The Effect of the Balcones Escarpment on Forecasting Major South Central Texas Rainfall Events

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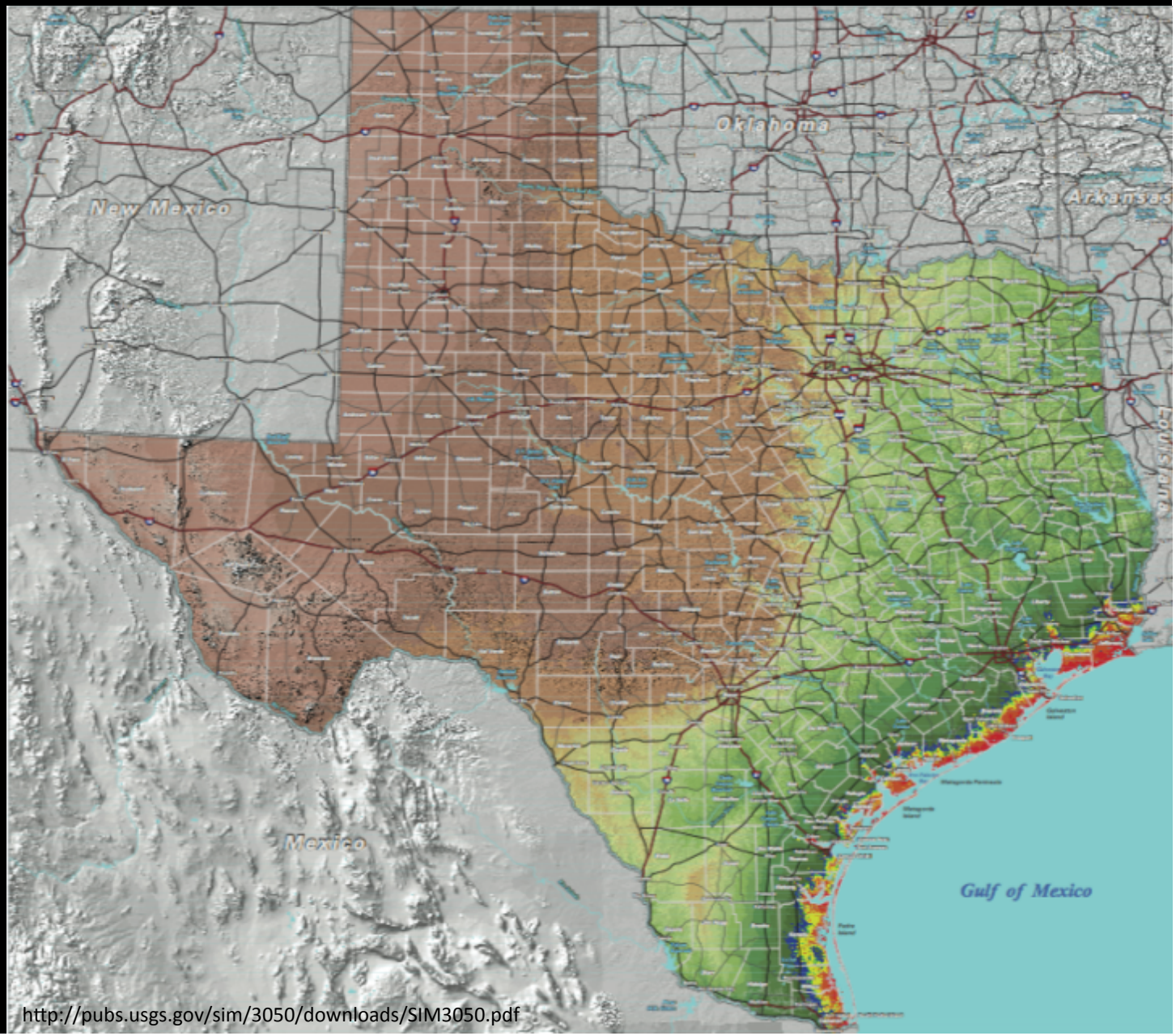
http://www.ktvu.com/news/news/disasters/official-woman-killed-san-antonio-flooding/nX3p8/

AP

Flooding

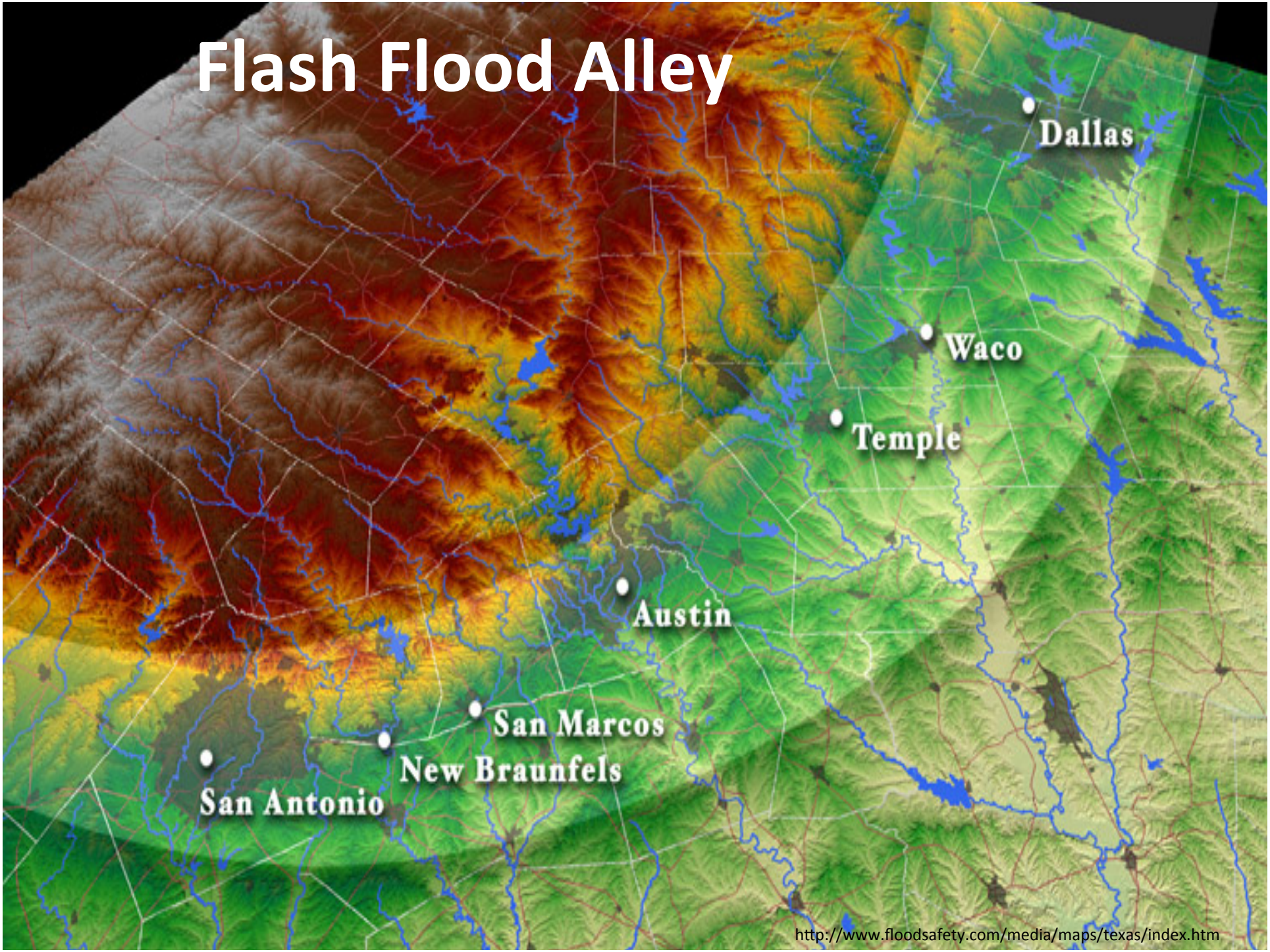
- 76 deaths/year (US 10 year average)
- Flood vs. Flash Flood
- P = R*D

