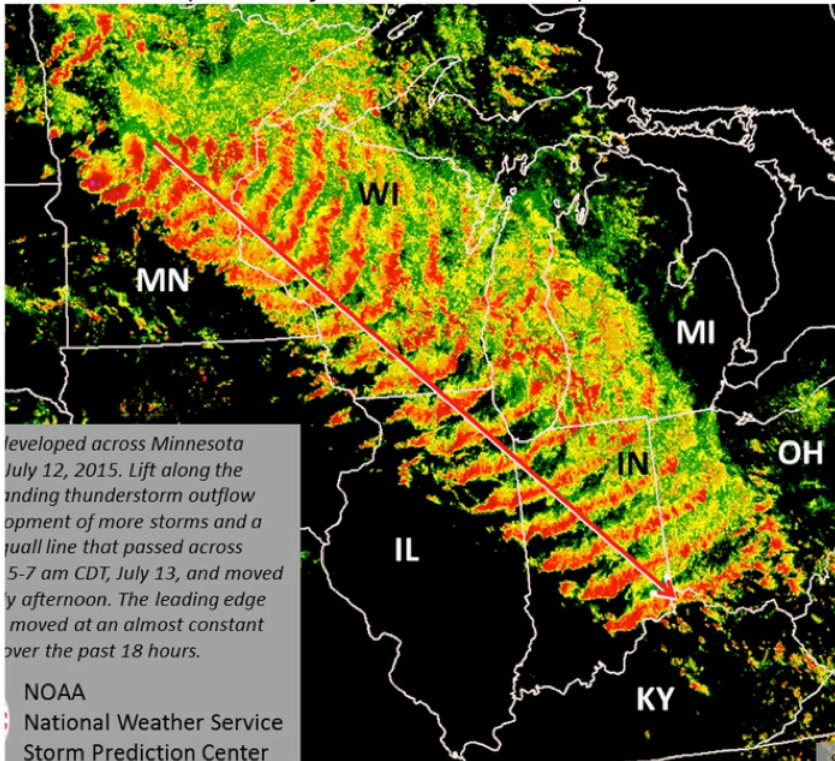


# “Booms and Busts with the Real-time WRF-ARW Convective-scale Ensemble”

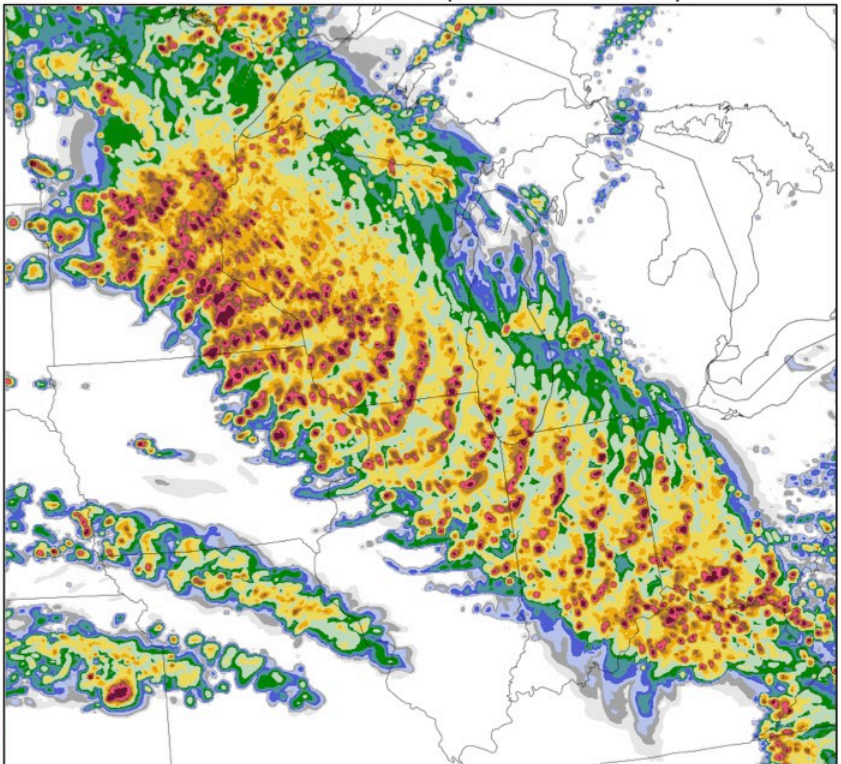
Morris Weisman, Glen Romine, Craig Schwartz, Ryan Sobash

17<sup>th</sup> WRF USERS Workshop 2016

**Observed** (courtesy G. Carbin, SPC)



**NCAR Ensemble Member (26 – 45 hr fcst)**



**July 12 2015 Derecho**

**\*Convective-scale ensembles offer unique guidance for significant weather hazards: tornadoes, high winds, hail, flash flooding....**

**VIA:**

**Convective mode:** – supercells, squall lines, bow echoes/derechoes, training echoes

**Model surrogates** – derived from simulated convection

- updraft speed/helicity
- surface wind speeds
- low-level vorticity
- maximum hail size

**Accumulated precipitation** – flash flooding

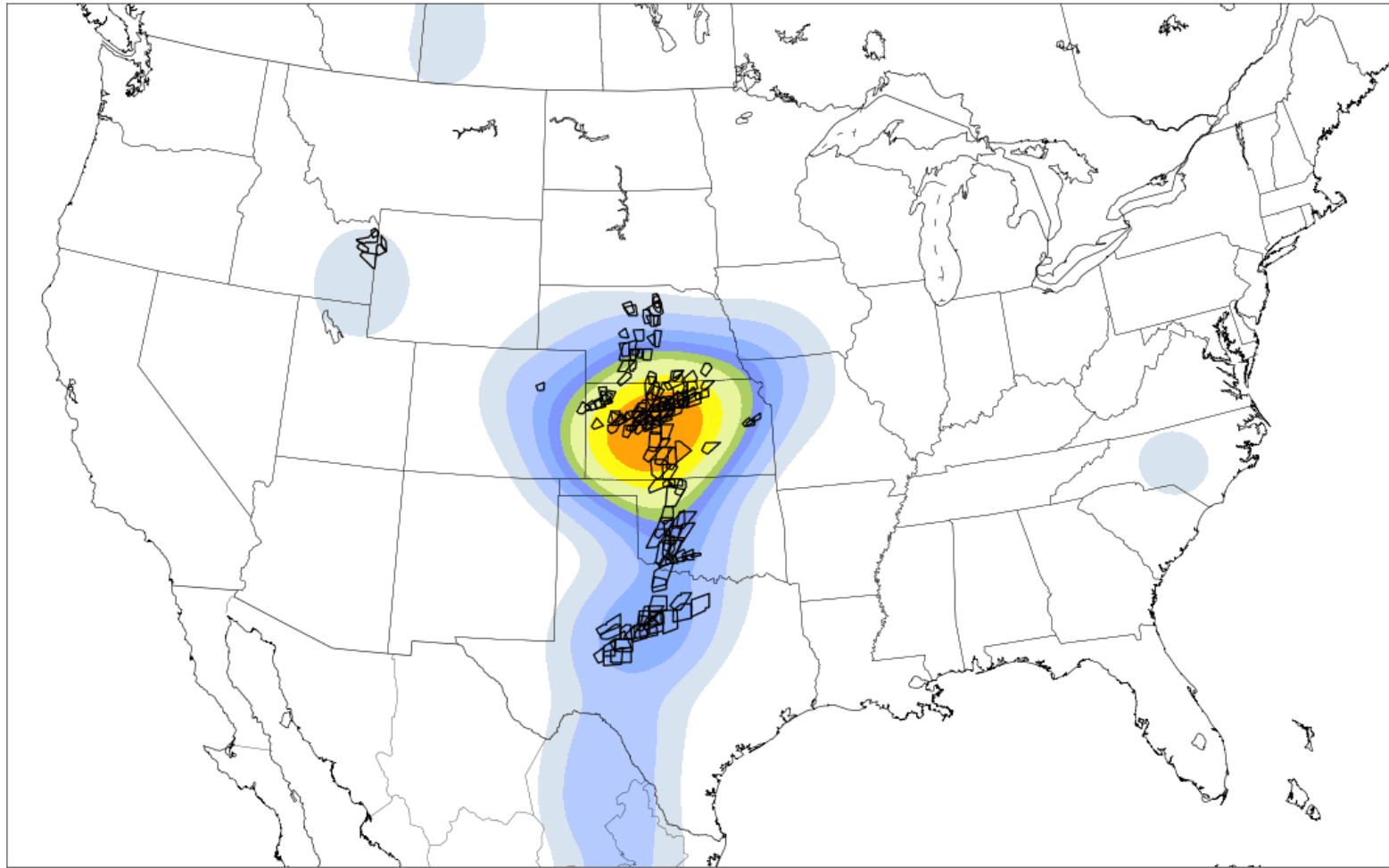
**Probabilistic Guidance!!**

**08 May 2016**

## Isolated, splitting supercells...

Day 1 prob. of UH > 75 m2/s2 w/ NWS warnings

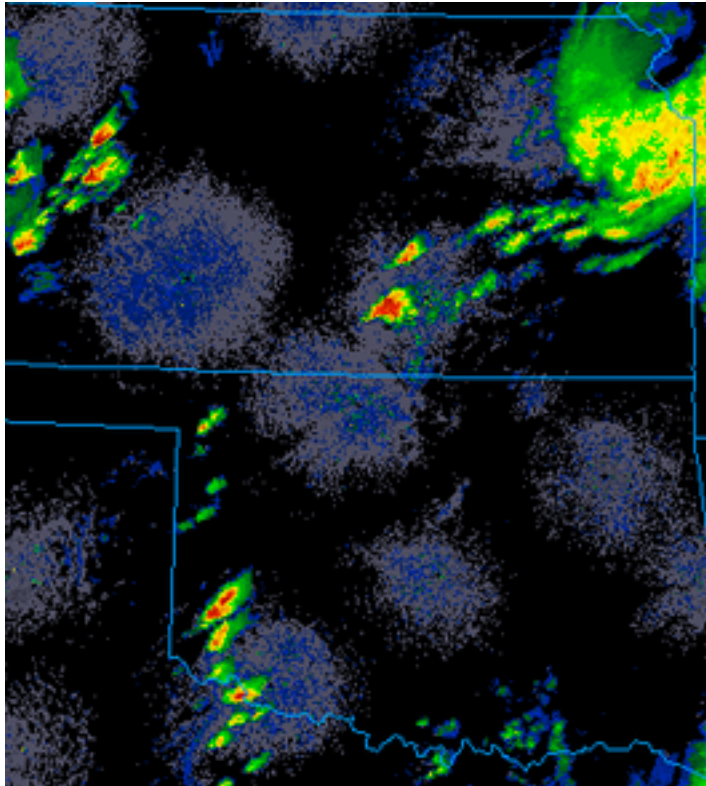
Init: Sun 2016-05-08 00 UTC  
Valid: Sun 2016-05-08 12 UTC - Mon 2016-05-09 12 UTC



