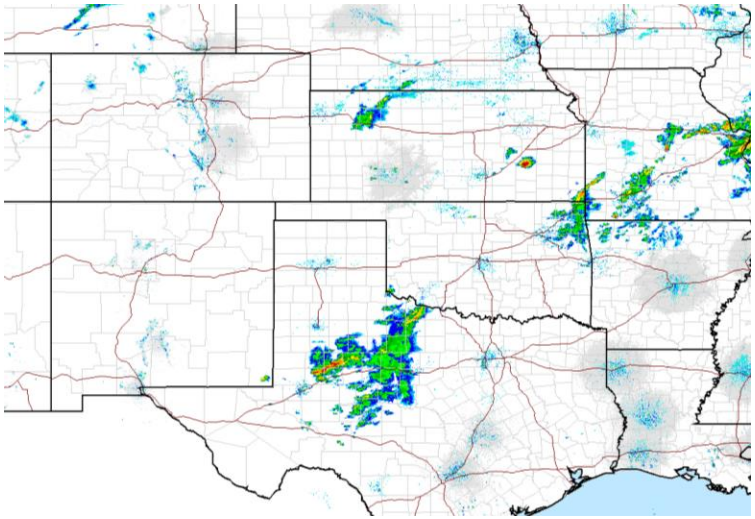


Dataset: nam RIP: reflect
Fcst: 4.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1600 UTC Tue 28 May 13 (1100 CDT Tue 28 May 13)

NAM initialization



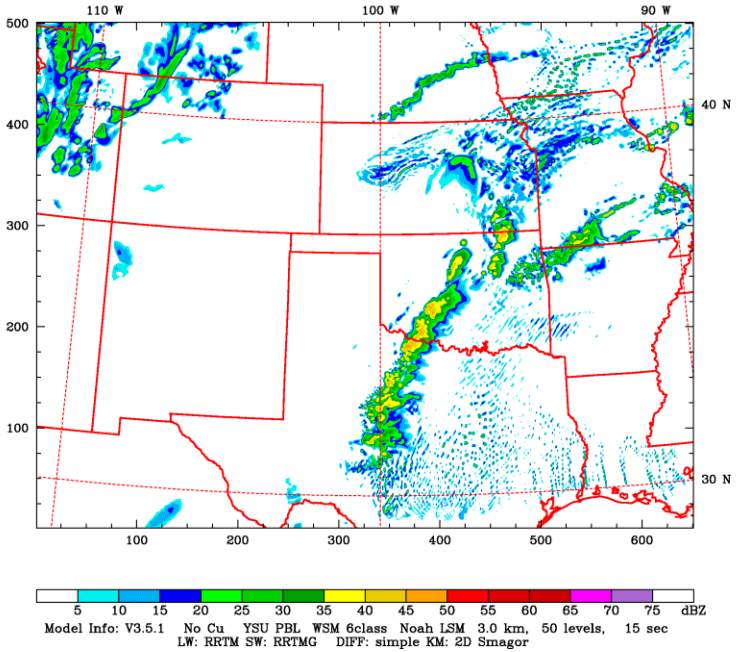
NEXRAD Mosaic



ARW 4-h forecast
v16Z/28 May 2013
i12Z/28 May 2013

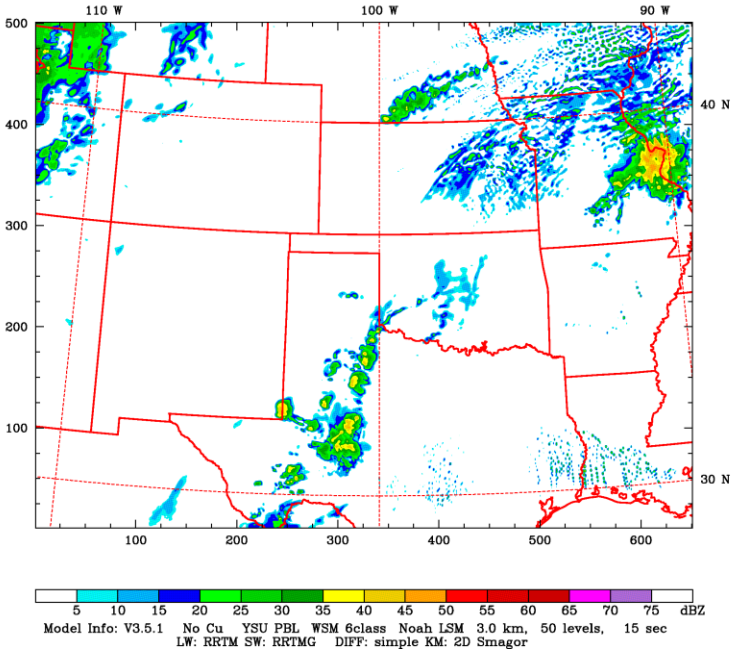
Dataset: gfs RIP: reflect
Fcst: 5.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1700 UTC Tue 28 May 13 (1200 CDT Tue 28 May 13)

GFS initialization

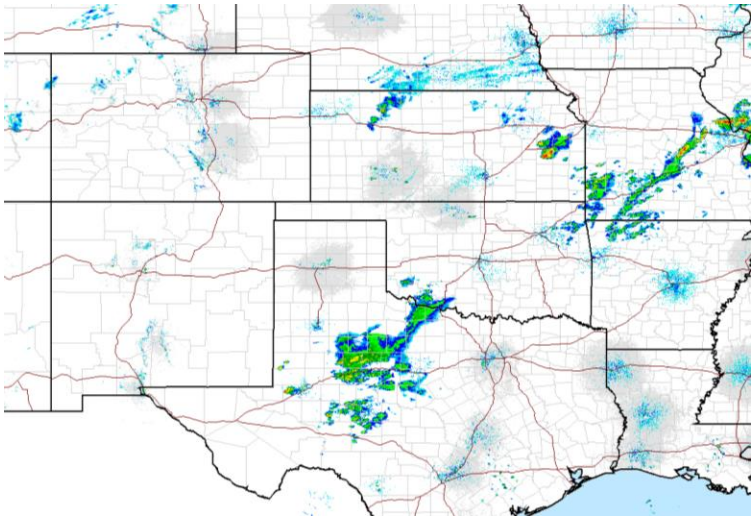


Dataset: nam RIP: reflect
Fcst: 5.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1700 UTC Tue 28 May 13 (1200 CDT Tue 28 May 13)

NAM initialization



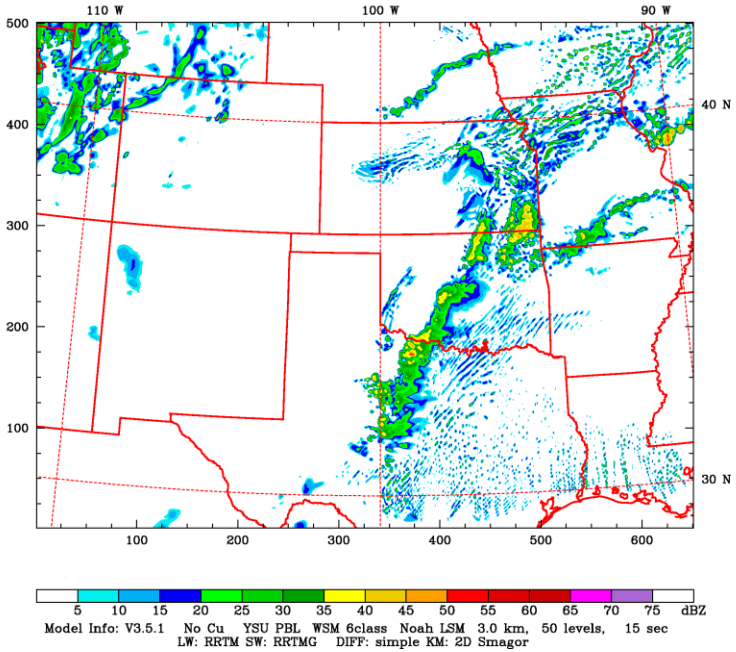
NEXRAD Mosaic



ARW 5-h forecast
v17Z/28 May 2013
i12Z/28 May 2013

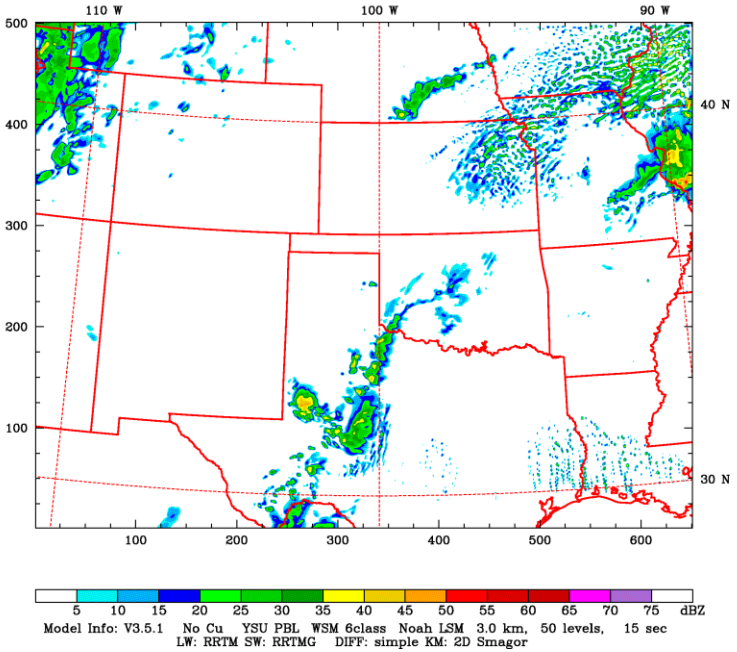
Dataset: gfs RIP: reflect
Fcst: 6.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1800 UTC Tue 28 May 13 (1300 CDT Tue 28 May 13)

GFS initialization

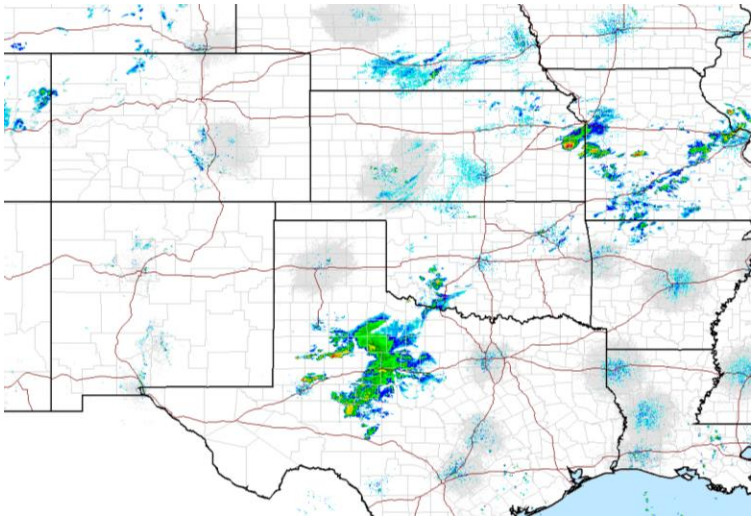


Dataset: nam RIP: reflect
Fcst: 6.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1800 UTC Tue 28 May 13 (1300 CDT Tue 28 May 13)

NAM initialization



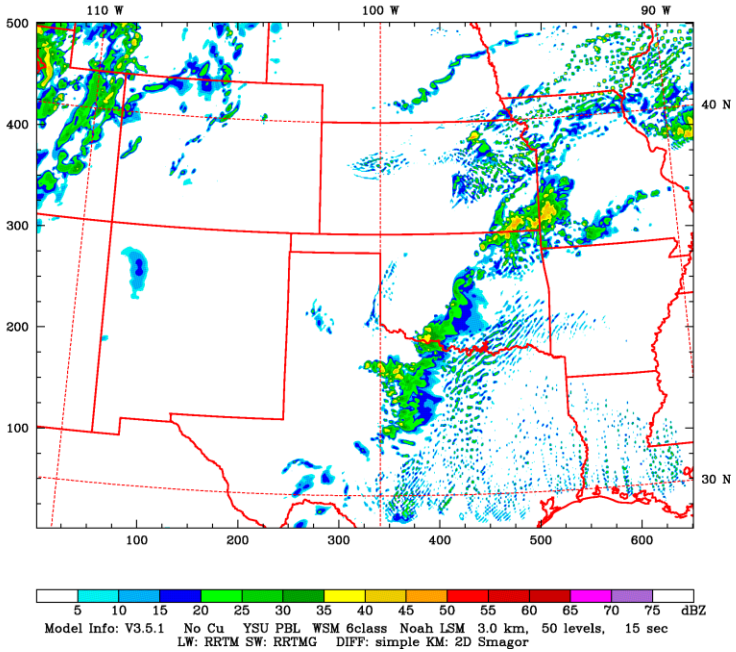
NEXRAD Mosaic



ARW 6-h forecast
v18Z/28 May 2013
i12Z/28 May 2013

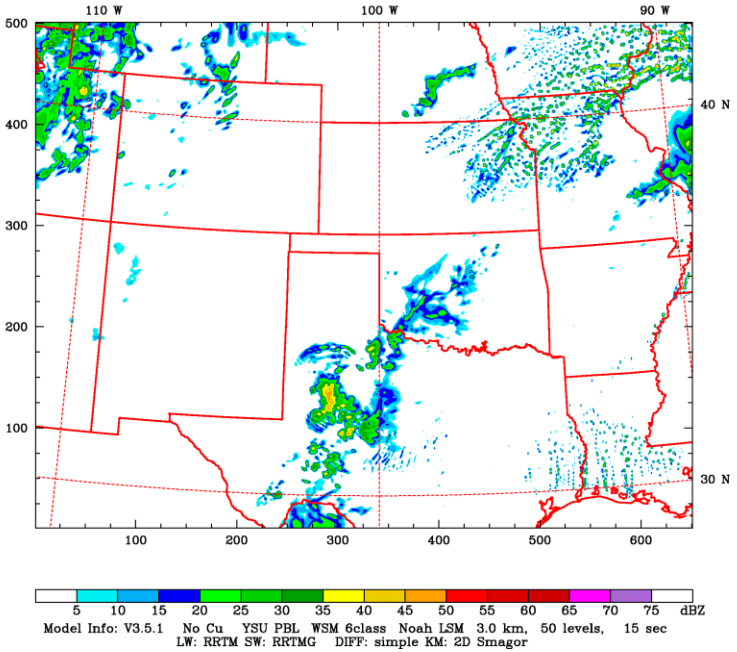
Dataset: gfs RIP: reflect
Fcst: 7.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1900 UTC Tue 28 May 13 (1400 CDT Tue 28 May 13)

GFS initialization

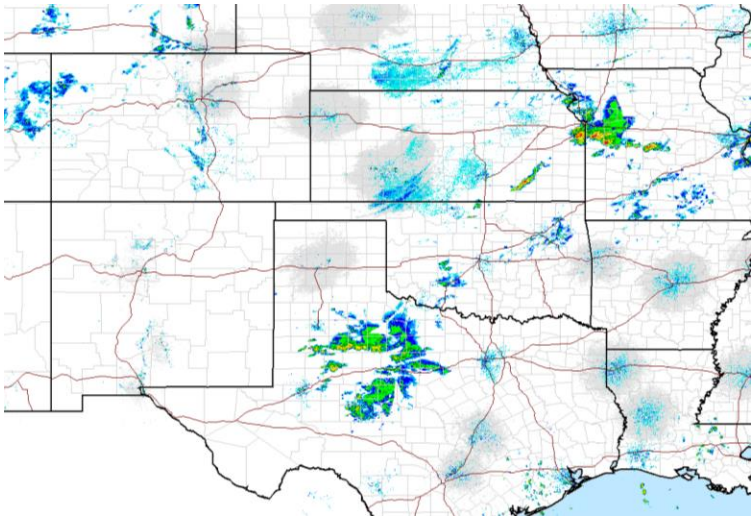


Dataset: nam RIP: reflect
Fcst: 7.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1900 UTC Tue 28 May 13 (1400 CDT Tue 28 May 13)

NAM initialization



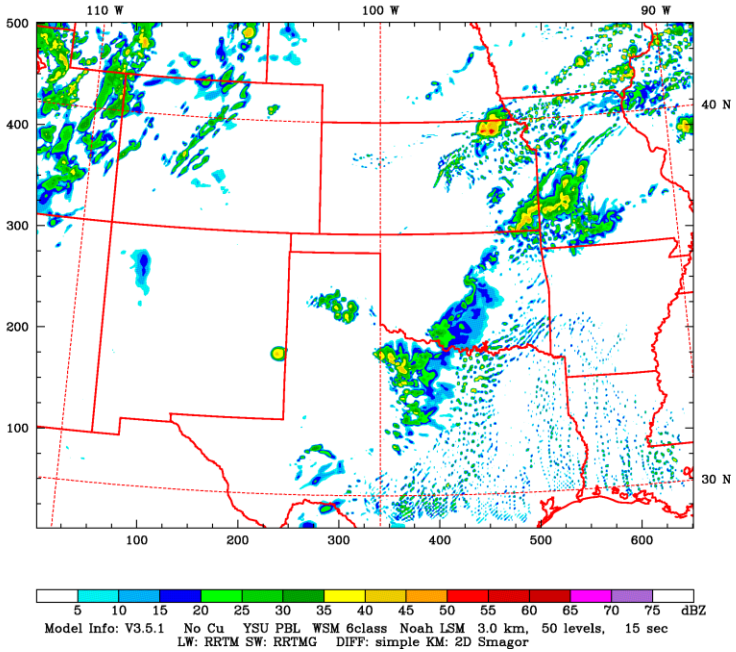
NEXRAD Mosaic



ARW 7-h forecast
v19Z/28 May 2013
i12Z/28 May 2013

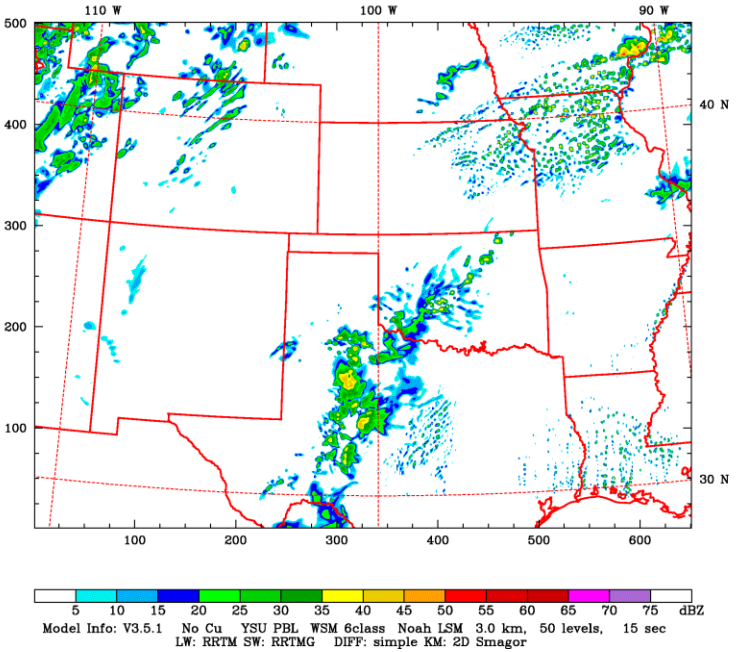
Dataset: gfs RIP: reflect
Fcst: 8.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 2000 UTC Tue 28 May 13 (1500 CDT Tue 28 May 13)

GFS initialization

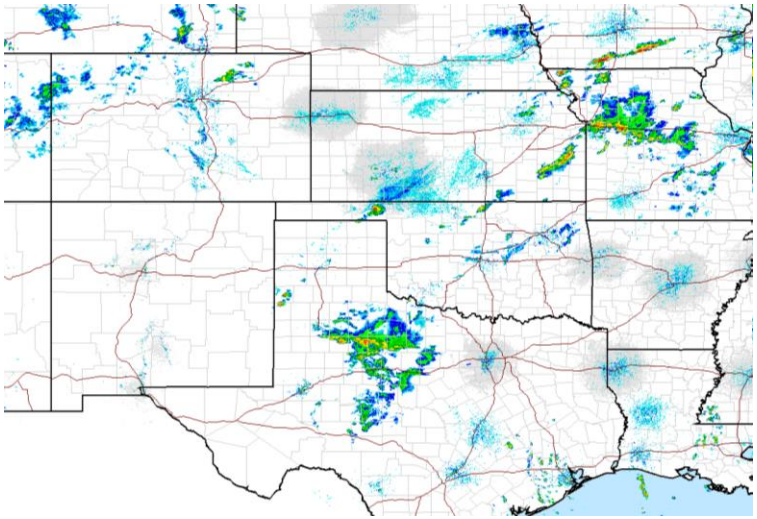


Dataset: nam RIP: reflect
Fcst: 8.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 2000 UTC Tue 28 May 13 (1500 CDT Tue 28 May 13)

NAM initialization



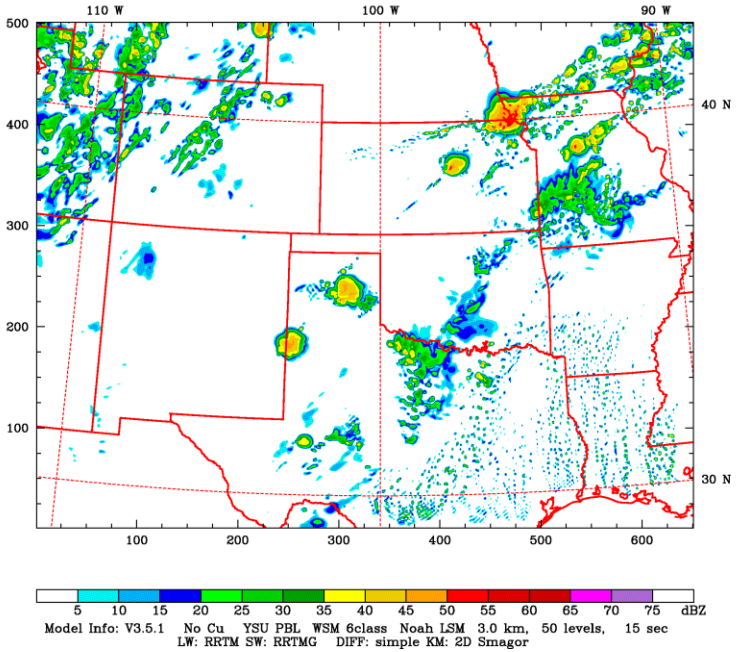
NEXRAD Mosaic



ARW 8-h forecast
v20Z/28 May 2013
i12Z/28 May 2013

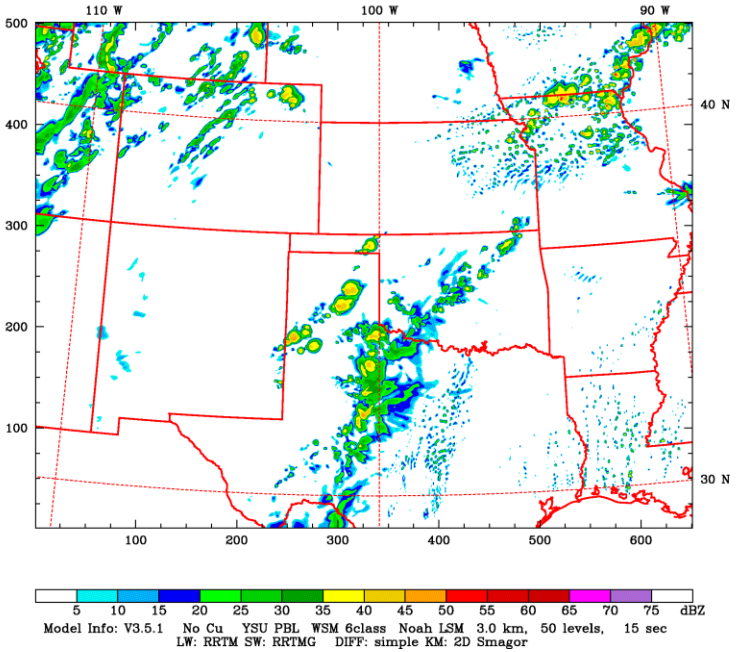
Dataset: gfs RIP: reflect
Fcst: 9.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 2100 UTC Tue 28 May 13 (1600 CDT Tue 28 May 13)

GFS initialization

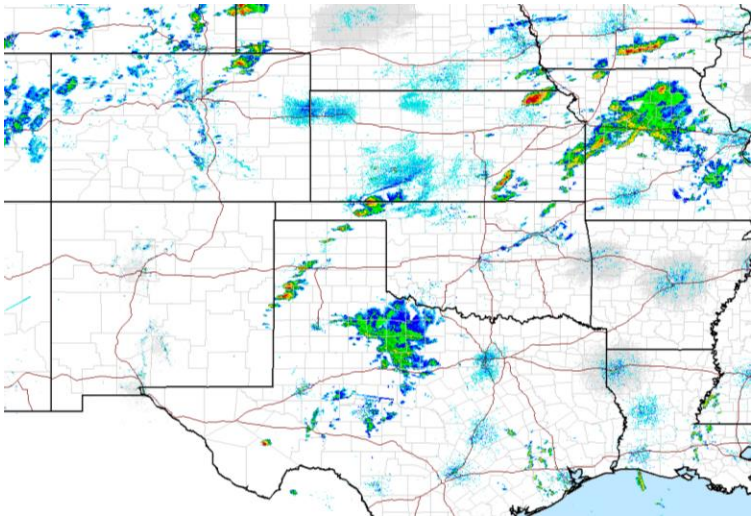


Dataset: nam RIP: reflect
Fcst: 9.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 2100 UTC Tue 28 May 13 (1600 CDT Tue 28 May 13)