Texas Topography/Geography



http://pubs.usgs.gov/sim/3050/downloads/SIM3050.pdf

Flash Flood Alley



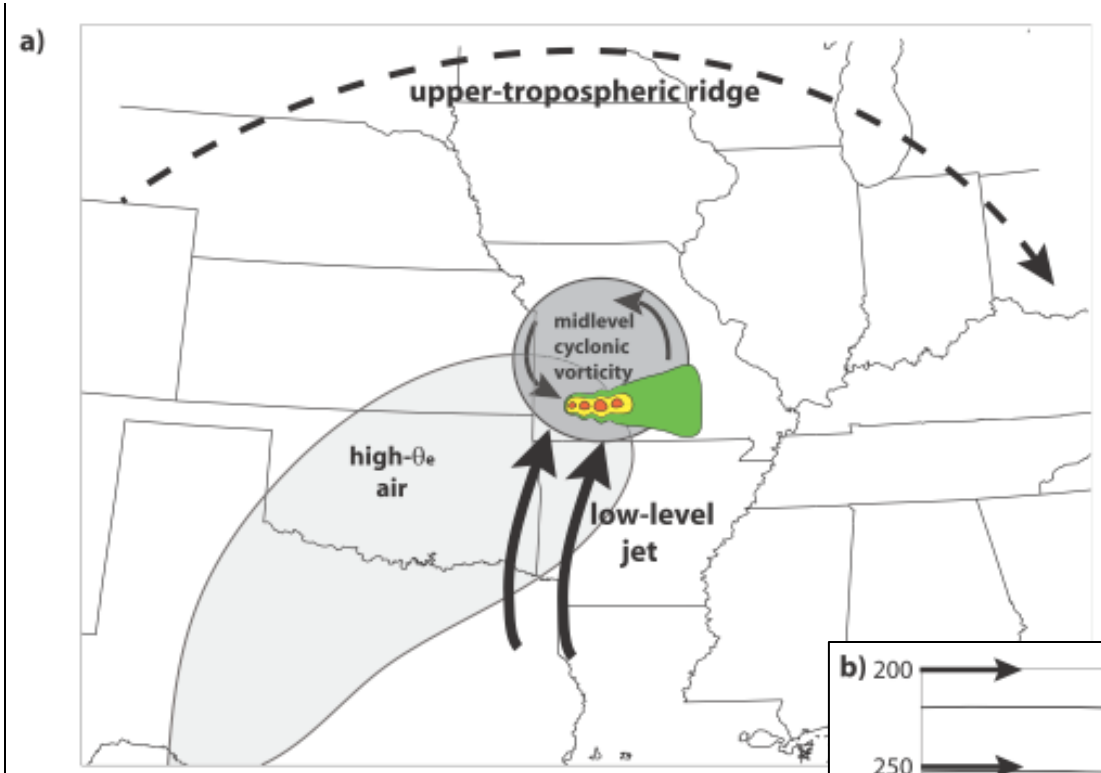
http://www.floodsafety.com/media/maps/texas/index.htm

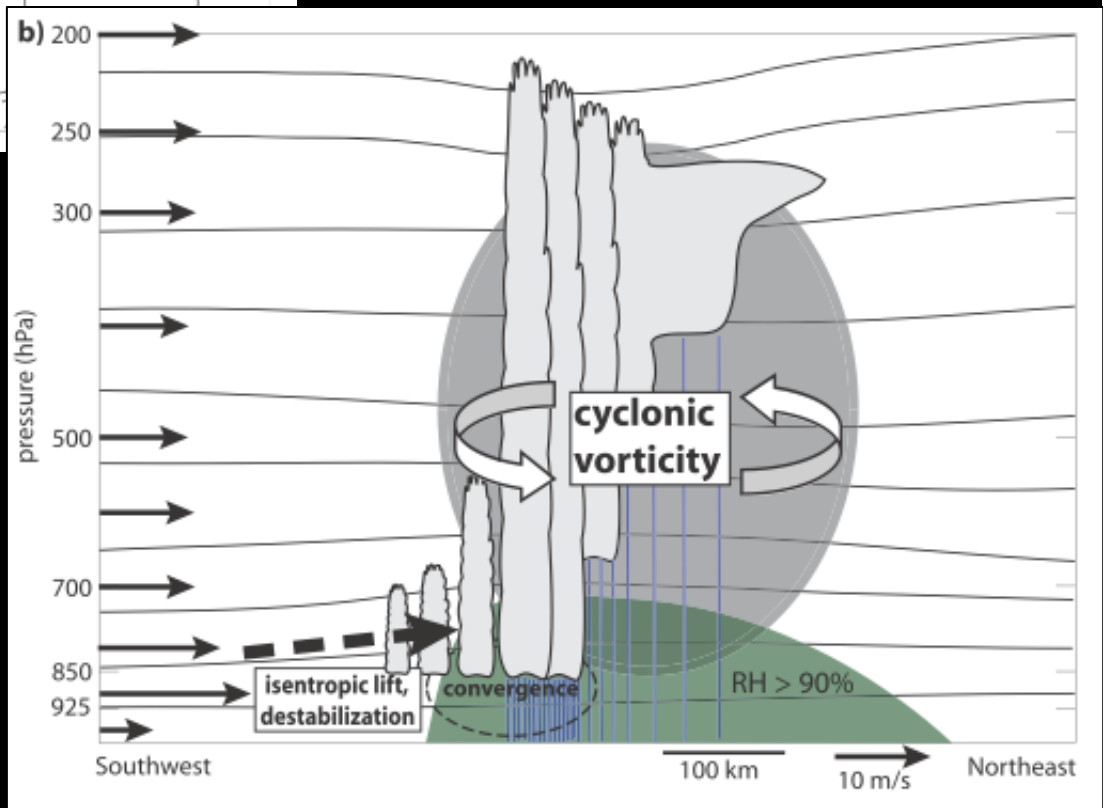
What influence does the Balcones Escarpment have in determining the location and intensity of heavy rainfall events in South Central Texas?

