Preliminary Evaluation of Forecasting Techniques for High-Shear, Low-CAPE Environments

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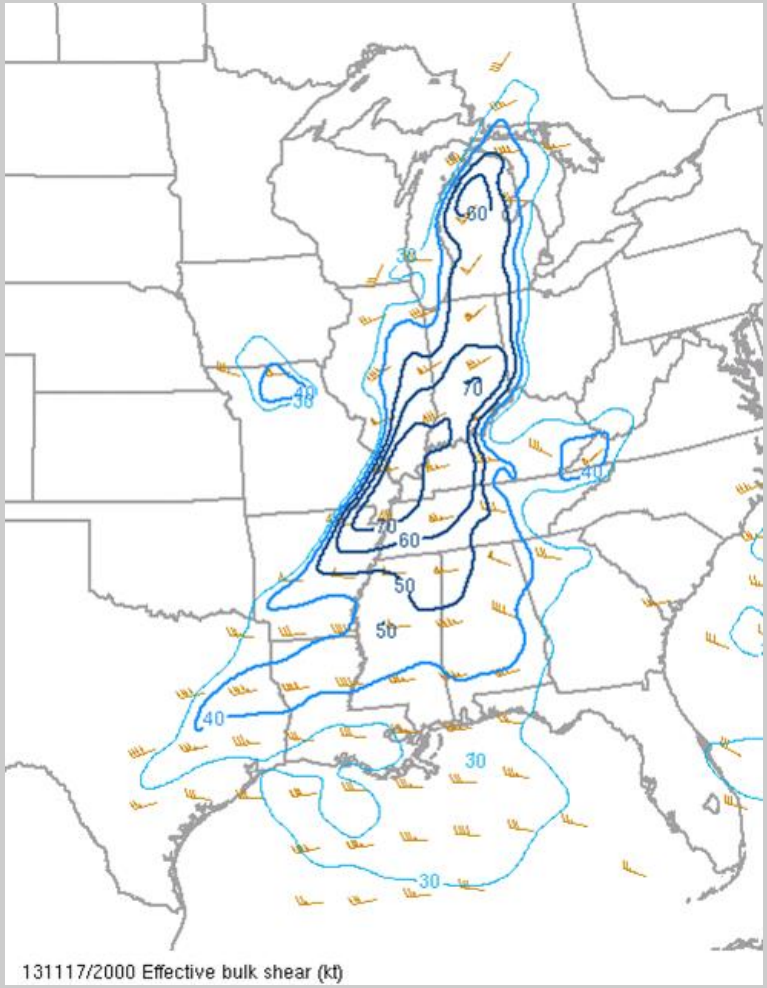
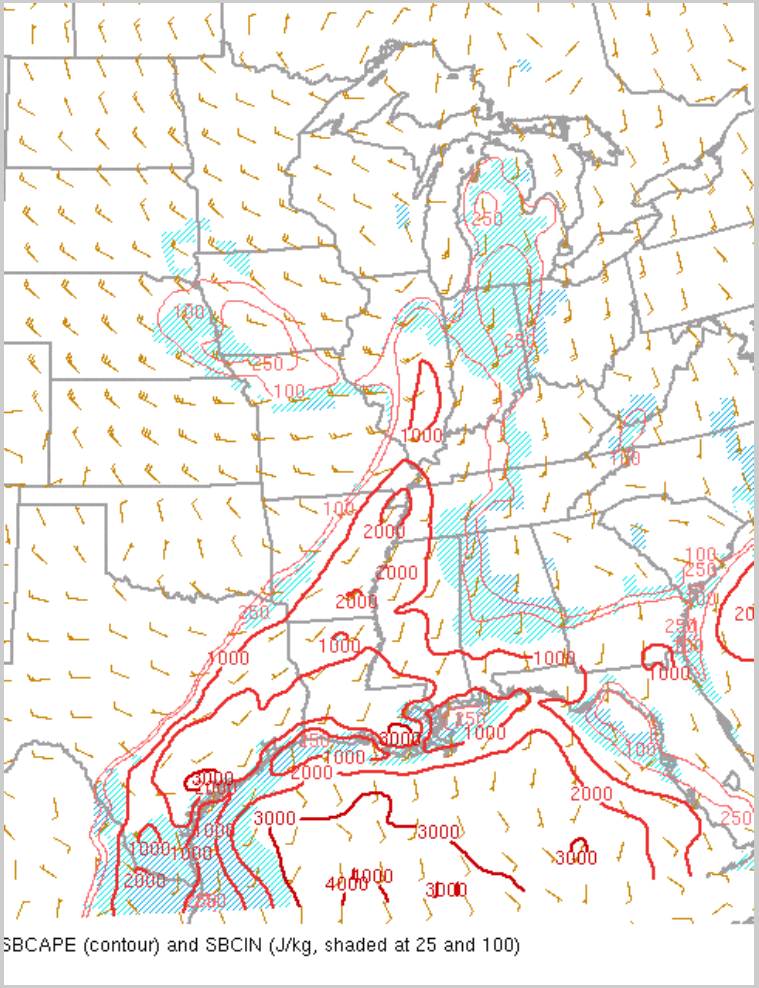
Great Lakes Operational Meteorology Workshop
August 25th-27th, 2015
Grand Rapids, MI