NAM initialization



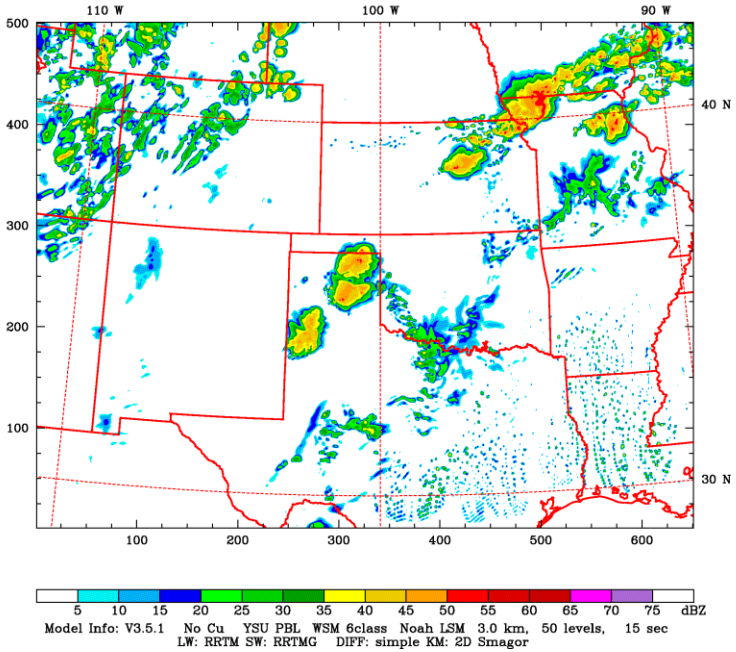
NEXRAD Mosaic



ARW 9-h forecast
v21Z/28 May 2013
i12Z/28 May 2013

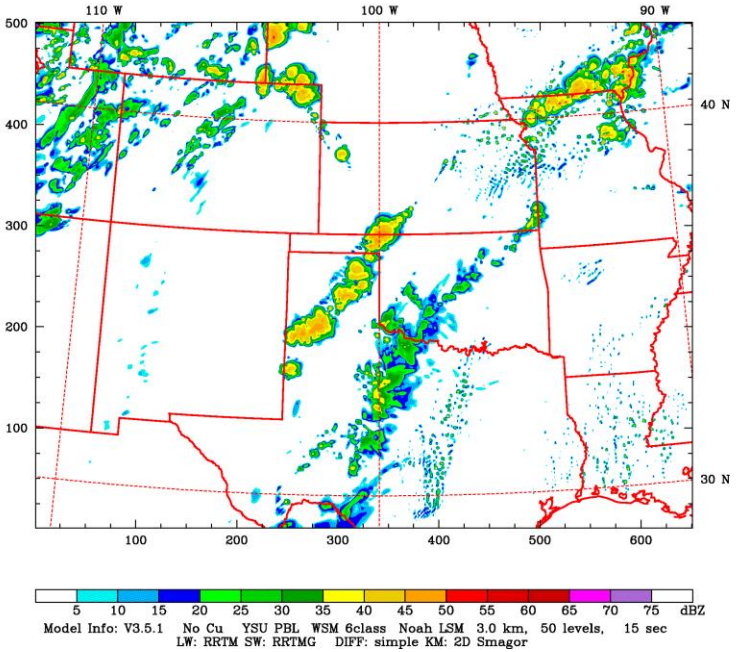
Dataset: gfs RIP: reflect
Fcst: 10.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 2200 UTC Tue 28 May 13 (1700 CDT Tue 28 May 13)

GFS initialization

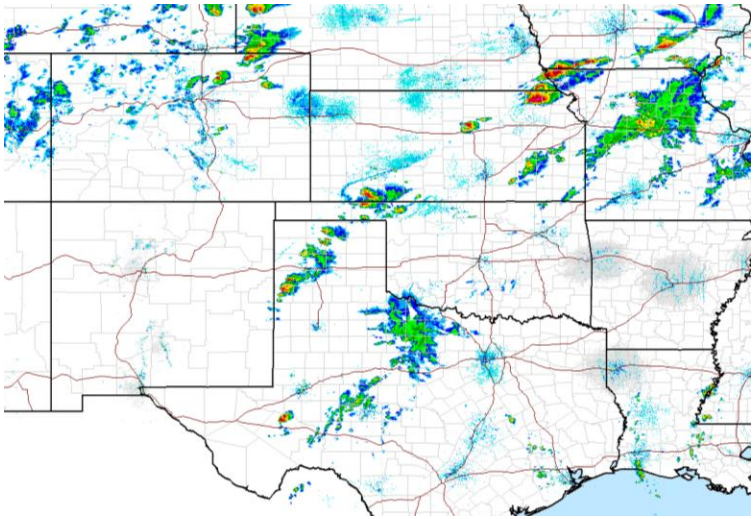


Dataset: nam RIP: reflect
Fcst: 10.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 2200 UTC Tue 28 May 13 (1700 CDT Tue 28 May 13)

NAM initialization

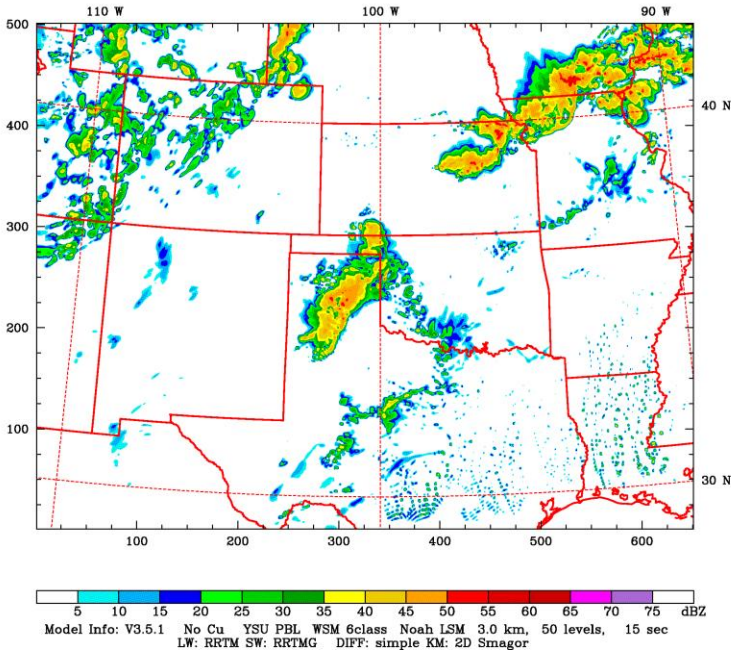


NEXRAD Mosaic

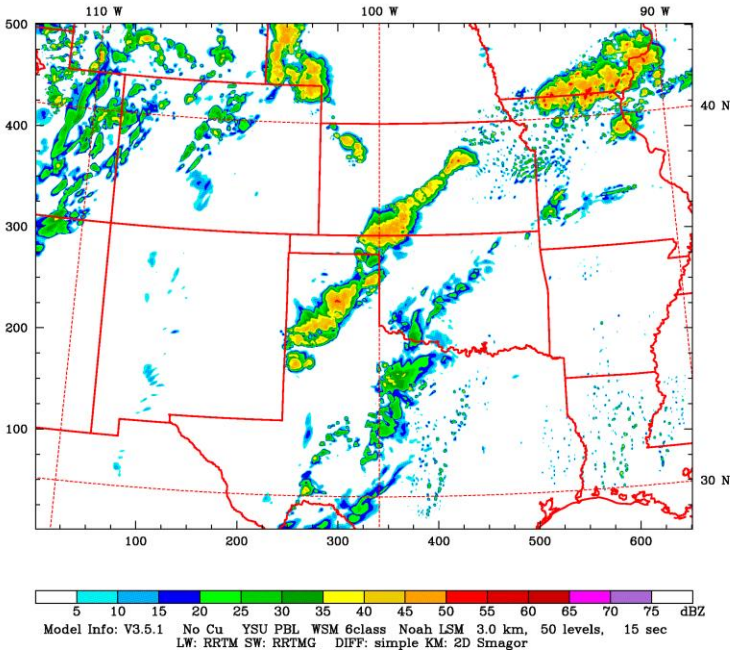


ARW 10-h forecast
v22Z/28 May 2013
i12Z/28 May 2013

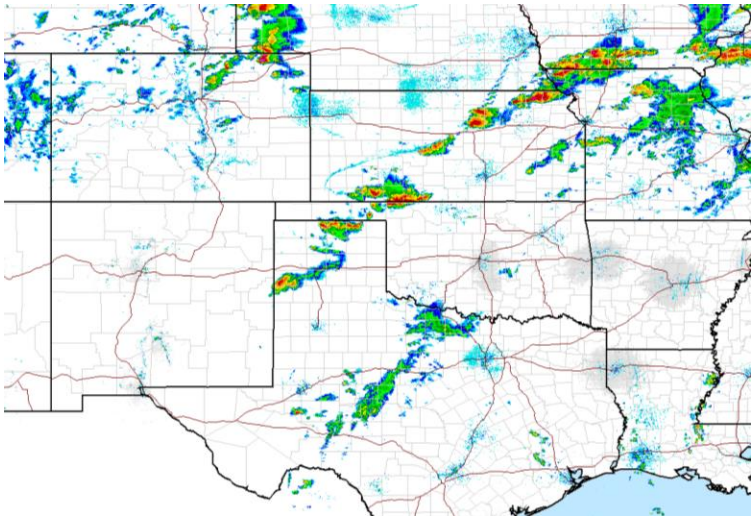
GFS initialization



NAM initialization



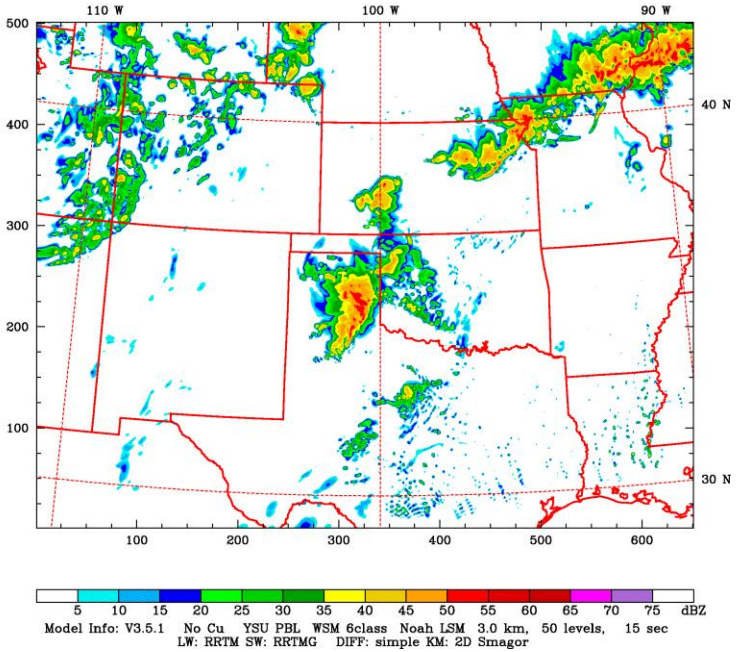
NEXRAD Mosaic



ARW 11-h forecast
v23Z/28 May 2013
i12Z/28 May 2013

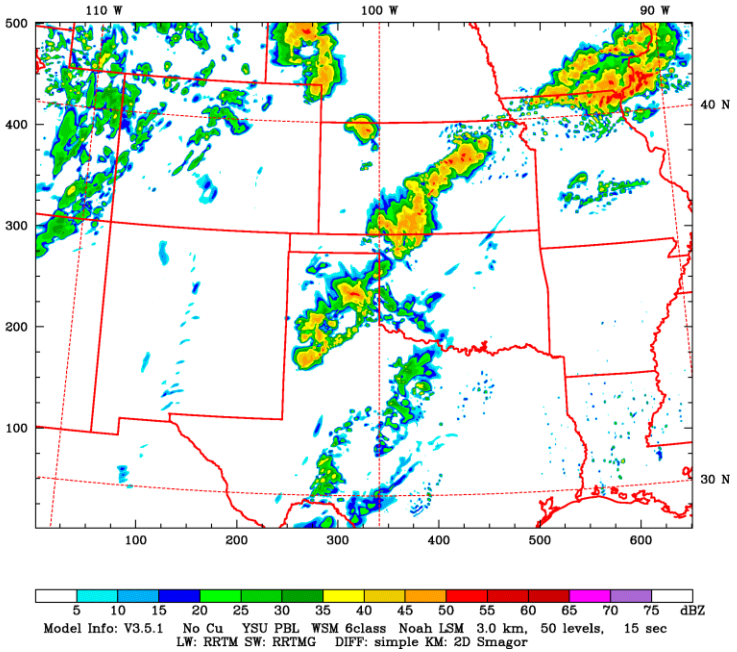
Dataset: gfs RIP: reflect
Fcst: 12.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0000 UTC Wed 29 May 13 (1900 CDT Tue 28 May 13)

GFS initialization

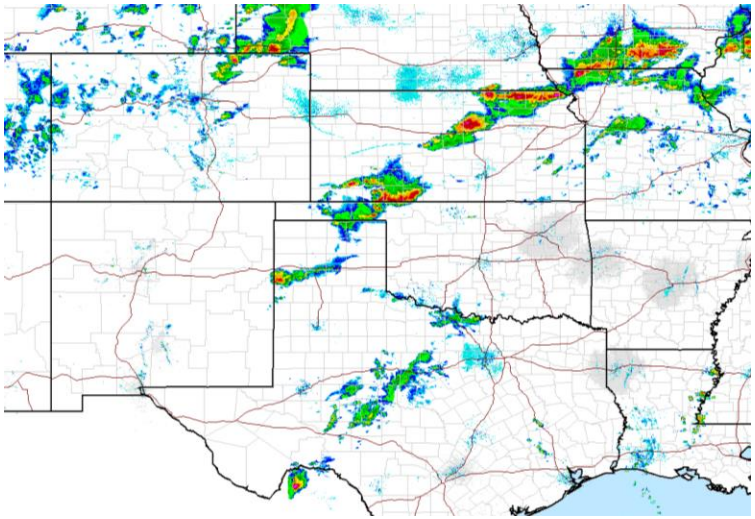


Dataset: nam RIP: reflect
Fcst: 12.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0000 UTC Wed 29 May 13 (1900 CDT Tue 28 May 13)

NAM initialization

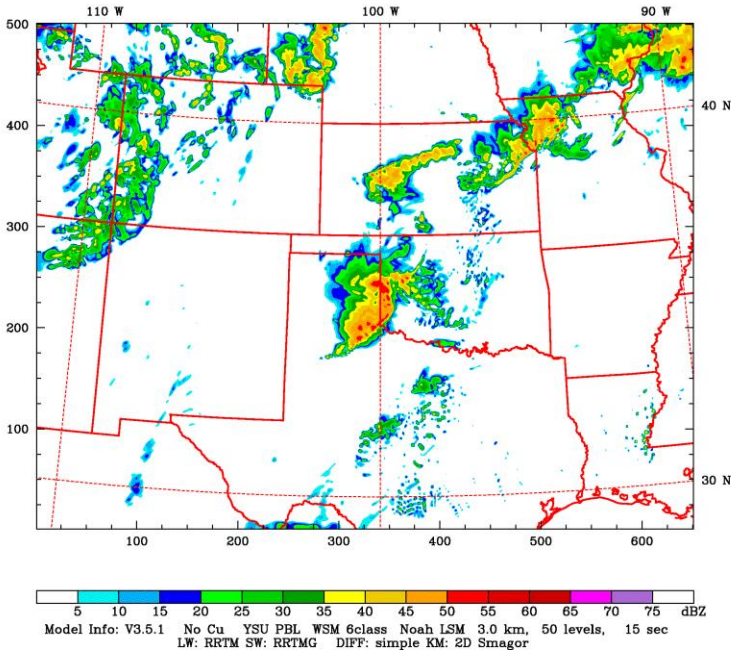


NEXRAD Mosaic

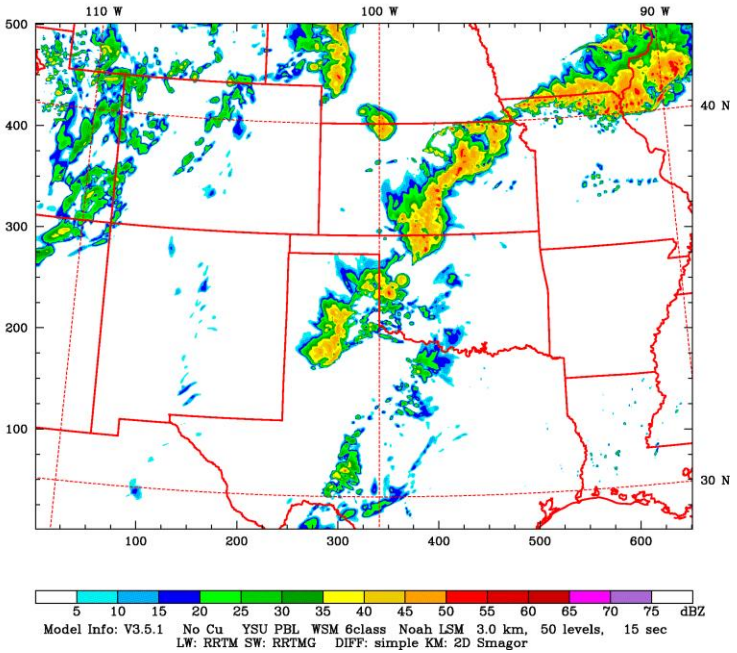


ARW 12-h forecast
v00Z/29 May 2013
i12Z/28 May 2013

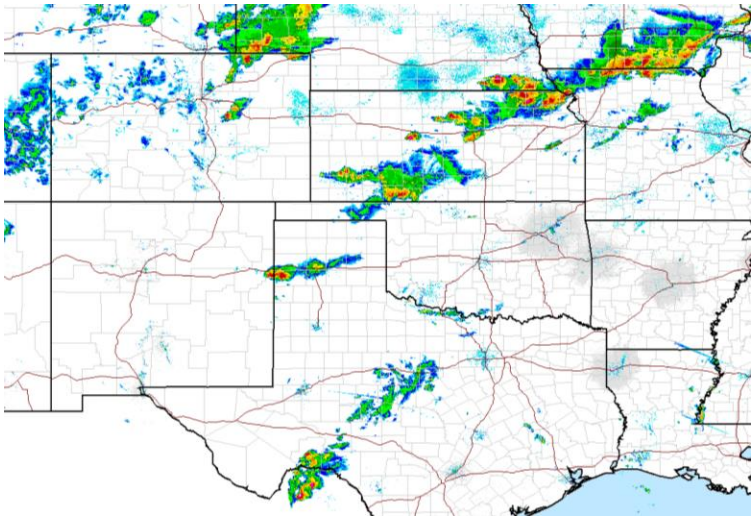
GFS initialization



NAM initialization



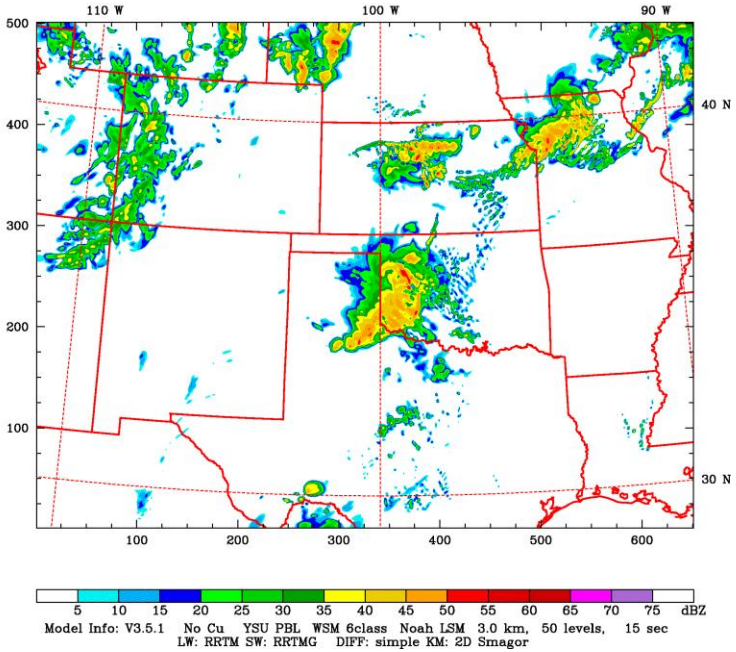
NEXRAD Mosaic



ARW 13-h forecast
v01Z/29 May 2013
i12Z/28 May 2013

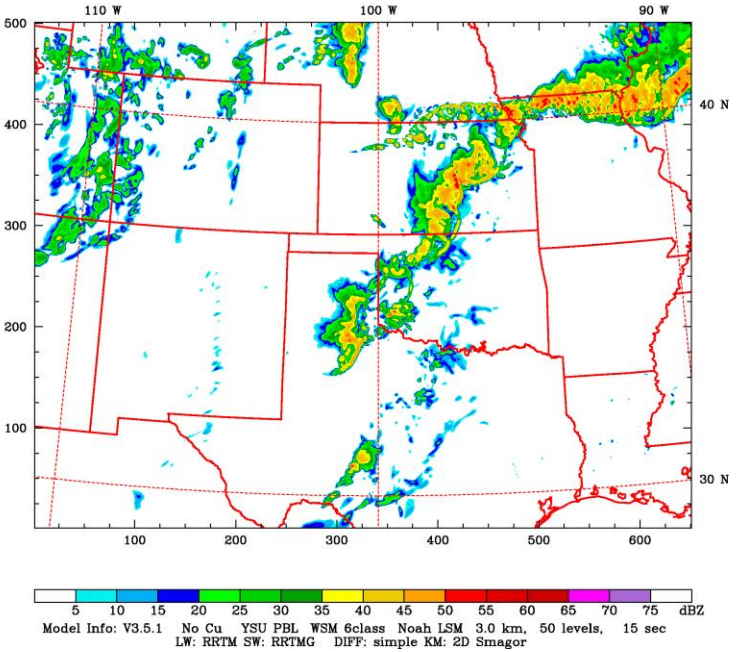
Dataset: gfs RIP: reflect
Fcst: 14.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0200 UTC Wed 29 May 13 (2100 CDT Tue 28 May 13)

GFS initialization

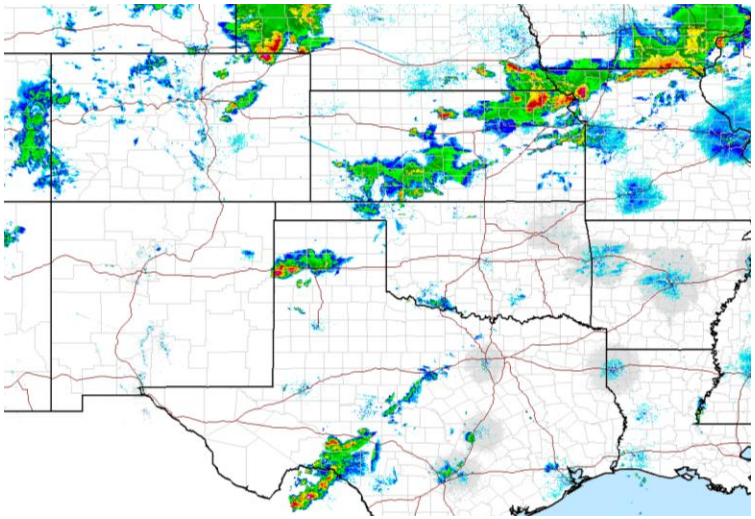


Dataset: nam RIP: reflect
Fcst: 14.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0200 UTC Wed 29 May 13 (2100 CDT Tue 28 May 13)