Low Level Jet

+ Midlevel Vortex

Extreme-Rain-Producing Mesoscale Convective System

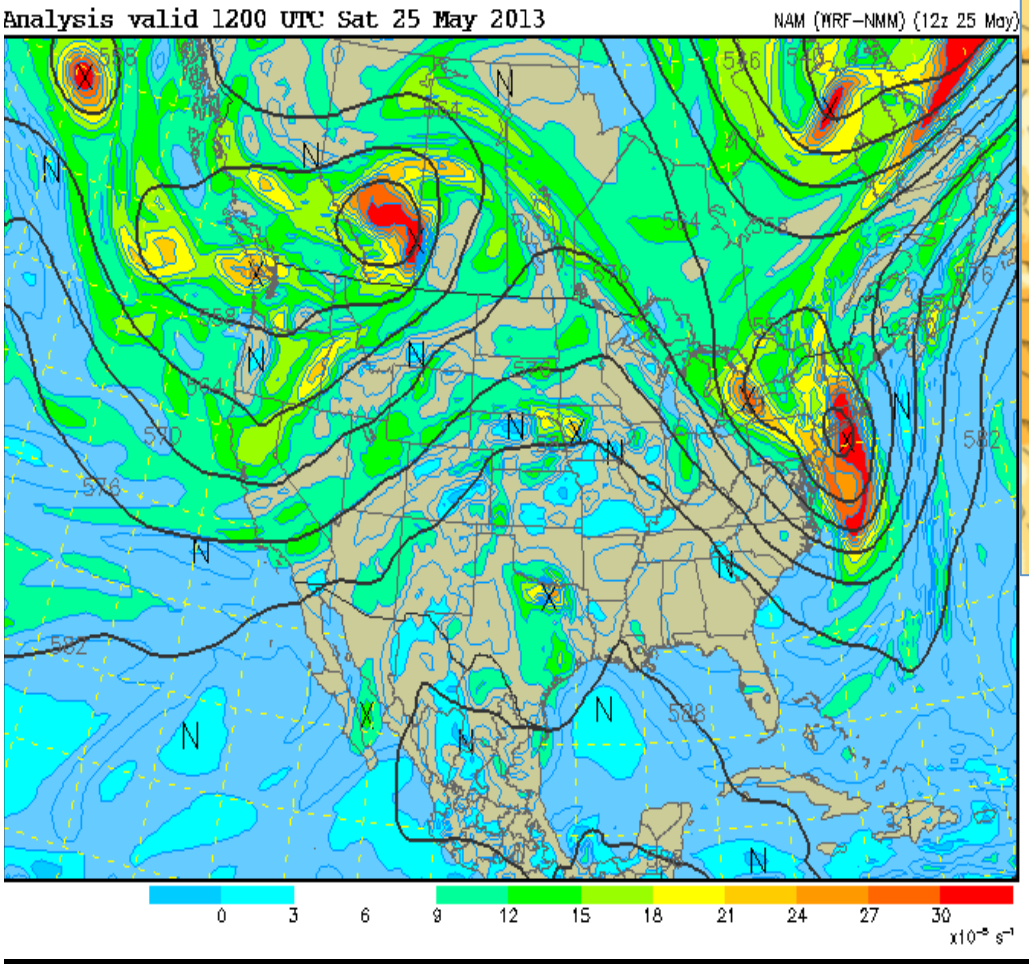


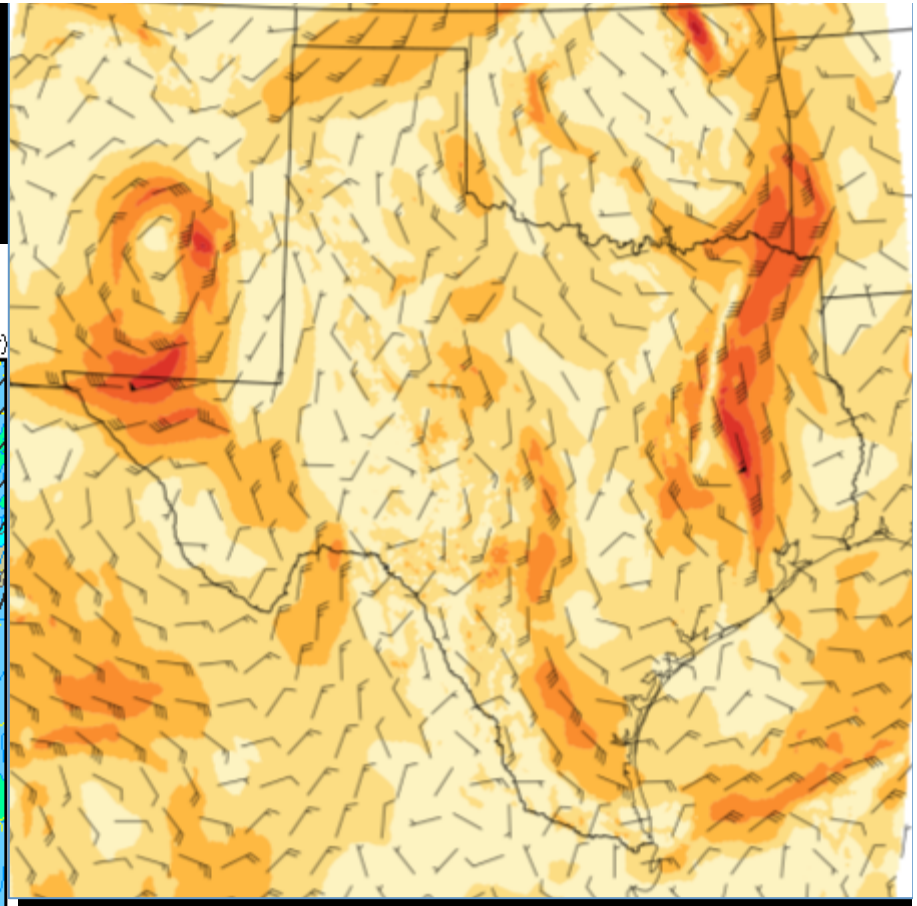


Schumacher and Johnson (2009)

25 May 2013

500 mb Heights (dm) / Abs. Vorticity ($x10^{-5}$ s^{-1})