Motivation

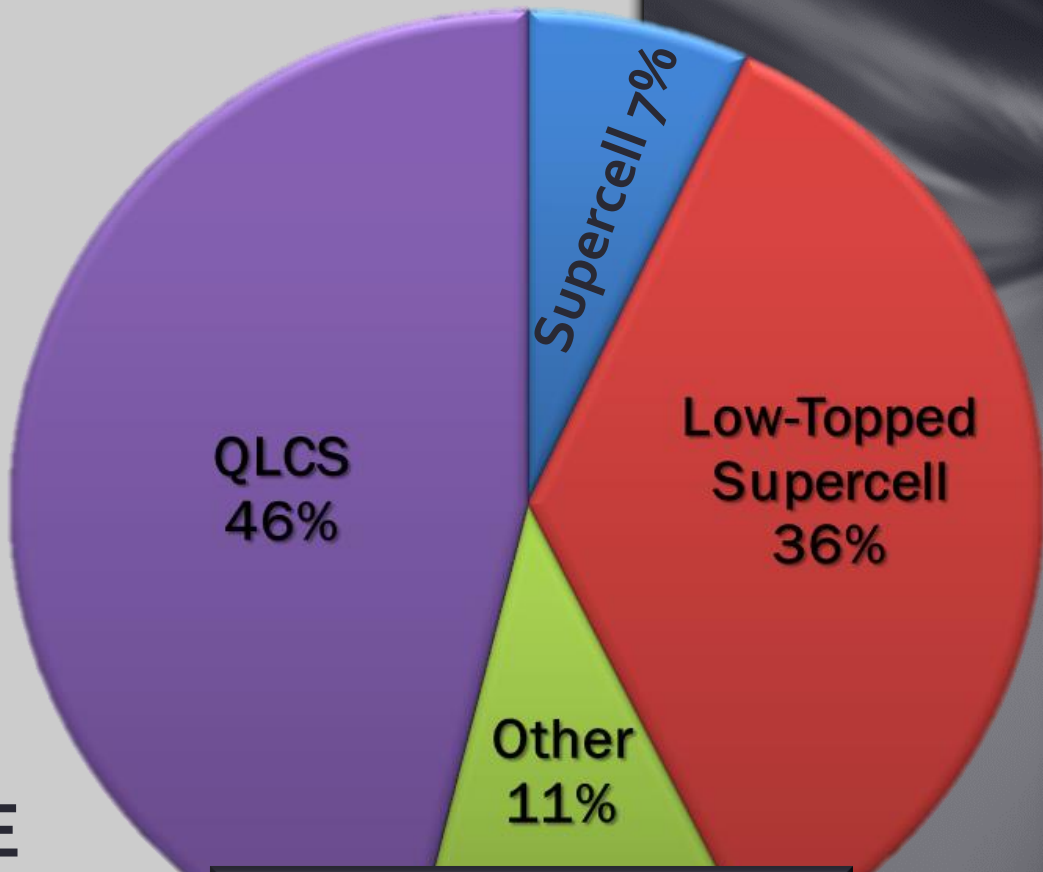
- 2-3 times/year we sit on a fence…





IWX Tornadoes

- Recent Outbreaks:
  - Nov. 17th, 2013 (16)
  - Apr. 19th, 2011 (6)
  - Oct. 26th, 2010 (13)
- Half of total tornadoes since 2010
- Only 3 high(er)-CAPE outbreaks (>5) in 10 years



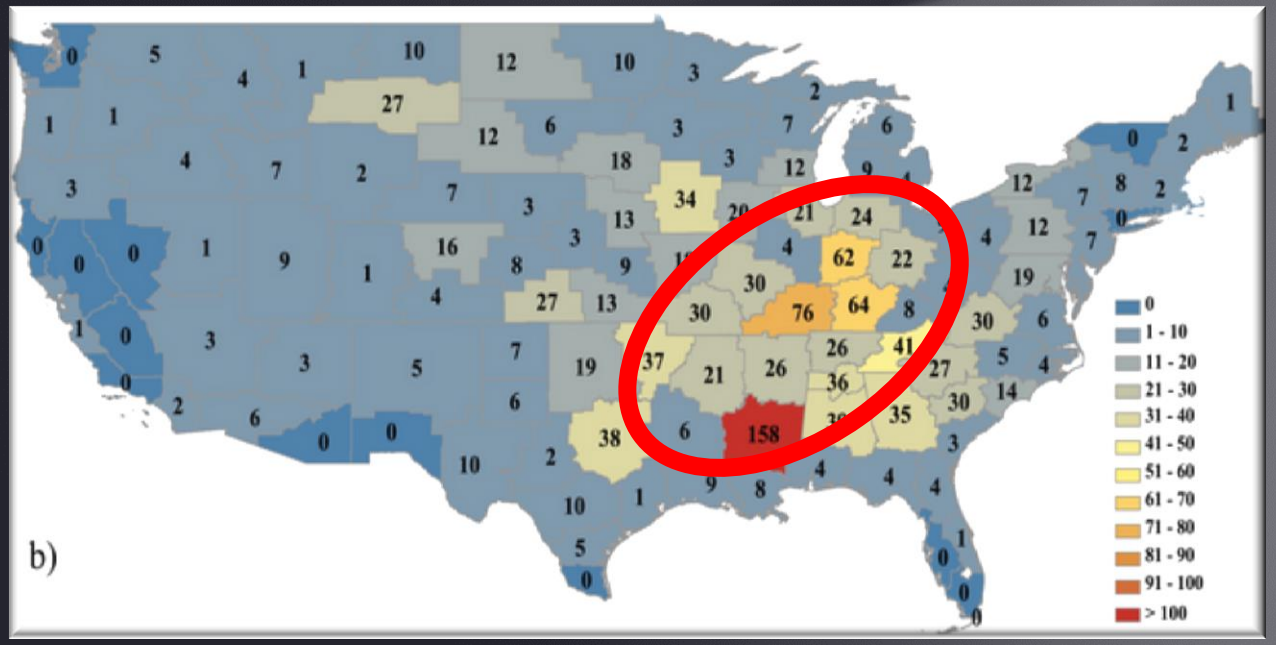
Tornadoes by Storm Type 1980-2010

Sherburn and Parker (2014)