NAM initialization



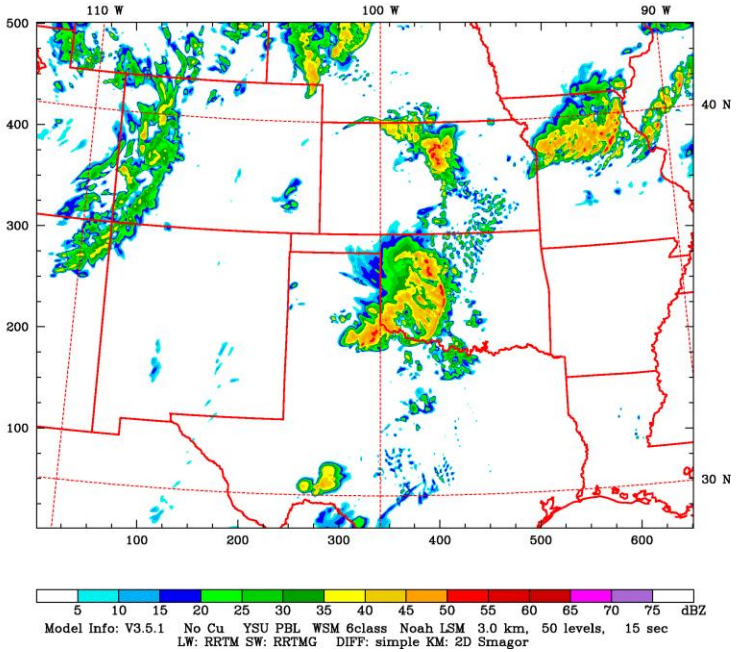
NEXRAD Mosaic



ARW 14-h forecast
v02Z/29 May 2013
i12Z/28 May 2013

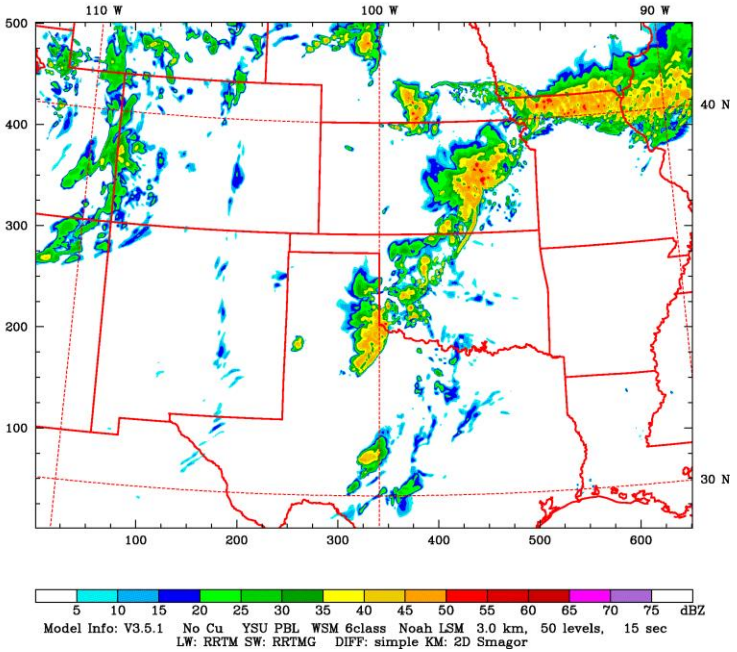
Dataset: gfs RIP: reflect
Fcst: 15.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0300 UTC Wed 29 May 13 (2200 CDT Tue 28 May 13)

GFS initialization

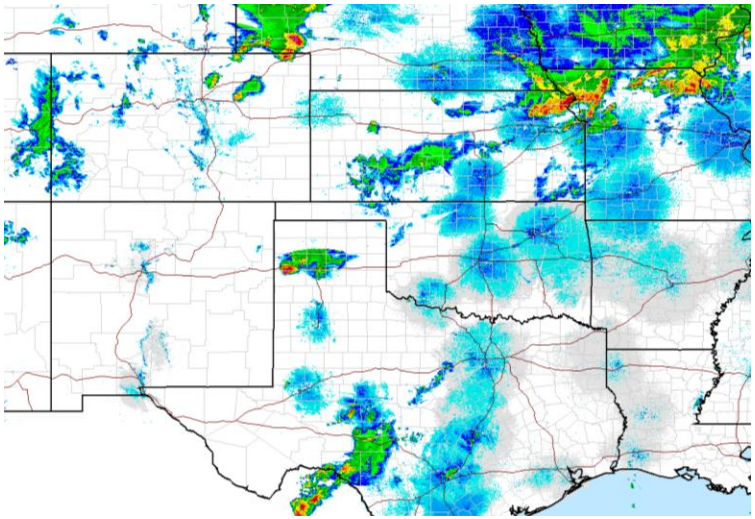


Dataset: nam RIP: reflect
Fcst: 15.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0300 UTC Wed 29 May 13 (2200 CDT Tue 28 May 13)

NAM initialization



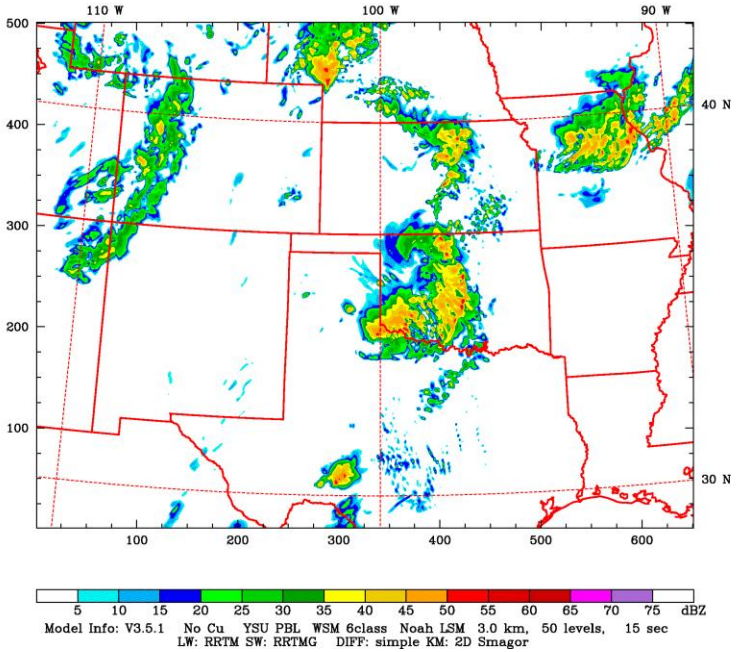
NEXRAD Mosaic



ARW 15-h forecast
v03Z/29 May 2013
i12Z/28 May 2013

Dataset: gfs RIP: reflect
Fcst: 16.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0400 UTC Wed 29 May 13 (2300 CDT Tue 28 May 13)

GFS initialization



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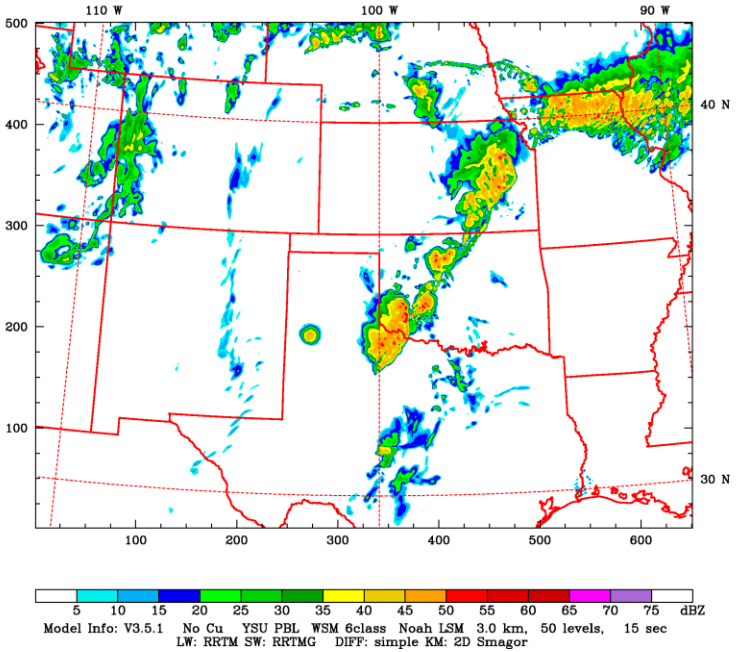
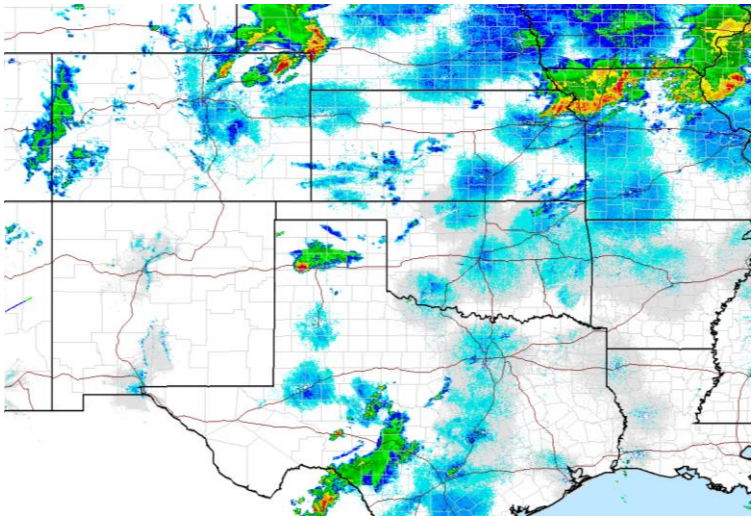
NAM initialization



NEXRAD Mosaic



ARW 16-h forecast
v04Z/29 May 2013
i12Z/28 May 2013

Dataset: gfs RIP: reflect
Fcst: 17.00 h
Max Reflectivity
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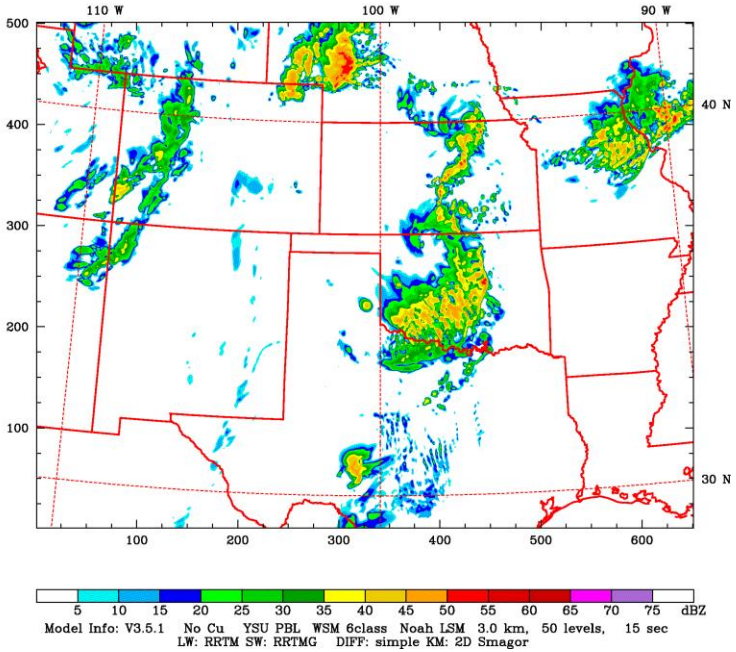
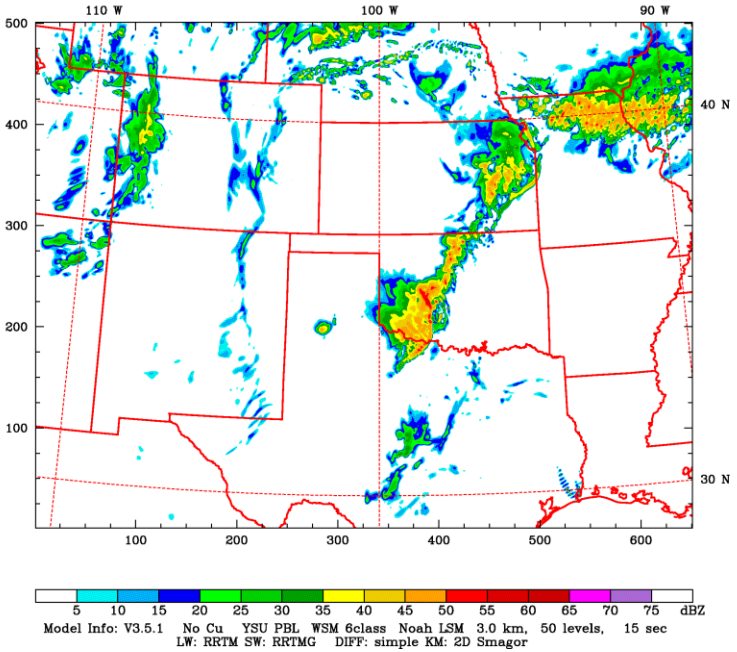
Valid: 0500 UTC Wed 29 May 13 (0000 CDT Wed 29 May 13)

GFS initialization

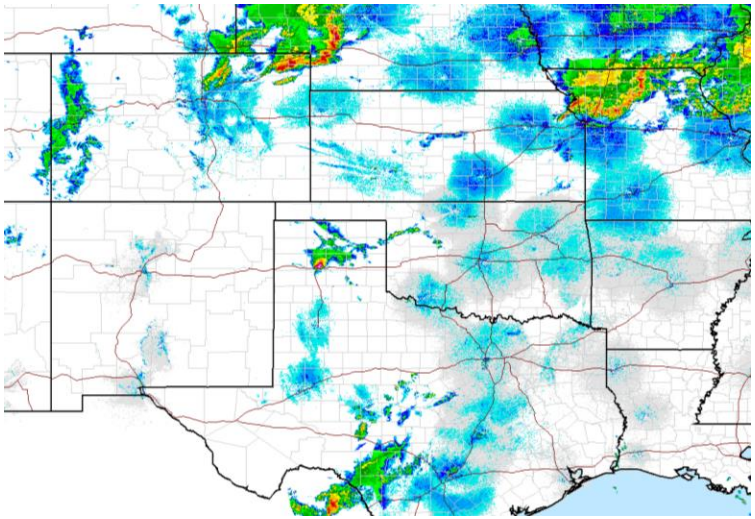


Dataset: nam RIP: reflect
Fcst: 17.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0500 UTC Wed 29 May 13 (0000 CDT Wed 29 May 13)

NAM initialization



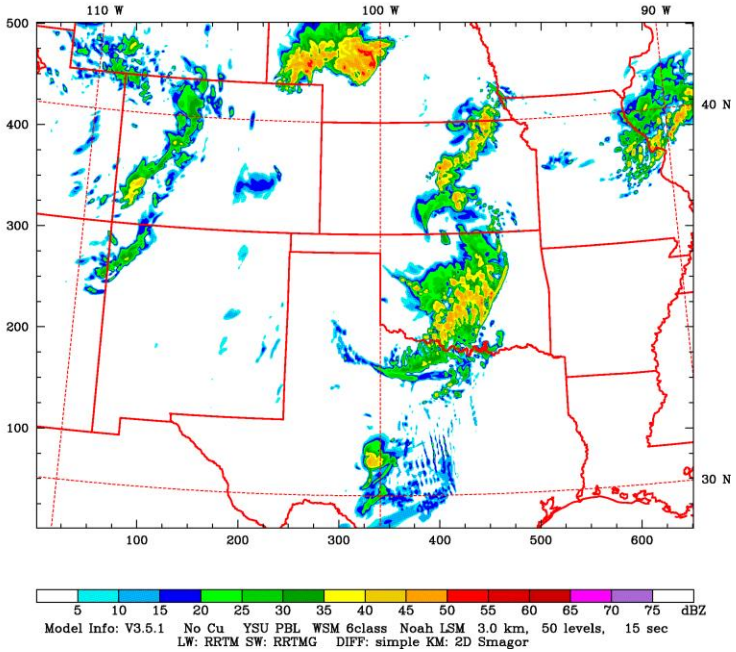
NEXRAD Mosaic



ARW 17-h forecast
v05Z/29 May 2013
i12Z/28 May 2013

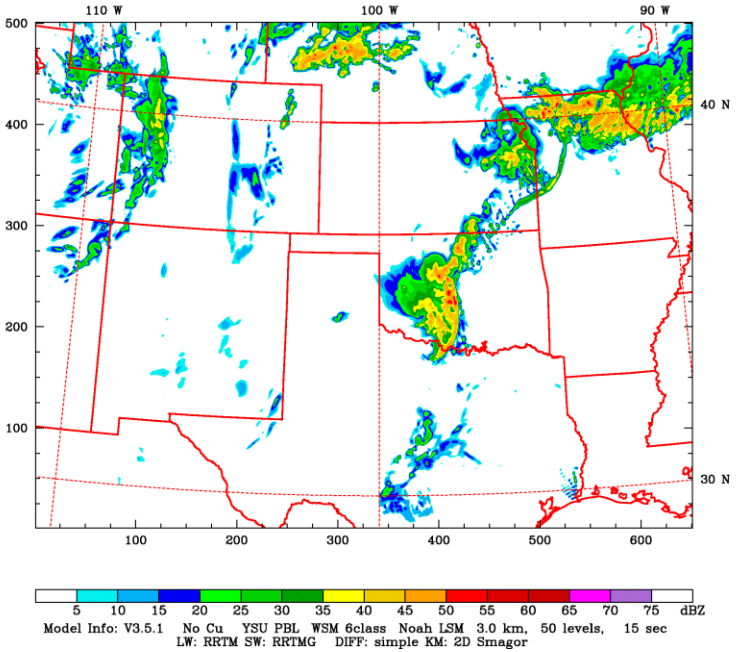
Dataset: gfs RIP: reflect
Fcst: 18.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0600 UTC Wed 29 May 13 (0100 CDT Wed 29 May 13)

GFS initialization

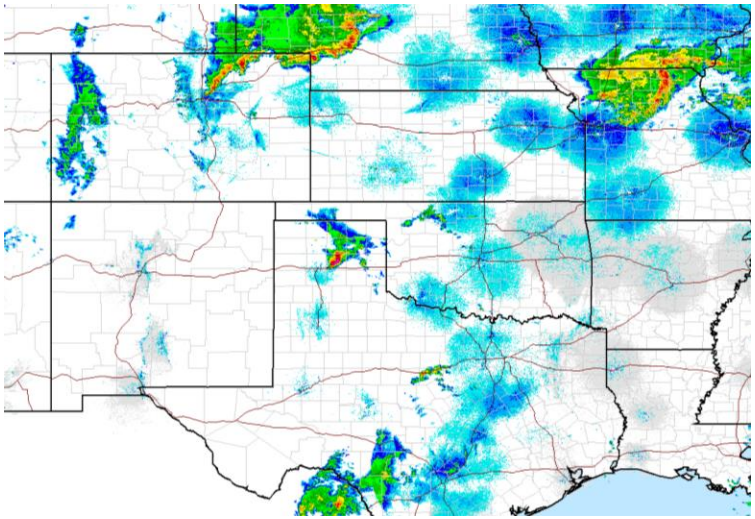


Dataset: nam RIP: reflect
Fcst: 18.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0600 UTC Wed 29 May 13 (0100 CDT Wed 29 May 13)

NAM initialization



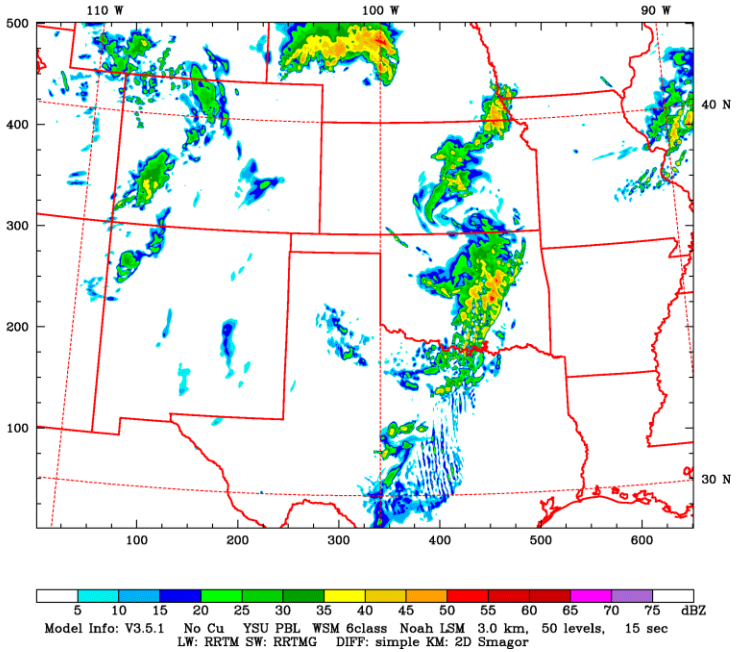
NEXRAD Mosaic



ARW 18-h forecast
v06Z/29 May 2013
i12Z/28 May 2013

Dataset: gfs RIP: reflect
Fcst: 19.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0700 UTC Wed 29 May 13 (0200 CDT Wed 29 May 13)

GFS initialization



Dataset: nam RIP: reflect
Fcst: 19.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
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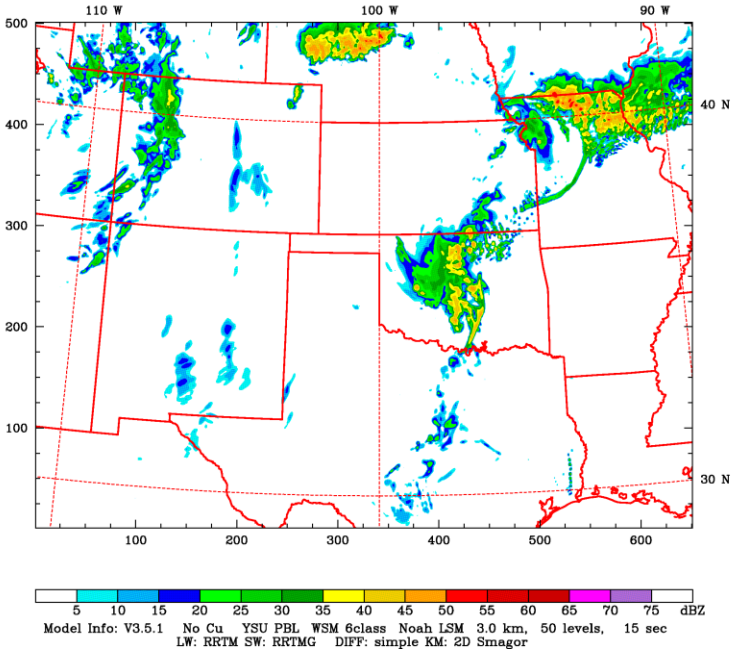
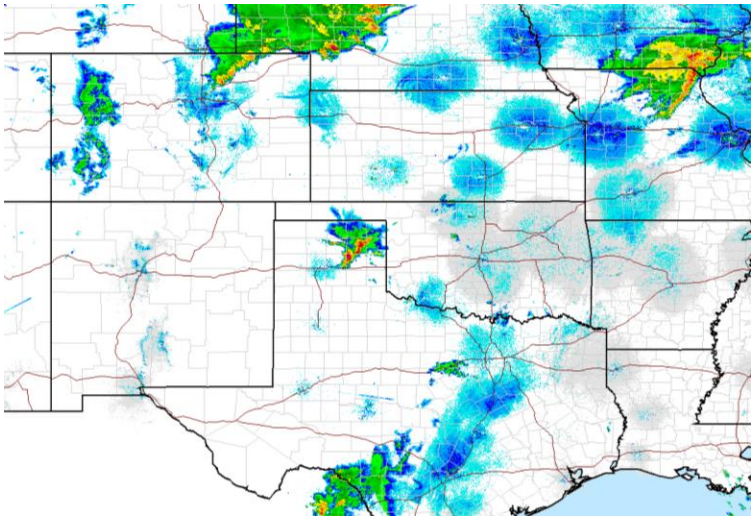
NAM initialization



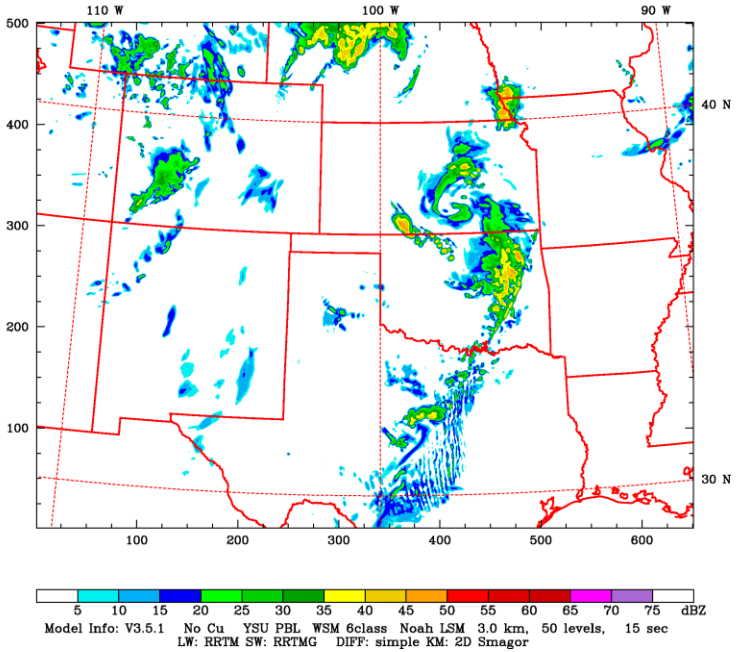
NEXRAD Mosaic



ARW 19-h forecast
v07Z/29 May 2013
i12Z/28 May 2013

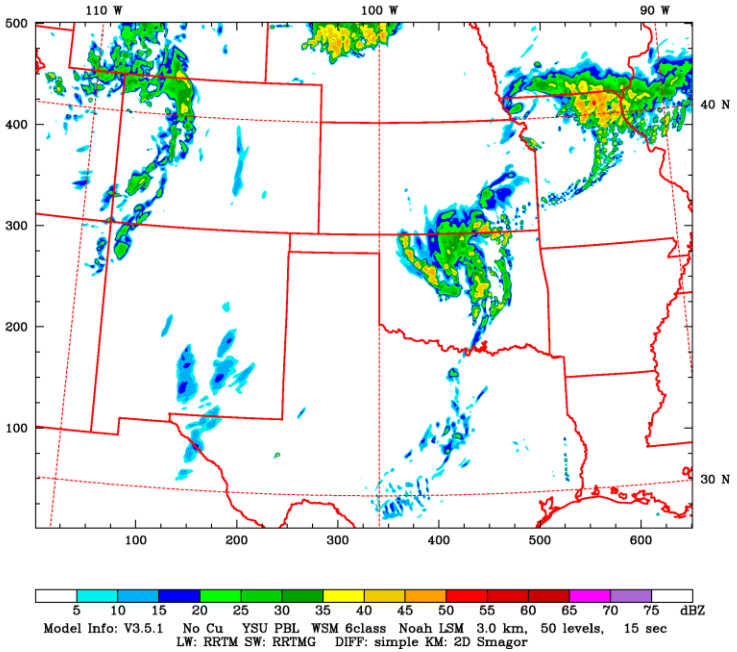
Dataset: gfs RIP: reflect
Fcst: 20.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0800 UTC Wed 29 May 13 (0300 CDT Wed 29 May 13)