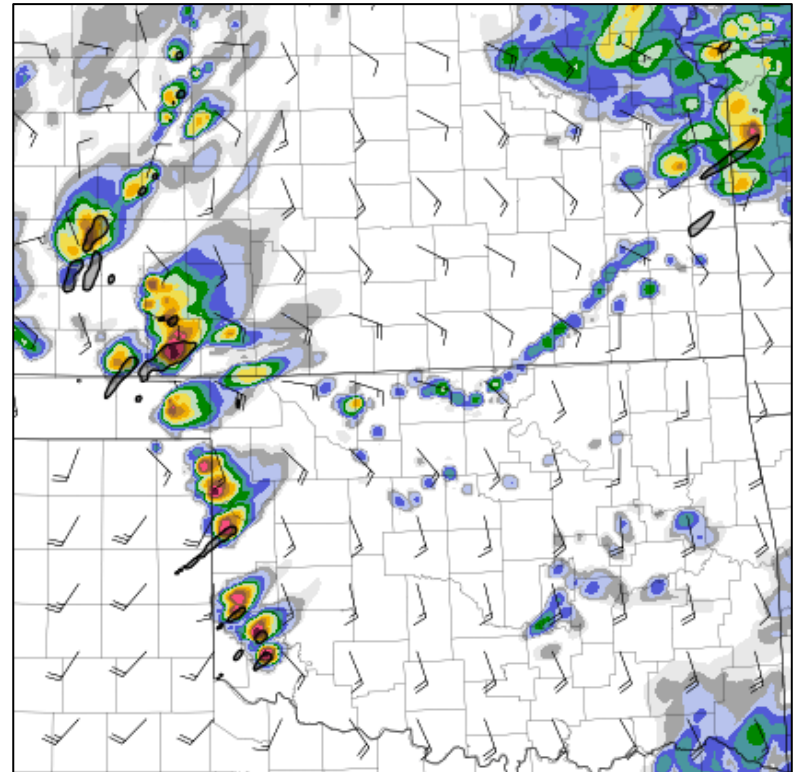
**08 May 2016**

**Isolated, splitting supercells...**

**Radar**



**Model Reflectivity 21h**



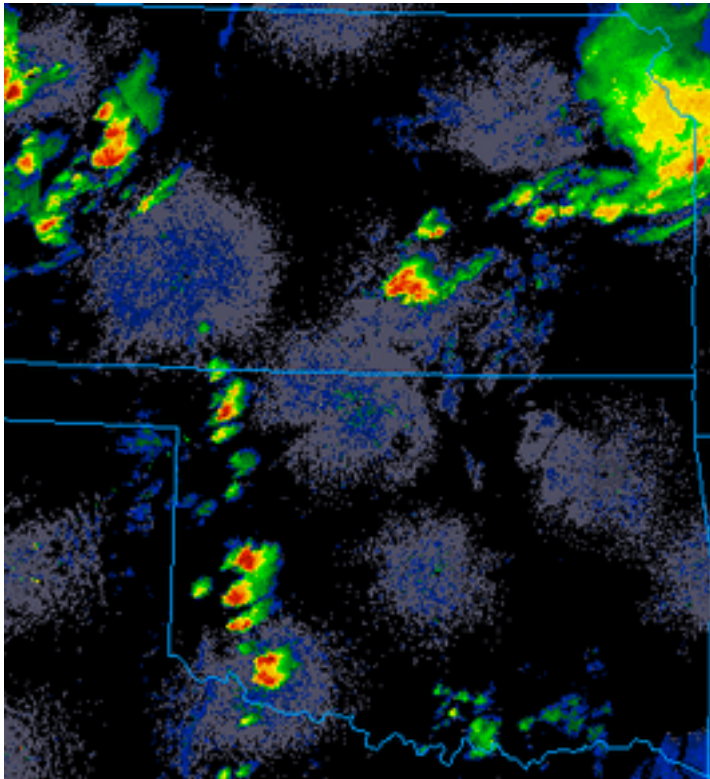
**21:00 UTC**



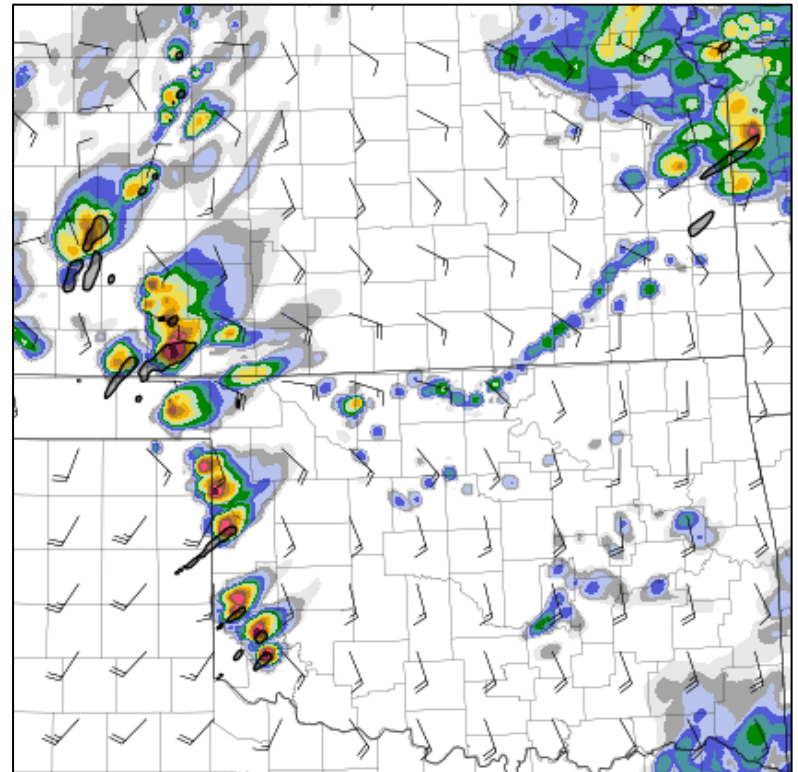
**08 May 2016**

**Isolated, splitting supercells...**

**Radar**



**Model Reflectivity 21h**

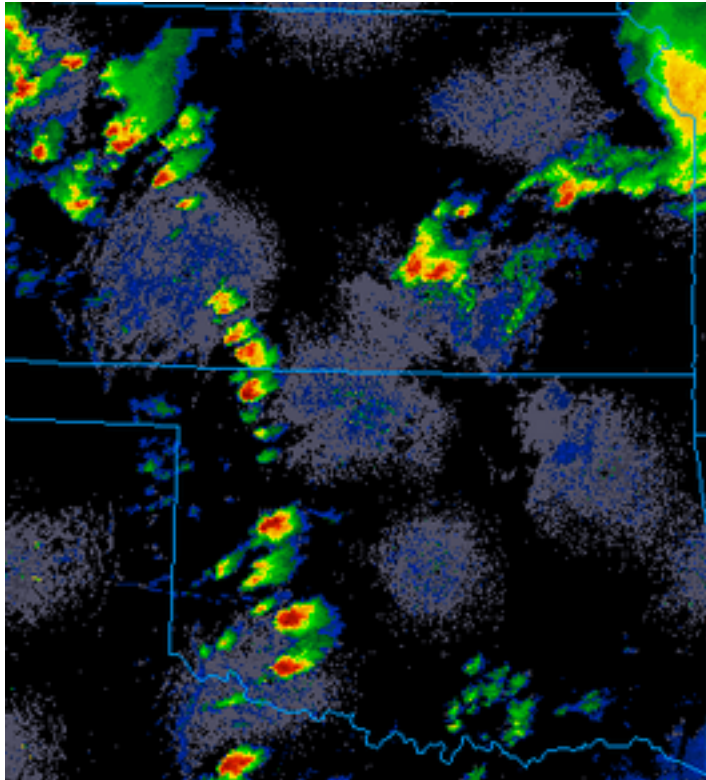


**21:30 UTC**

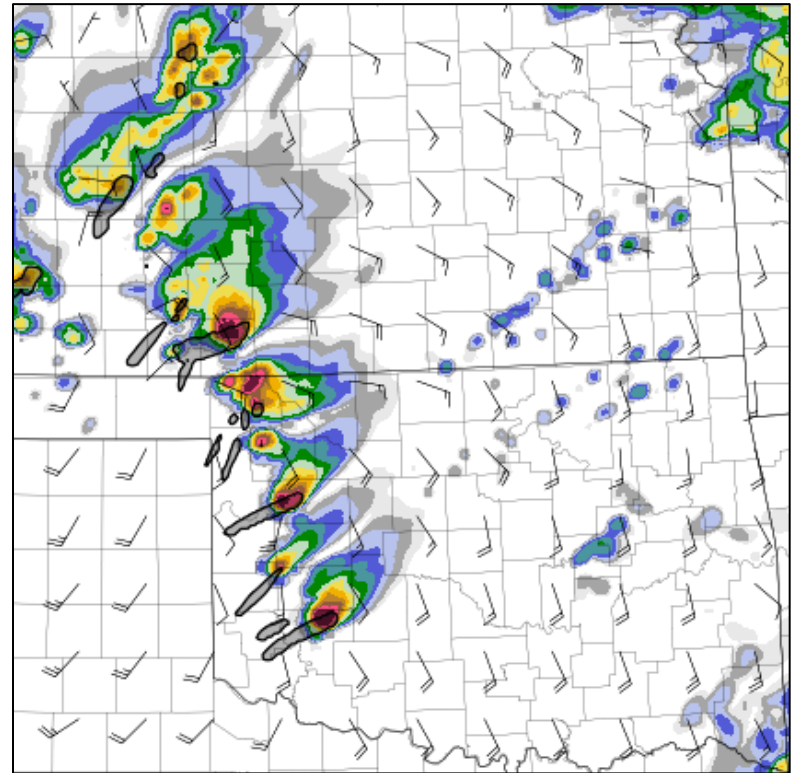
**08 May 2016**

**Isolated, splitting supercells...**

**Radar**



**Model Reflectivity 22h**

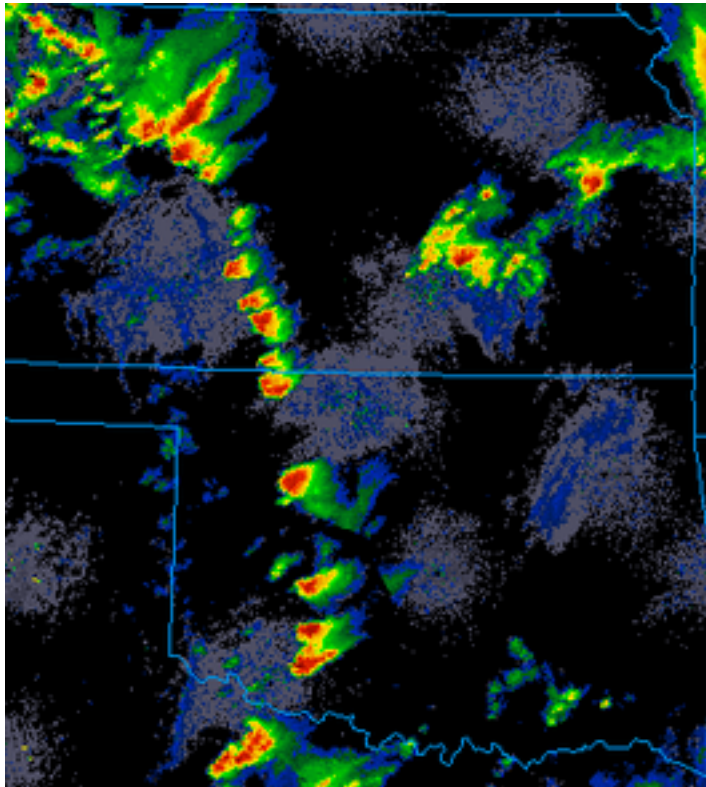


**22:00 UTC**

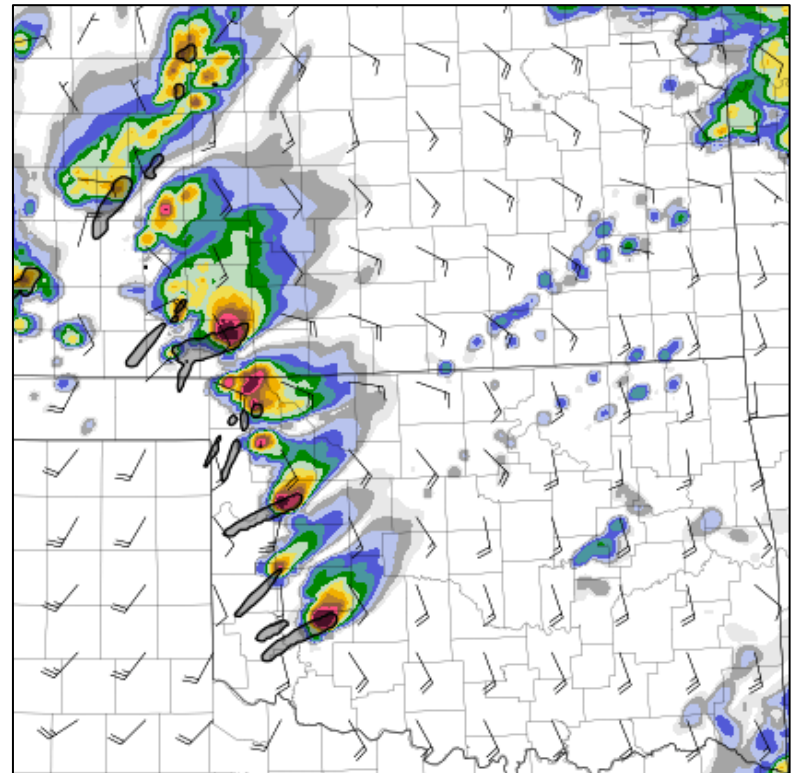
**08 May 2016**

**Isolated, splitting supercells...**

**Radar**



**Model Reflectivity 22 h**

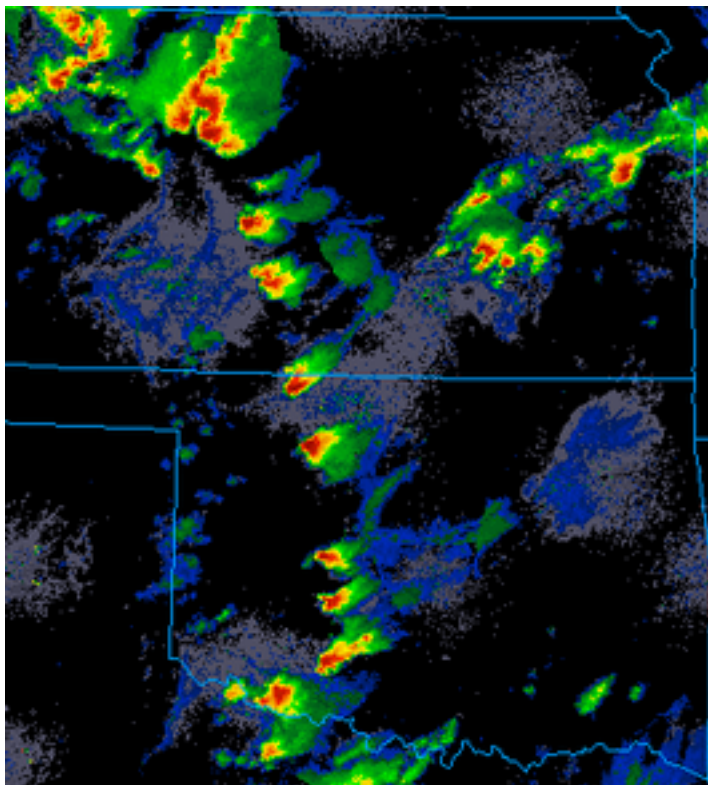