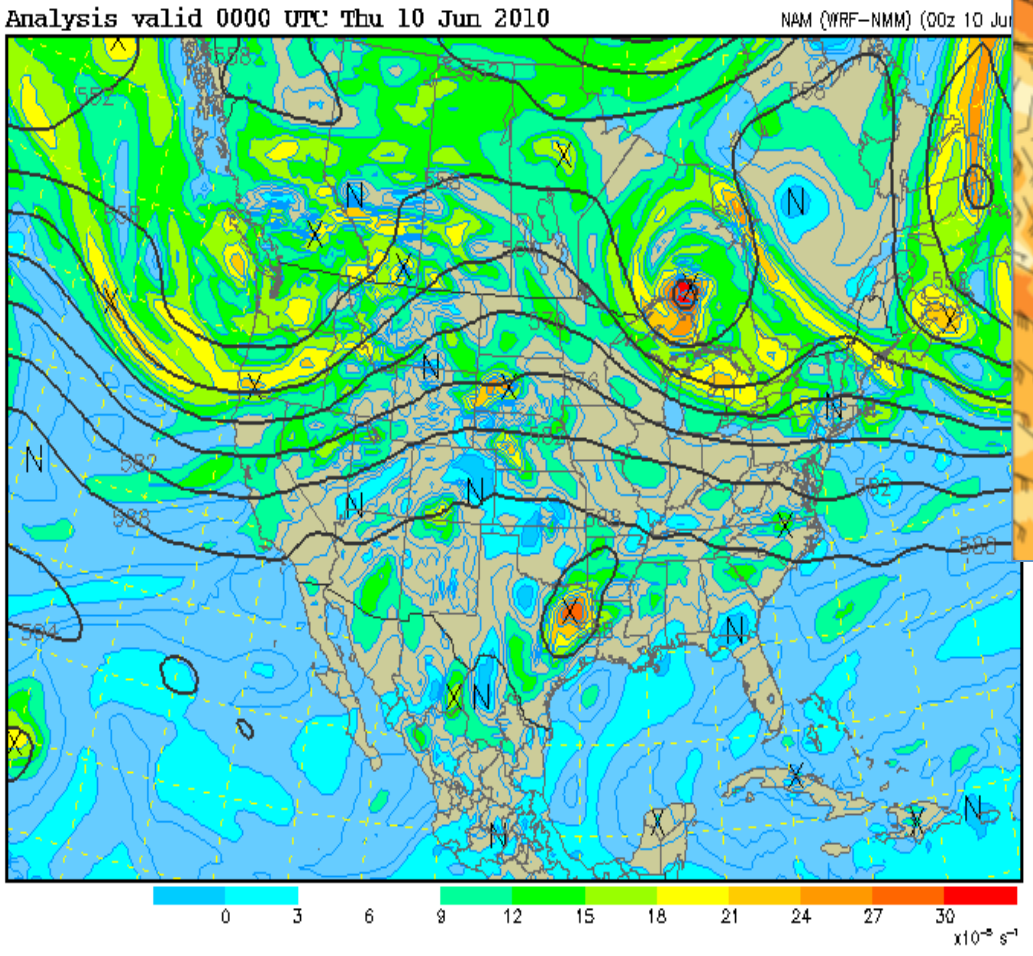


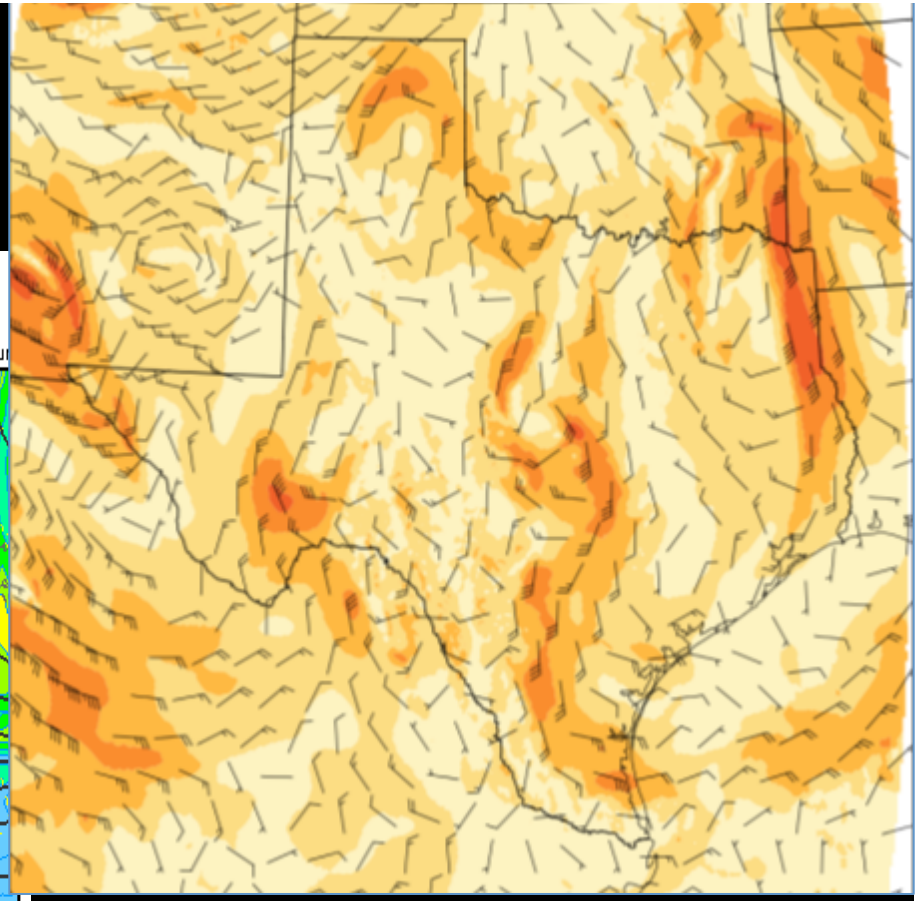
925 mb Winds at 1200 UTC

0 5 10 15 20 25 30 35 (m/

09 June 2010

500 mb Heights (dm) / Abs. Vorticity ($x10^{-5}$ s^{-1})