GFS initialization

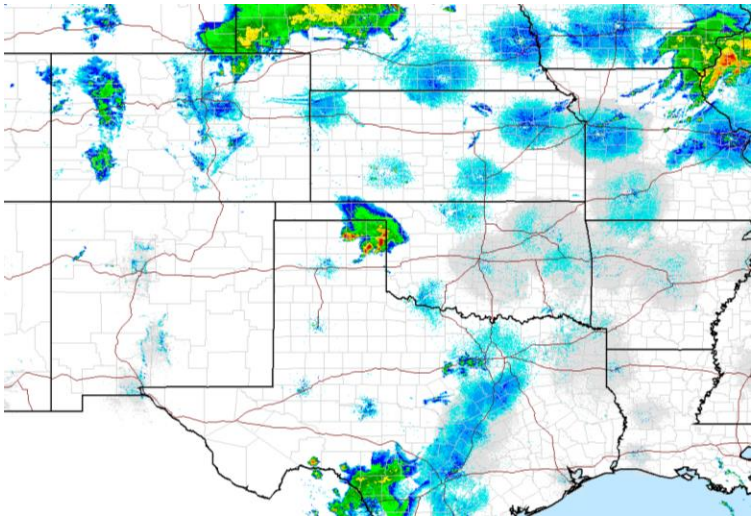


Dataset: nam RIP: reflect
Fcst: 20.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0800 UTC Wed 29 May 13 (0300 CDT Wed 29 May 13)

NAM initialization



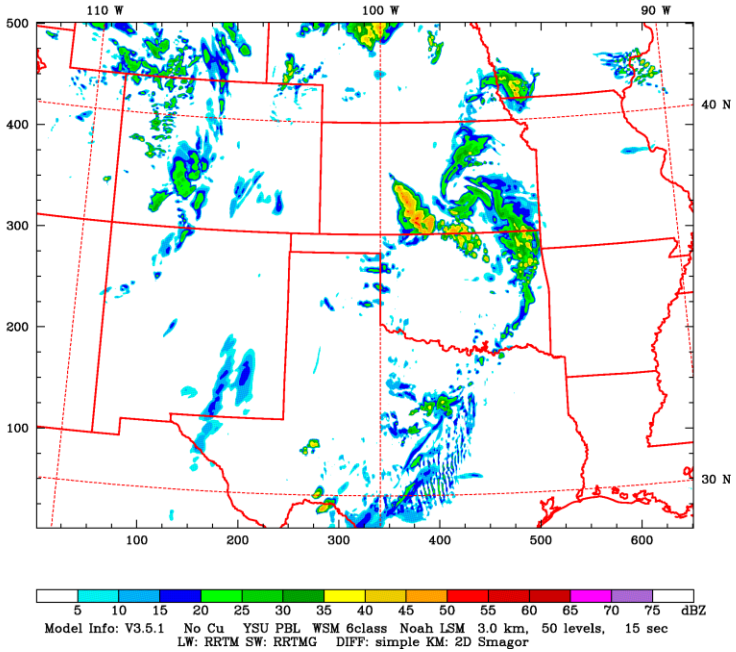
NEXRAD Mosaic



ARW 20-h forecast
v08Z/29 May 2013
i12Z/28 May 2013

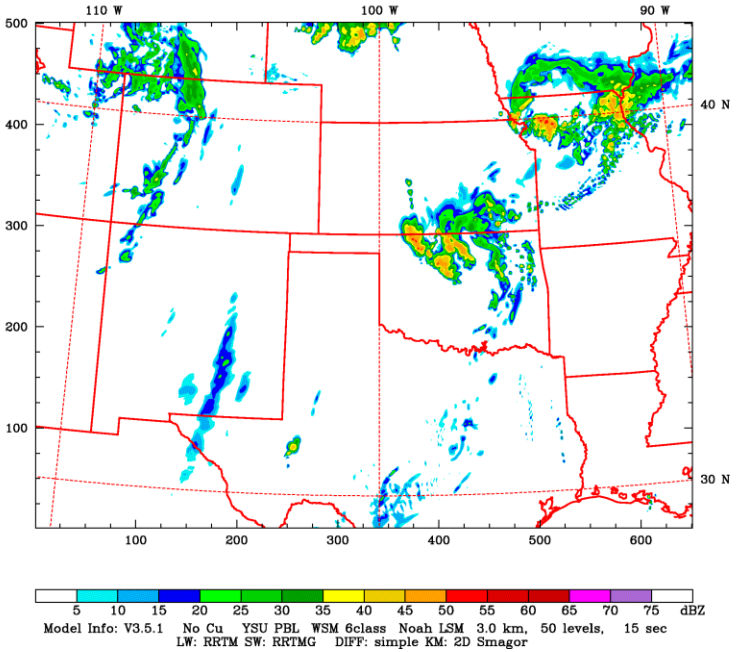
Dataset: gfs RIP: reflect
Fcst: 21.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0900 UTC Wed 29 May 13 (0400 CDT Wed 29 May 13)

GFS initialization

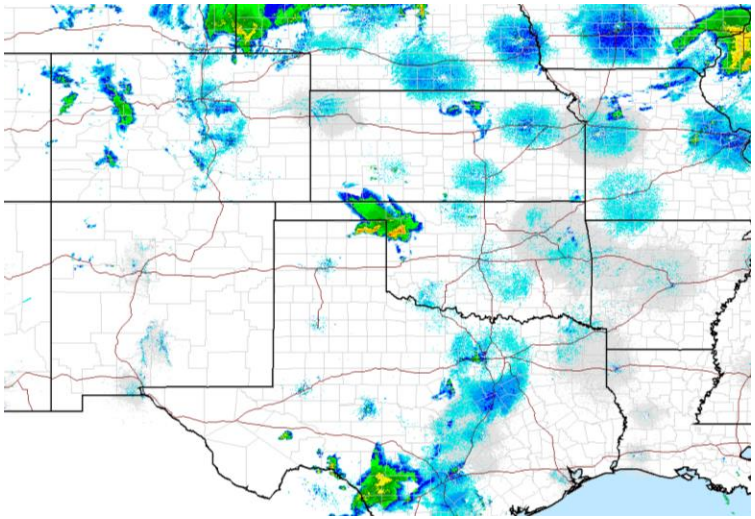


Dataset: nam RIP: reflect
Fcst: 21.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 0900 UTC Wed 29 May 13 (0400 CDT Wed 29 May 13)

NAM initialization



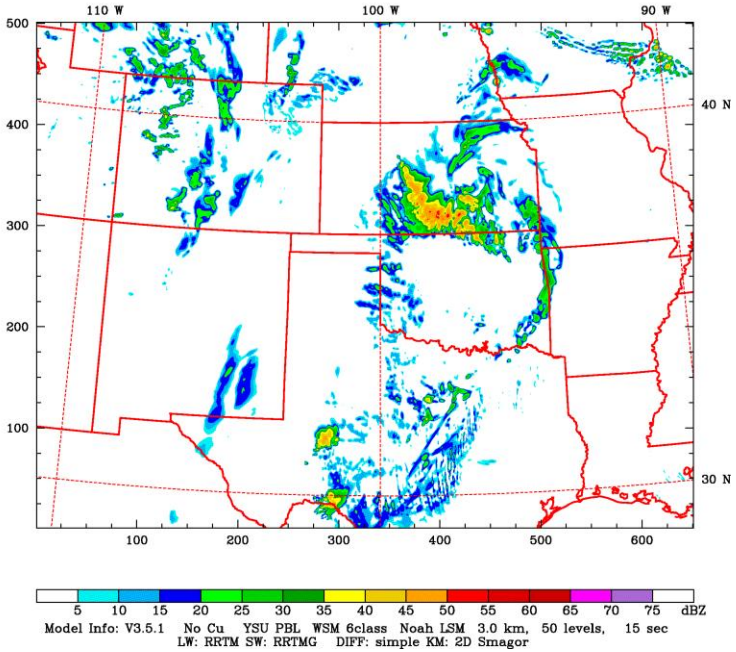
NEXRAD Mosaic



ARW 21-h forecast
v09Z/29 May 2013
i12Z/28 May 2013

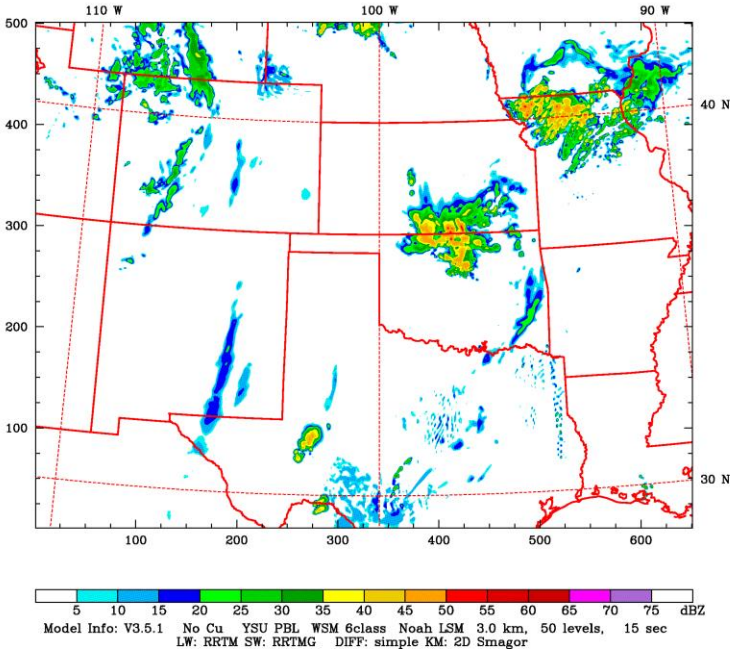
Dataset: gfs RIP: reflect
Fcst: 22.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1000 UTC Wed 29 May 13 (0500 CDT Wed 29 May 13)

GFS initialization

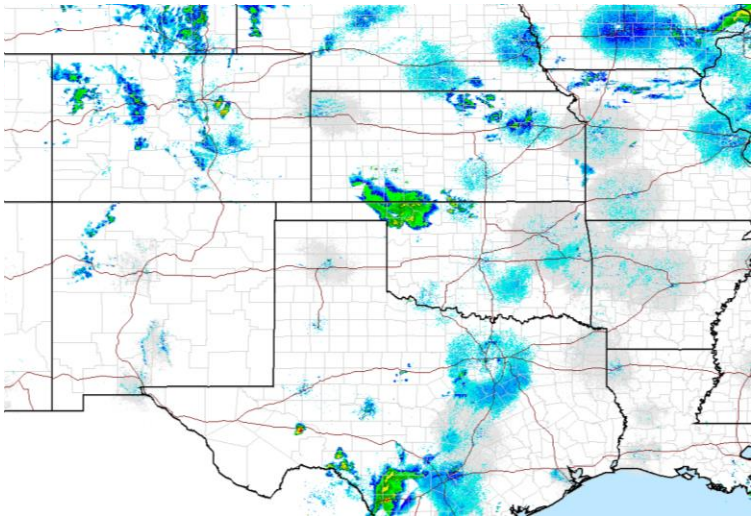


Dataset: nam RIP: reflect
Fcst: 22.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1000 UTC Wed 29 May 13 (0500 CDT Wed 29 May 13)

NAM initialization



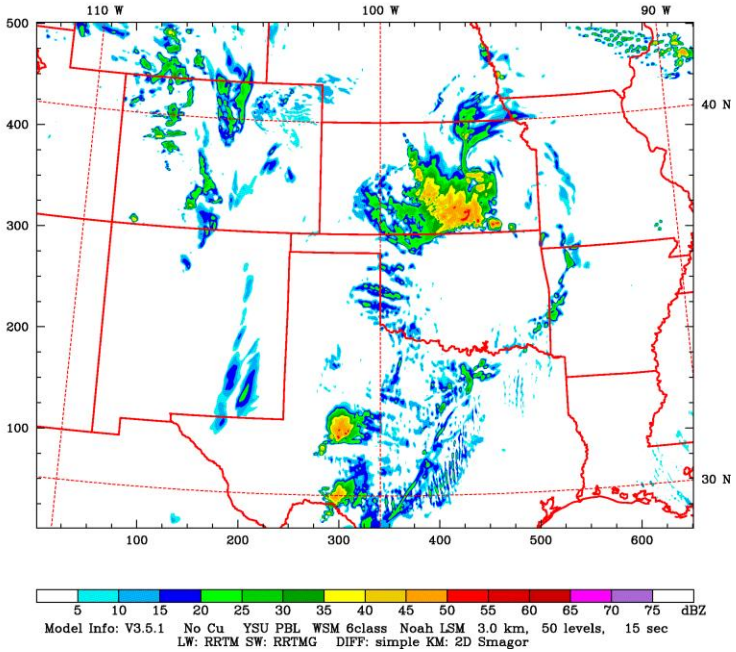
NEXRAD Mosaic



ARW 22-h forecast
v10Z/29 May 2013
i12Z/28 May 2013

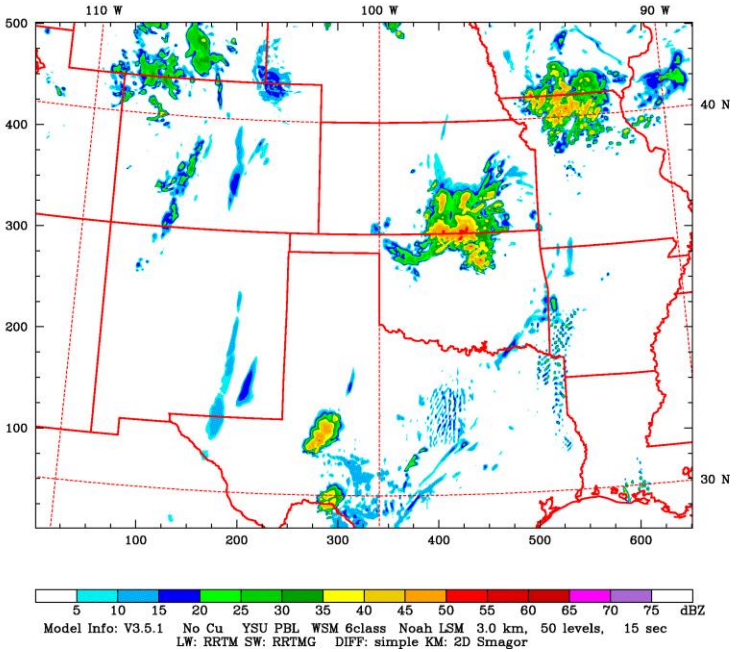
Dataset: gfs RIP: reflect
Fcst: 23.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1100 UTC Wed 29 May 13 (0600 CDT Wed 29 May 13)

GFS initialization

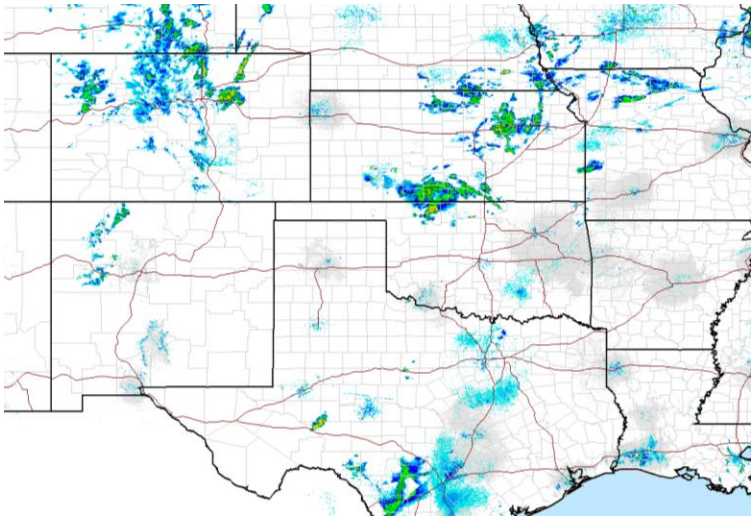


Dataset: nam RIP: reflect
Fcst: 23.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1100 UTC Wed 29 May 13 (0600 CDT Wed 29 May 13)

NAM initialization



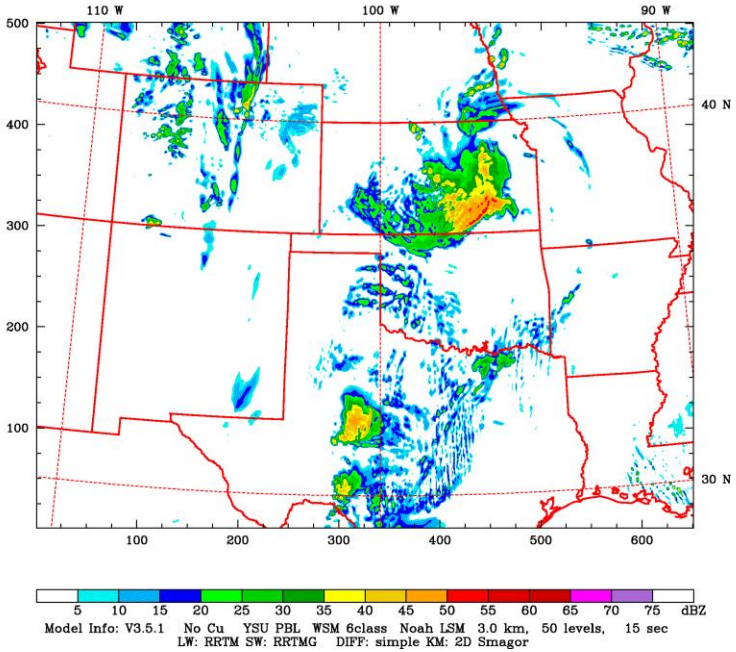
NEXRAD Mosaic



ARW 23-h forecast
v11Z/29 May 2013
i12Z/28 May 2013

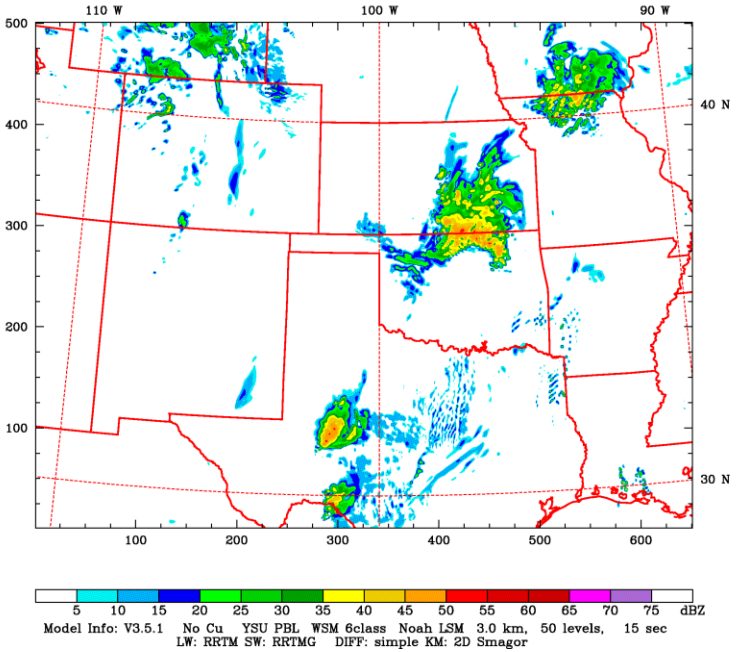
Dataset: gfs RIP: reflect
Fcst: 24.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1200 UTC Wed 29 May 13 (0700 CDT Wed 29 May 13)

GFS initialization



Dataset: nam RIP: reflect
Fcst: 24.00 h
Max Reflectivity
Init: 1200 UTC Tue 28 May 13
Valid: 1200 UTC Wed 29 May 13 (0700 CDT Wed 29 May 13)

NAM initialization



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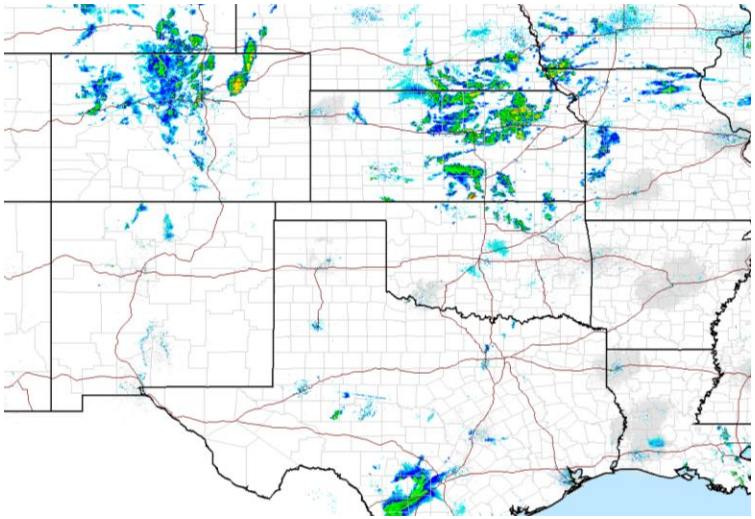
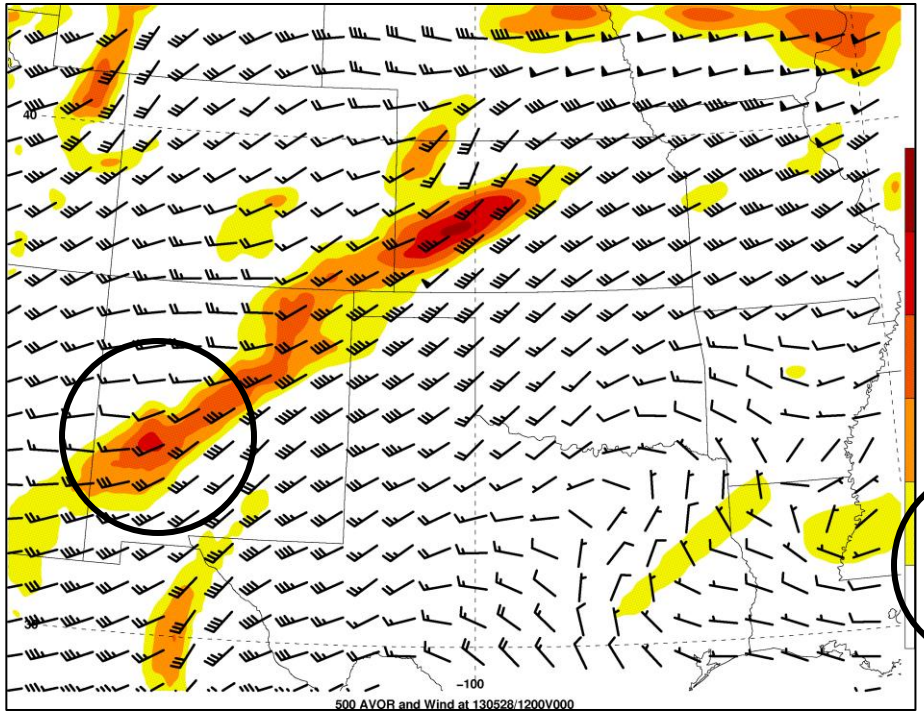


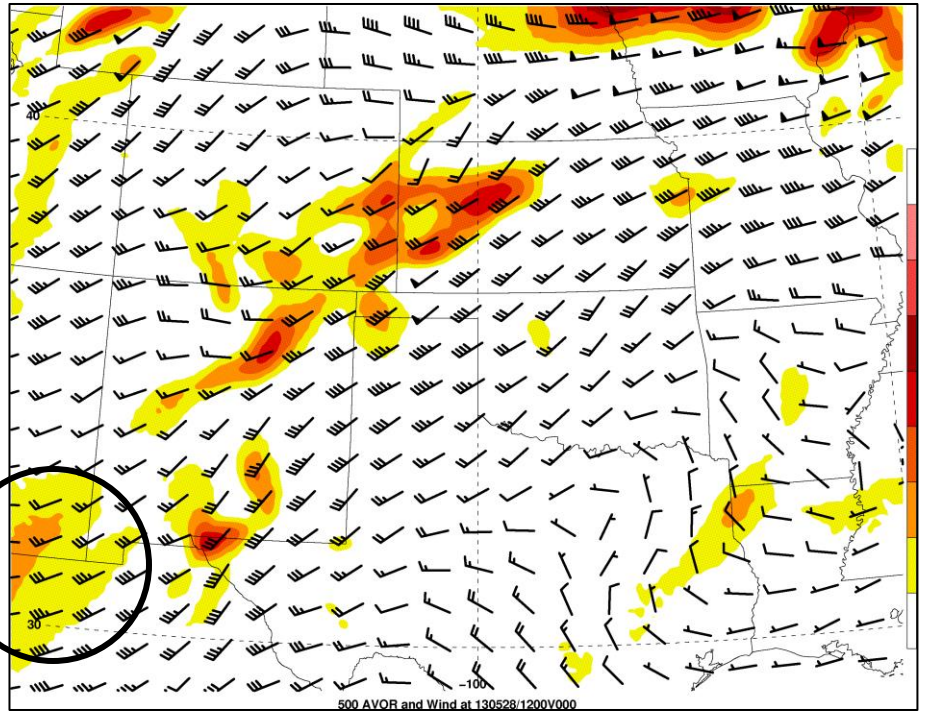
ARW 24-h forecast
v12Z/29 May 2013
i12Z/28 May 2013