**22:30 UTC**

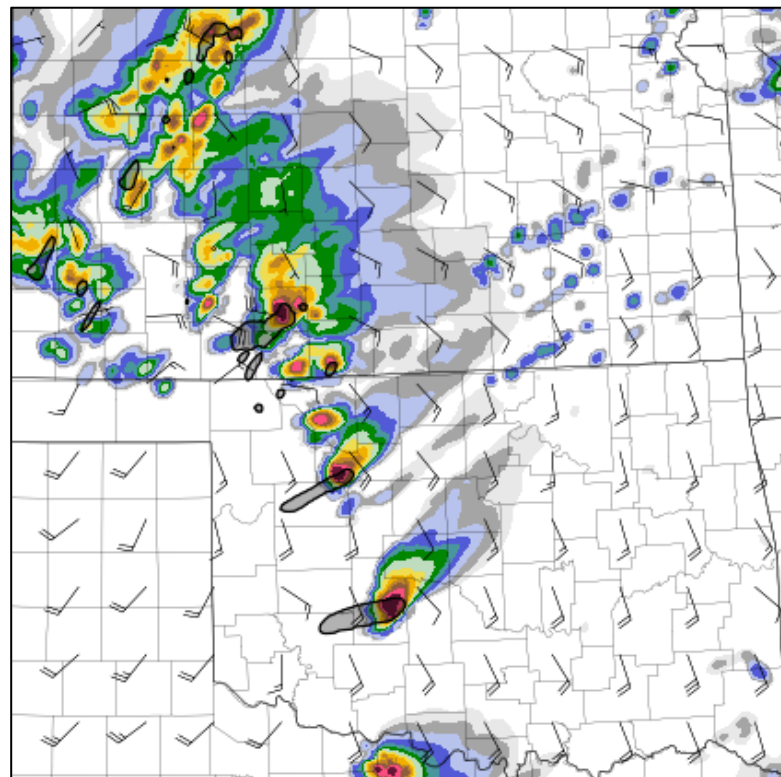
**08 May 2016**

**Isolated, splitting supercells...**

**Radar**



**Model Reflectivity 23h**



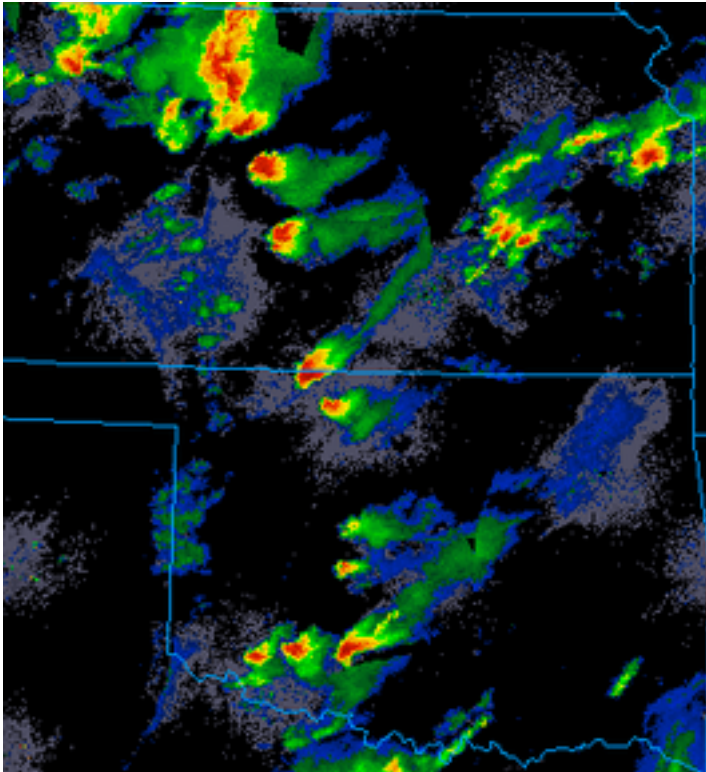
**23:00 UTC**



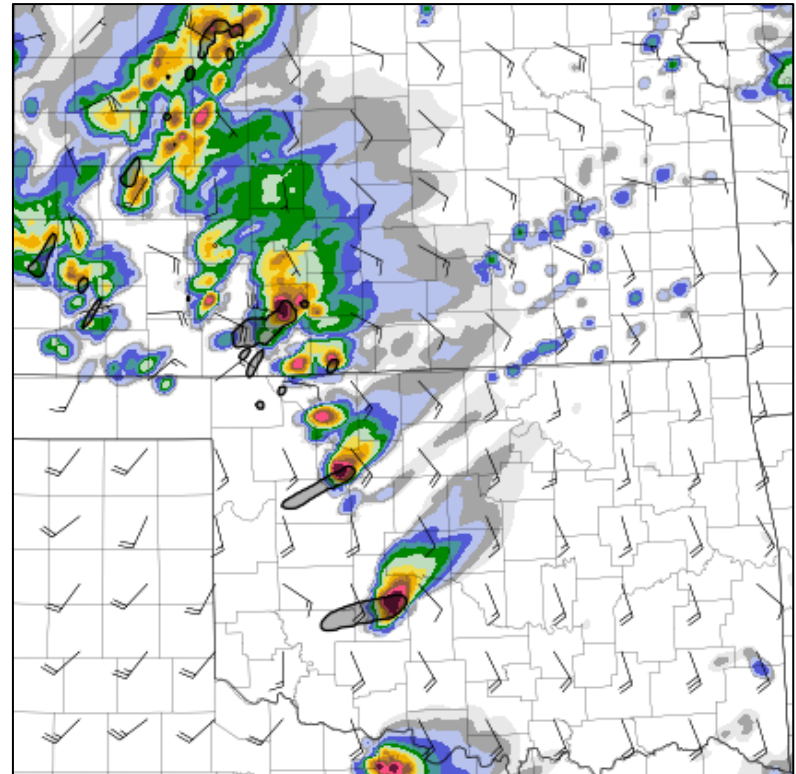
**08 May 2016**

**Isolated, splitting supercells...**

**Radar**



**Model Reflectivity 23 h**

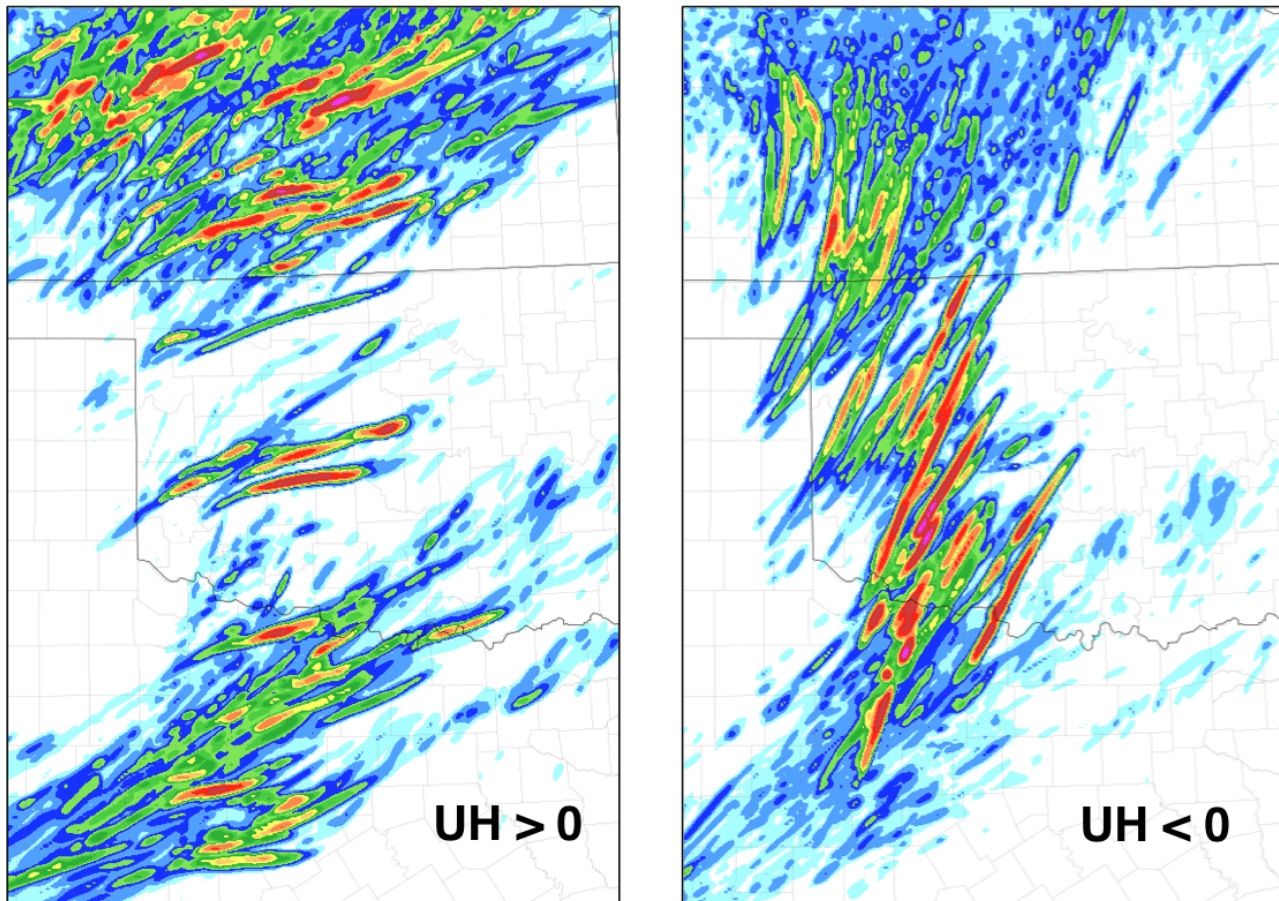


**23:30 UTC**

**08 May 2016**

**\*Left-movers preferred on this day...**

**Ensemble max 2-5 km UH over 6-hr period**

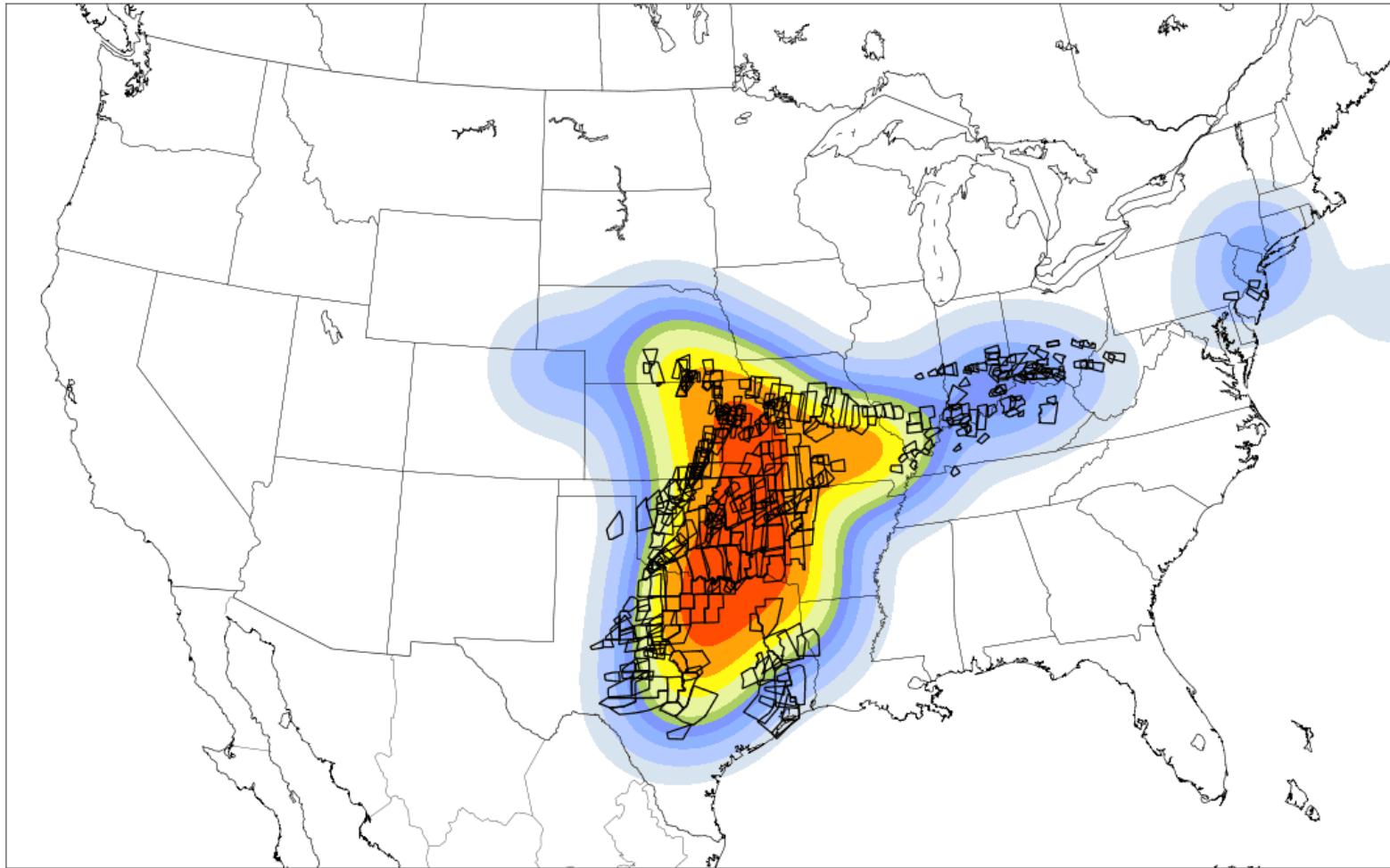


**26 April 2016**

## Dominant squall line...

Day 1 prob. of UH > 75 m2/s2 w/ NWS warnings

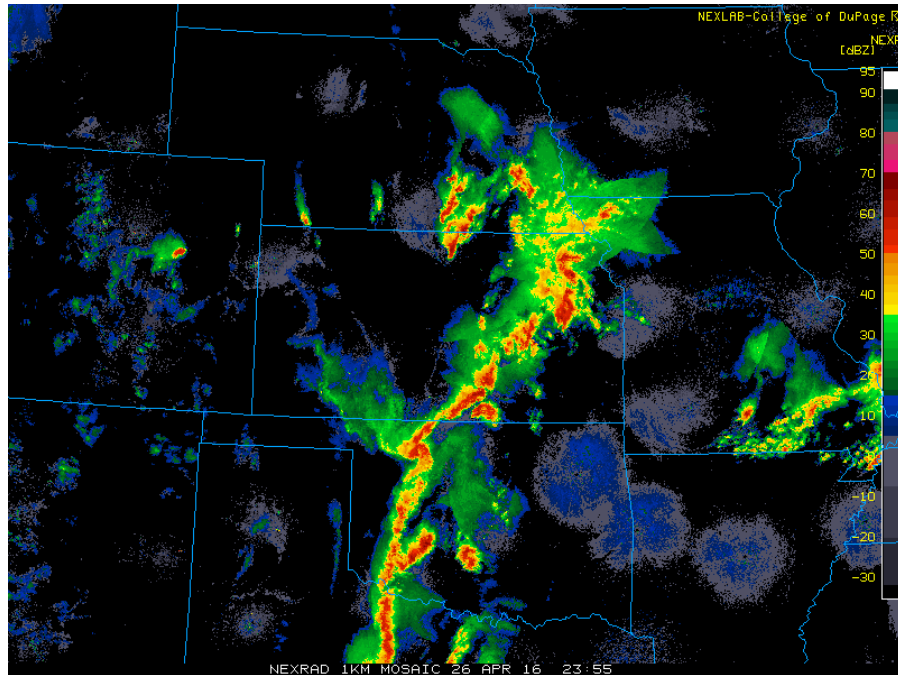
Init: Tue 2016-04-26 00 UTC  
Valid: Tue 2016-04-26 12 UTC - Wed 2016-04-27 12 UTC