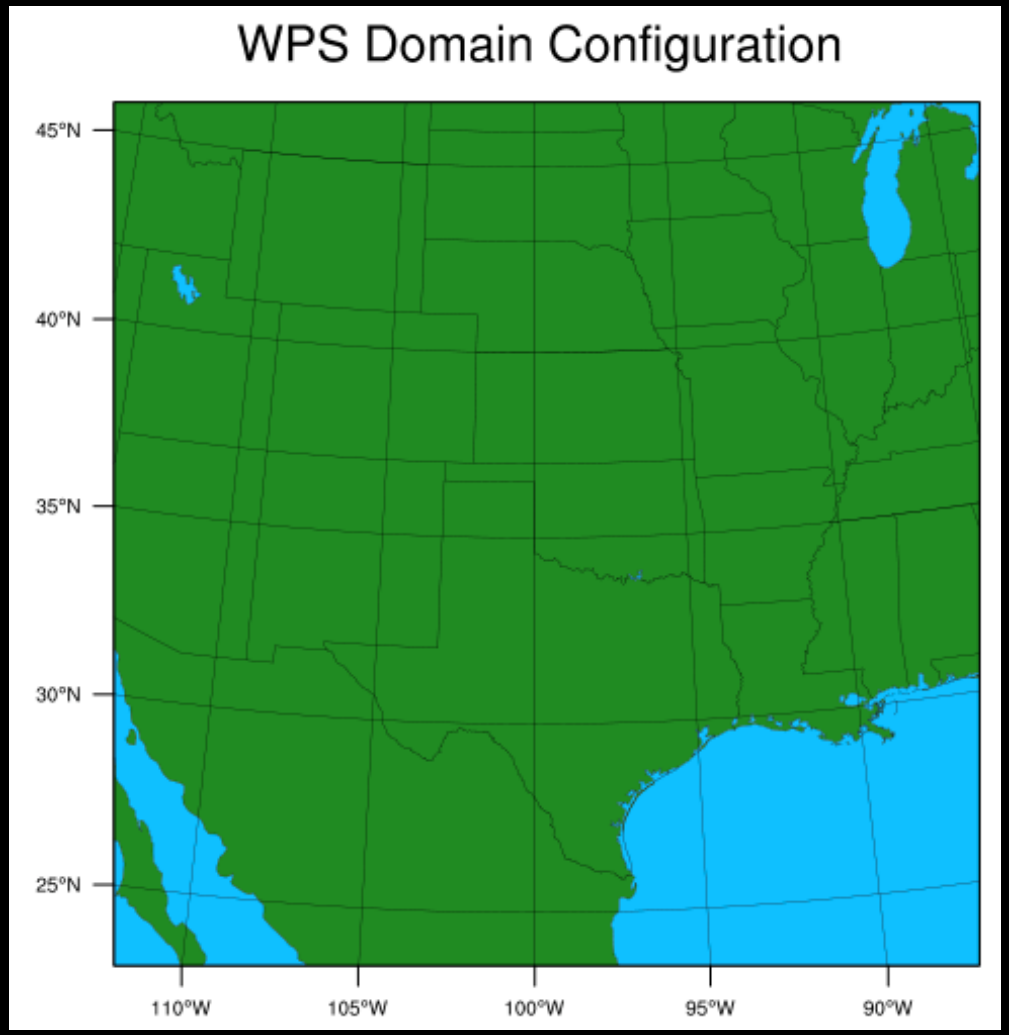


925 mb Winds at 0600 UTC

METHODOLOGY

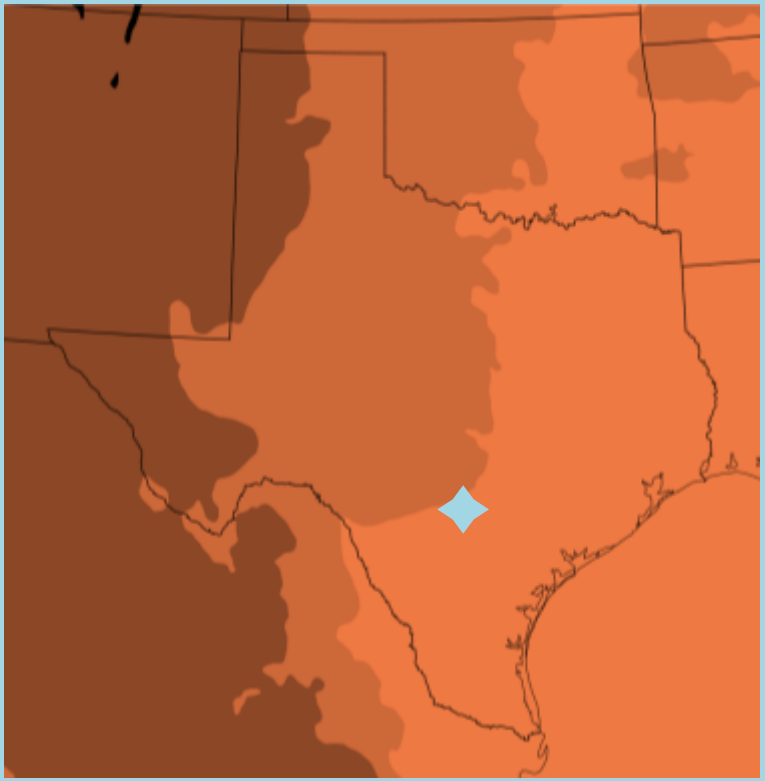
- San Antonio Flash Flood Cases
- NCEP Stage IV Precipitation Analysis
  - National Centers for Environmental Prediction
  - Amount of precipitation that occurred
- Control: best forecast
  - 25 May 2013: NAM initialized WRF
  - 09 June 2010: best WRF-DART member
- NOBALC: topography edit
  - Move the Balcones Escarpment northwest

Model Configuration

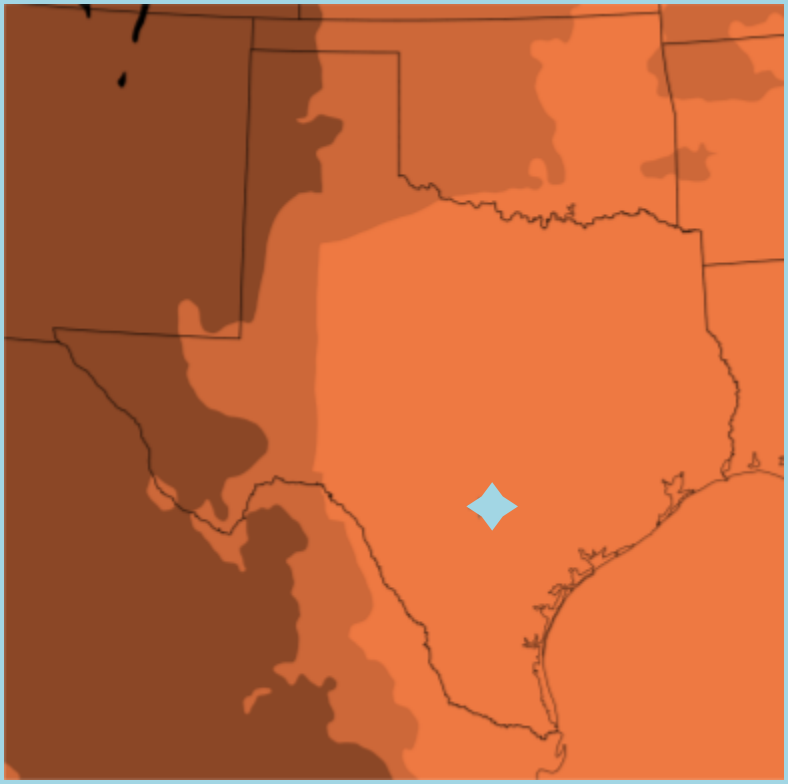


- Weather Reasearch and Forecasting (WRF) V3.4.1
- Grid Spacing: 4 km
- Resolution: 10 minutes of longitude/latitude (10 m)
- Convection: Explicit
- PBL: Mellor-Yamada-Janjic scheme
- Microphysics: Morrison 2-moment scheme
- SW Radiation: RRTMG
- LW Radiation: RRTMG