500 hPa $\zeta+f$ and Wind at 12Z/28 May 2013

ARW (GFS Init) 0-h Forecast



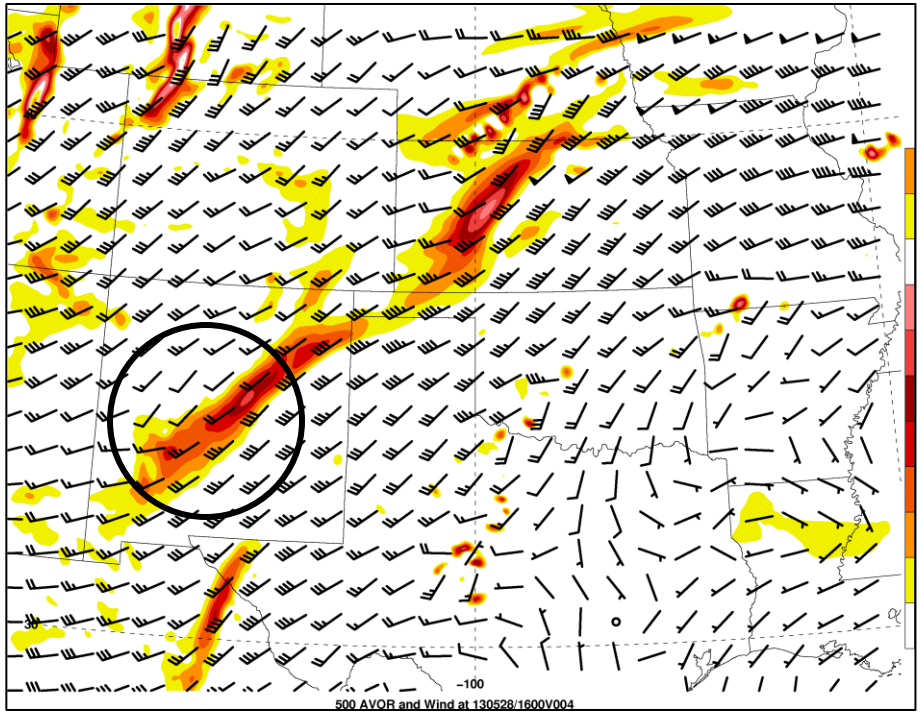
RAP Analysis



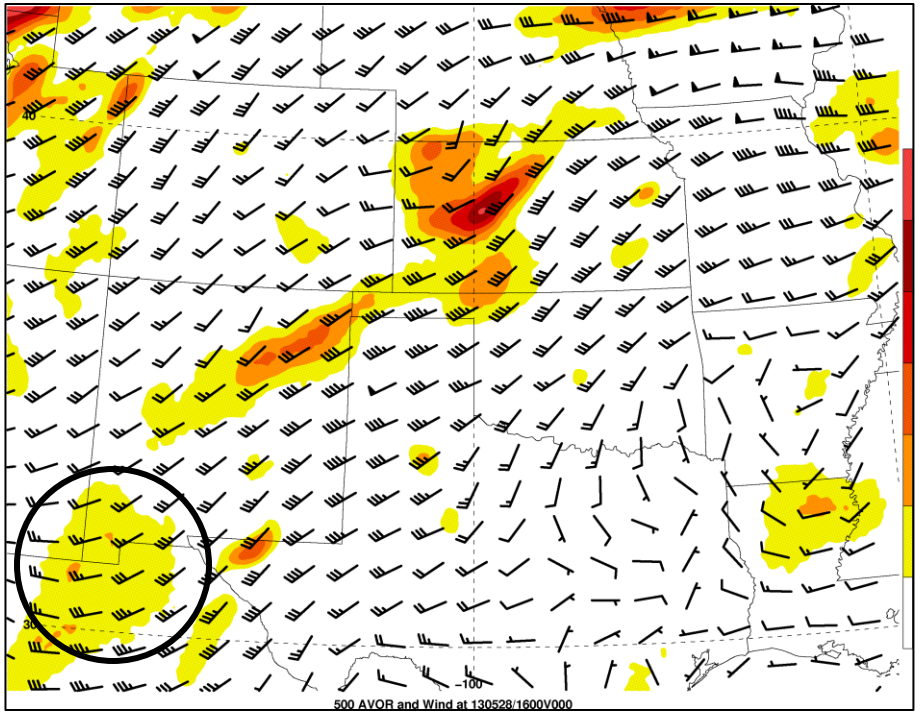
- **Differences in trough structure over New Mexico**
- **Southwest end of vorticity filament over Mexico absent in ARW**

500 hPa $\zeta+f$ and Wind at 16Z/28 May 2013

ARW (GFS Init) 4-h Forecast

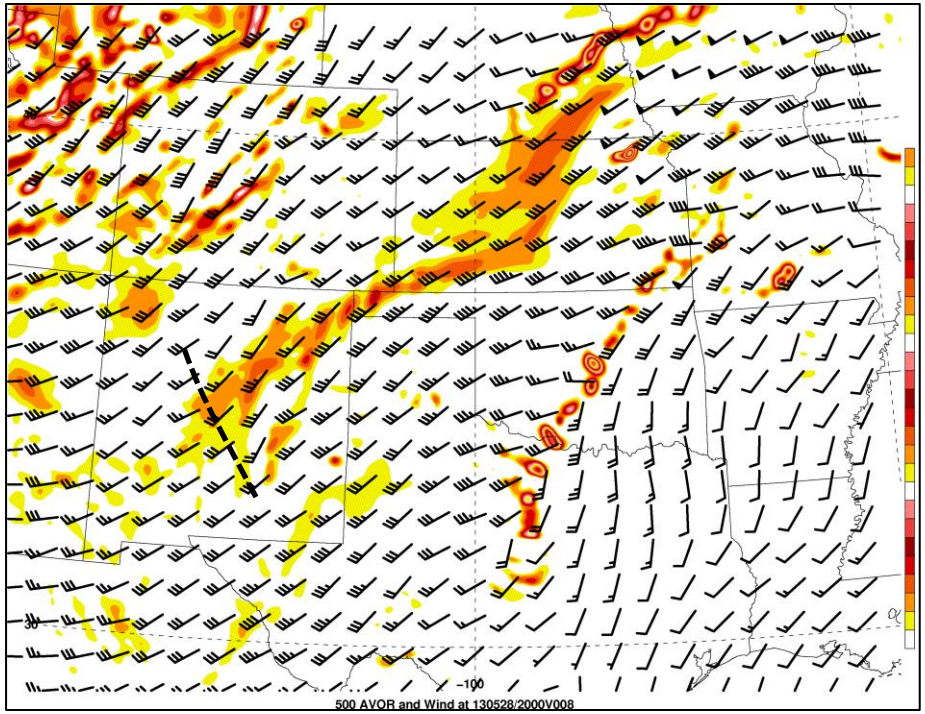


RAP Analysis

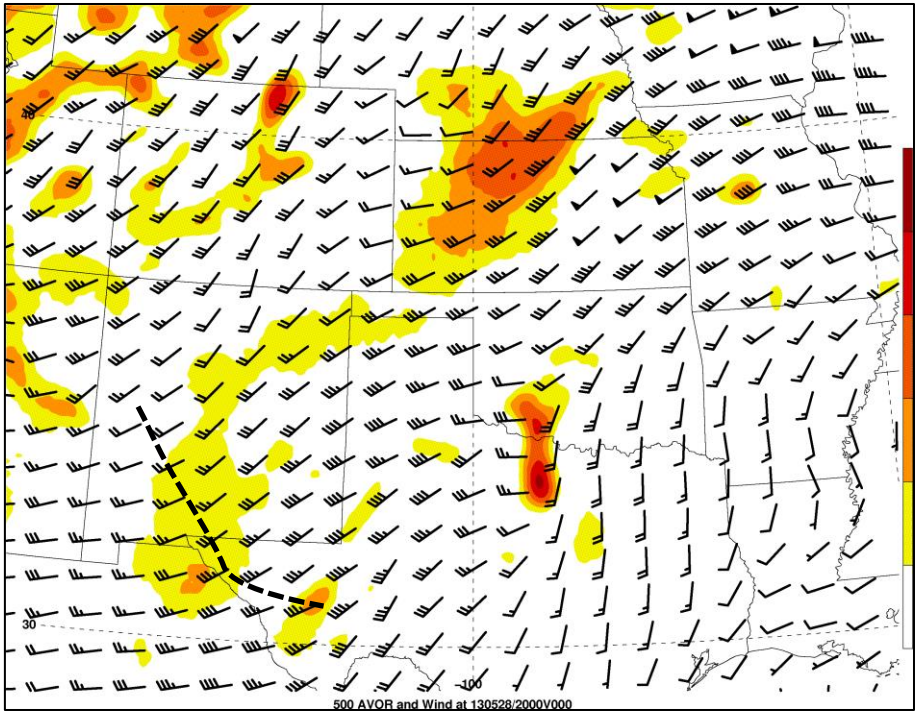


500 hPa $\zeta+f$ and Wind at 20Z/28 May 2013

ARW (GFS Init) 8-h Forecast

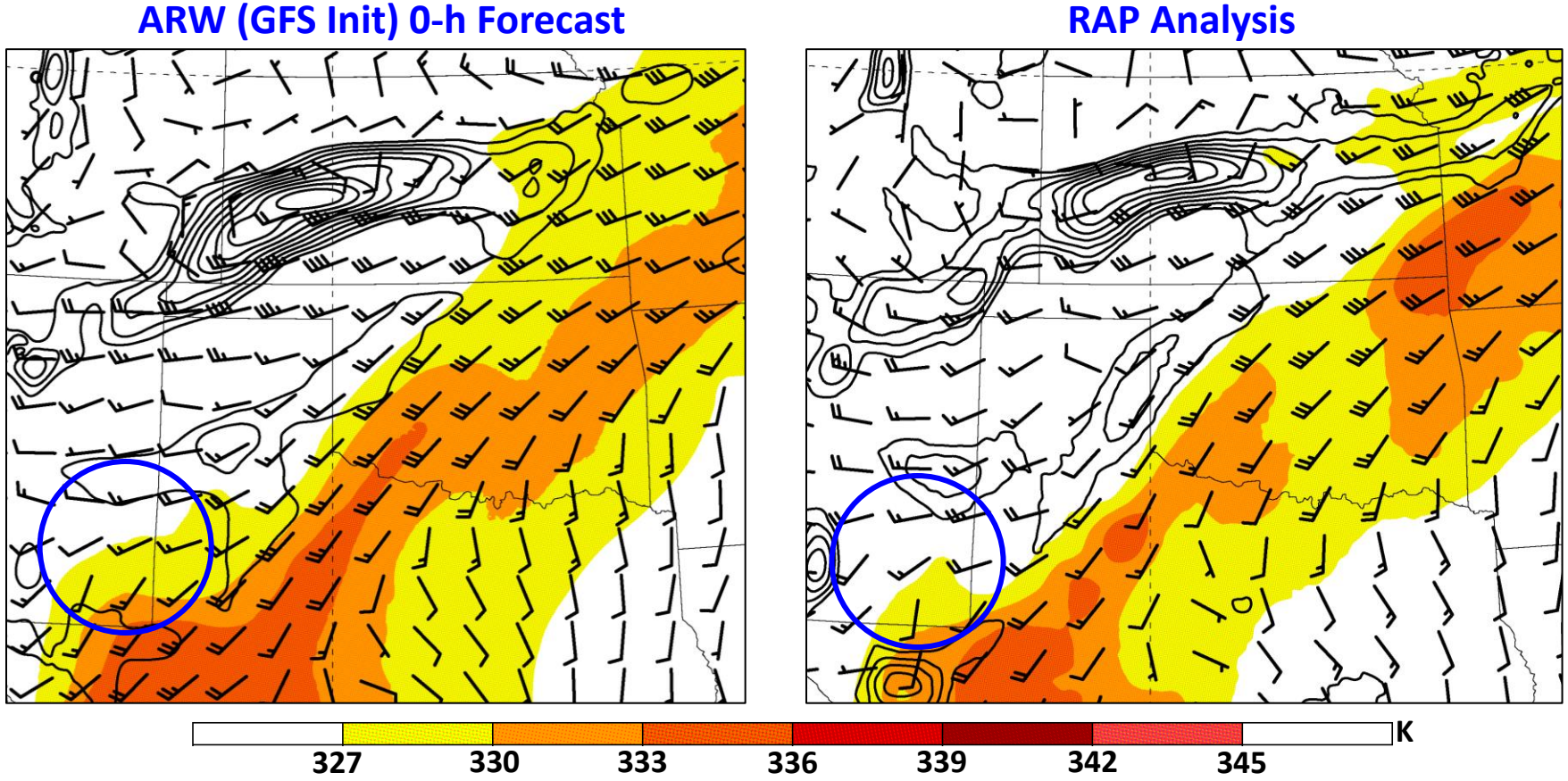


RAP Analysis



- **Disturbance farther south in RAP analysis**
- **Flow more SW over TX Panhandle in ARW**

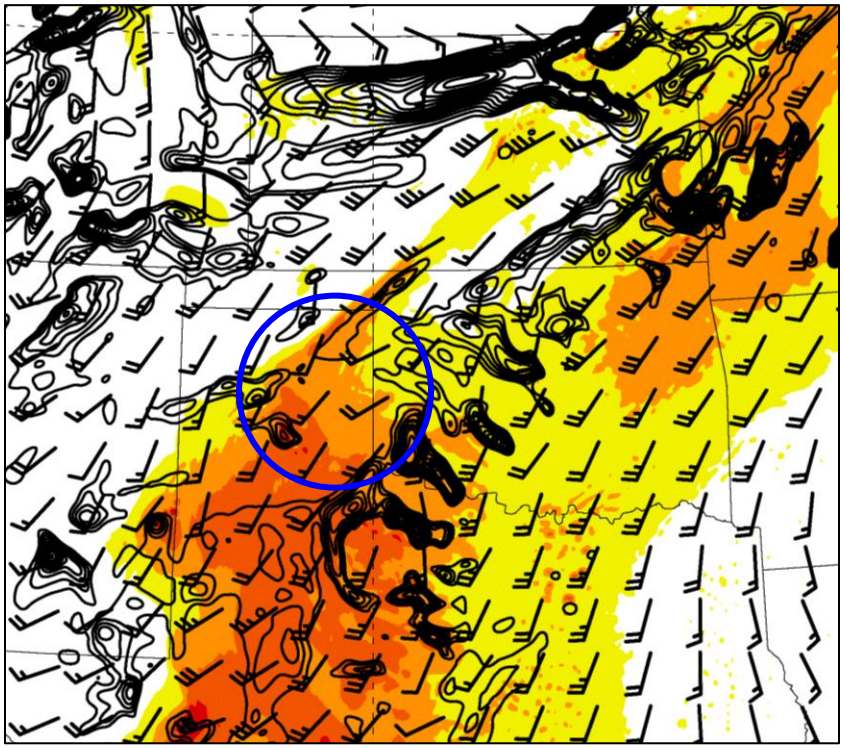
800–400 hPa Mean θ_e, and 700 hPa Wind and ζ at 12Z/28 May 2013



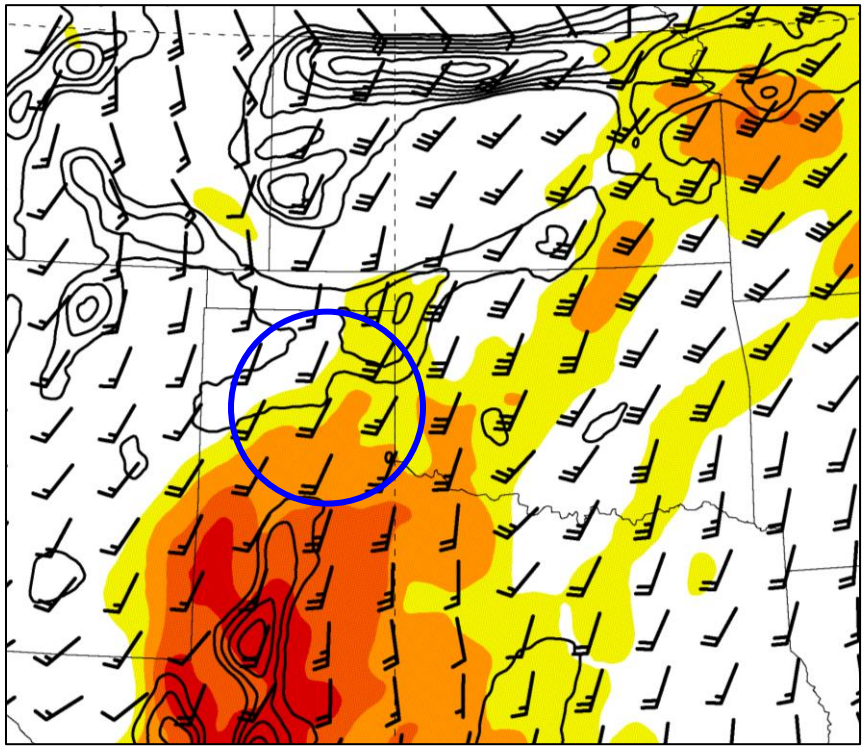
- Midlevel $\theta_e \geq 3$ K too high in ARW

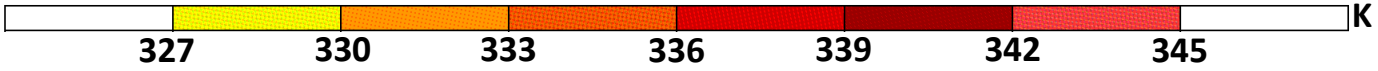
800–400 hPa Mean θ_e, and 700 hPa Wind and ζ at 20Z/28 May 2013

ARW (GFS Init) 8-h Forecast



RAP Analysis



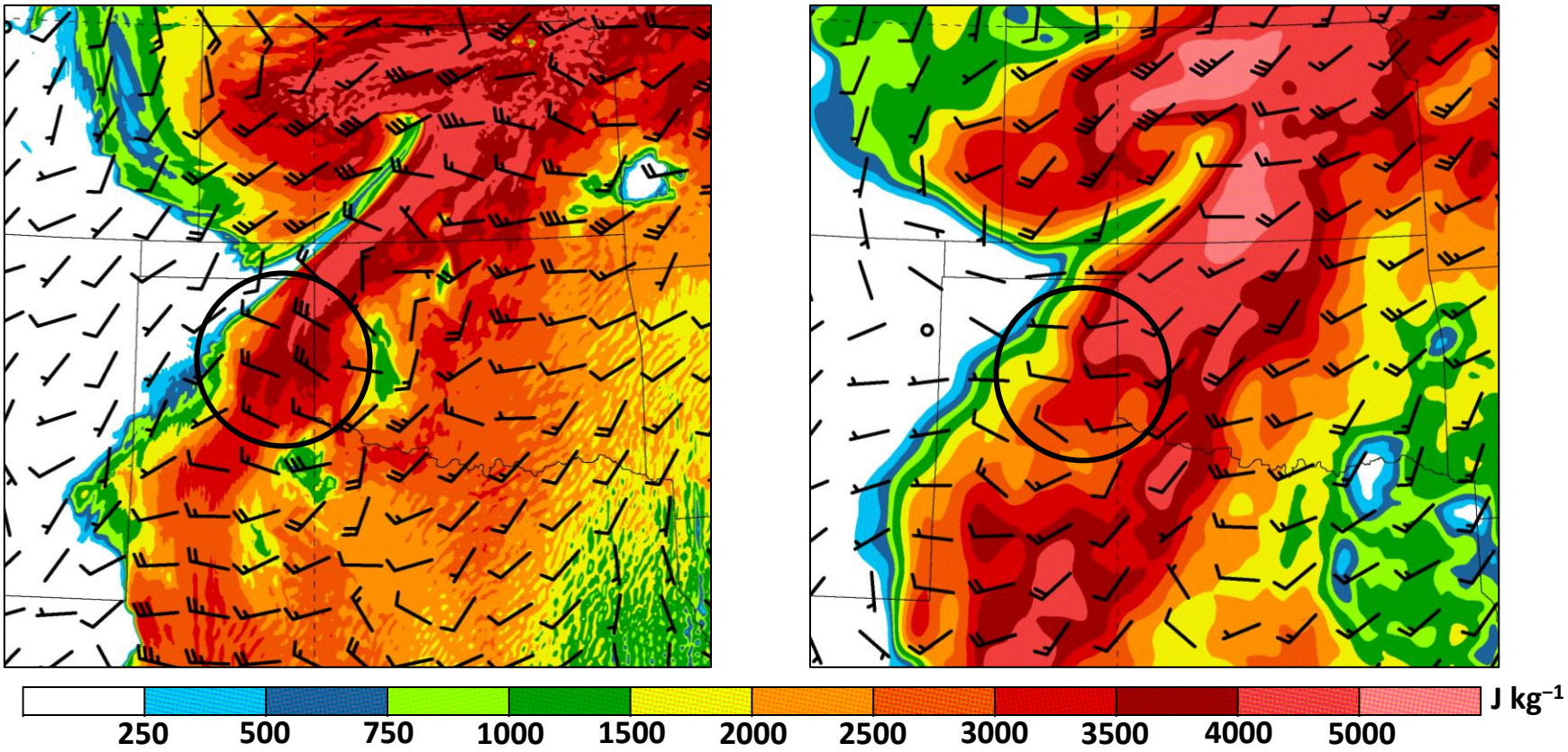


- Midlevel $\theta_e \geq 3$ K too high in ARW over TX Panhandle prior to initiation
- Flow is more SW in ARW → impact on vertical shear?
- Flow stronger in NM in ARW → signature of triggering wave?

CAPE and SFC–700 hPa Wind Shear at 20Z/28 May 2013

ARW (GFS Init) 8-h Forecast

RAP Analysis

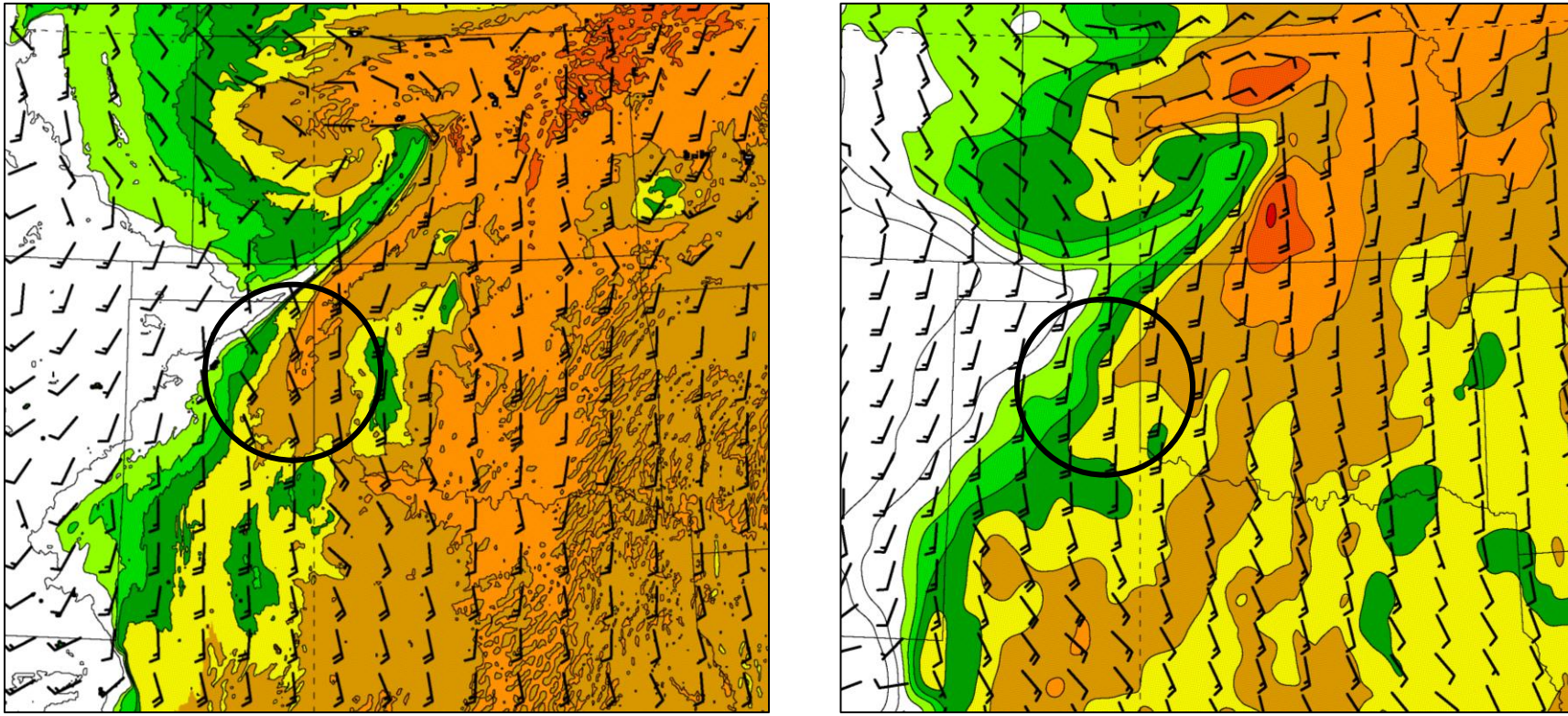


- CAPE comparable between ARW and RAP
- Vertical shear much stronger in ARW!