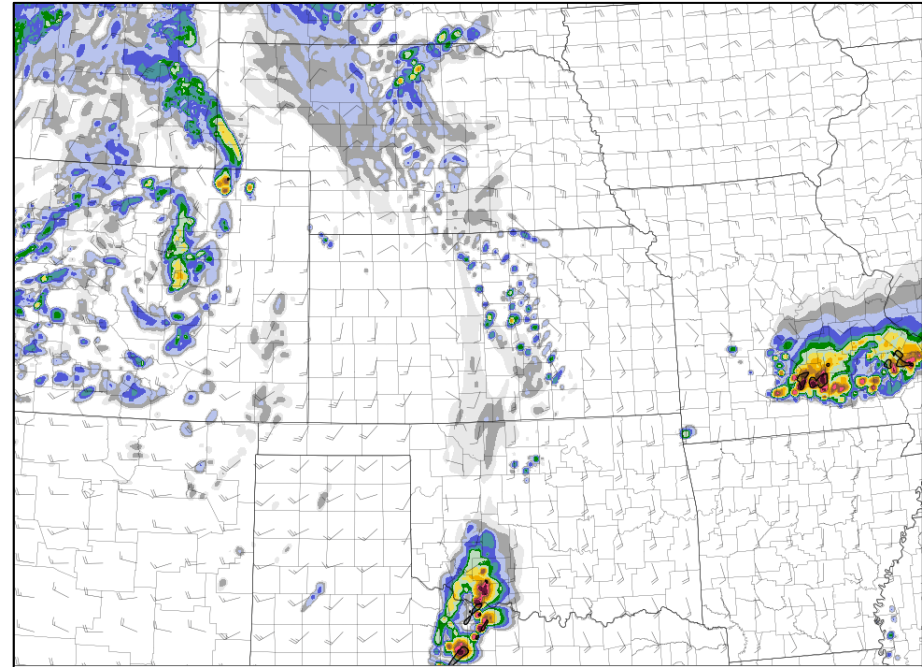
**27 April 2016**

**Dominant squall line...**

**Radar**



**Model Reflectivity 24h**



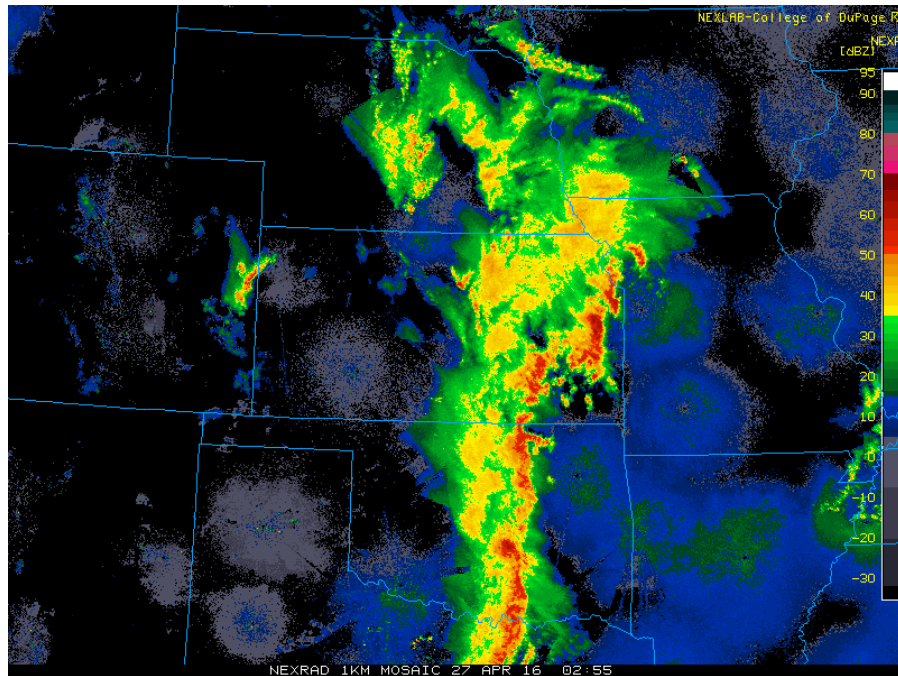
**00:00 UTC**



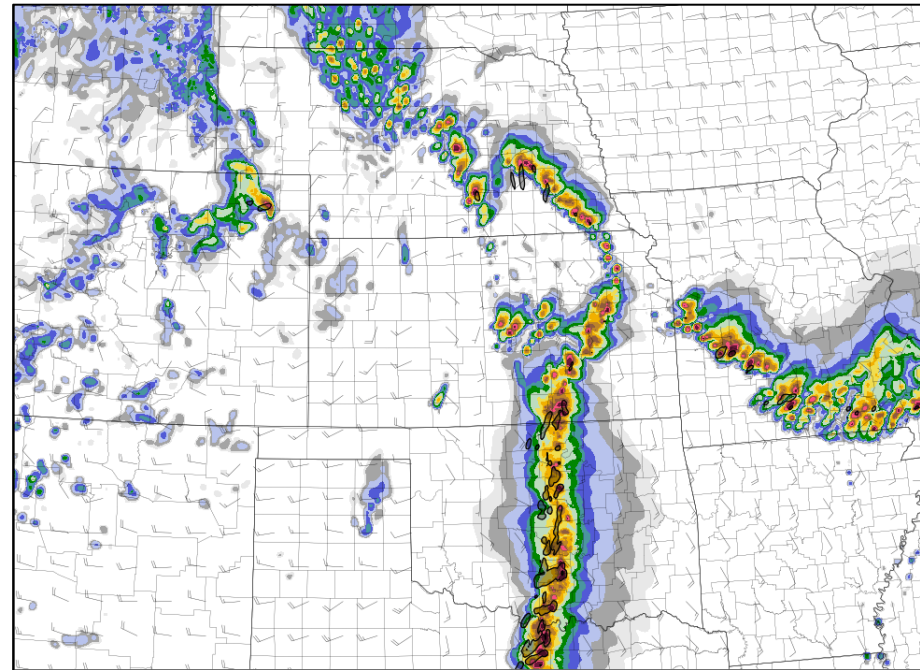
**27 April 2016**

**Dominant squall line...**

**Radar**



**Model Reflectivity 27h**

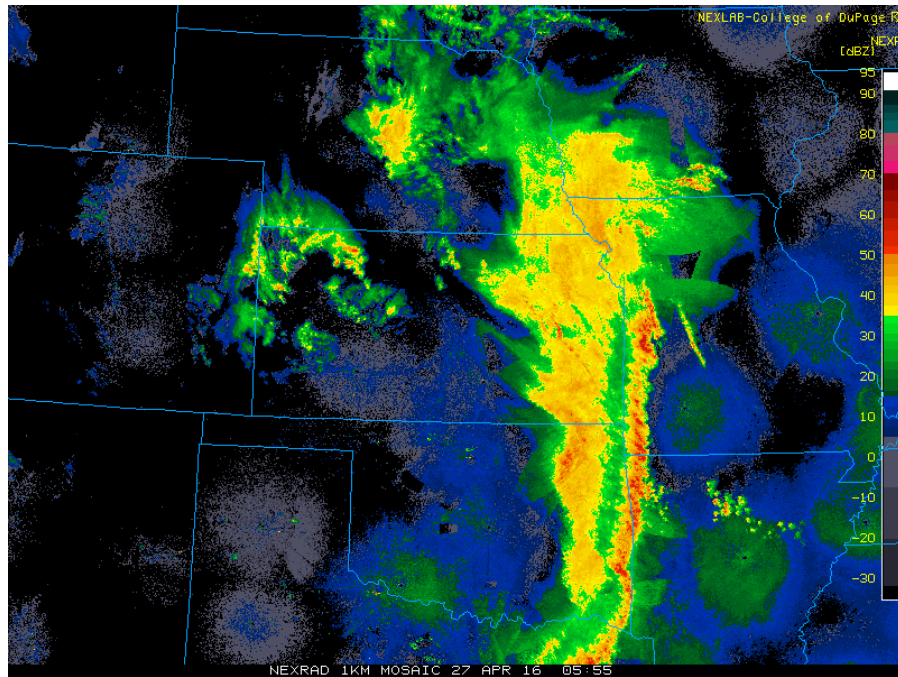


**03:00 UTC**

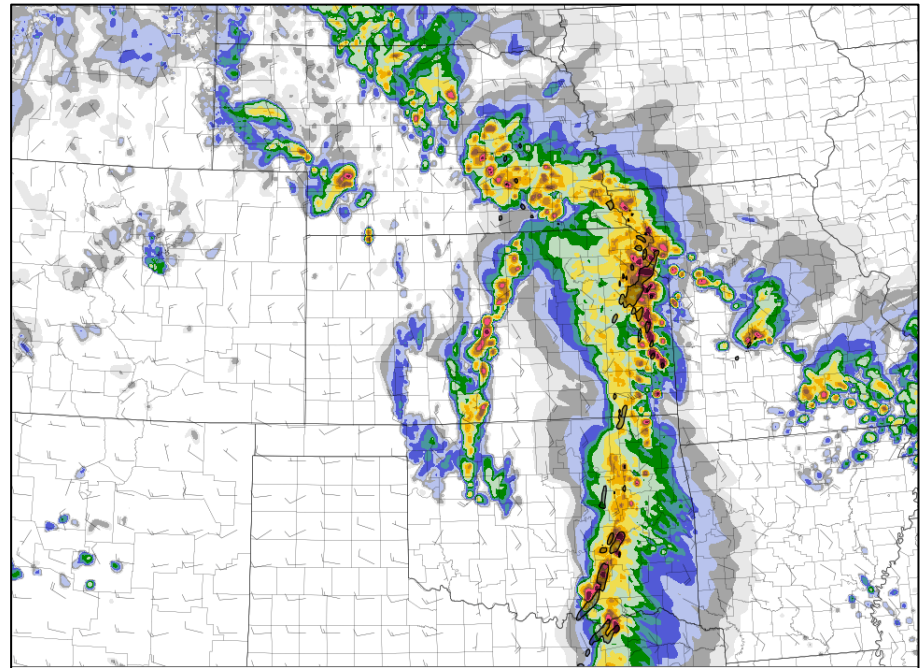
**27 April 2016**

**Dominant squall line...**

**Radar**



**Model Reflectivity 30h**



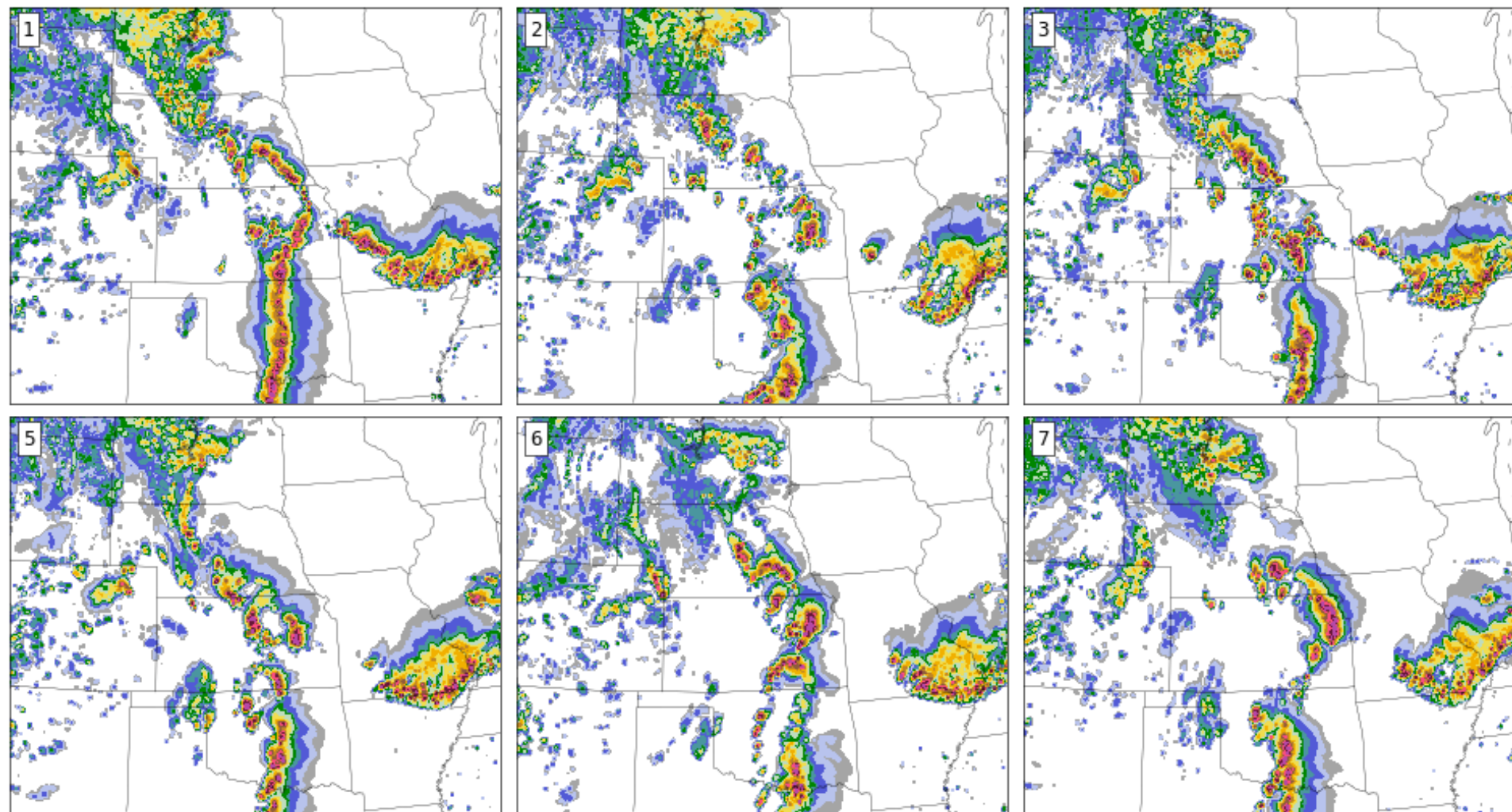
**06:00 UTC**



**26 April 2016**

**Dominant squall line...**

**24 h forecast 6 Ensemble Members**

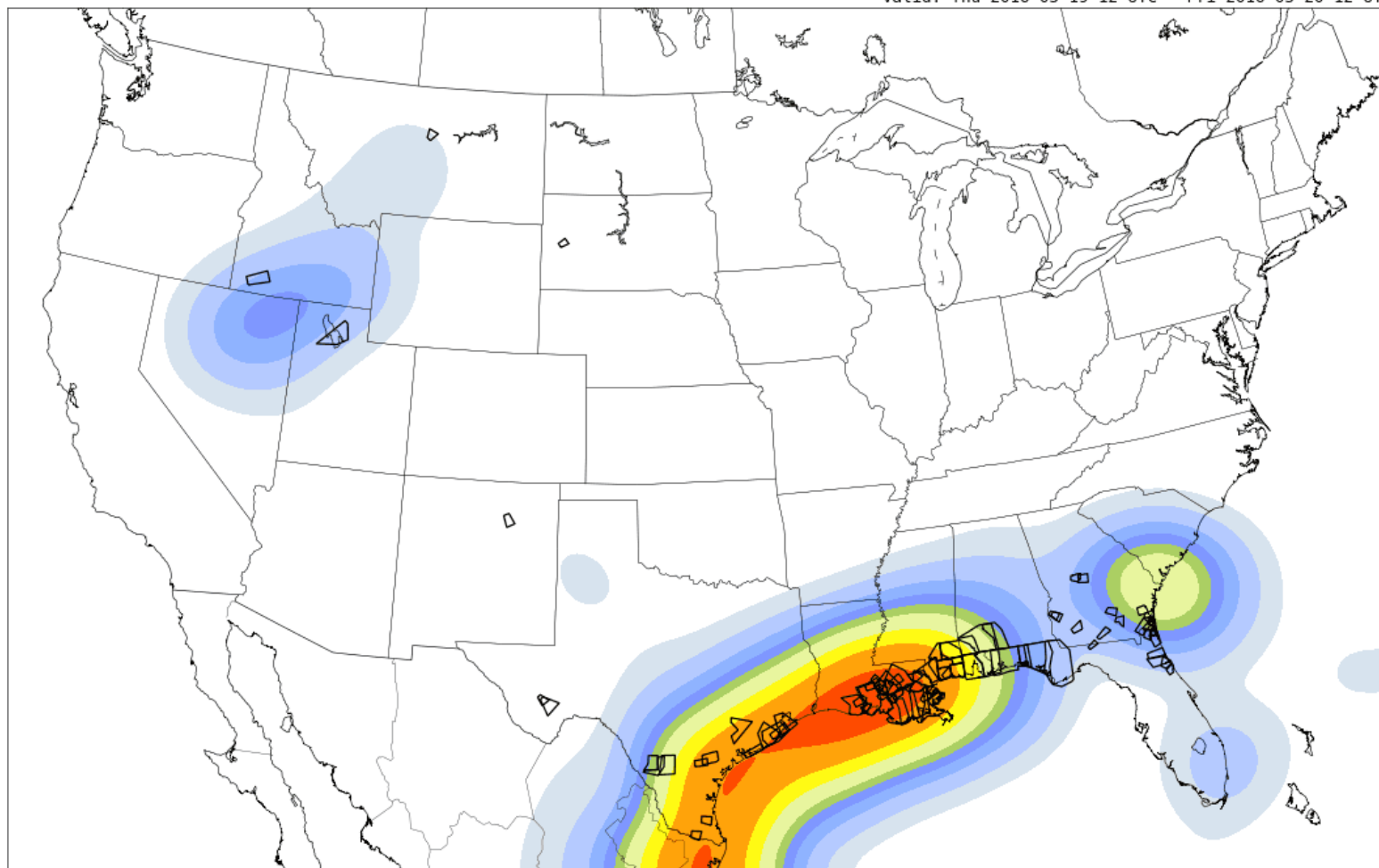