CONTROL



NOBALC

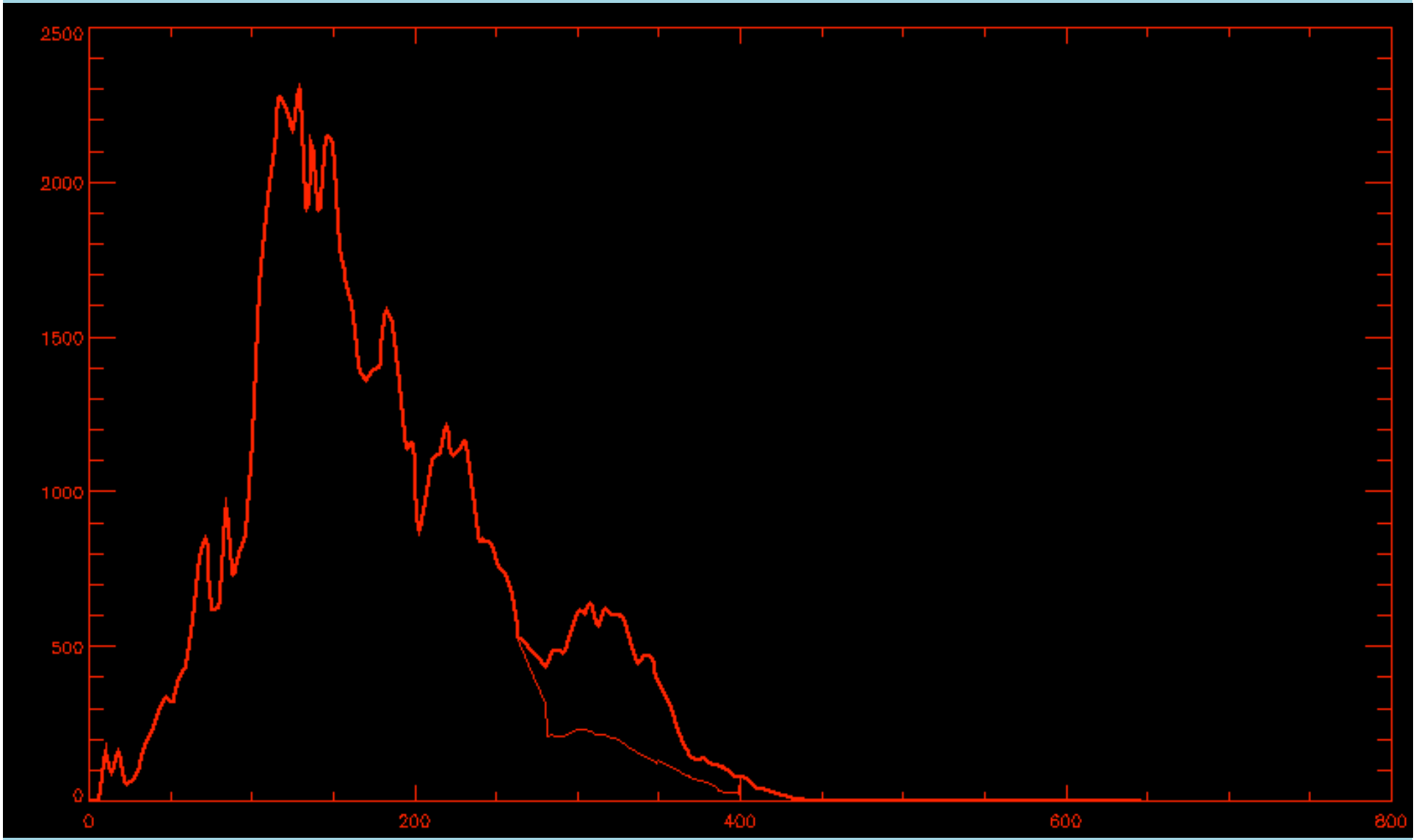


3000 m
9842.52 ft

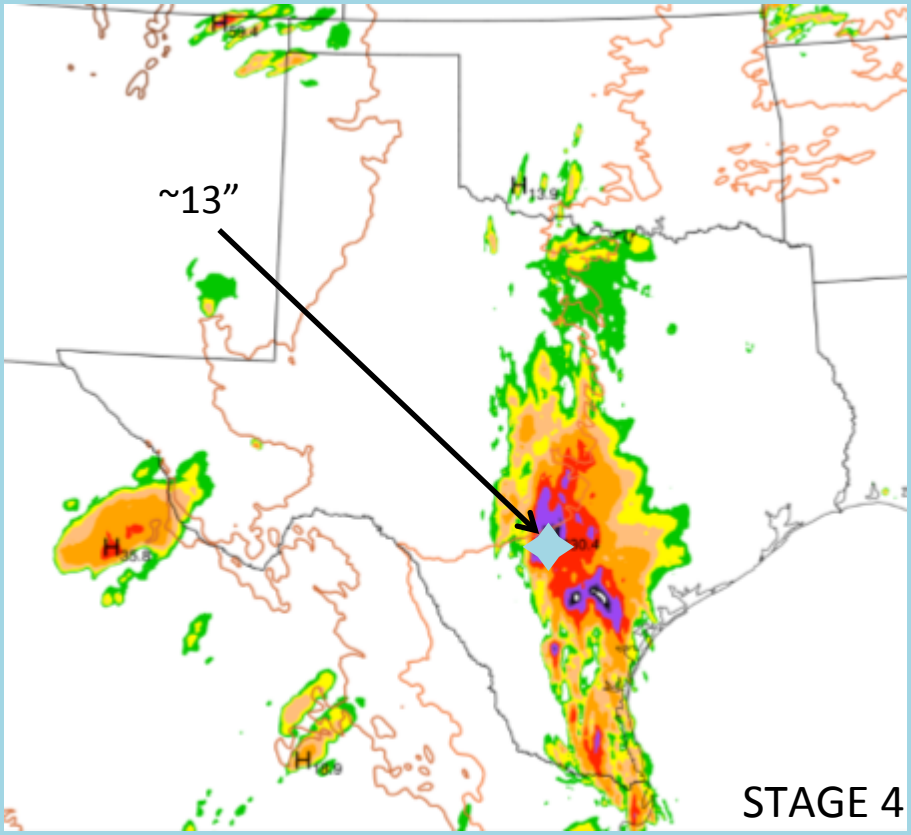
1000 m
3280.84 ft

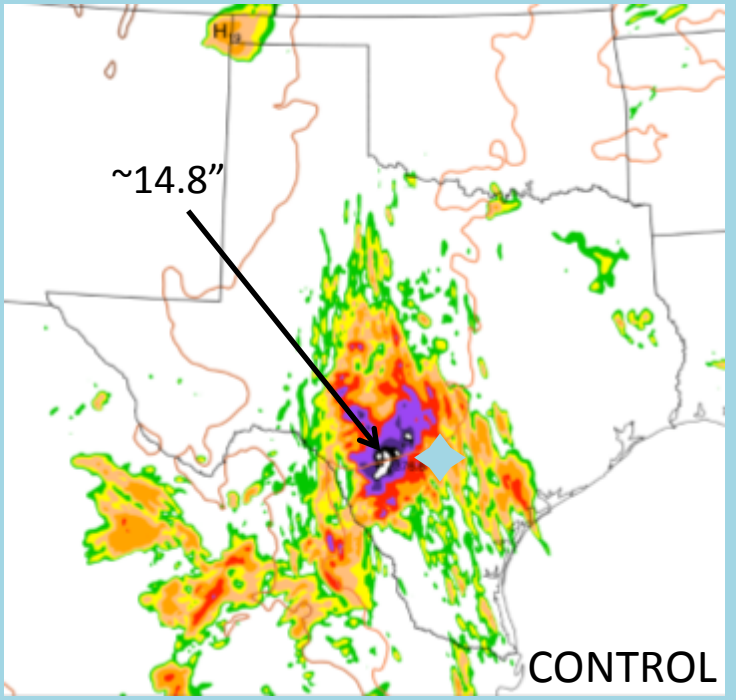
300 m
984.252 ft

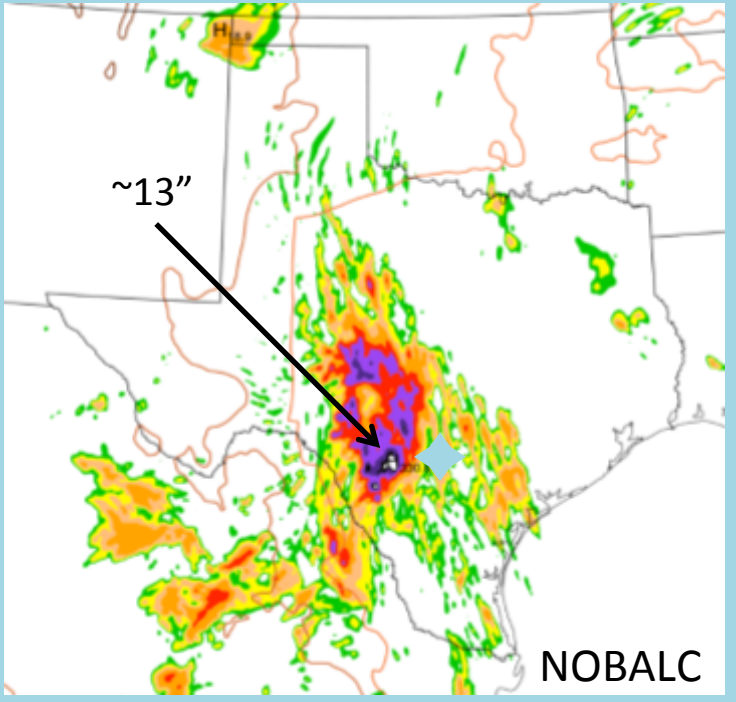
East-West Terrain Cross Section



25 May 2013
0600-1800 UTC







~ 25 mm = 1 inch

Total Precipitation (mm)

1 2.5 5 10 25 50 100 150 200

Height (m)