Surface Wind and Mixing Ratio at 20Z/28 May 2013

ARW (GFS Init) 8-h Forecast

RAP Analysis



- Surface more moist and flow is backed to southeasterly
- Response to upper wave over NM in ARW?

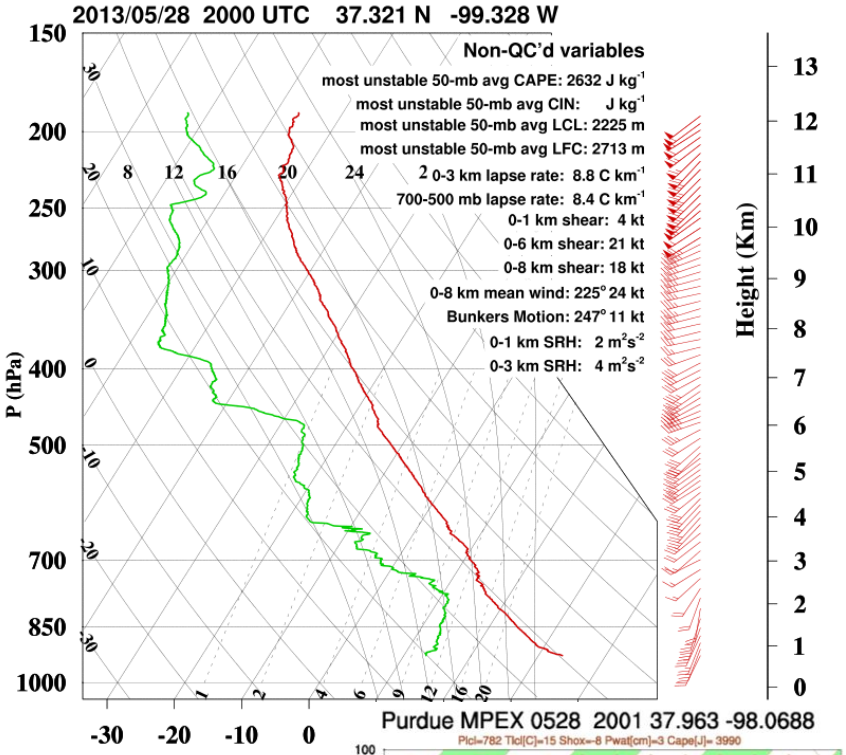
Summary

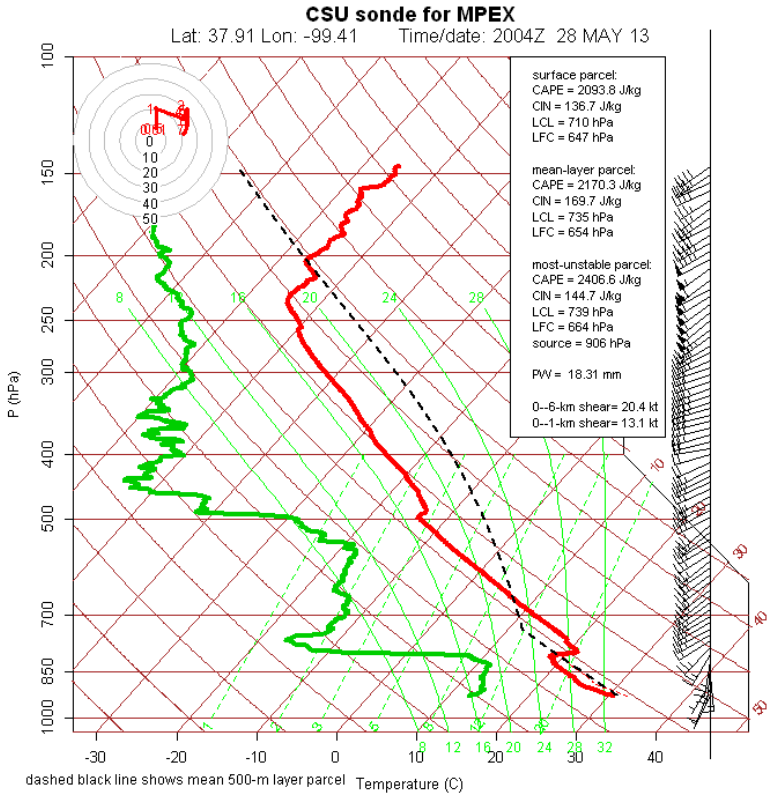
- GFS analyses too moist over west Texas/east New Mexico in region marked as sensitive in ensemble analysis
- Moist airmass moved to TX Panhandle by initiation time (~20Z)
- GFS analyses did not capture southwest end of vorticity streamer over northern Mexico
- Convective initiation in ARW forecasts was accurate; but convection overdeveloped in forecast
  - Higher vertical shear and deeper moisture in ARW, problems that originated in the GFS analyses

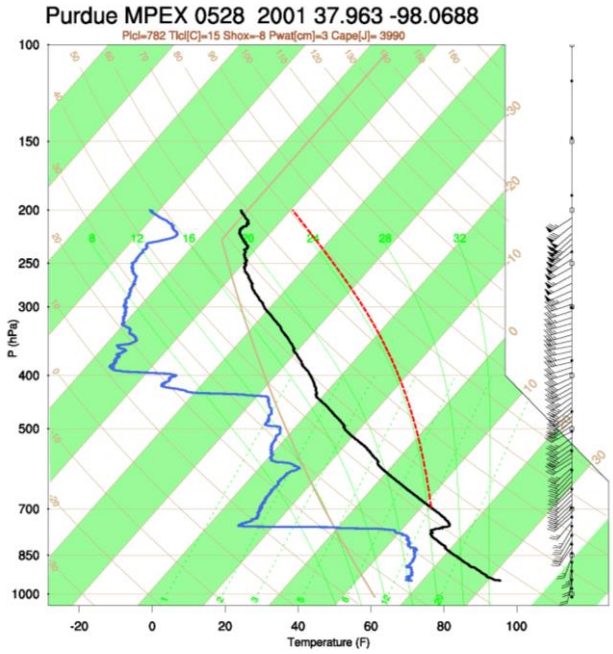
Final Comments

- **Dropsondes revealed that the operational GFS analysis:**
  - **was too moist over west Texas and east New Mexico**
  - **had weaker horizontal shear near vorticity streamer**
- **Dropsondes probably not useful for addressing analysis issues with southern end of vorticity streamer over Mexico**
- **Convective forecasts for southern Plains region may always have problems; even if dropsonde obs can identify persistent moisture errors in operational analysis, how do we deal systems over northern Mexico**

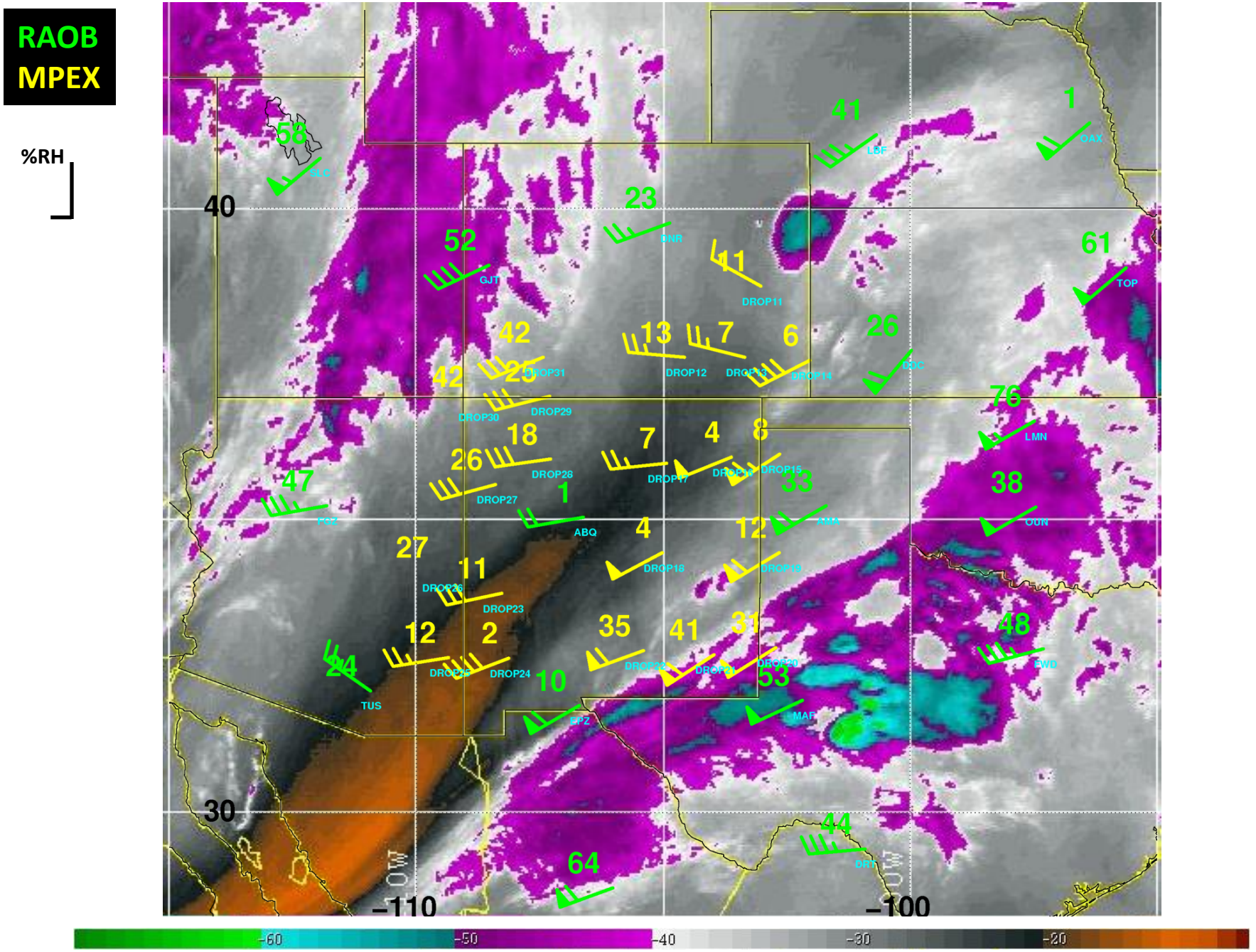
Extra slides


2013/05/28 2000 UTC 37.321 N -99.328 W
Non-QC'd variables
most unstable 50-mb avg CAPE: 2632 J kg-1
most unstable 50-mb avg CIN: J kg-1
most unstable 50-mb avg LCL: 2225 m
most unstable 50-mb avg LFC: 2713 m
0-3 km lapse rate: 8.8 C km-1
700-500 mb lapse rate: 8.4 C km-1
0-1 km shear: 4 kt
0-6 km shear: 21 kt
0-8 km shear: 18 kt
0-8 km mean wind: 225° 24 kt
Bunkers Motion: 247° 11 kt
0-1 km SRH: 2 m2s-2
0-3 km SRH: 4 m2s-2
P (hPa)
Height (Km)

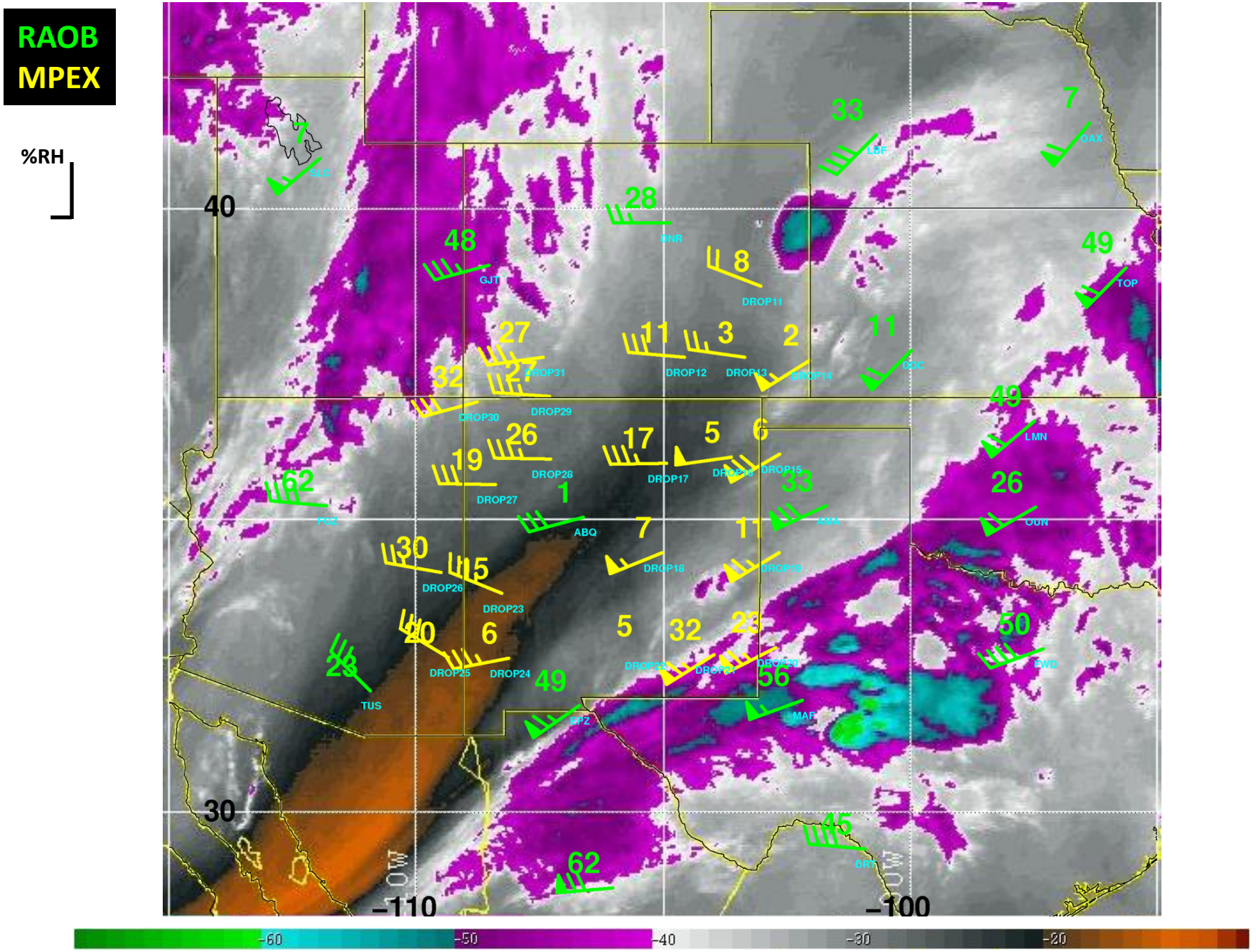

CSU sonde for MPEX
Lat: 37.91 Lon: -99.41 Time/date: 2004Z 28 MAY 13
surface parcel:
CAPE = 2093.8 J/kg
CIN = 136.7 J/kg
LCL = 710 hPa
LFC = 647 hPa
mean-layer parcel:
CAPE = 2170.3 J/kg
CIN = 169.7 J/kg
LCL = 735 hPa
LFC = 654 hPa
most-unstable parcel:
CAPE = 2406.6 J/kg
CIN = 144.7 J/kg
LCL = 739 hPa
LFC = 664 hPa
source = 906 hPa
PW = 18.31 mm
0--6-km shear= 20.4 kt
0--1-km shear= 13.1 kt
P (hPa)
dashed black line shows mean 500-m layer parcel
Temperature (C)


Purdue MPEX 0528 2001 37.963 -98.0688
Plcl=782 Tlcl[C]=15 Shox=-8 Pwat[cm]=3 Cape[J]= 3990
P (hPa)
Temperature (F)

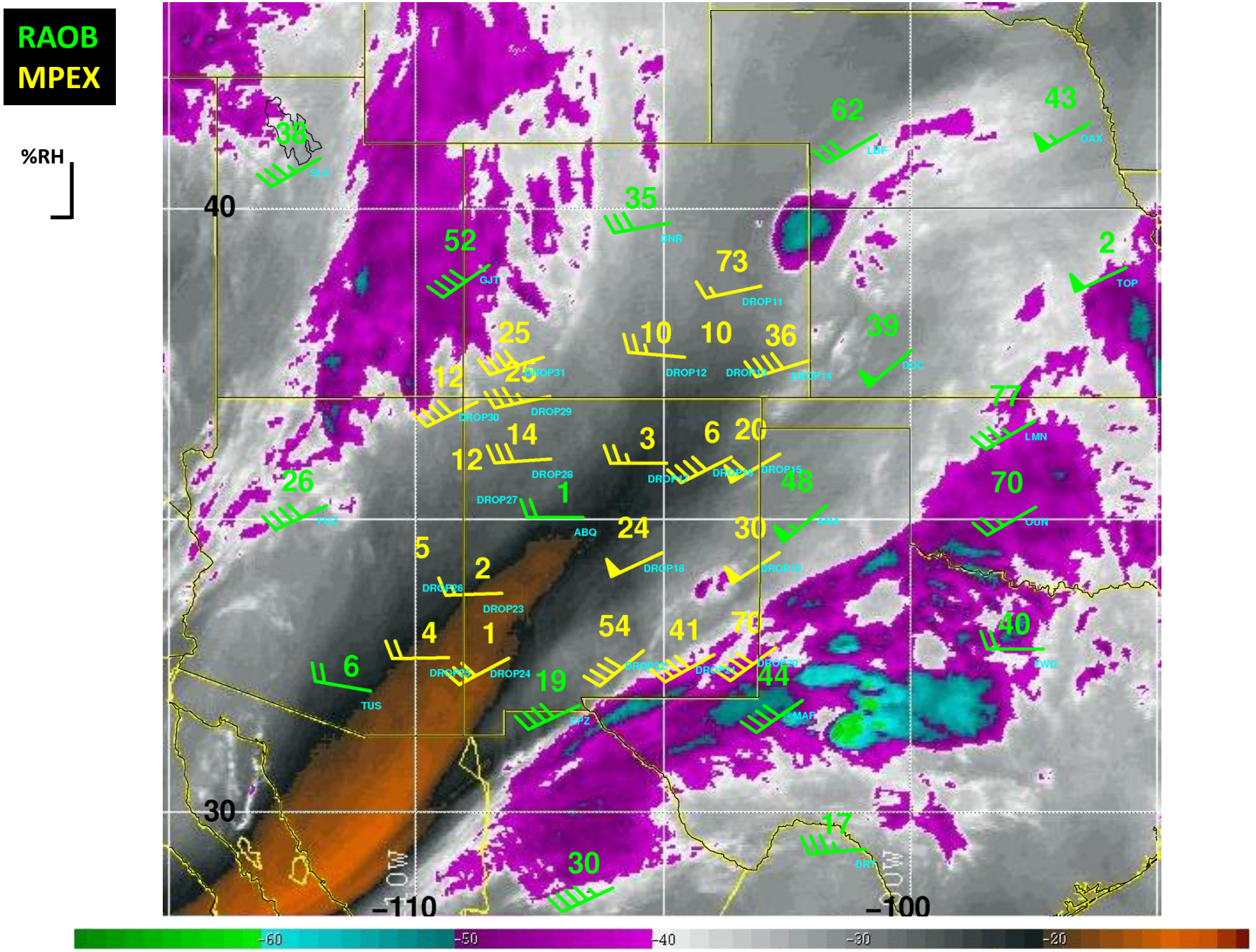
GOES-15 Water Vapor and 300 mb Upper-Air Observations: 12Z/28 May 2013



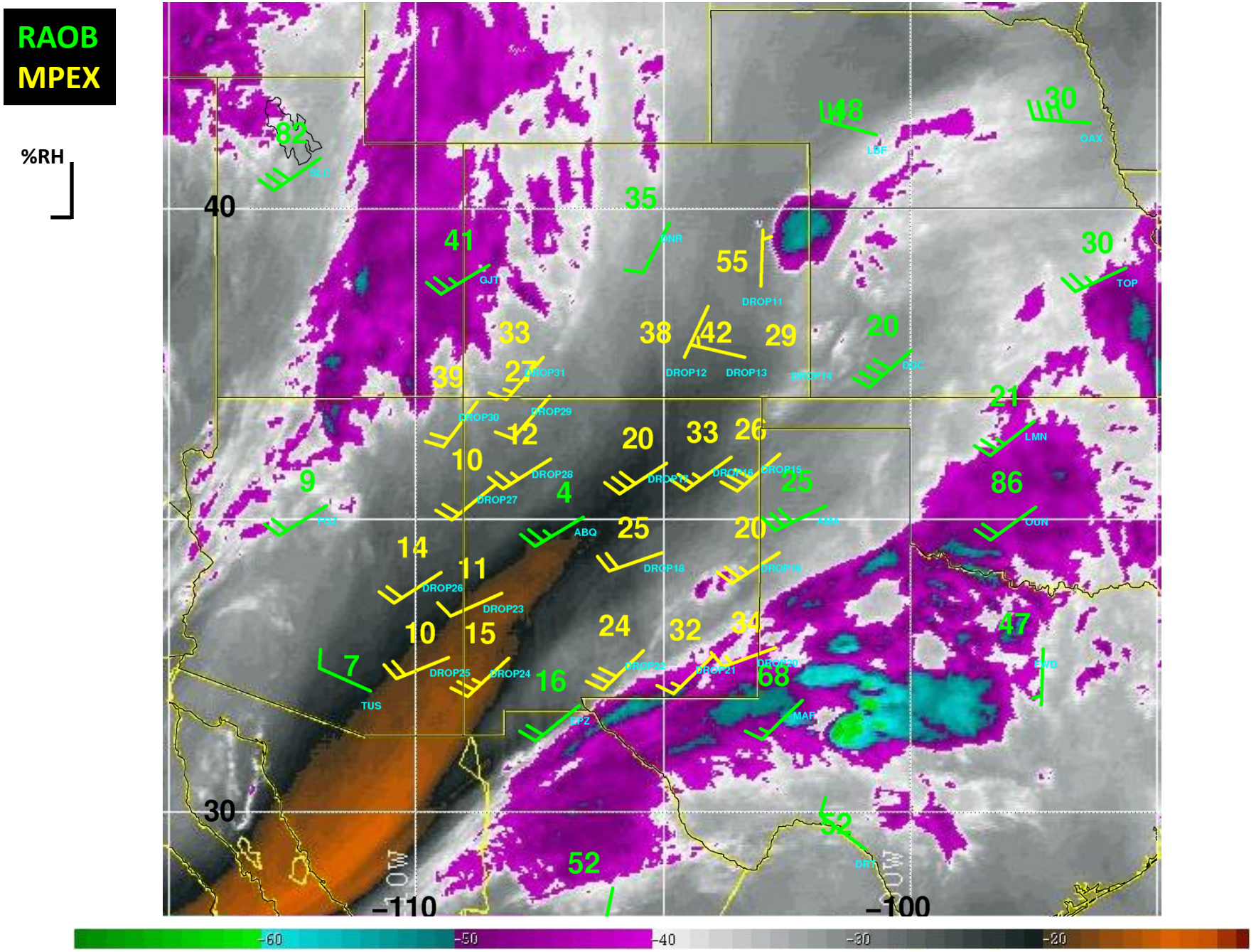
GOES-15 Water Vapor and 250 mb Upper-Air Observations: 12Z/28 May 2013

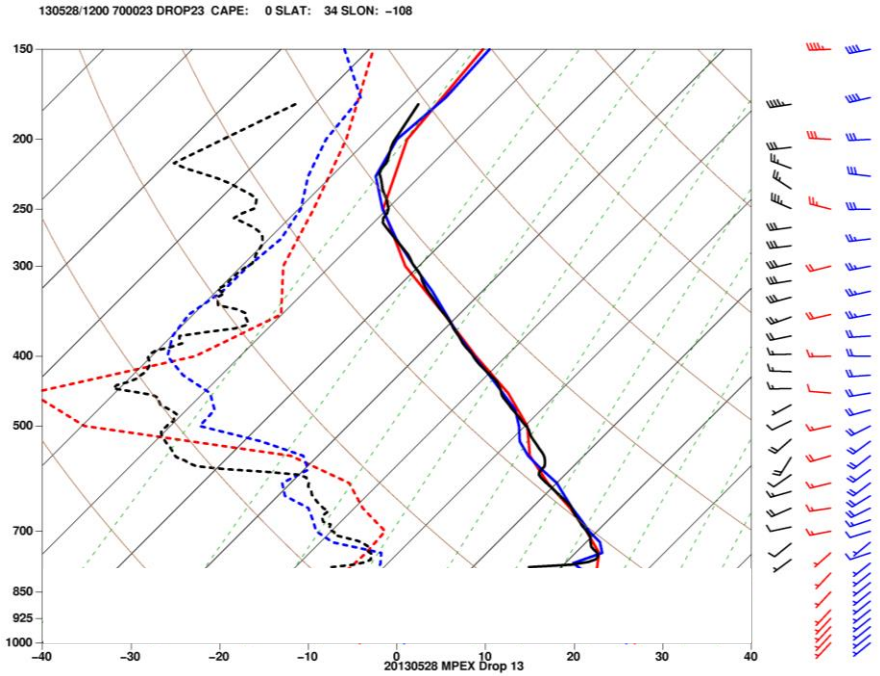


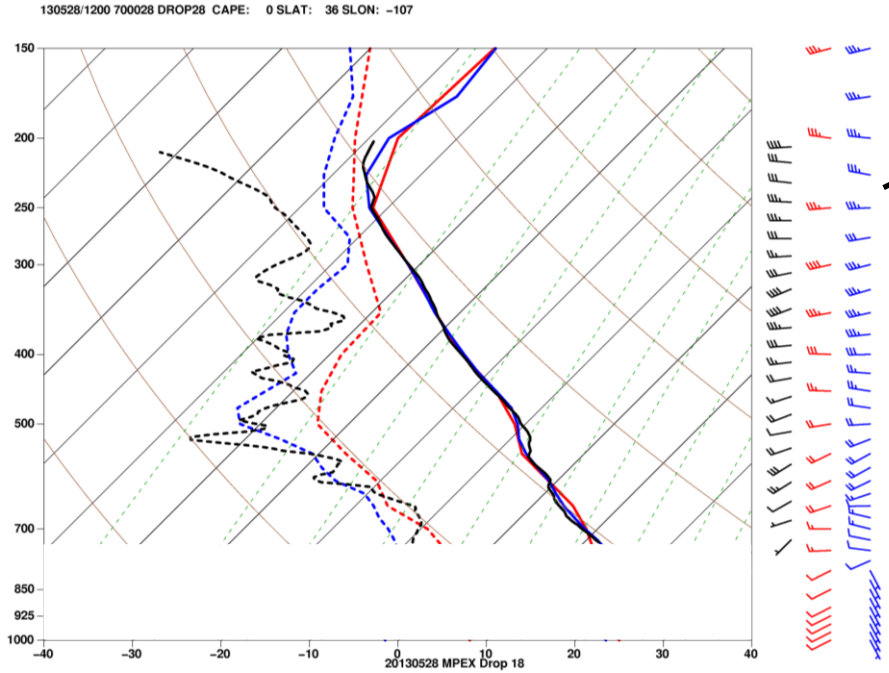
GOES-15 Water Vapor and 400 mb Upper-Air Observations: 12Z/28 May 2013