# 19 May 2016

## Bow echo/ Derecho...

Day 1 prob. of UH > 75 m/s<sup>2</sup> w/ NWS warnings

Init: Thu 2016-05-19 00 UTC  
Valid: Thu 2016-05-19 12 UTC - Fri 2016-05-20 12 UTC

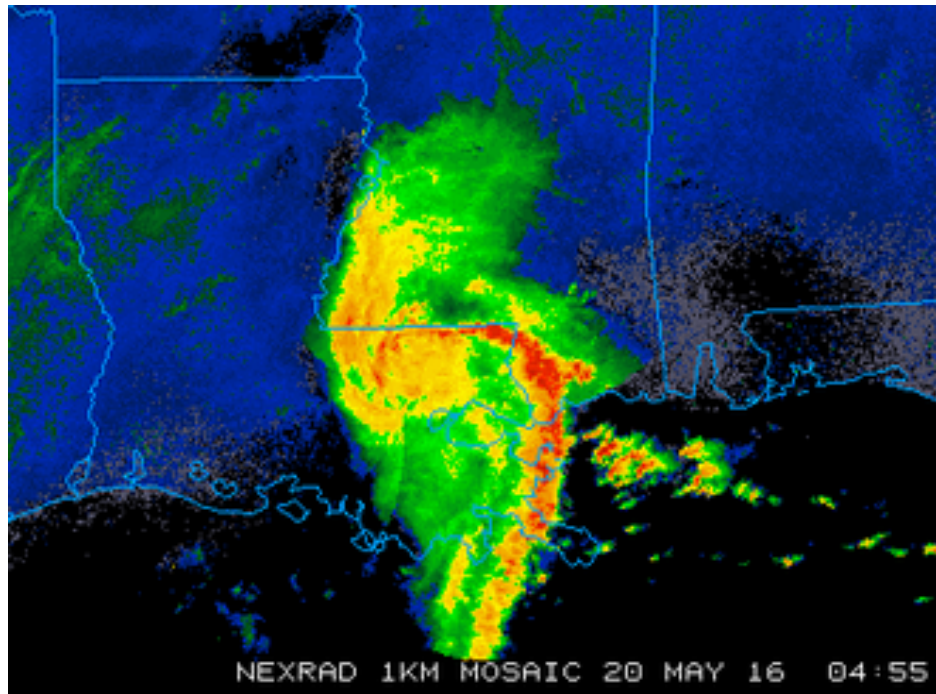




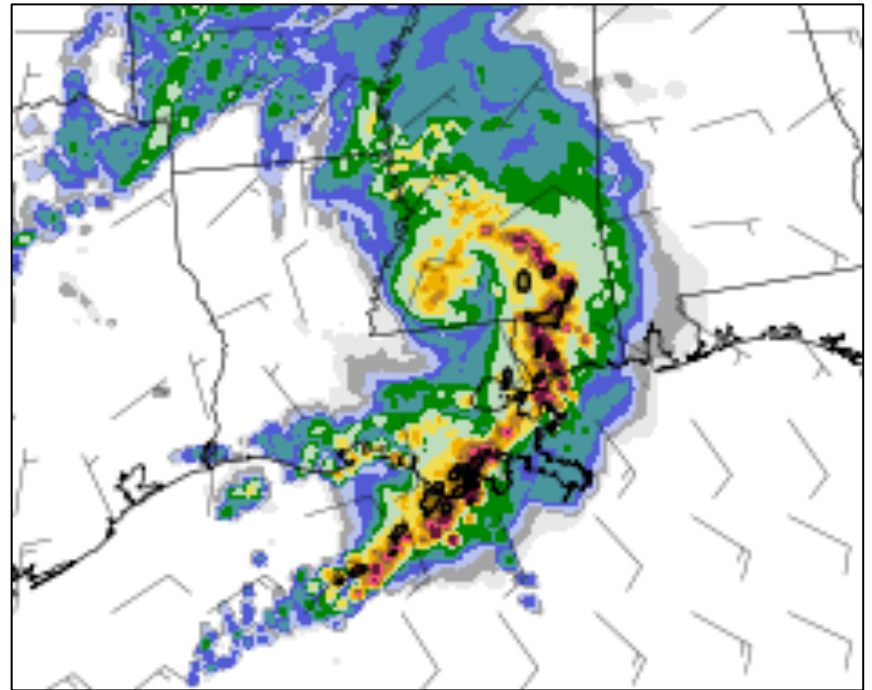
**20 May 2016**

**Bow echo/ Derecho...**

**Radar**



**Model Reflectivity 29h**

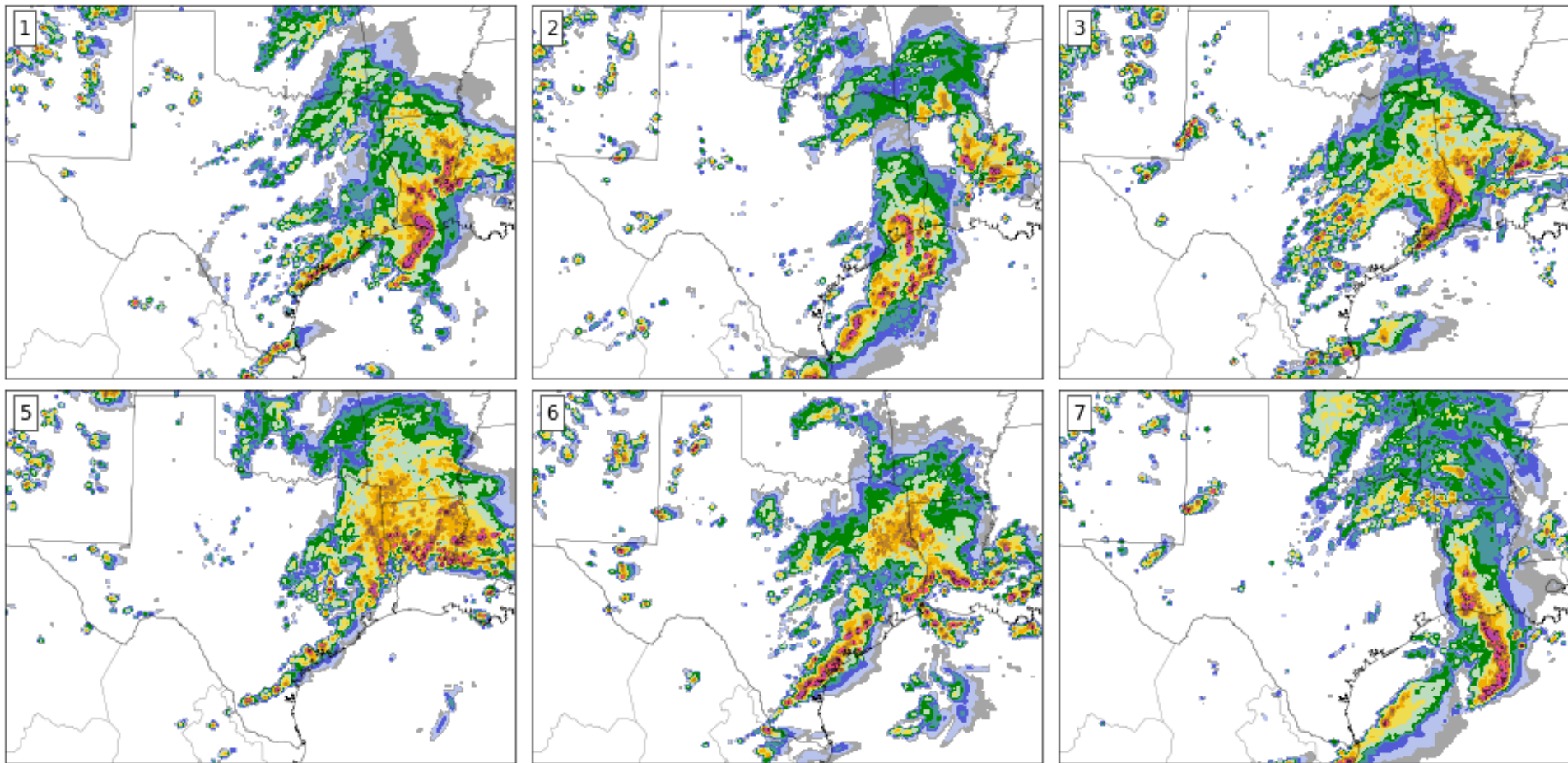


**05:00 UTC**

**19 May 2016**

**Bow echo/ Derecho...**

**24 h forecast 6 Ensemble Members**

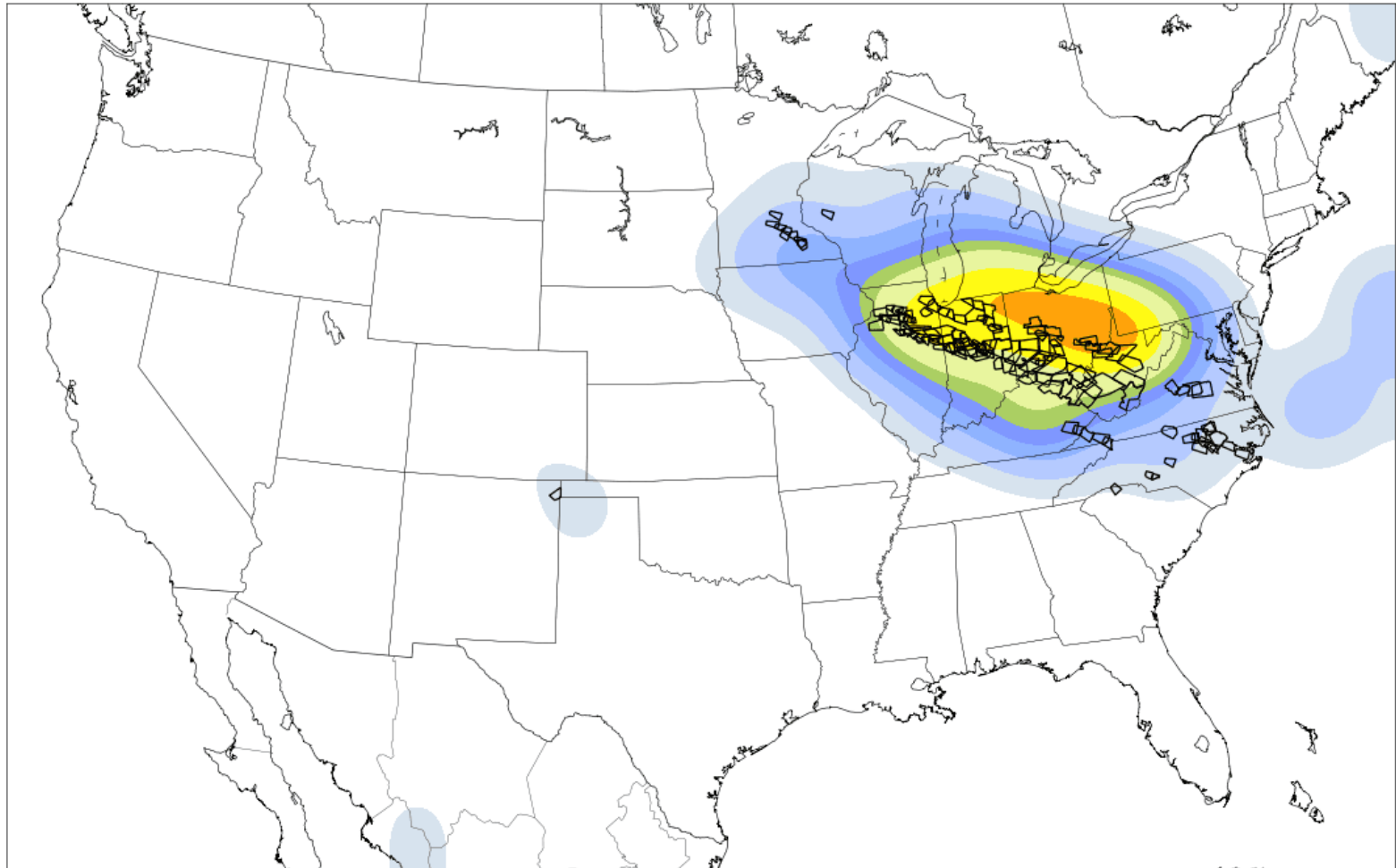


**22 June 2016**

**Derecho/training echoes/flash flooding...**

Day 1 prob. of UH > 75 m2/s2 w/ NWS warnings

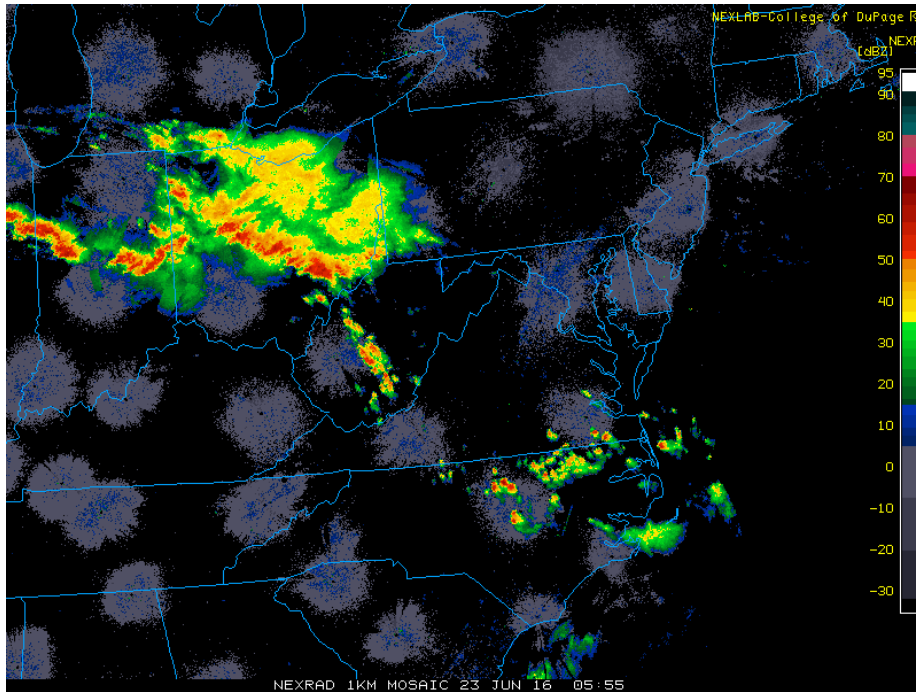
Init: Wed 2016-06-22 00 UTC  
Valid: Wed 2016-06-22 12 UTC - Thu 2016-06-23 12 UTC