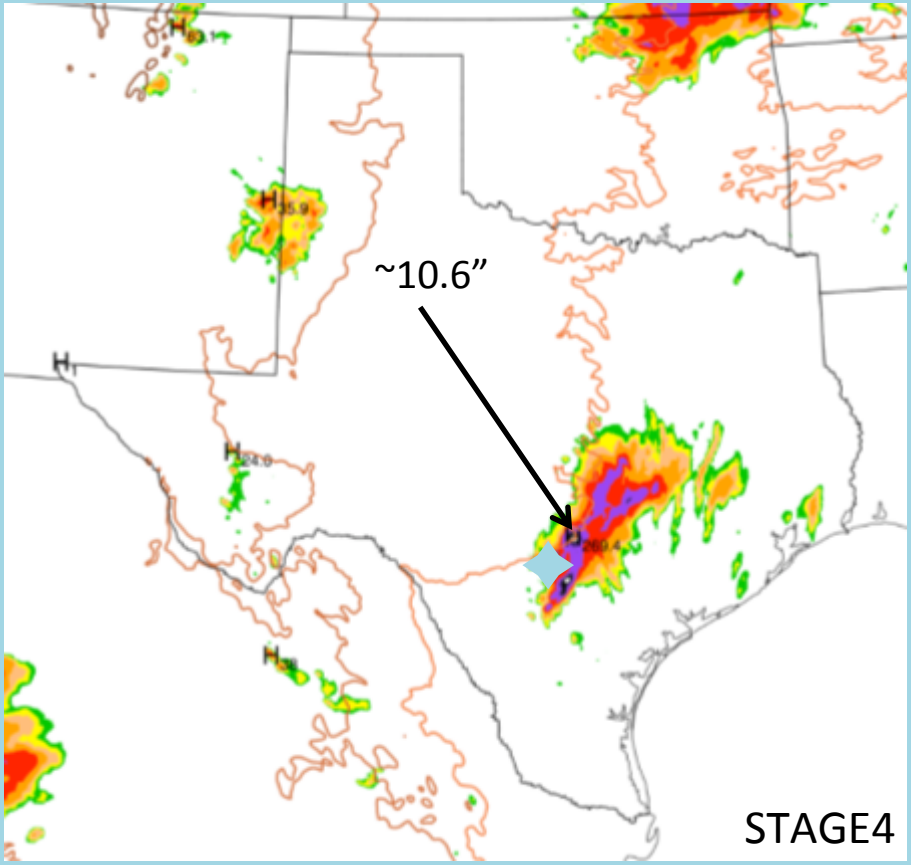
3000

1000

300

1 m = ~3.28 ft

09 June 2010
0000-1200 UTC



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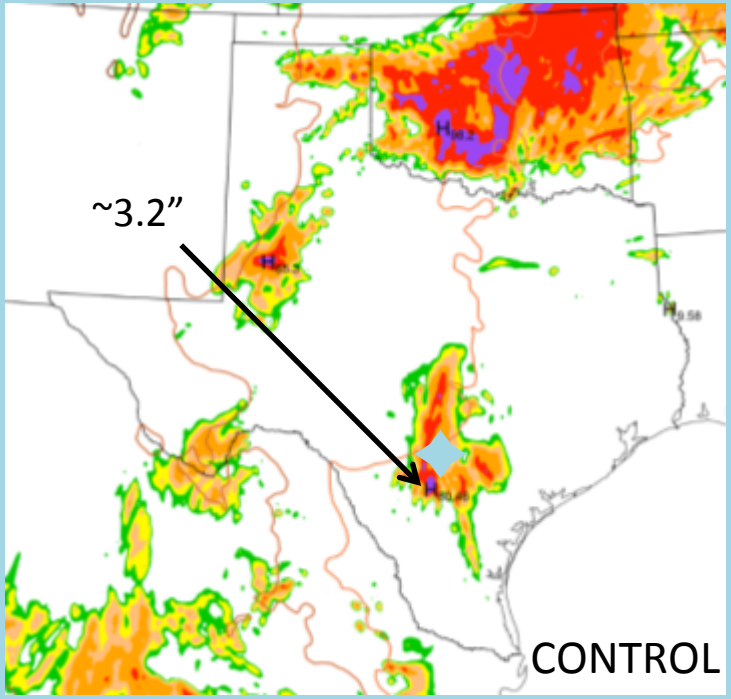