- Addressed the need for better understanding and forecasts of high-shear, low-CAPE (HSLC) convection
- Focused on significant severe convection (tornadoes ≥ EF2, wind gusts ≥ 65 kts, or hail ≥ 2 in.)
- What about any severe?

HSLC significant severe reports by NWS CWA (2006-2011)

(Sherburn & Parker, 2014)



Sherburn and Parker (2014)

- Developed two new composite parameters

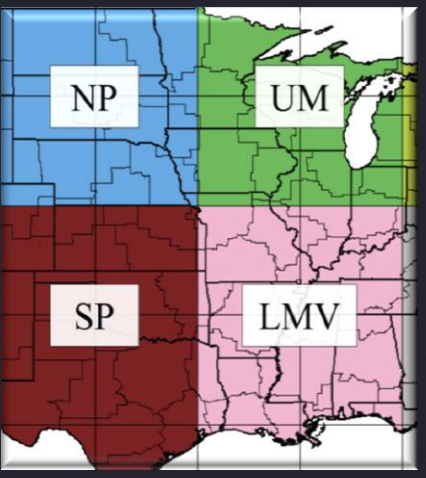
$$\mathrm{SHERBE} = (\mathrm{ESHR}/27\,\mathrm{m\,s^{-1}}) \times (\mathrm{LLLR}/5.2\,\mathrm{K\,km^{-1}}) \times (\mathrm{LR75}/5.6\,\mathrm{K\,km^{-1}}).$$

$$\mathrm{SHERBS3} = (\mathrm{S3MG}/26\,\mathrm{m\,s^{-1}}) \times (\mathrm{LLLR}/5.2\,\mathrm{K\,km^{-1}}) \times (\mathrm{LR75}/5.6\,\mathrm{K\,km^{-1}}).$$

ESHR=effective shear, S3MG=0-3km bulk shear, LLLR=0-3km lapse rate, LR75=700-500mb lapse rate