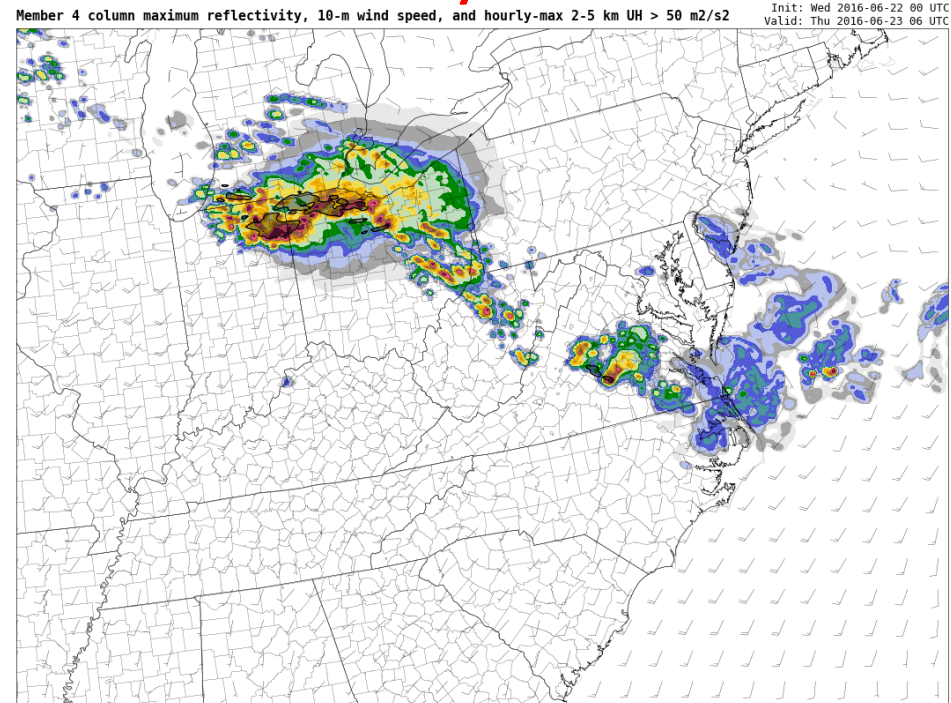
**23 June 2016**

**Derecho/training echoes/flash flooding...**

**Radar**



**Model Reflectivity 30h**



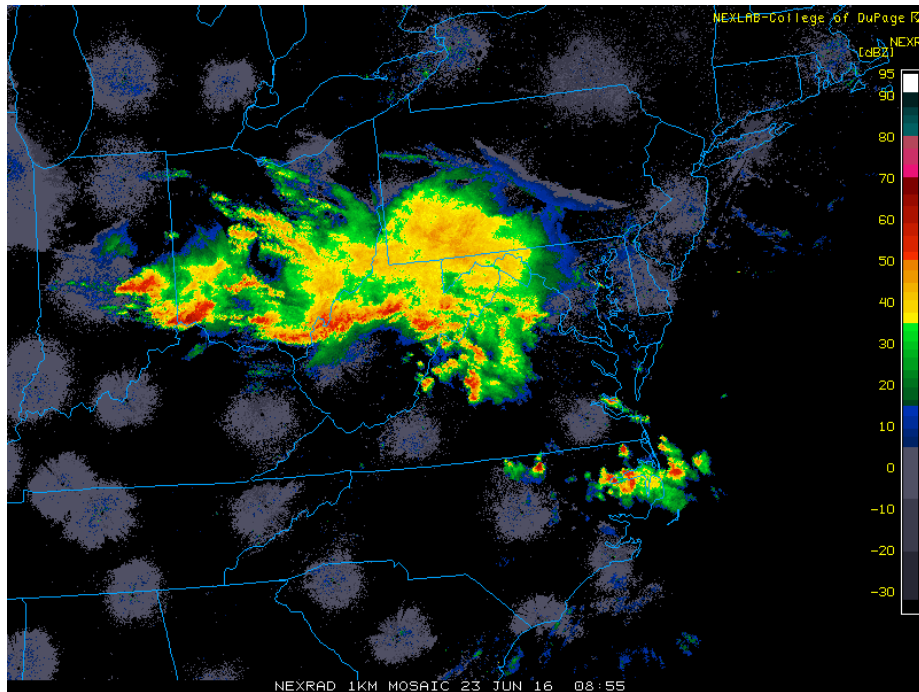
**06:00 UTC**



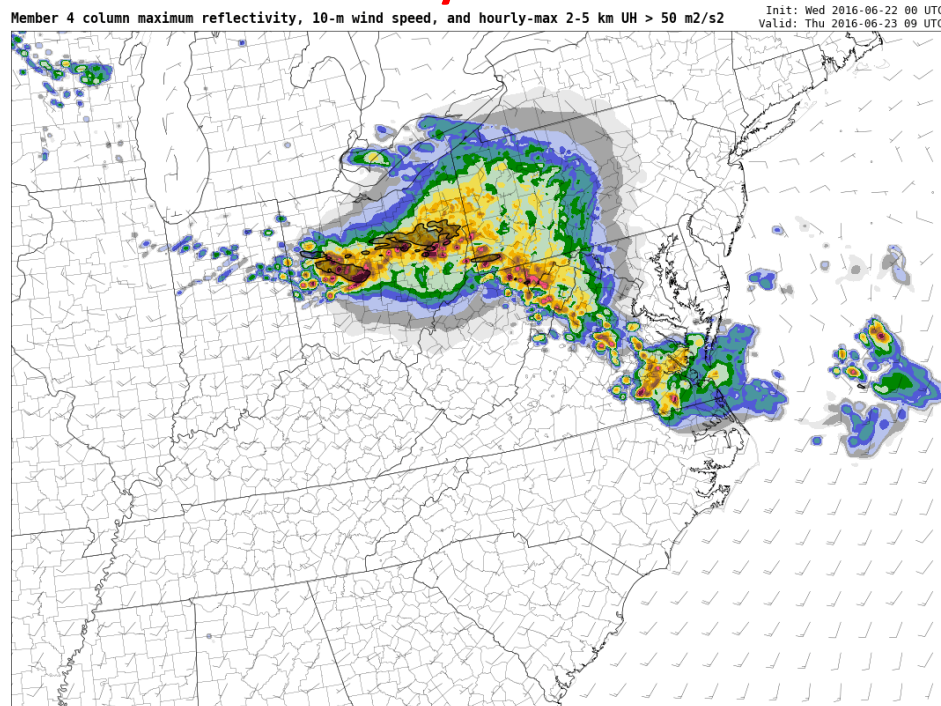
**23 June 2016**

**Derecho/training echoes/flash flooding...**

**Radar**



**Model Reflectivity 33h**

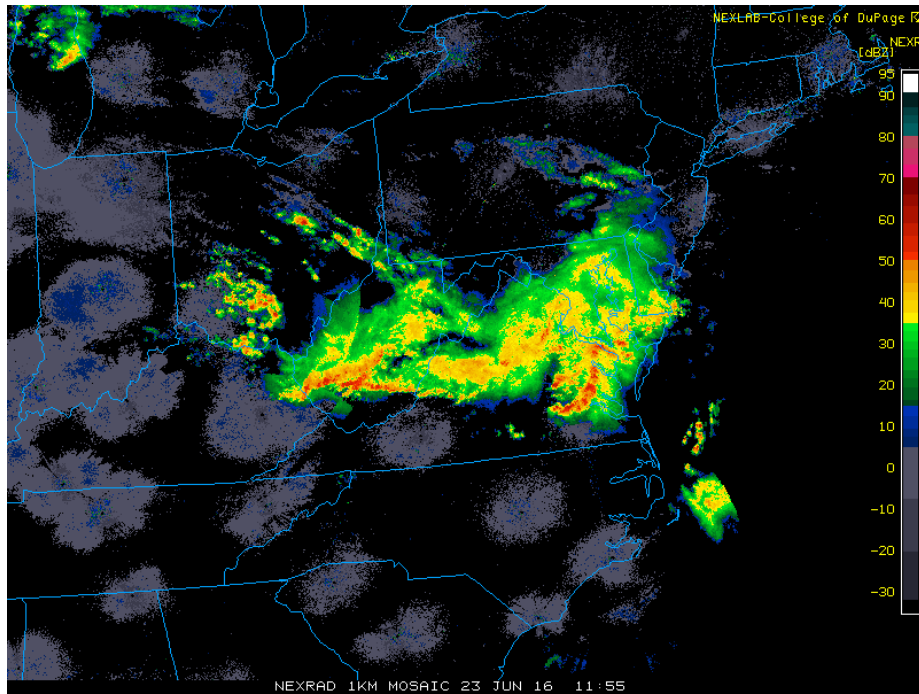


**09:00 UTC**

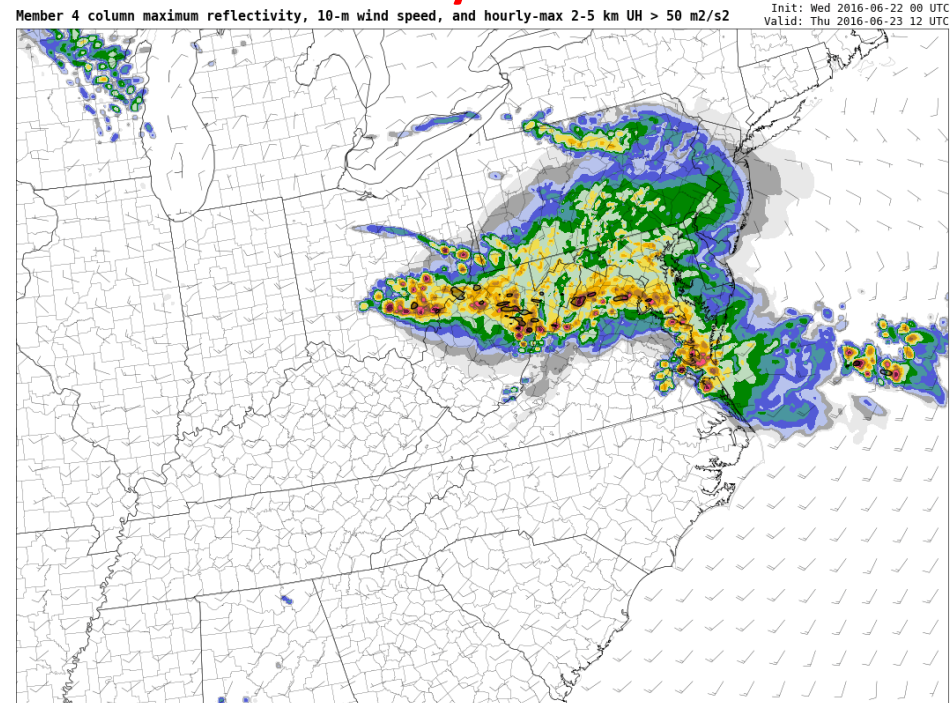
**23 June 2016**

**Derecho/training echoes/flash flooding...**

**Radar**



**Model Reflectivity 36h**

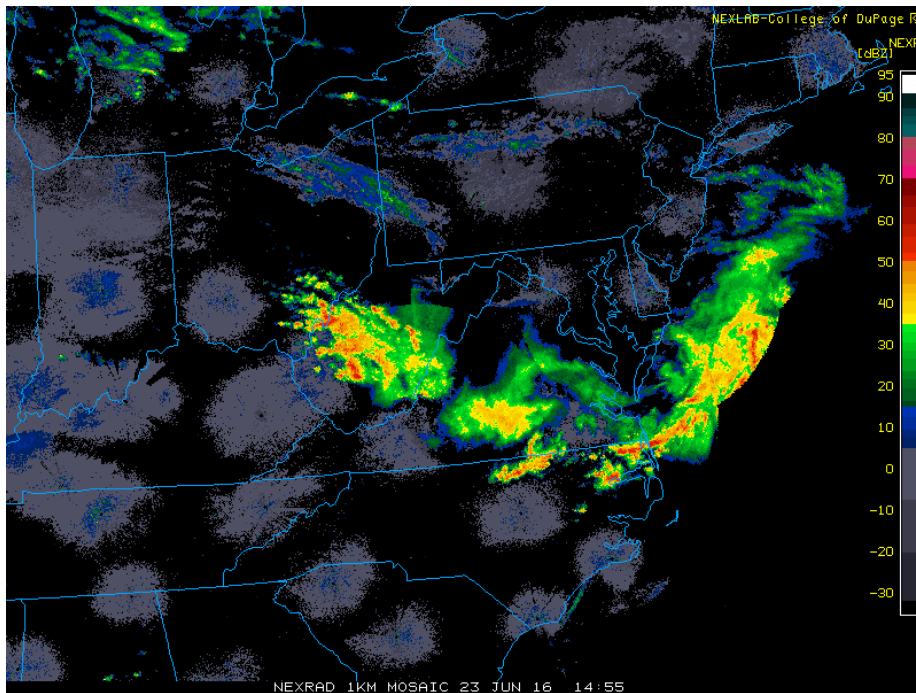


**12:00 UTC**

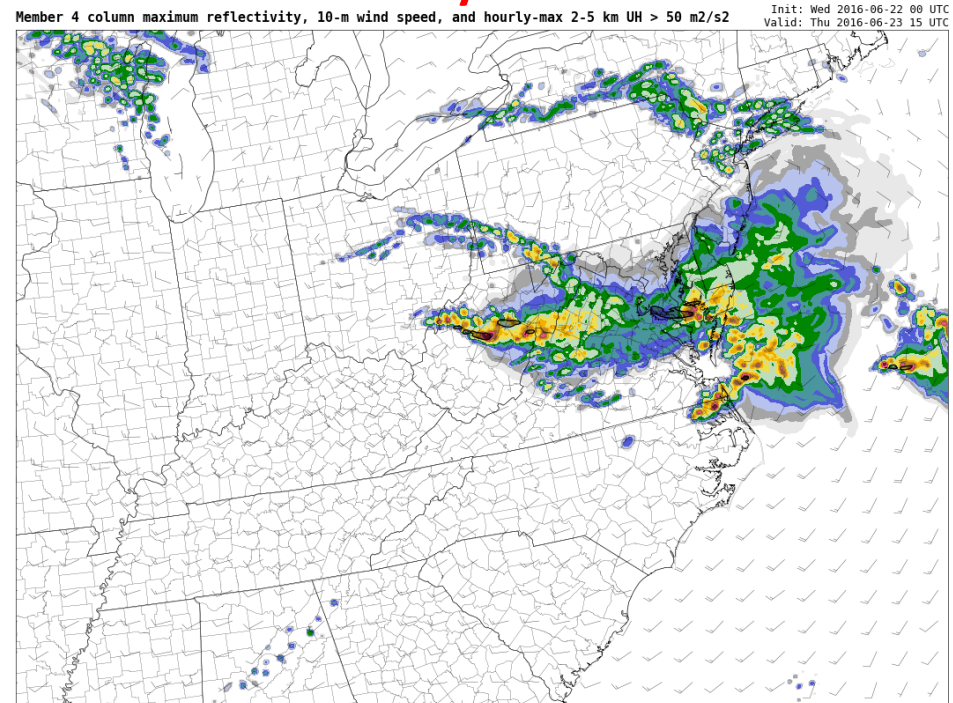
**23 June 2016**

**Derecho/training echoes/flash flooding...**

**Radar**



**Model Reflectivity 39h**



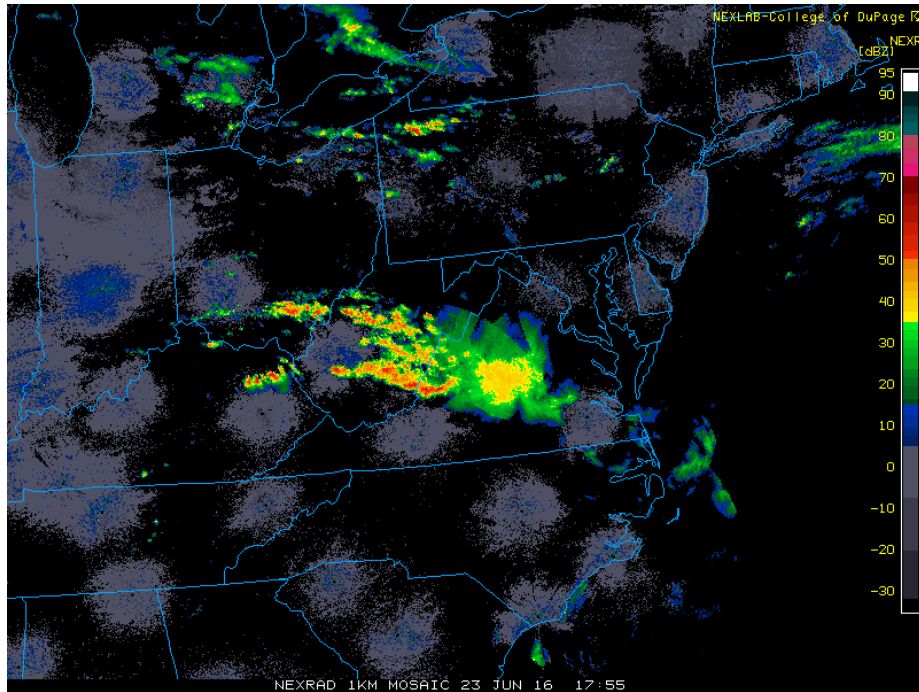
**15:00 UTC**



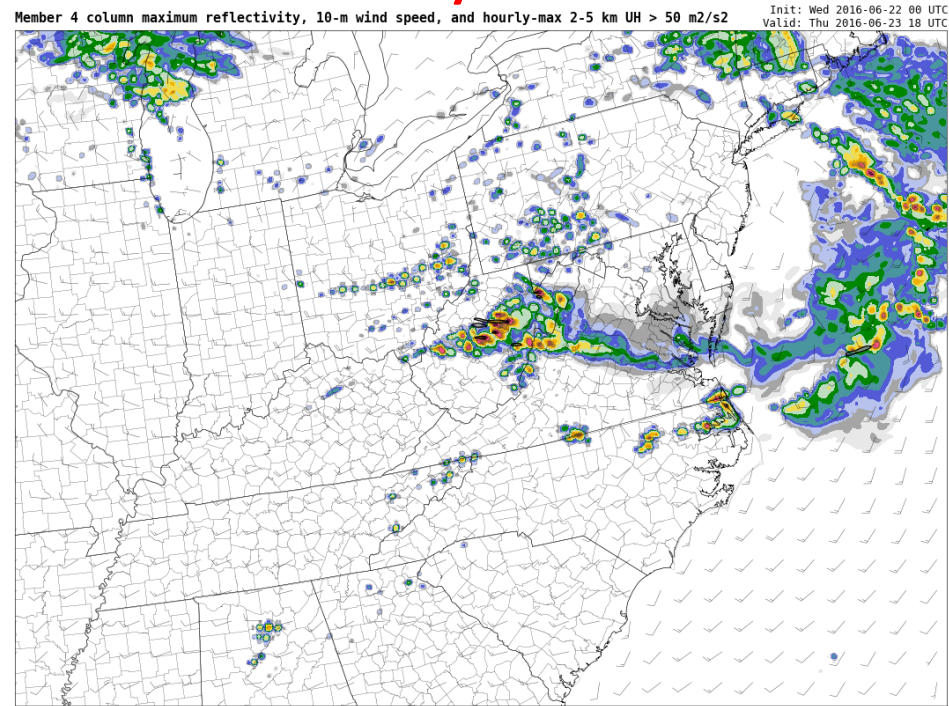
**23 June 2016**

**Derecho/training echoes/flash flooding...**

**Radar**



**Model Reflectivity 42h**



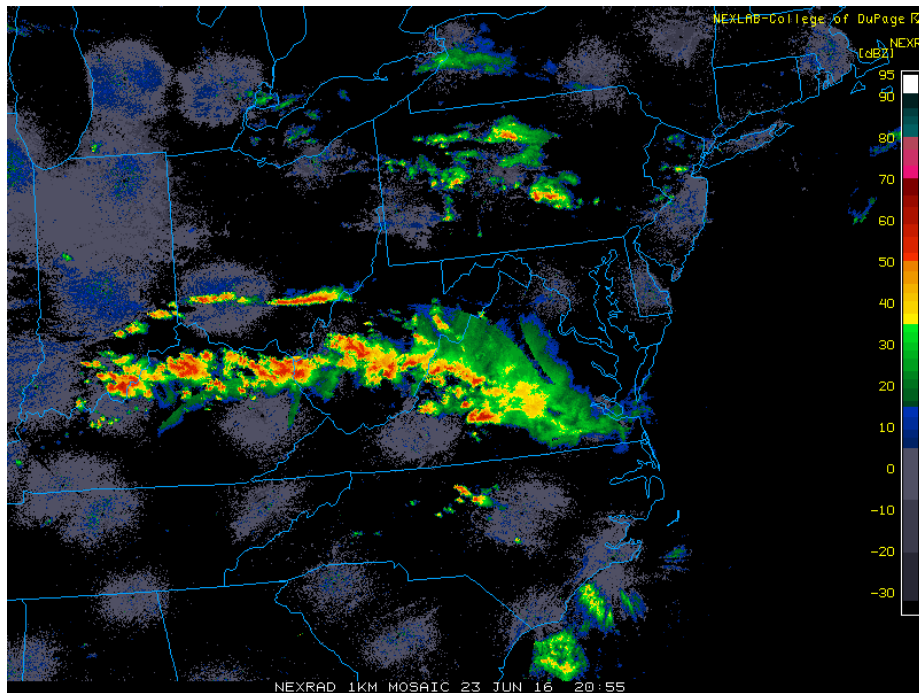
**18:00 UTC**



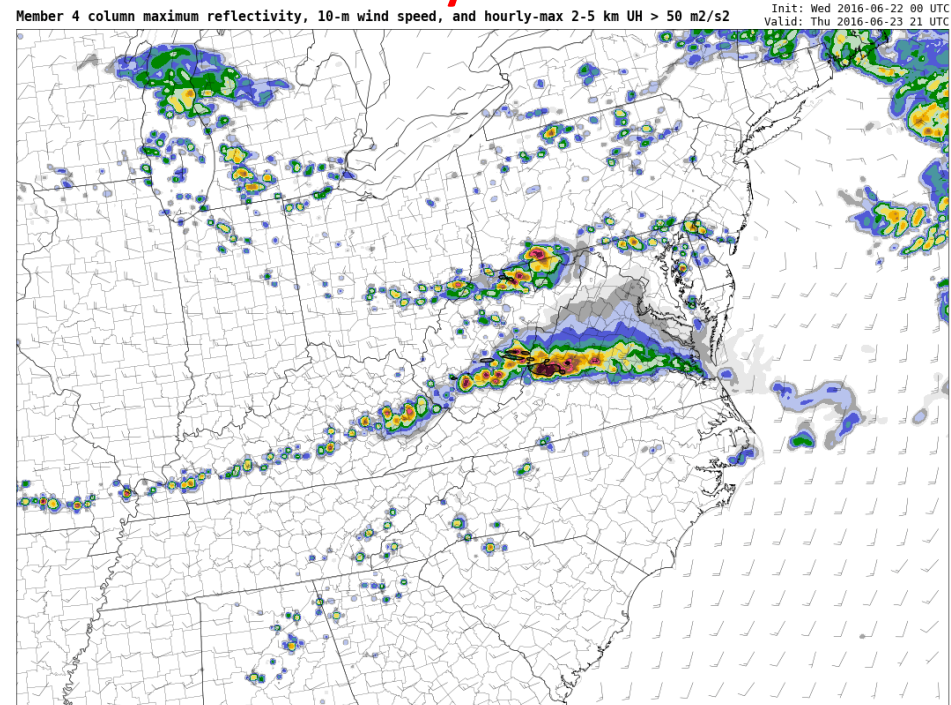
**23 June 2016**

**Derecho/training echoes/flash flooding...**

**Radar**



**Model Reflectivity 45h**

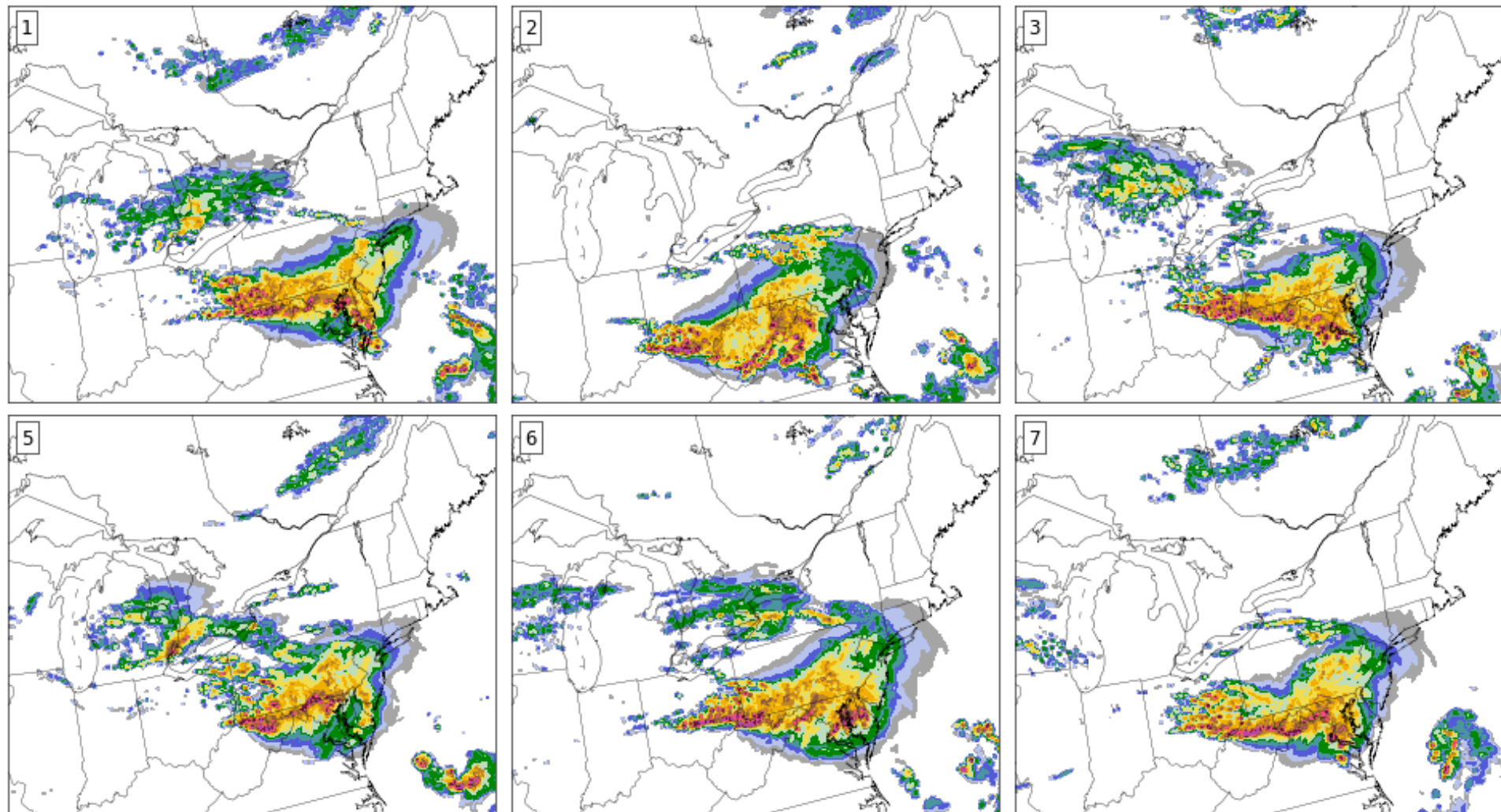


**21:00 UTC**

**22 June 2016**

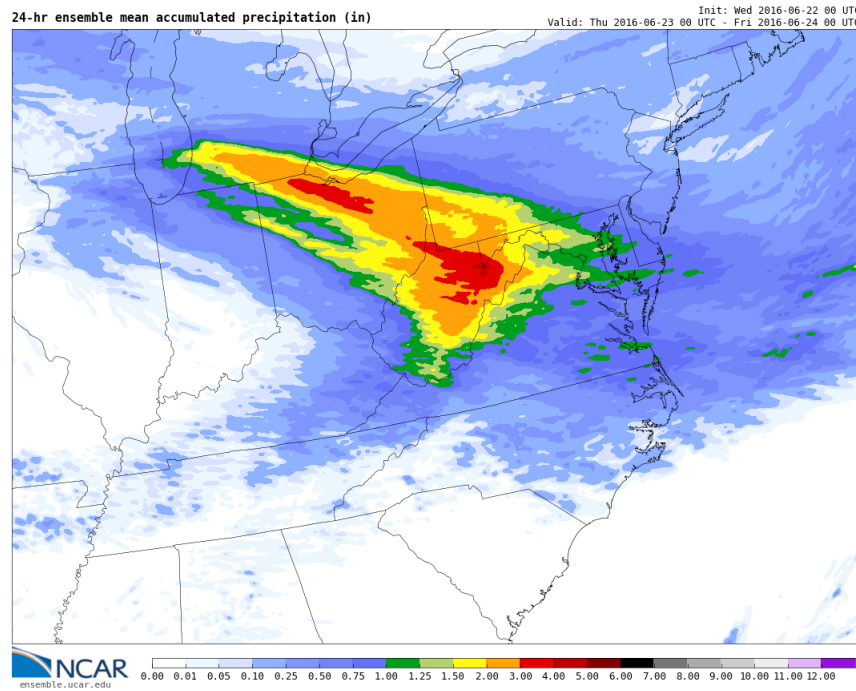
**Derecho/training echoes/flash flooding...**