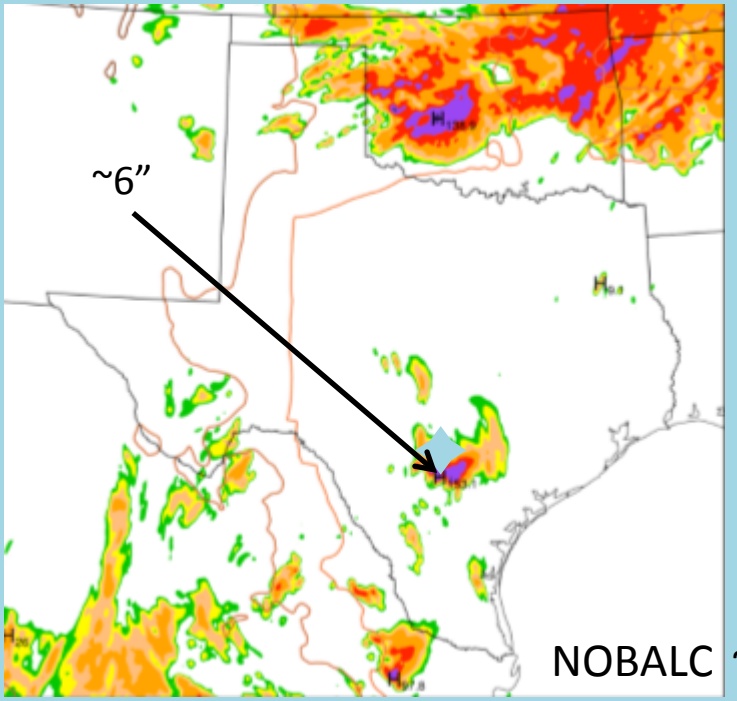

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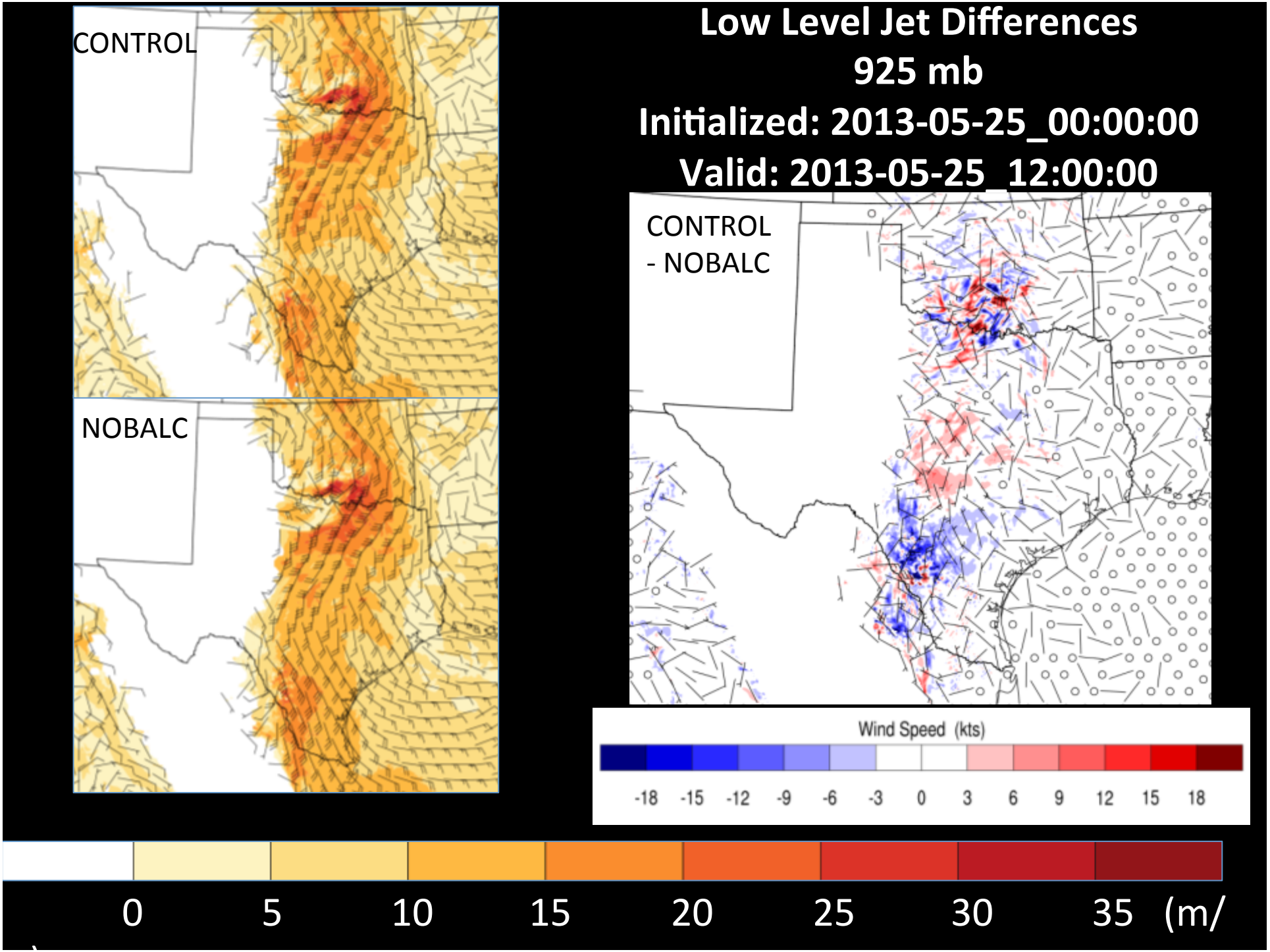
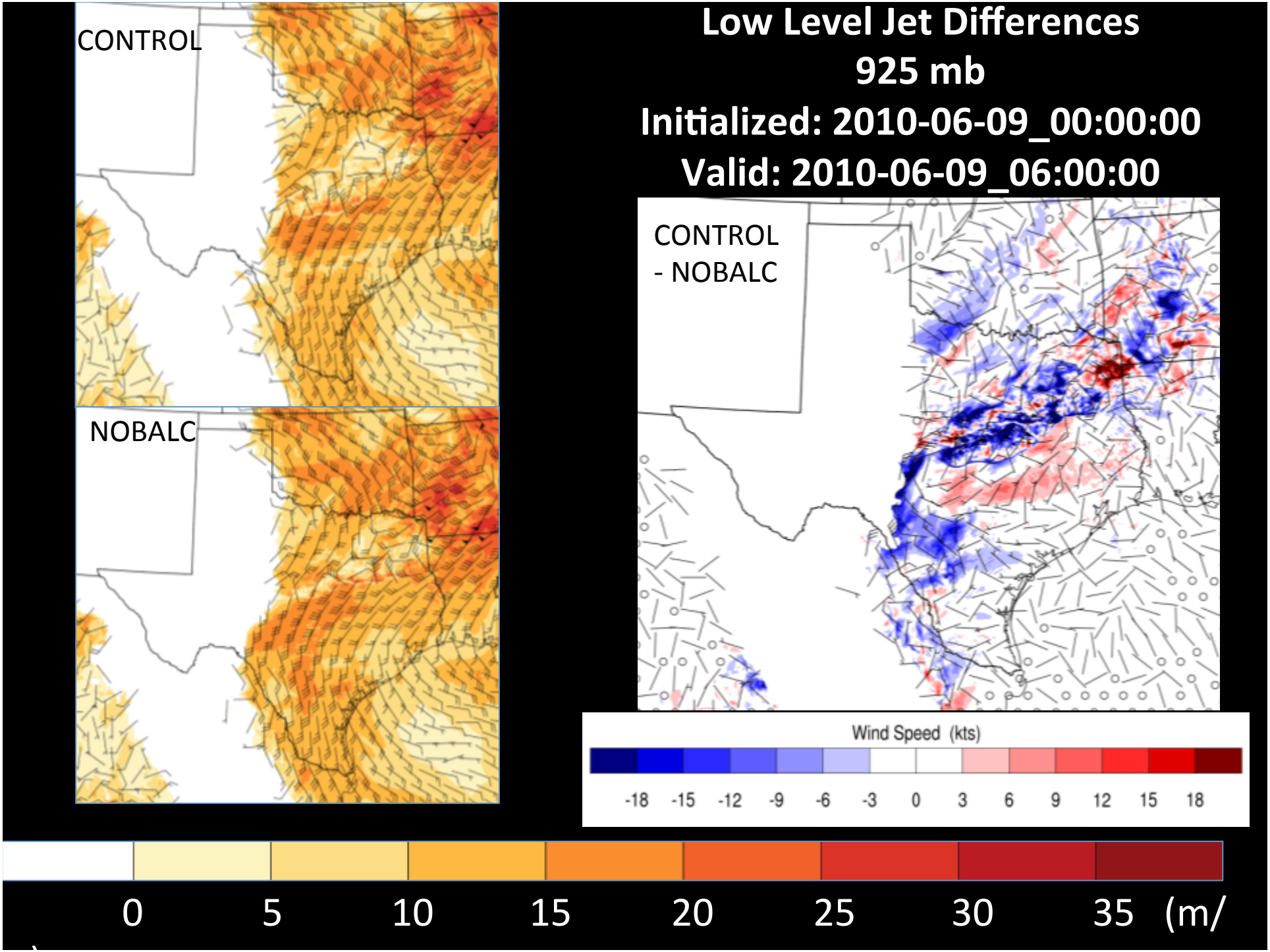
3000

1000

300

1 m = ~3.28 ft


Low Level Jet Differences
925 mb
Initialized: 2013-05-25_00:00:00
Valid: 2013-05-25_12:00:00
CONTROL
NOBALC
CONTROL
- NOBALC
Wind Speed (kts)
-18 -15 -12 -9 -6 -3 0 3 6 9 12 15 18
0 5 10 15 20 25 30 35 (m/


Low Level Jet Differences
925 mb
Initialized: 2010-06-09_00:00:00
Valid: 2010-06-09_06:00:00
CONTROL
NOBALC
CONTROL
- NOBALC
Wind Speed (kts)
-18 -15 -12 -9 -6 -3 0 3 6 9 12 15 18
0 5 10 15 20 25 30 35 (m/

Conclusions

- Surprisingly, removing the Balcones Escarpment in the model causes little change to the rainfall distribution and amount!
- Meteorological factors are what mainly affect the model forecasts.
- Future: test more cases and/or modify terrain differently.

THANK YOU!

CMMAP
Reach for the sky.

Photo credits: Melissa Burt

References

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