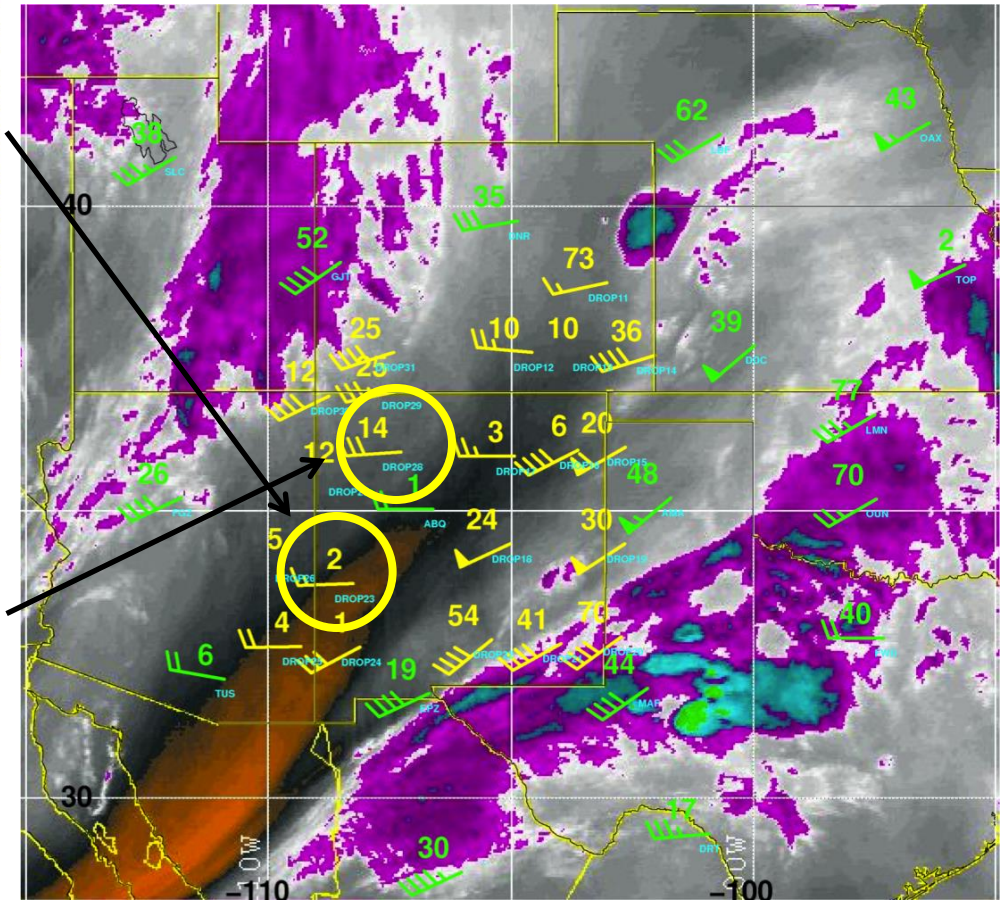
GOES-15 Water Vapor and 600 mb Upper-Air Observations: 12Z/28 May 2013





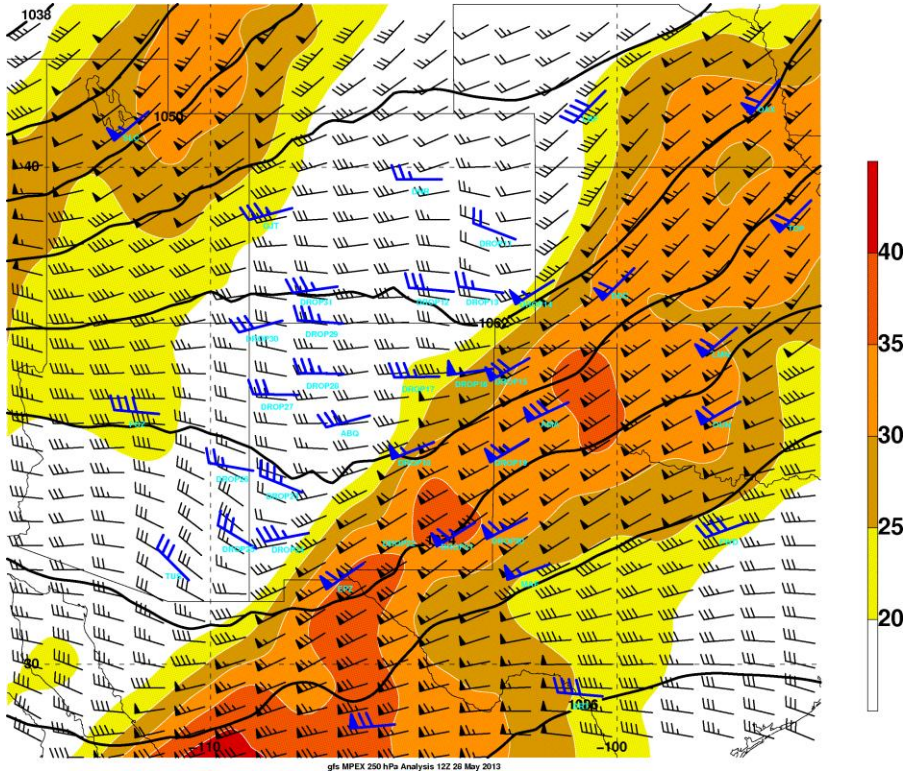


GOES-15 WV and 400 hPa RH and wind

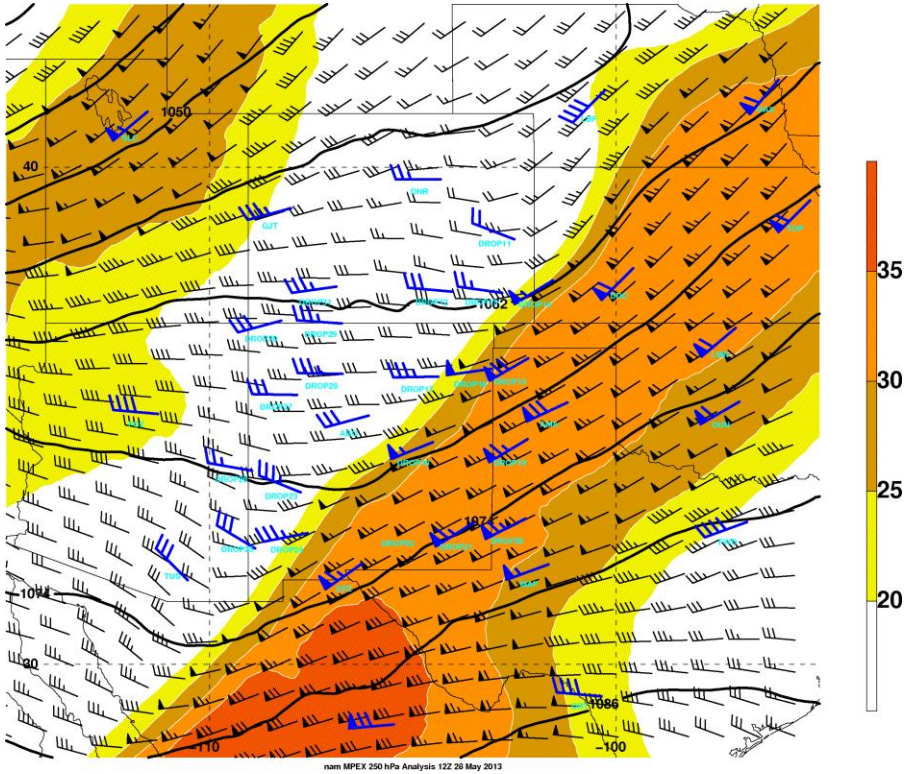


Dropsondes and Model Analyses

250 hPa Height and Wind at 1200 UTC 28 May 2013



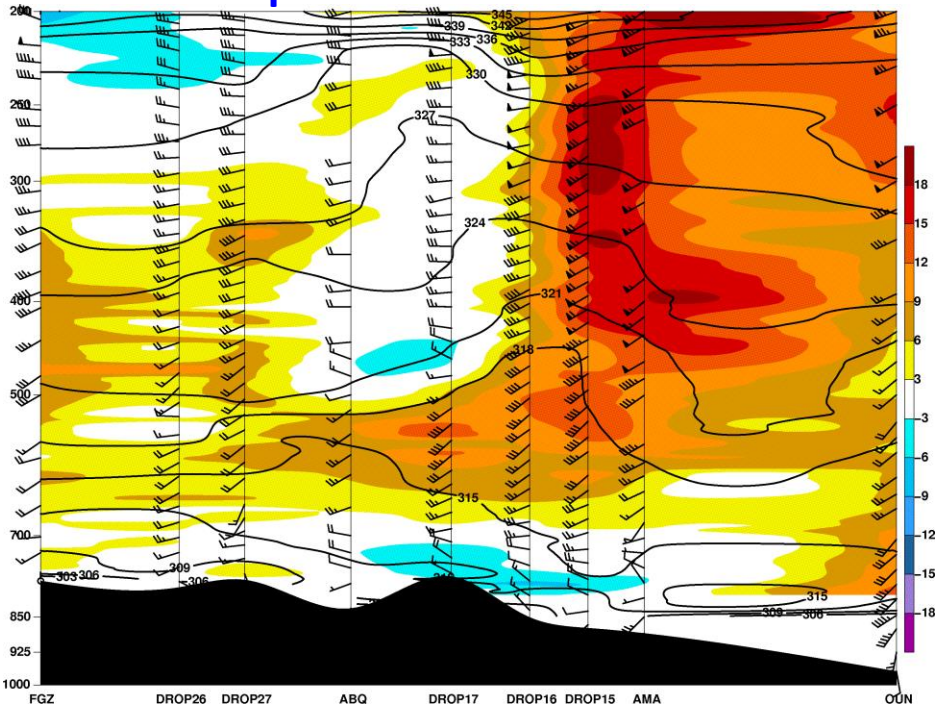
0.5° GFS Analysis



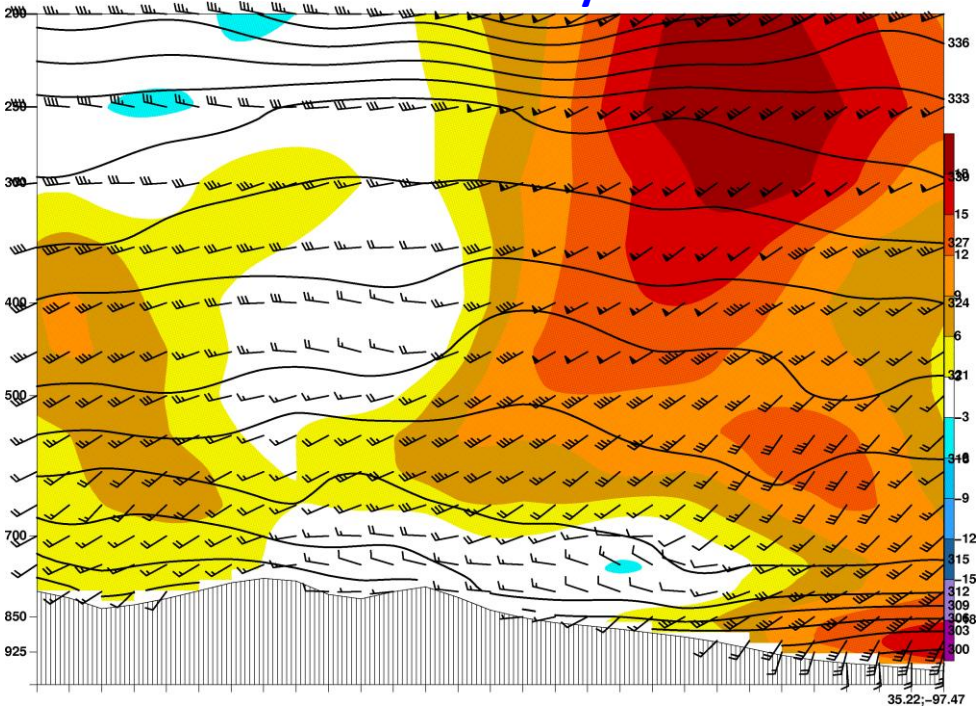
12 km NAM Analysis

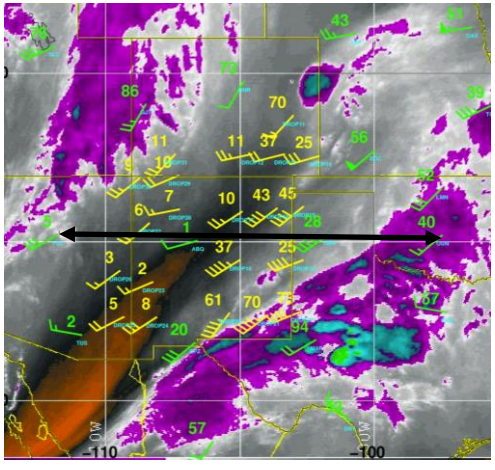
Cross Sections: θ and Wind at 12Z/28

Dropsonde Observations



0.5° GFS Analysis

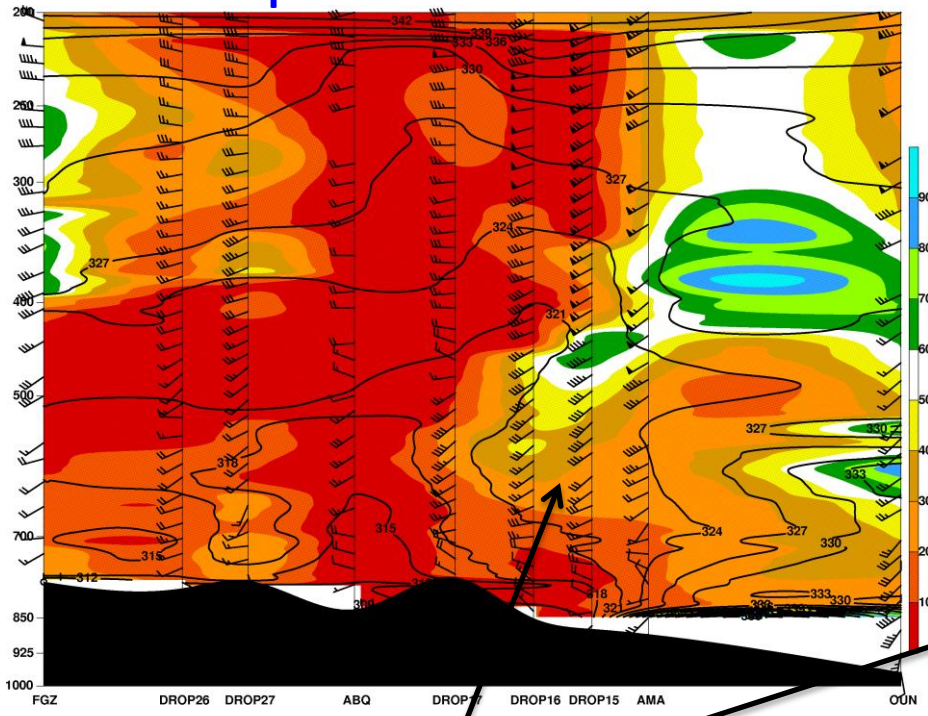




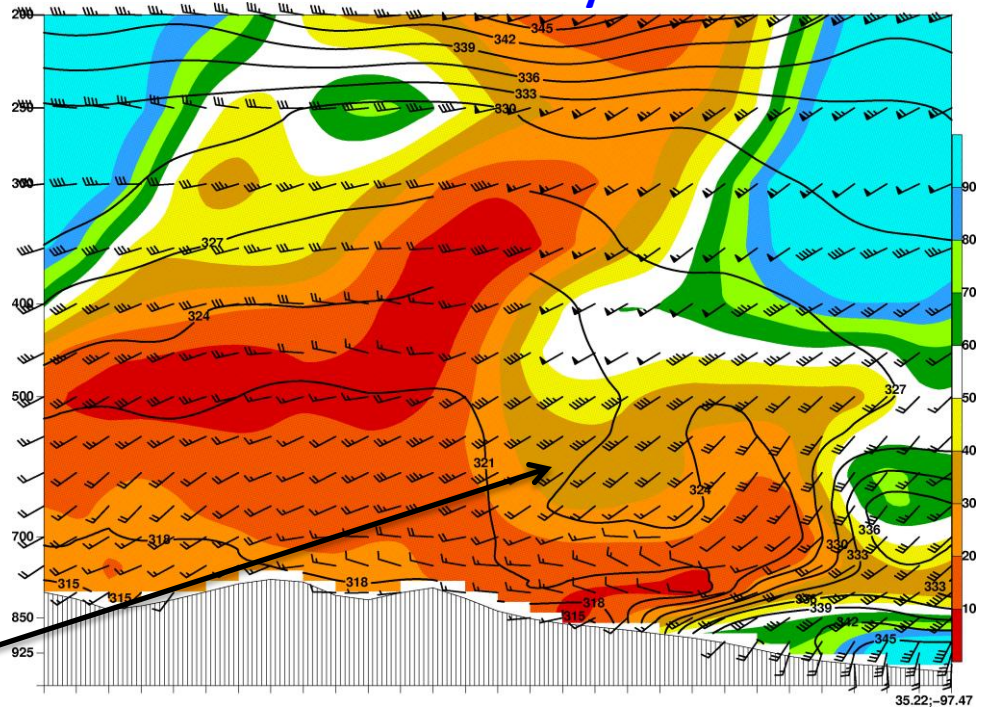
GOES-15 WV and
500 hPa RH and wind

Cross Sections: RH, θ_e and Wind at 12Z/28

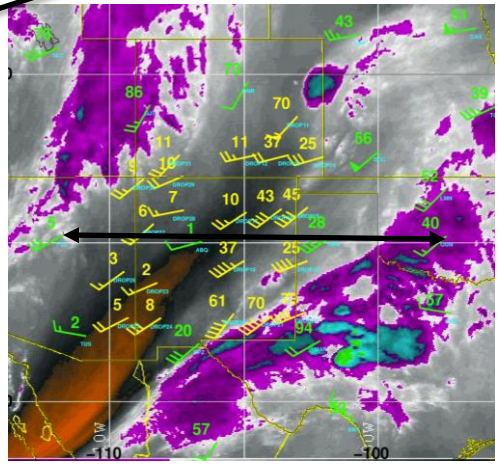
Dropsonde Observations



0.5° GFS Analysis



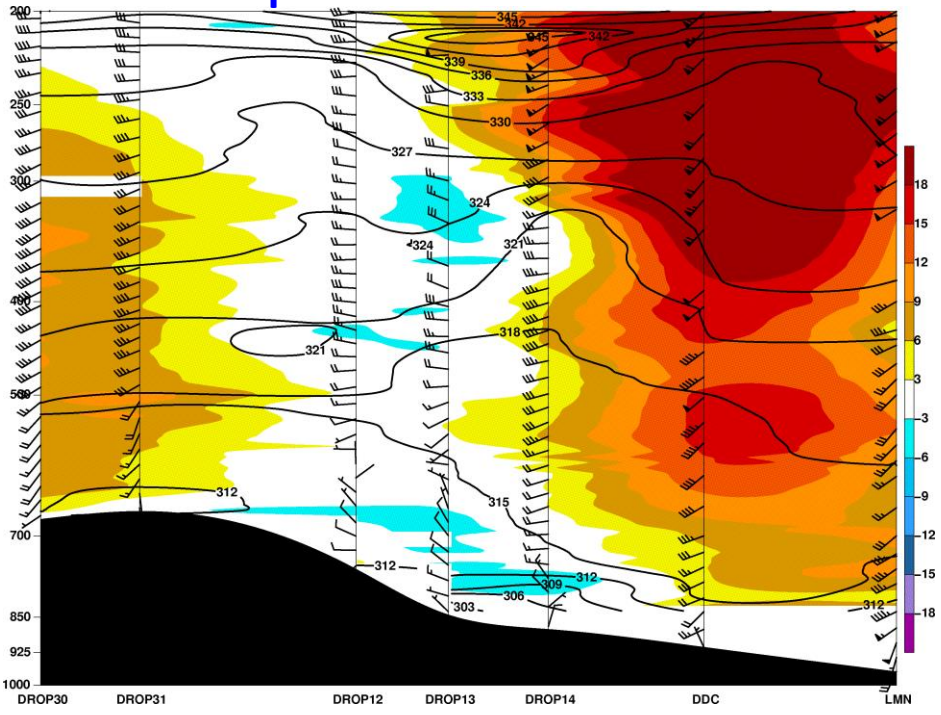
Mid-level θ_e 1-3 K warmer over eastern NM/western TX in GFS analysis compared to dropsondes