**36 h forecast 6 Ensemble Members**

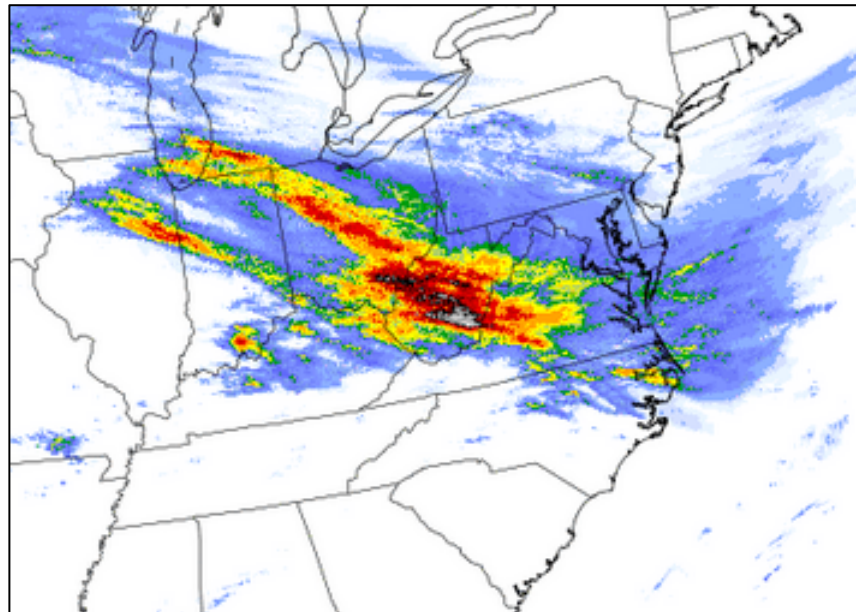


**22 June 2016**  
**24 h Precip**

**\*Slight  
northward  
bias**



**Ensemble Mean**

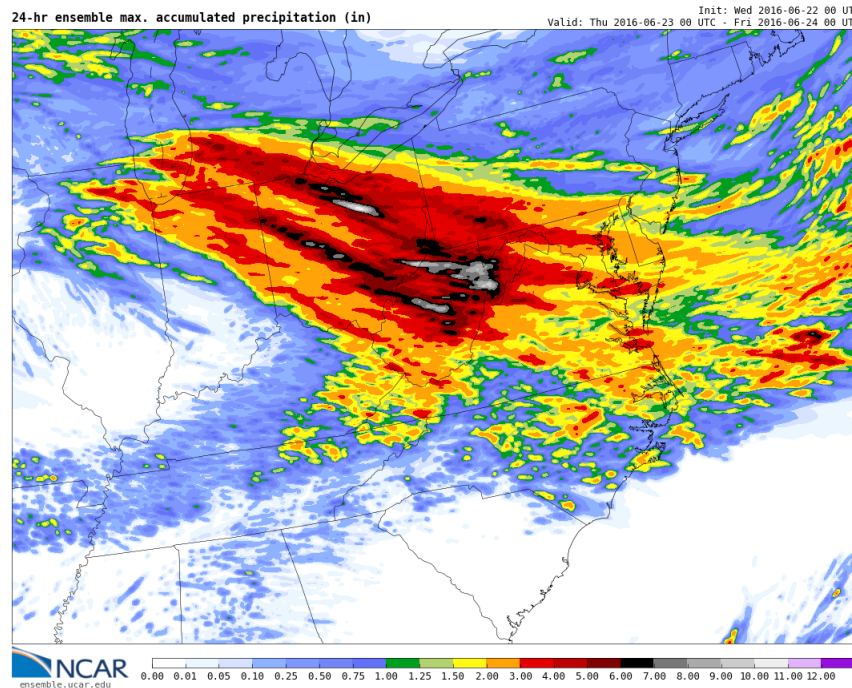


**Obs (MRMS)**

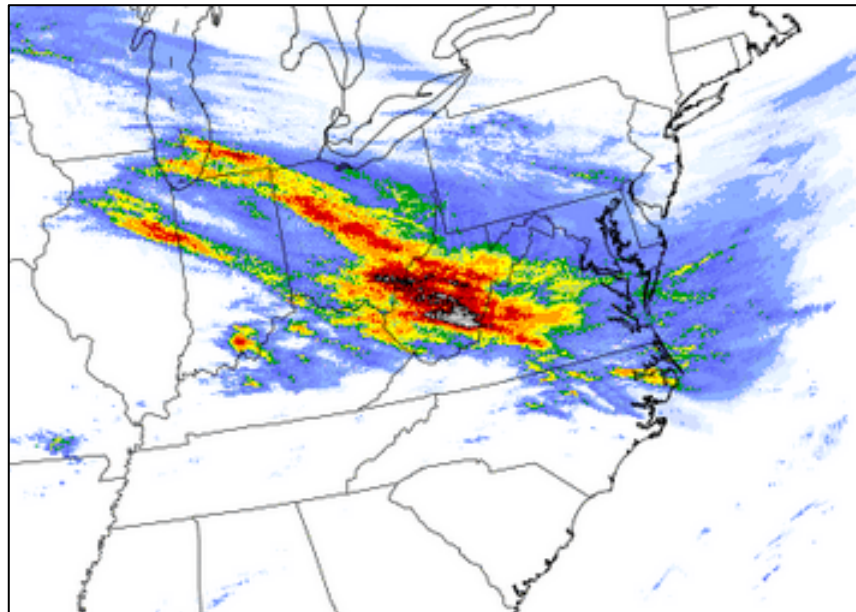


**22 June 2016**  
**24 h Precip**

**\*Slight  
northward  
bias**



**Ensemble Max**



**Obs (MRMS)**

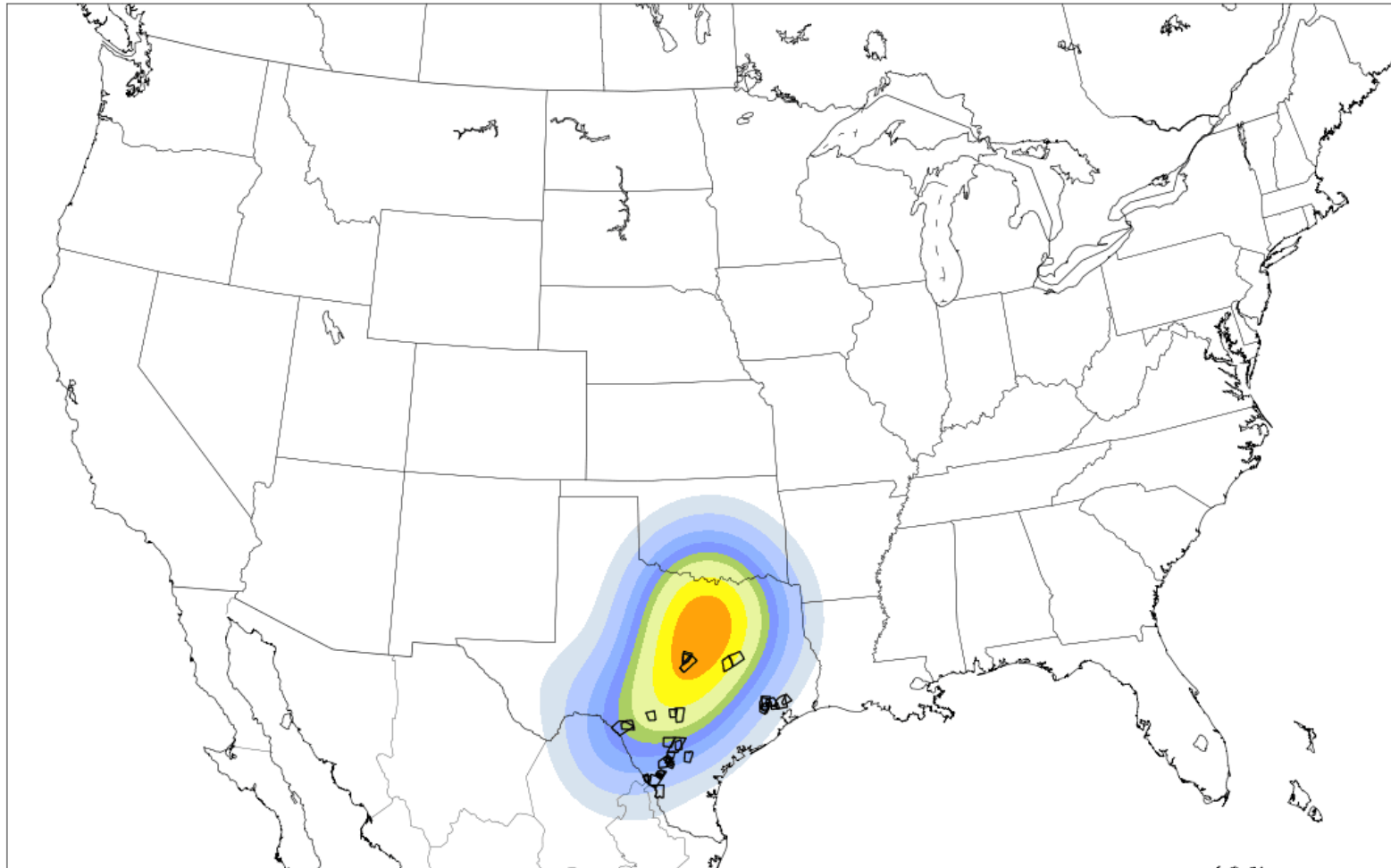


**17 April 2016**

**Training echoes/flash flooding... BUST!**

Day 1 prob. of UH > 75 m2/s2 w/ NWS warnings

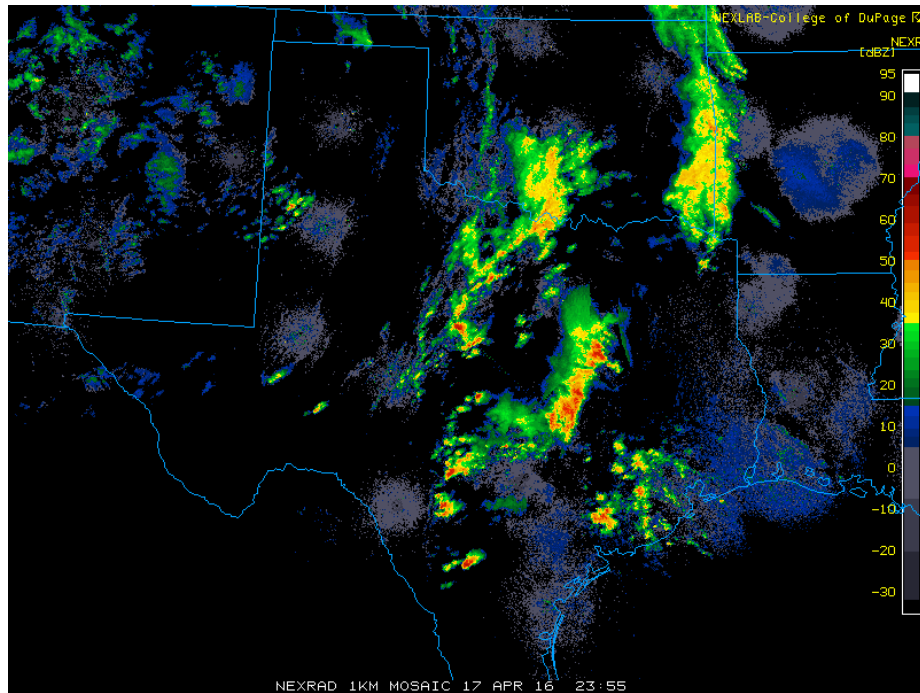
Init: Sun 2016-04-17 00 UTC  
Valid: Sun 2016-04-17 12 UTC - Mon 2016-04-18 12 UTC