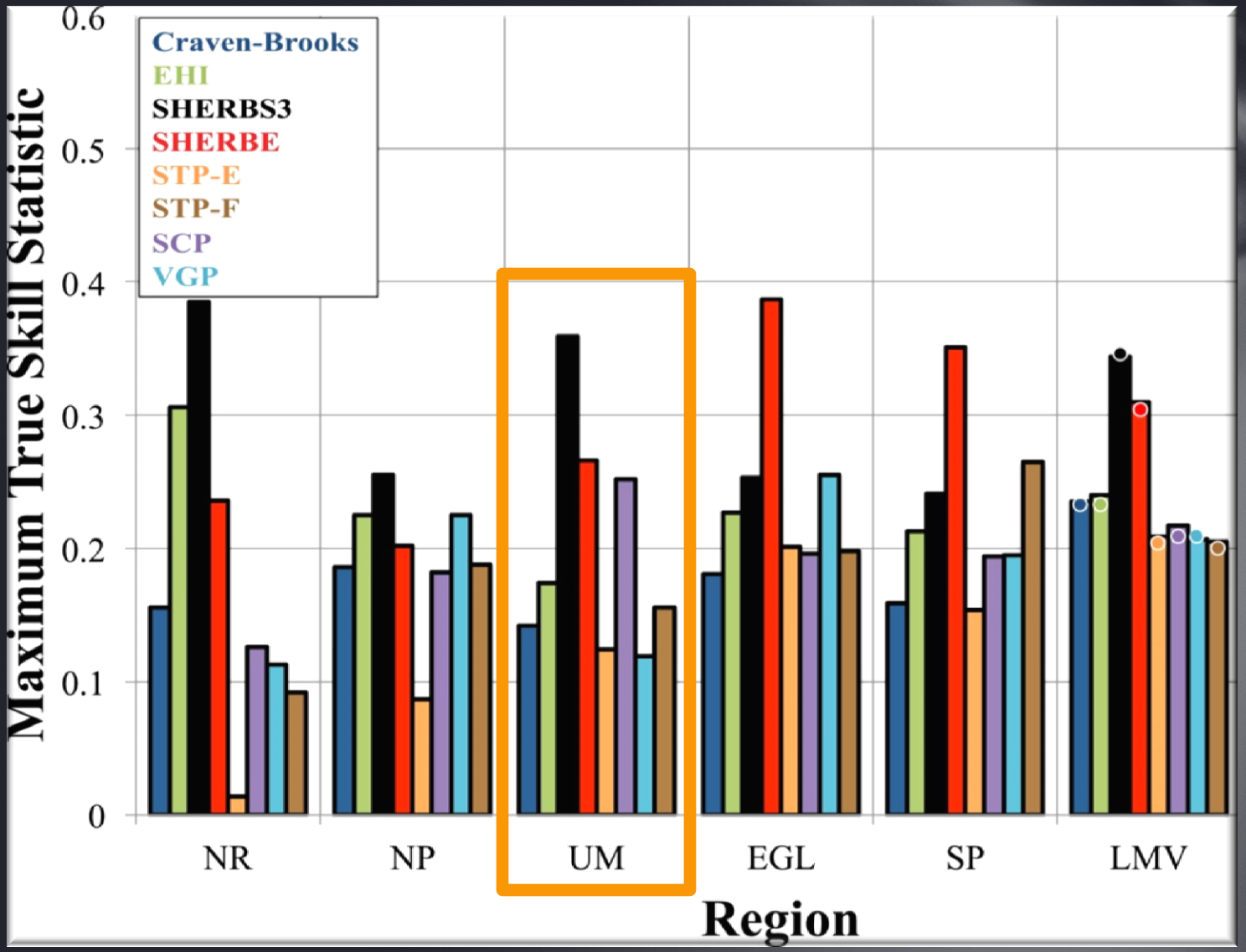
- Values $\geq$1 significant

Sherburn and Parker (2014)



Max TSS for discriminating HSLC significant severe and nulls (2006-2011)

(Sherburn & Parker, 2014)



Methods

To Start

- KILN Upper Air Data
- T_{sfc}>10°C & $Wind_{850mb}$>30 kts?

Outlook?

- Storm Prediction Center
- Initial 06Z SLGT Risk or higher?

HSLC?

- 0-6km shear ≥ 35 kts?
- SBCAPE ≤ 500 J/kg?
- MUCAPE ≤ 1000 J/kg?

Methods (cont.)

Hit/Miss?

- More than 1 severe report that day?
- If not, counted as "null"

SHERB3?

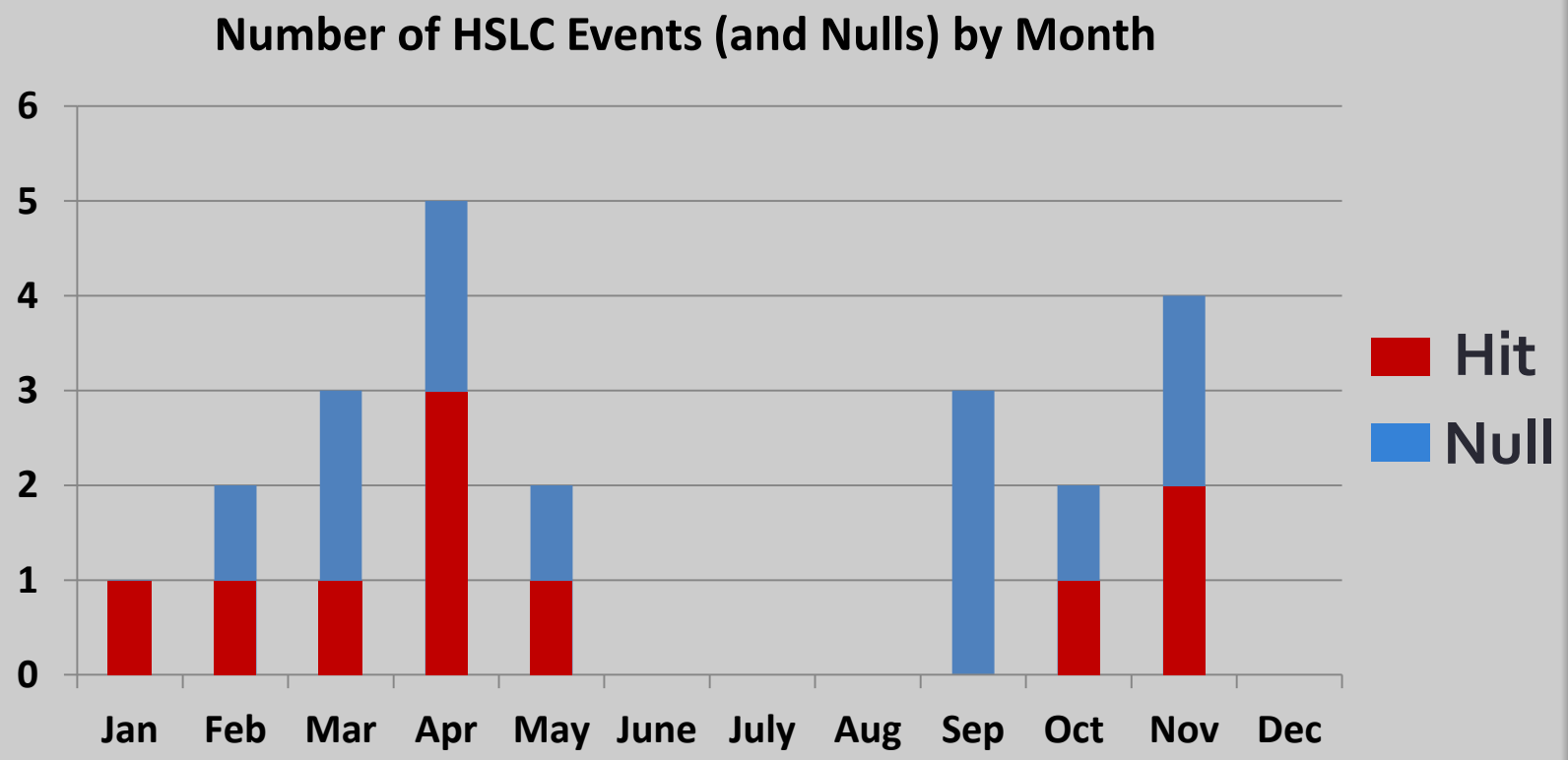
- Calculated from RUC/RAP Bufr Soundings
- Use max value from 5 sites in our CWA