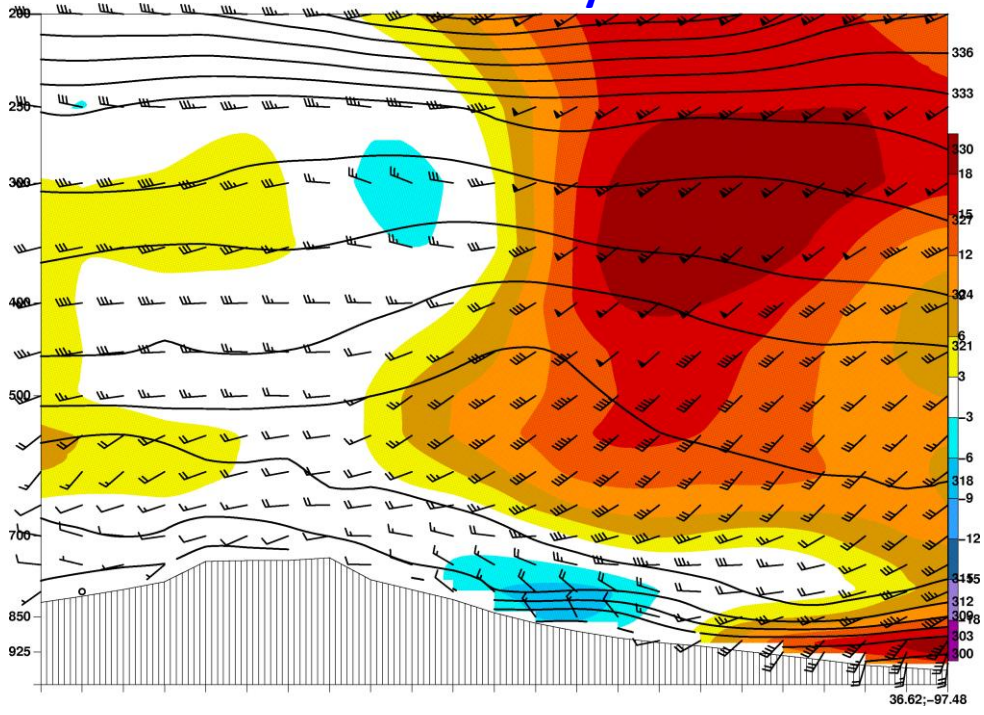
GOES-15 WV and 500 hPa RH and wind

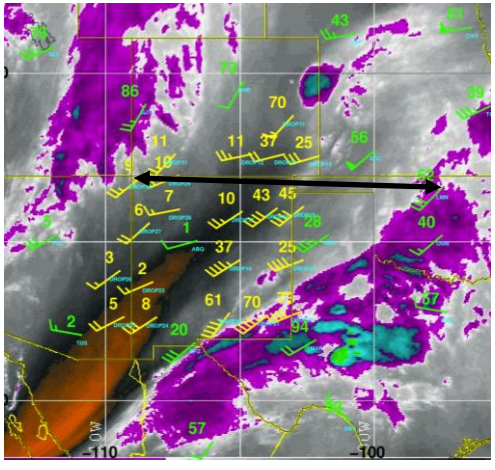
Cross Sections: θ and Wind at 12Z/28

Dropsonde Observations



0.5° GFS Analysis

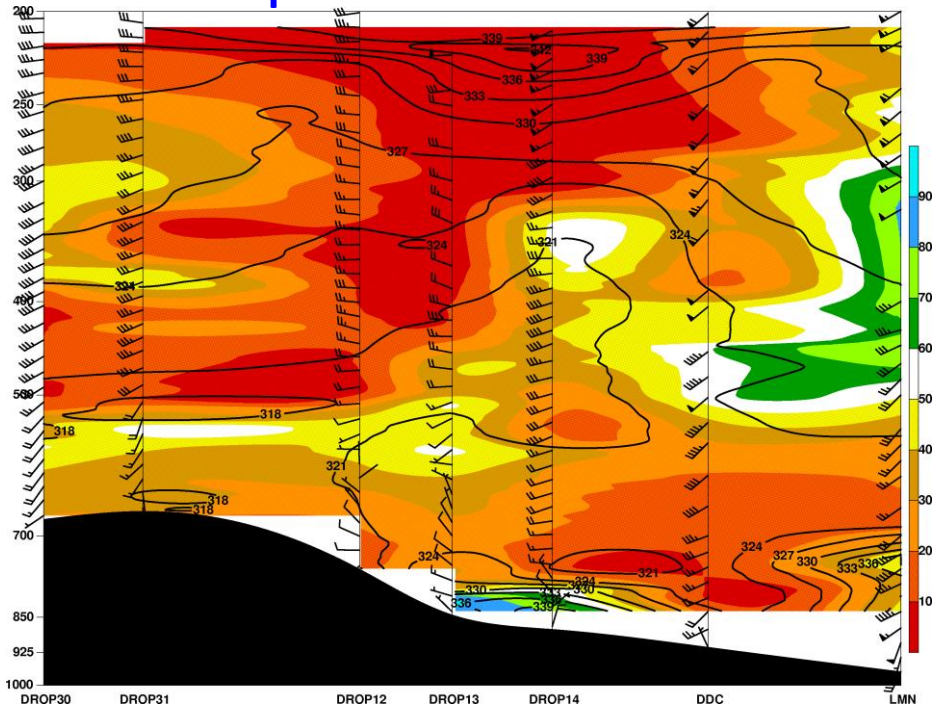




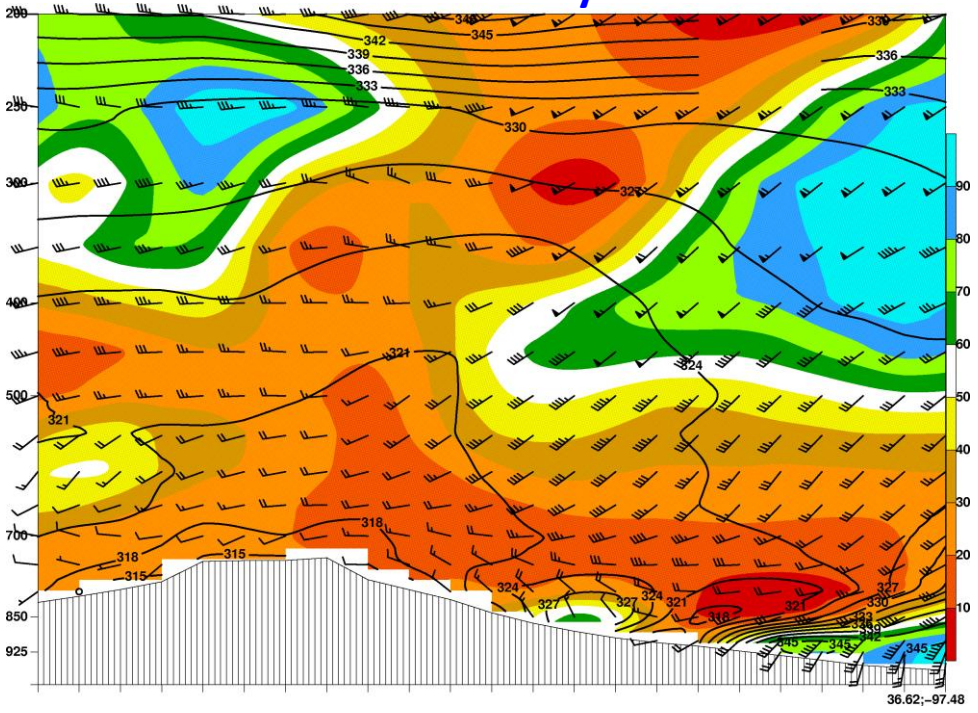
GOES-15 WV and
500 hPa RH and wind

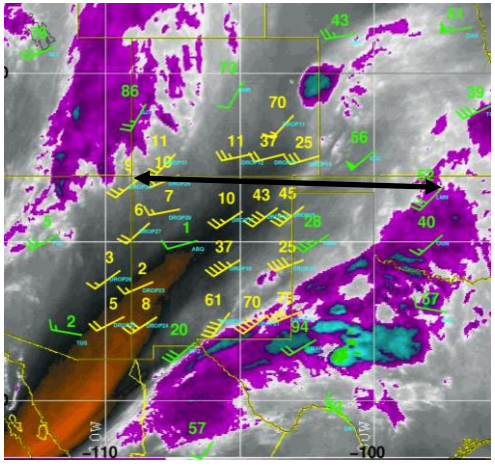
Cross Sections: RH, θ_e and Wind at 12Z/28

Dropsonde Observations



0.5° GFS Analysis

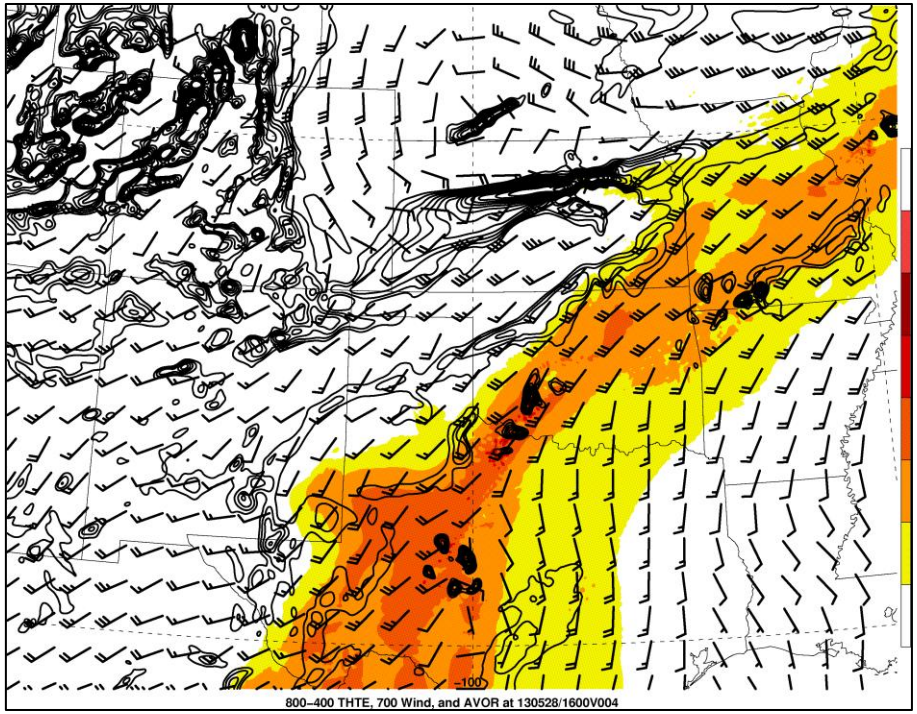




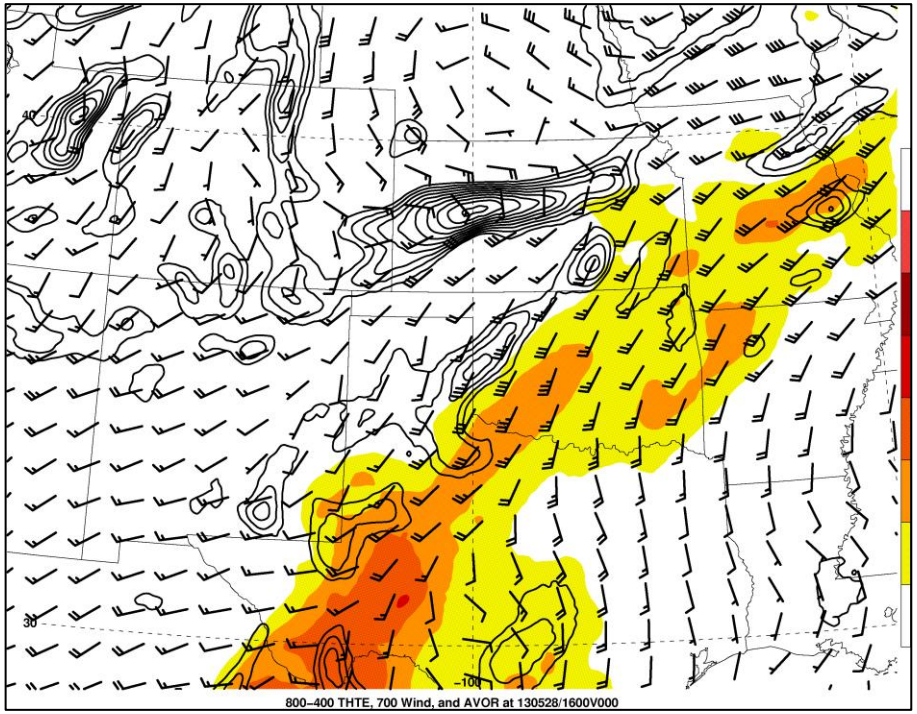
GOES-15 WV and
500 hPa RH and wind

800–400 hPa Mean θ_e, and 700 hPa Wind and ζ at 16Z/28 May 2013

ARW (GFS Init) 4-h Forecast



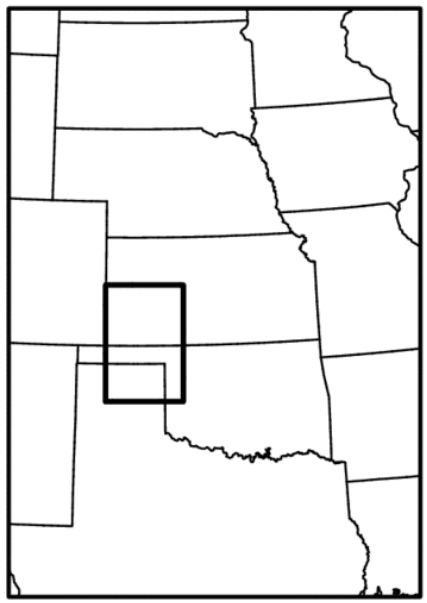
RAP Analysis

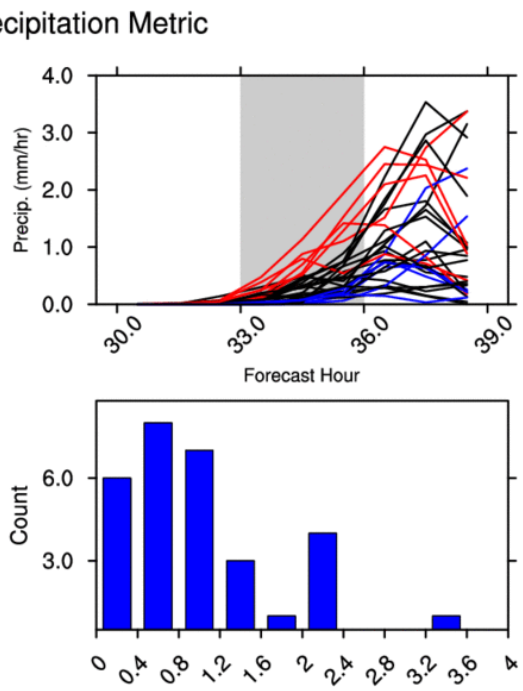


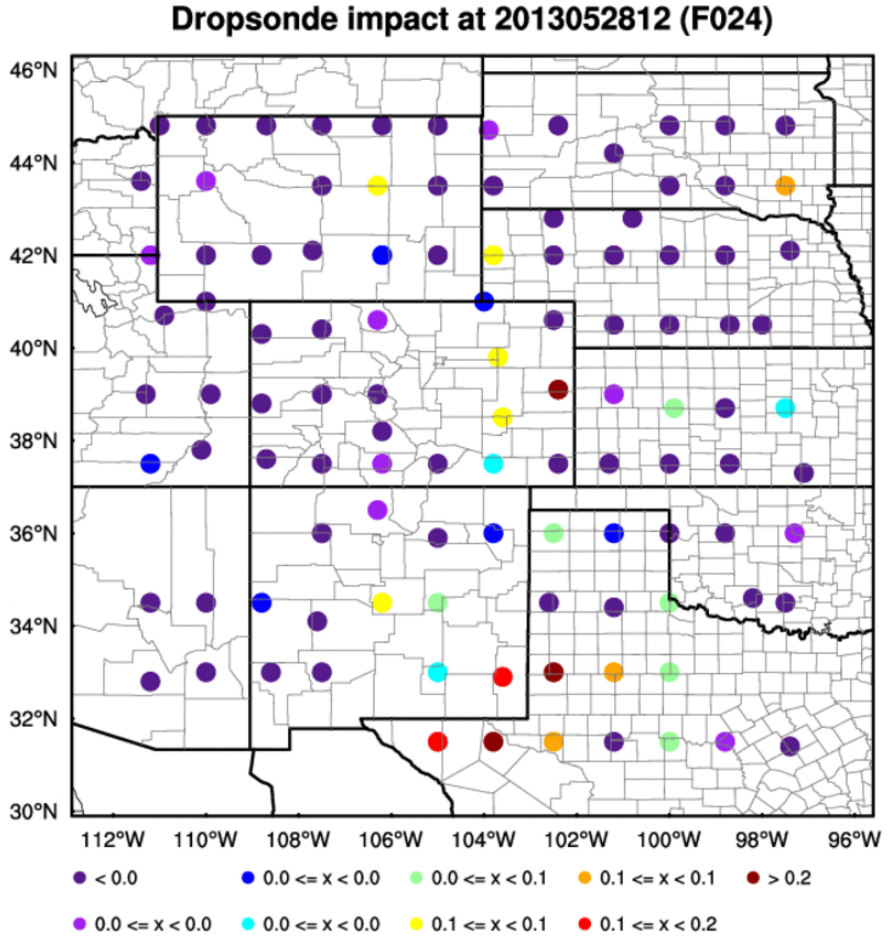
K

327 330 333 336 339 342 345

Ensemble Sensitivity: 12Z/27 May Init

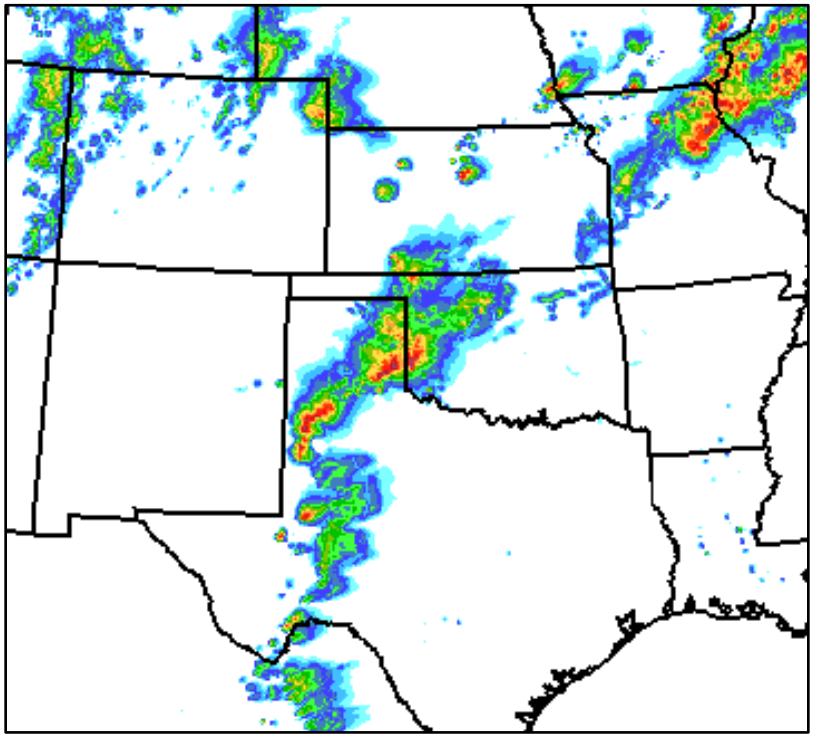




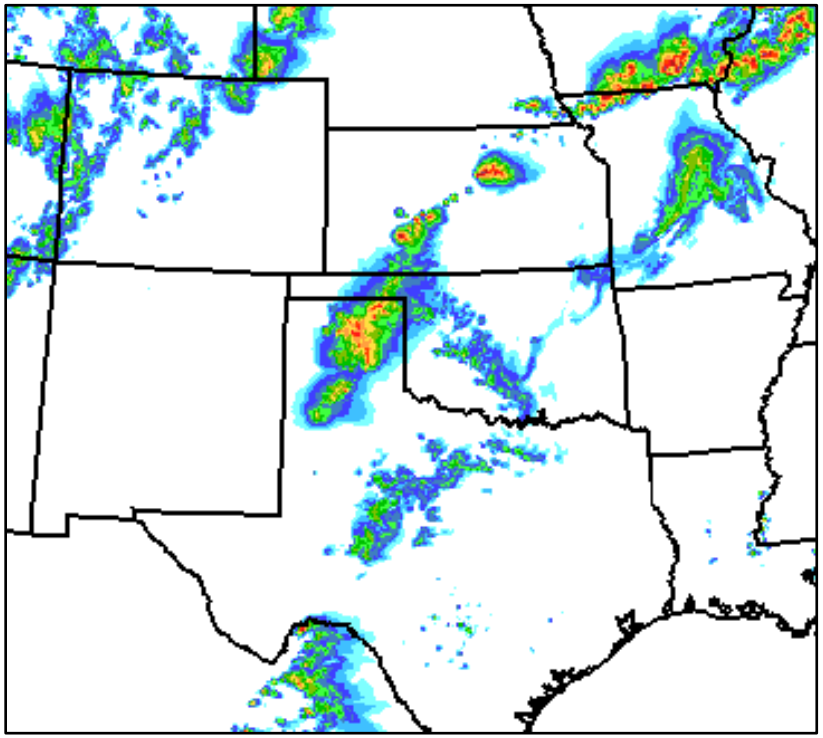


- **Goal of morning mission was to sample upper-level vorticity features and mid-tropospheric moisture over New Mexico**

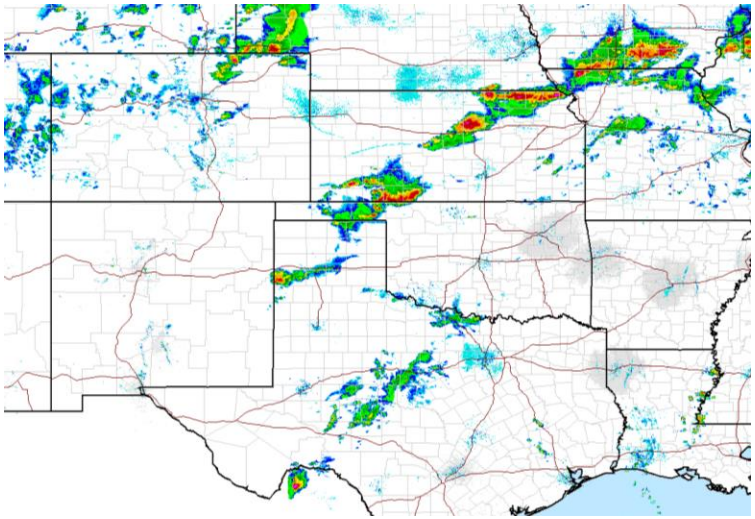
ARW Real-Time Forecast



ARW Real-Time Forecast (GFS init)

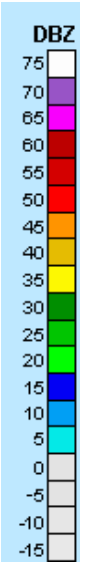


NEXRAD Mosaic

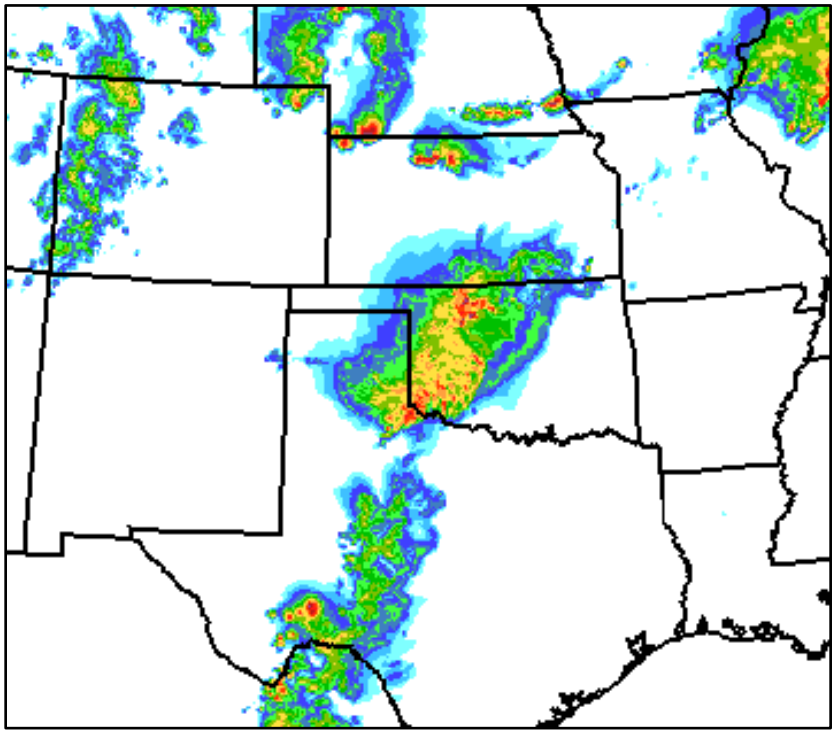


Hi-res guidance from NCAR
Initialized at 12Z/28 May

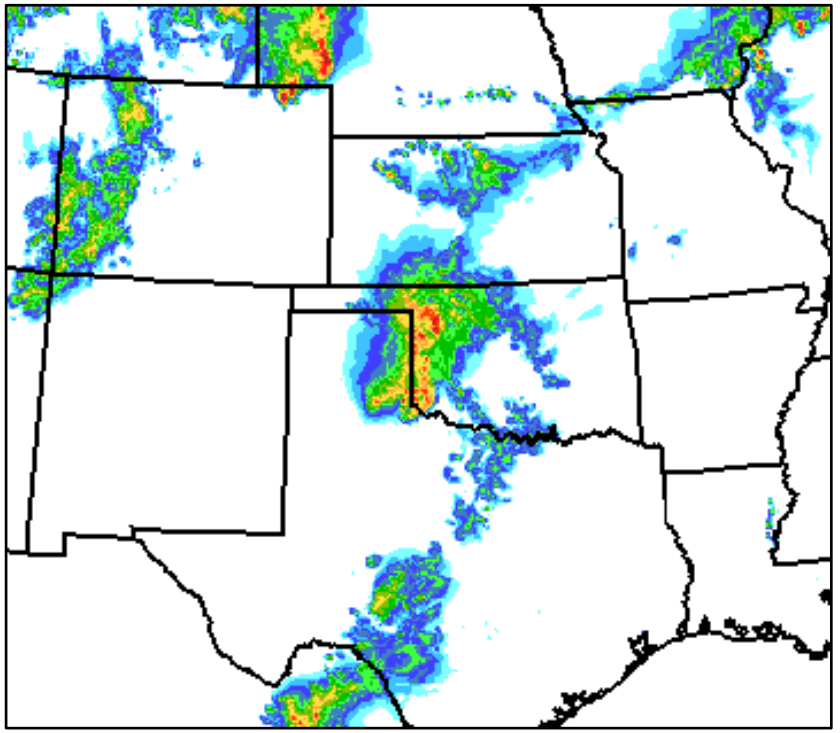
12-h forecast
v00Z/29 May 2013



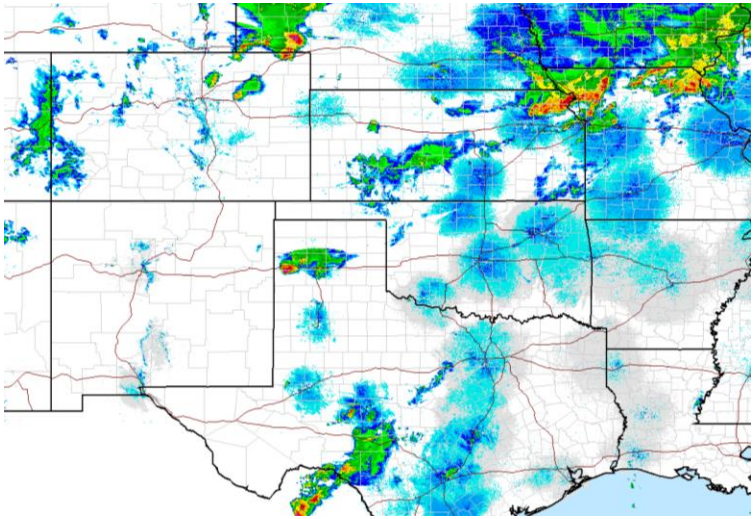
ARW Real-Time Forecast



ARW Real-Time Forecast (GFS init)



NEXRAD Mosaic



Hi-res guidance from NCAR
Initialized at 12Z/28 May

15-h forecast
v03Z/29 May 2013