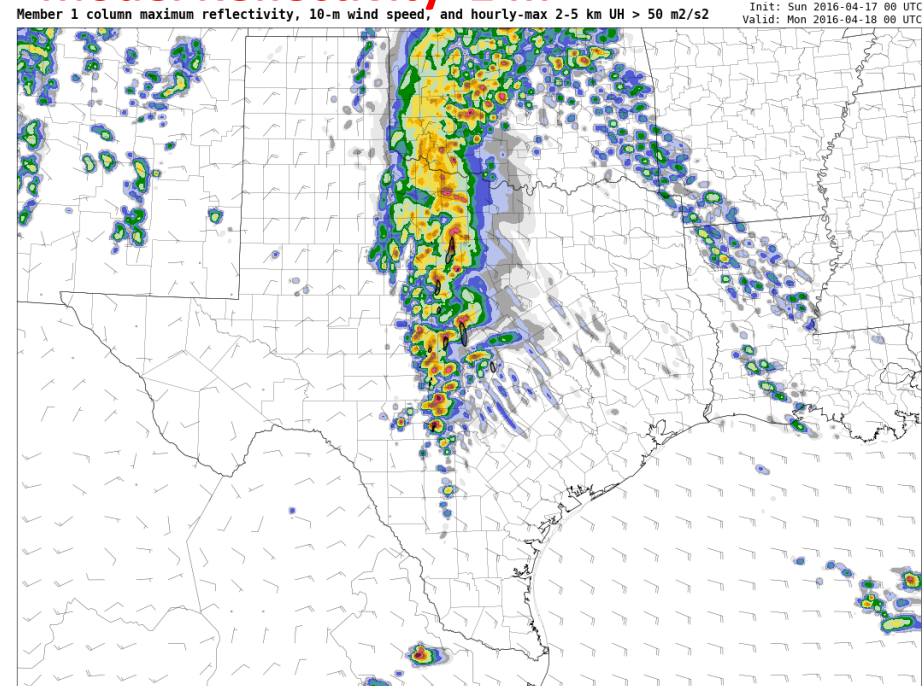
**18 April 2016**

**Training echoes/flash flooding... BUST!**

**Radar**



**Model Reflectivity 24h**

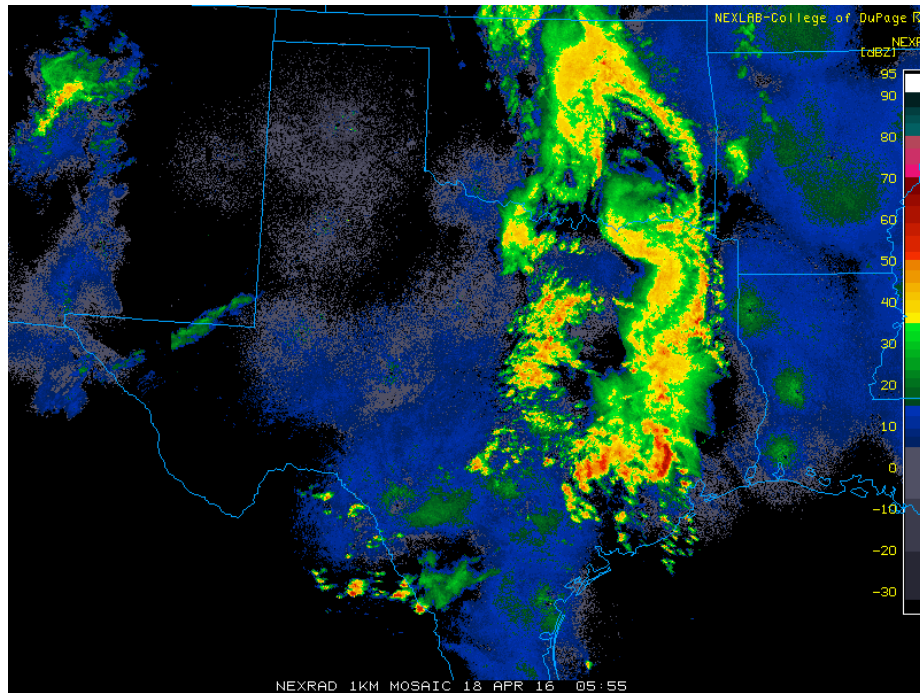


**00:00 UTC**

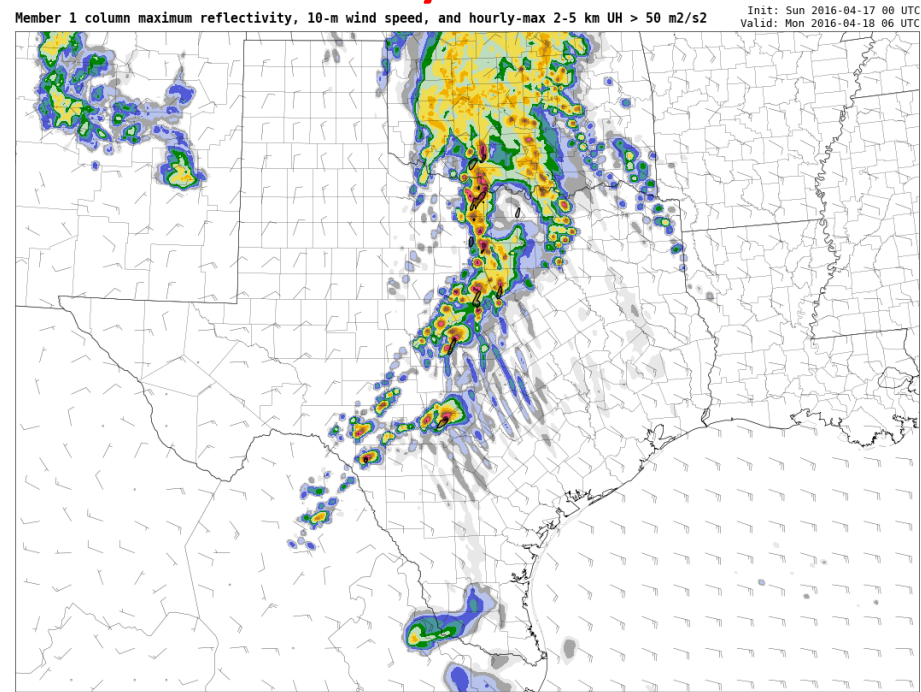
**18 April 2016**

**Training echoes/flash flooding... BUST!**

**Radar**



**Model Reflectivity 30h**

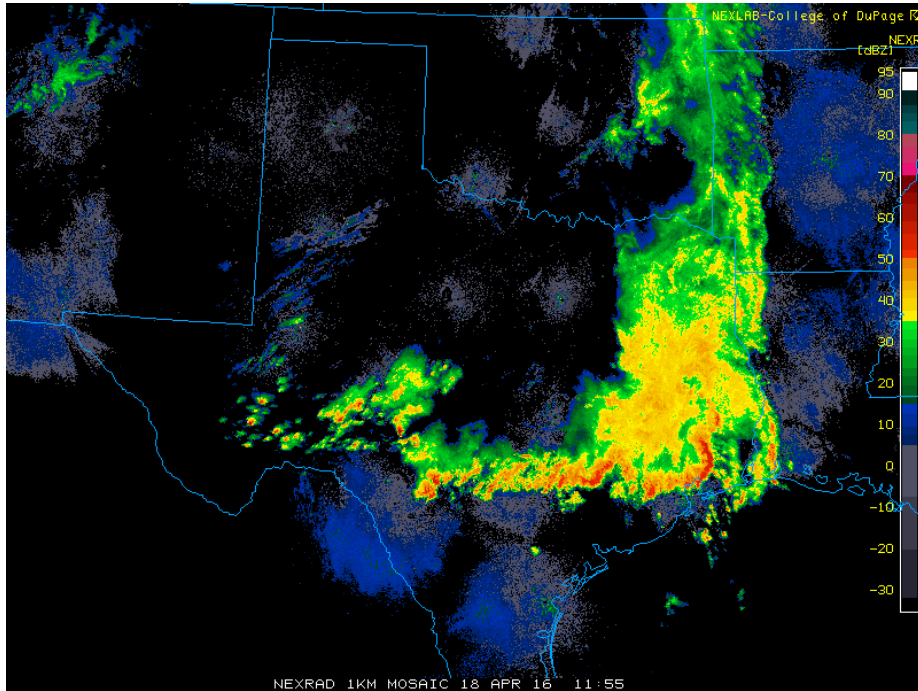


**06:00 UTC**

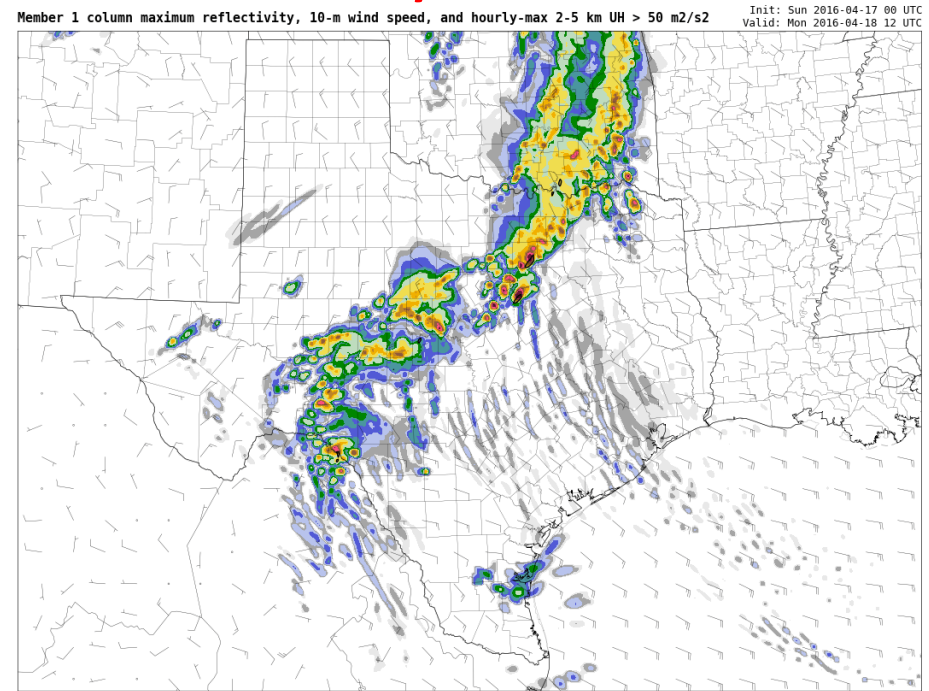
**18 April 2016**

**Training echoes/flash flooding... BUST!**

**Radar**



**Model Reflectivity 36h**



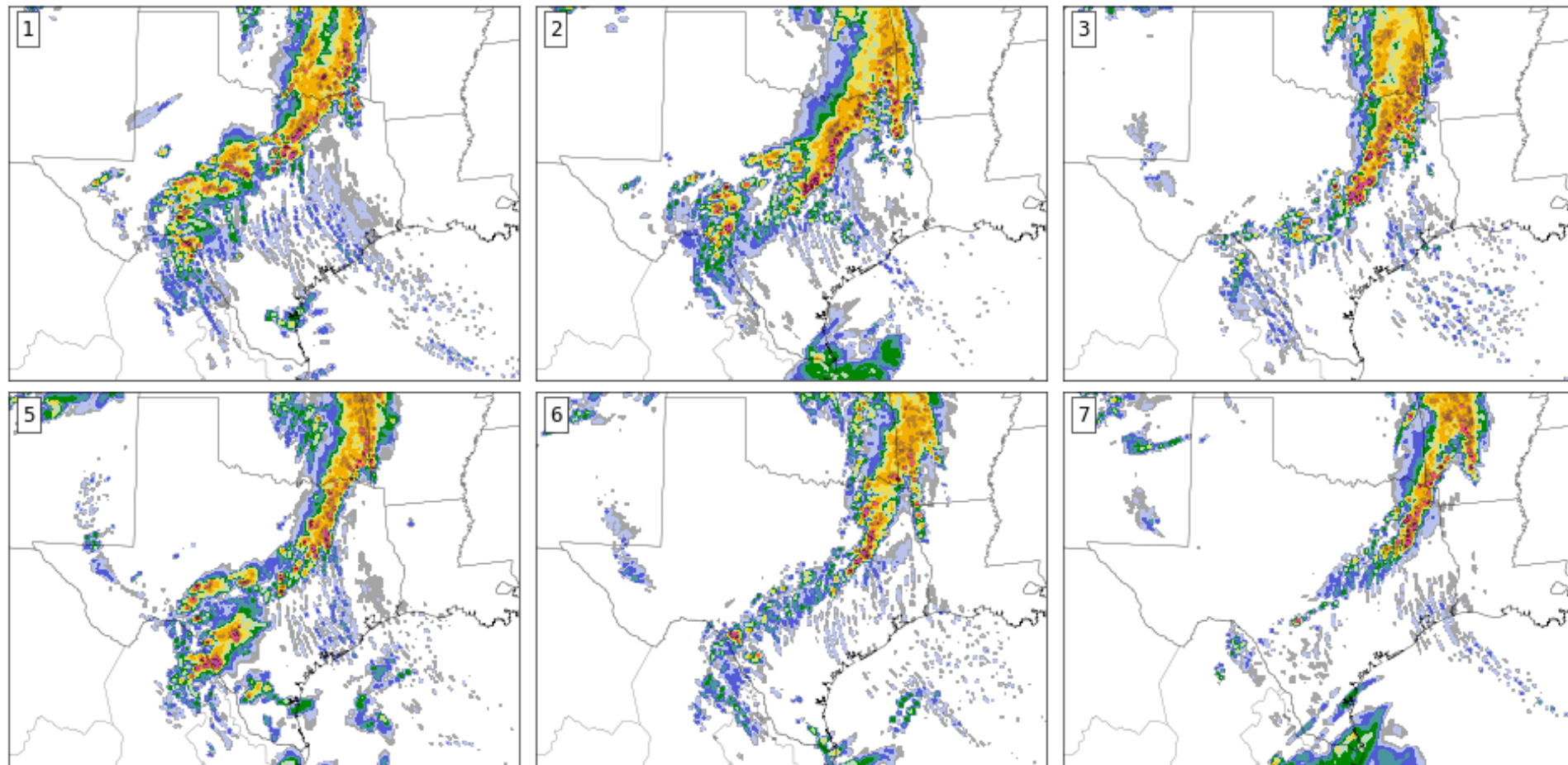
**12:00 UTC**



**17 April 2016**

**Training echoes/flash flooding... BUST!**

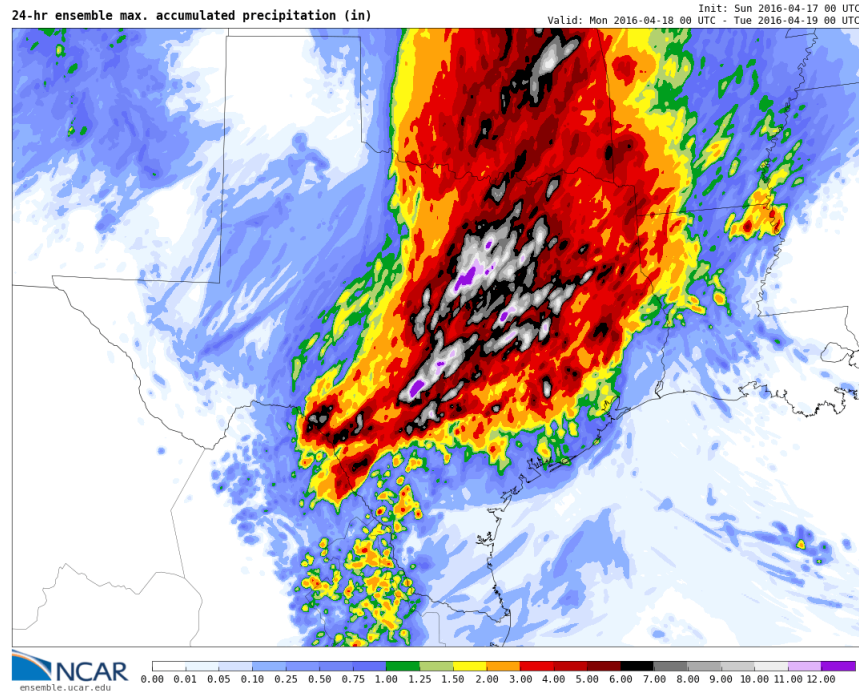
**36 h forecast 6 Ensemble Members**



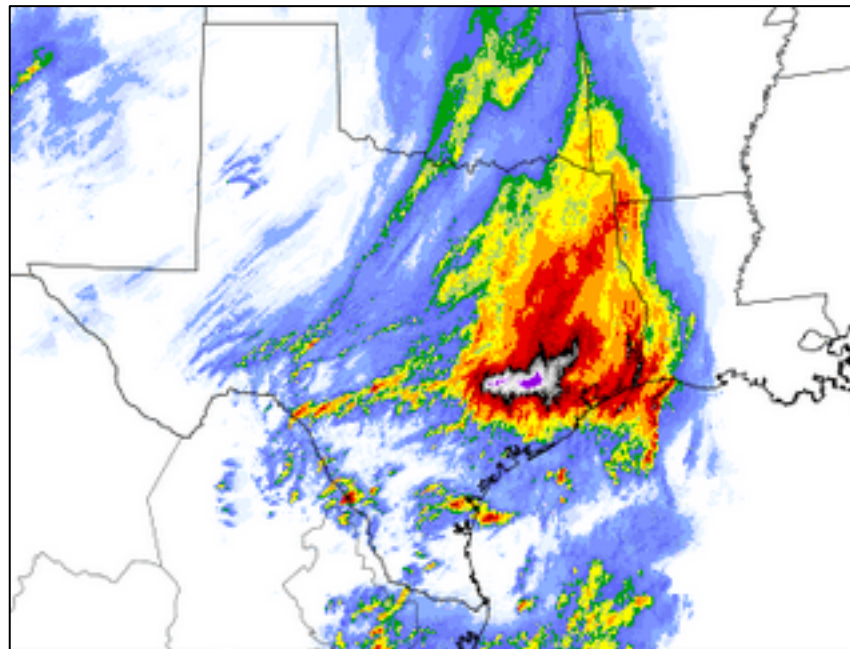
**\*Entire ensemble too far north!!**

**17 April 2016**  
**24 h Precip**

**\*Notable  
northward  
bias**



**Ensemble Max**



**Obs (MRMS)**

# Summary:

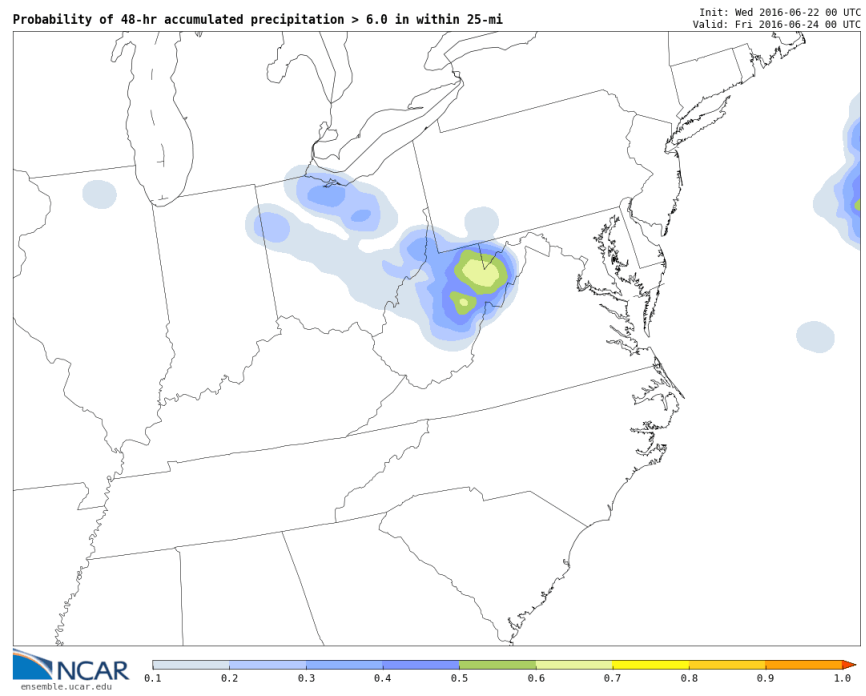
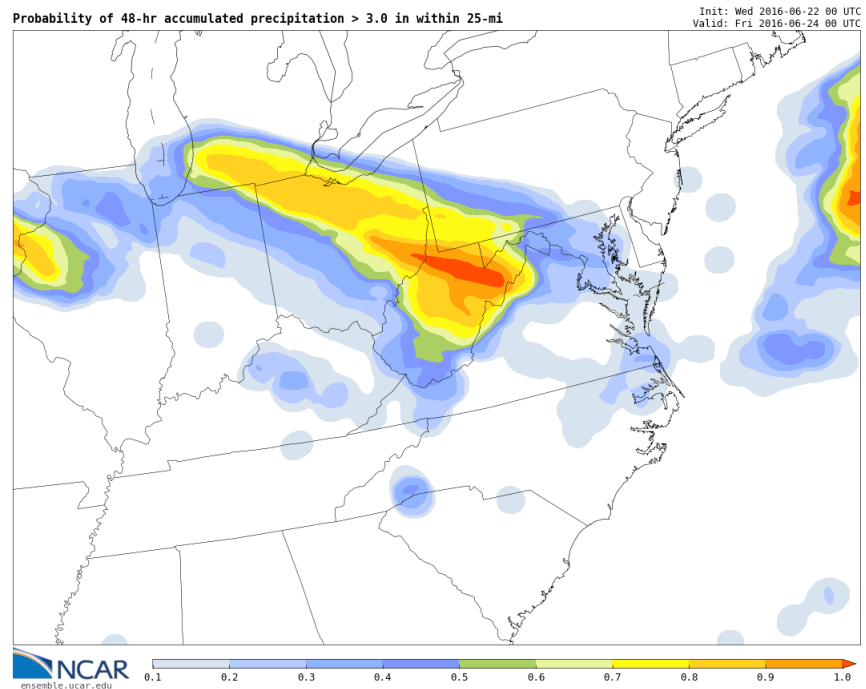
- \*Convective allowing (3 km) ensemble(s) quite skillful at distinguishing primary convective modes for a given day...
- \*Ensemble has been especially good at identifying the potential for heavy, flooding rainfall..
- \*Ensemble spread has improved, but a forecast bust is still usually a bust for the entire ensemble...
- \*Forecast busts often associated with a northward convective precipitation bias.... Resolution? PBL? ...







**22 June 2016**

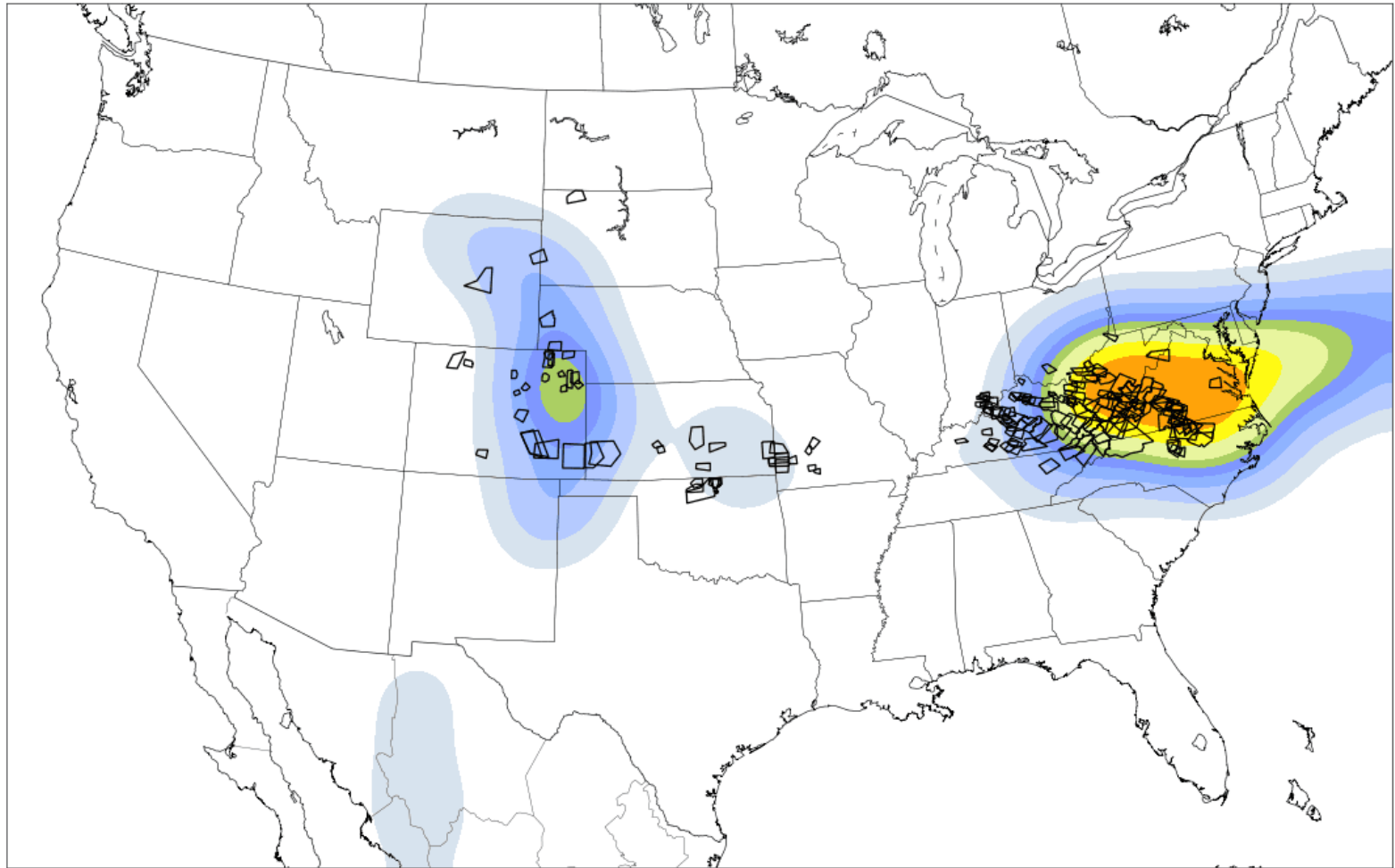


**23 June 2016**

## Derecho/training echoes/flash flooding...

Day 1 prob. of UH > 75 m2/s2 w/ NWS warnings

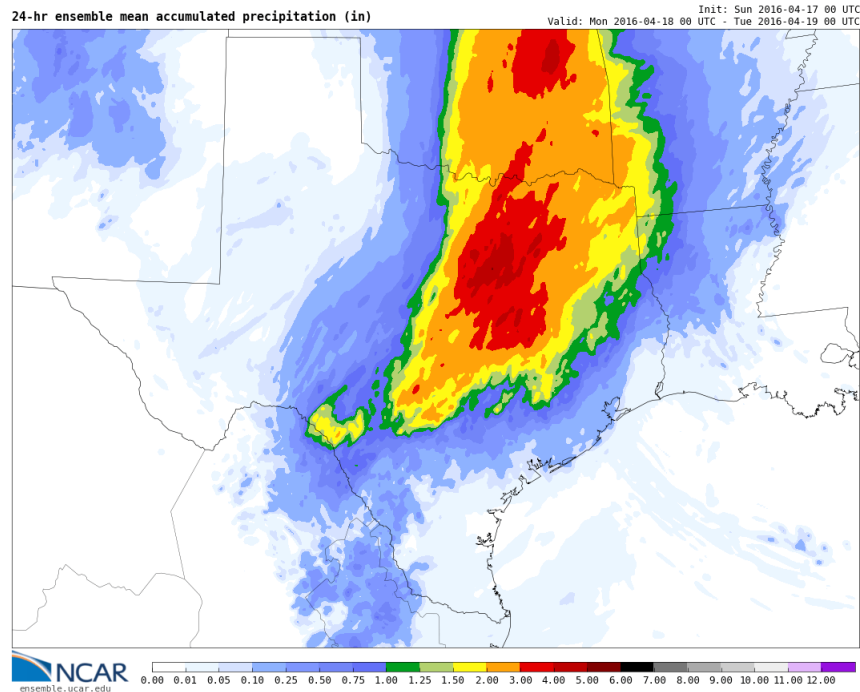
Init: Thu 2016-06-23 00 UTC  
Valid: Thu 2016-06-23 12 UTC - Fri 2016-06-24 12 UTC



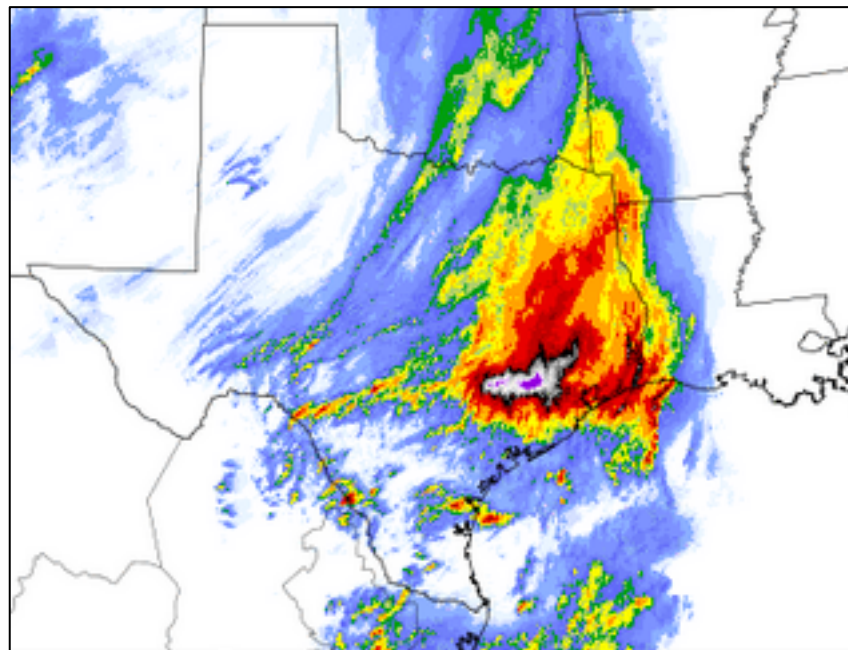


**17 April 2016**  
**24 h Precip**

**\*Notable  
northward  
bias**



**Ensemble Mean**



**Obs (MRMS)**

17 April 2016