Results

- Compared to other severe parameters
- Search for commonalities/forecasting aids

Results (2005-2014)

- Identified 10 “hits” & 12 “nulls”



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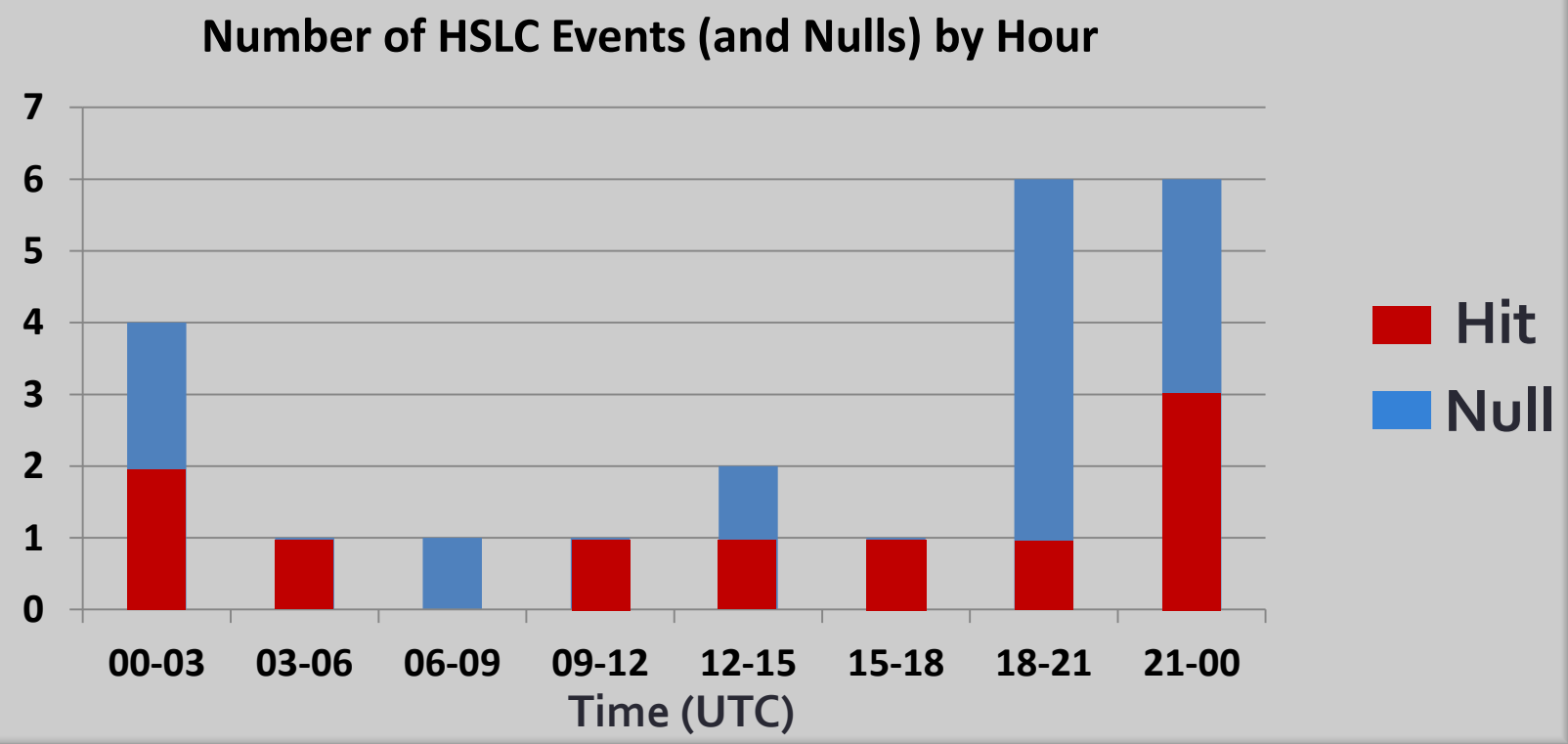
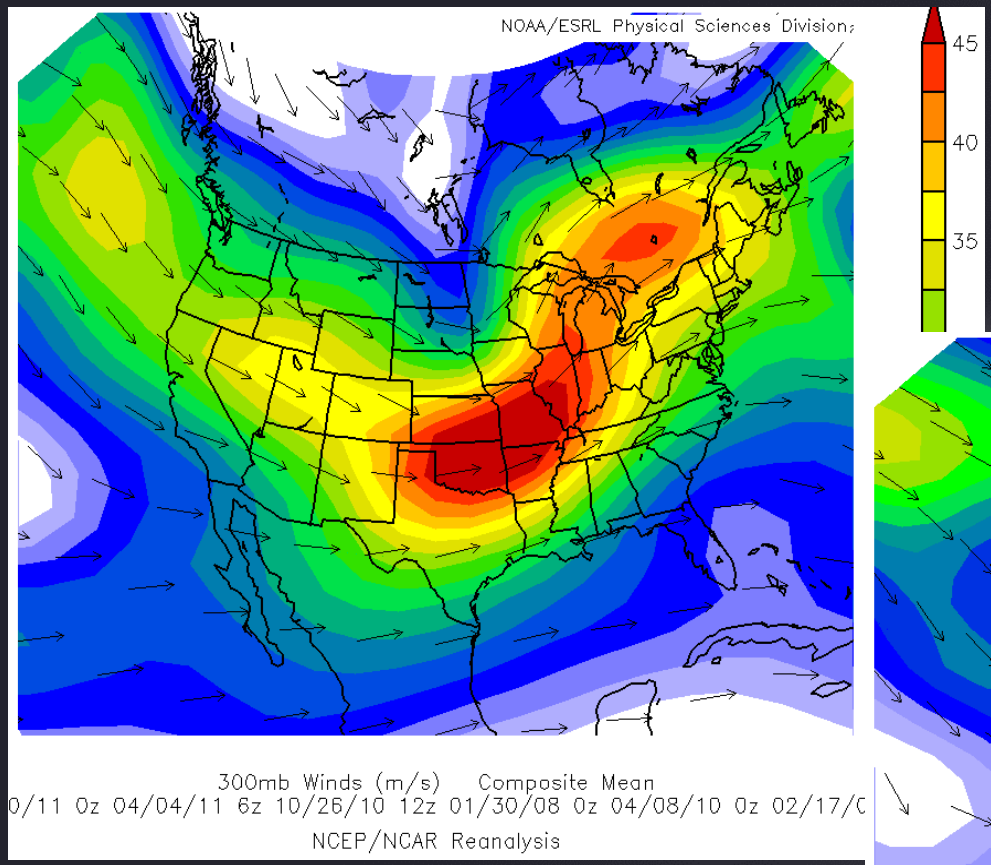
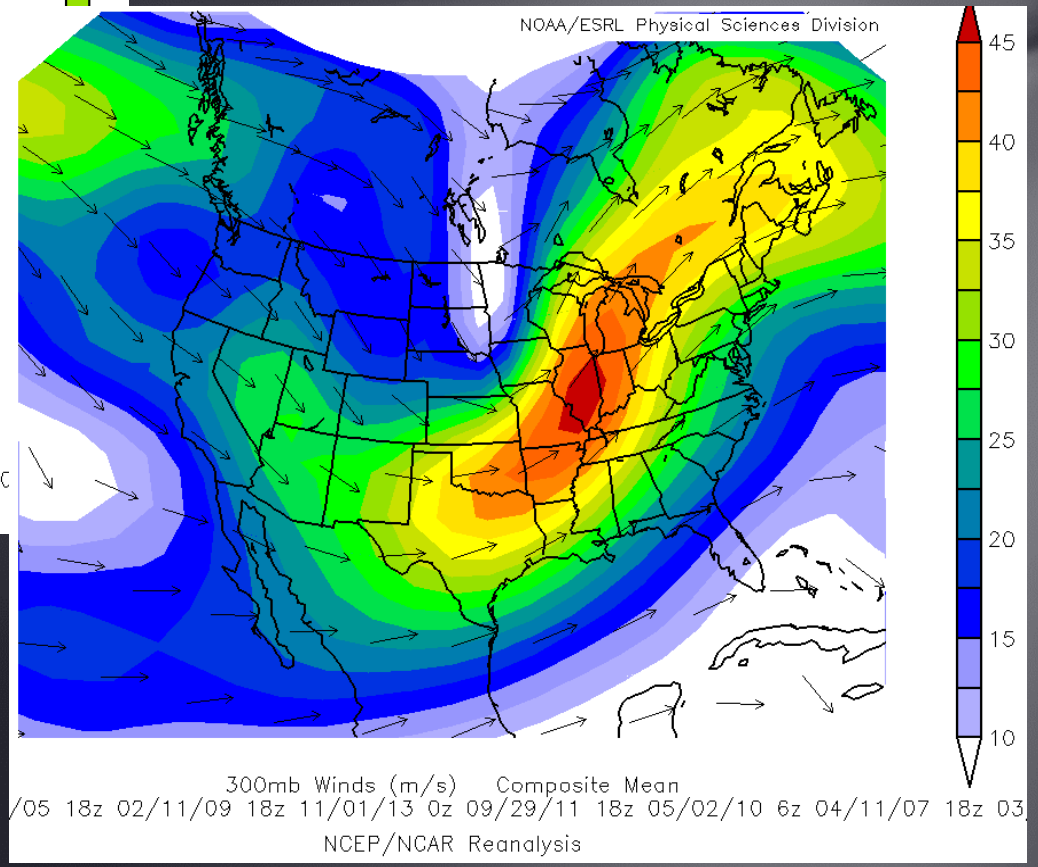


Composite Charts (300mb wind)

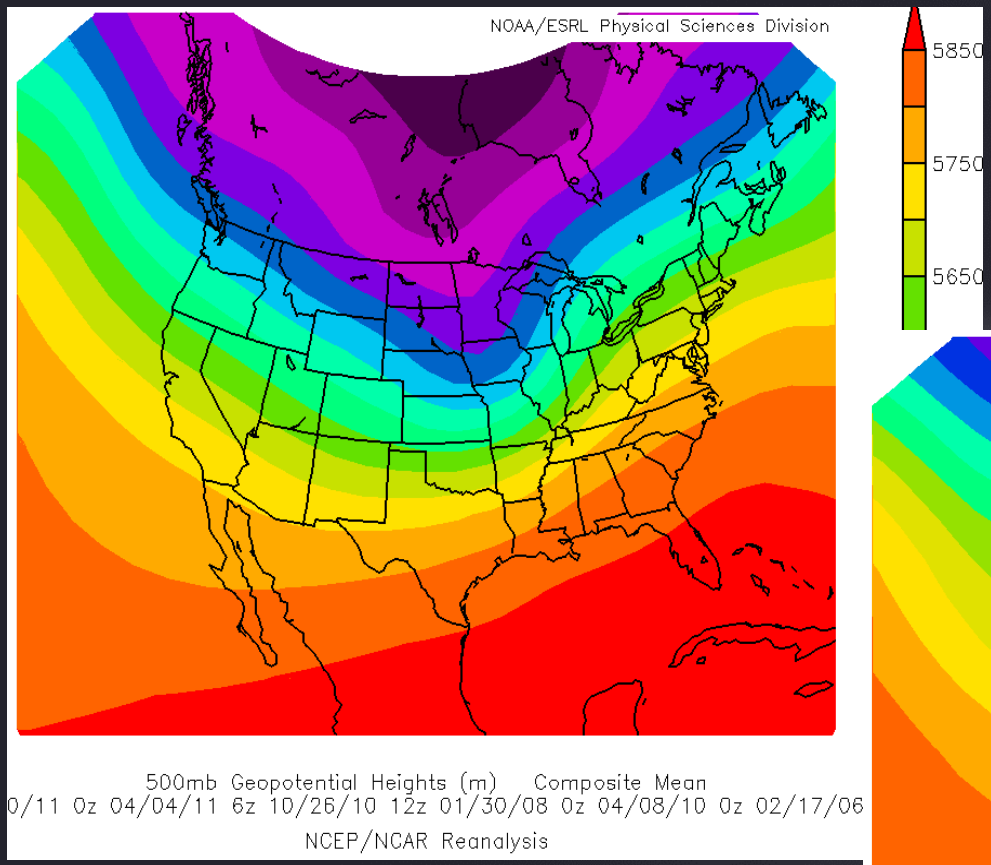


Hits

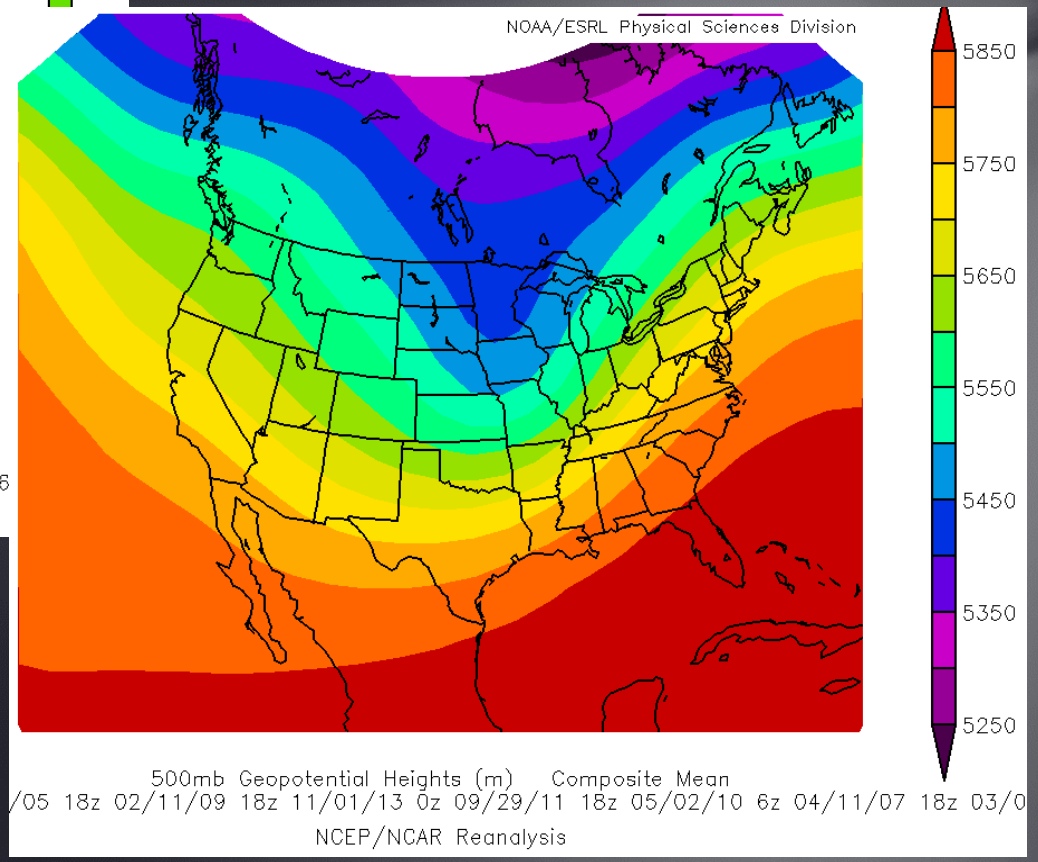


Nulls

Composite Charts (500mb height)

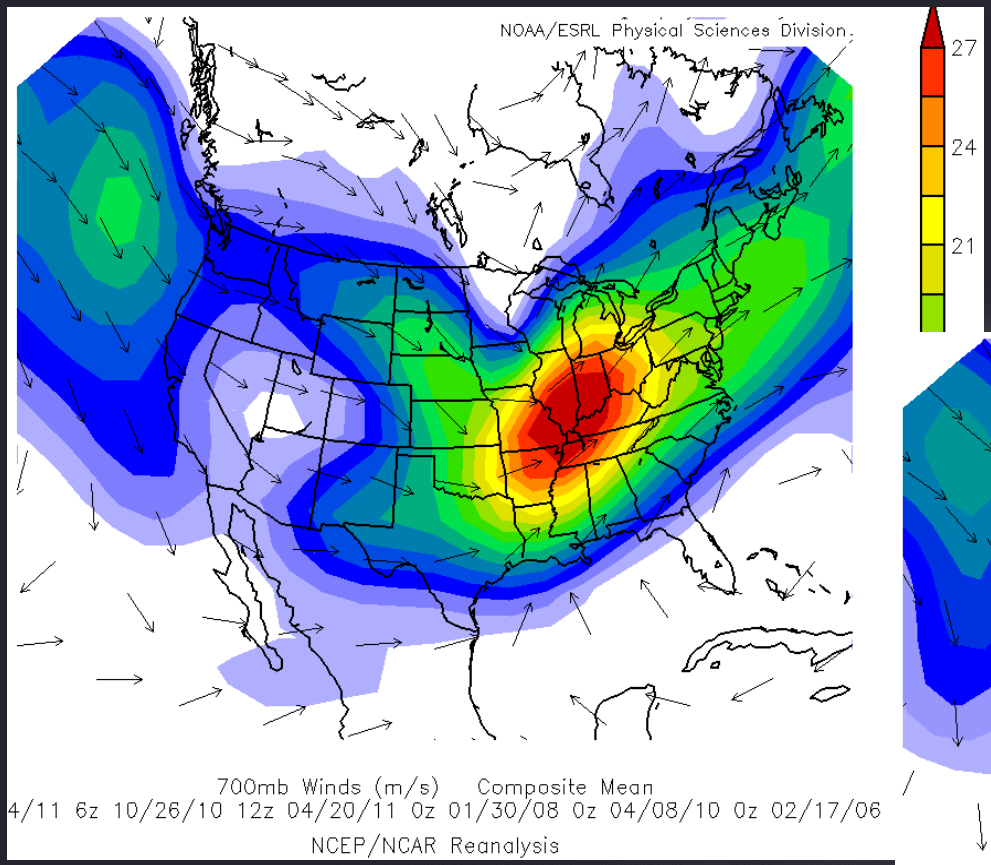


Hits

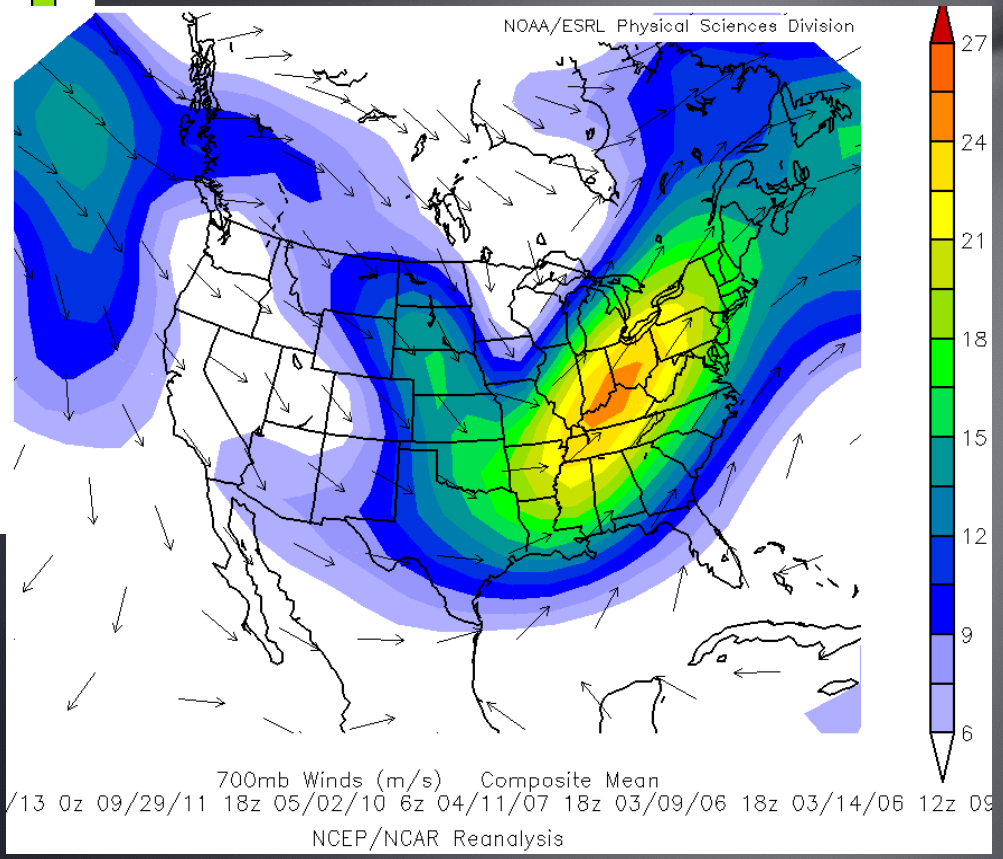


Nulls

Composite Charts (700mb wind)

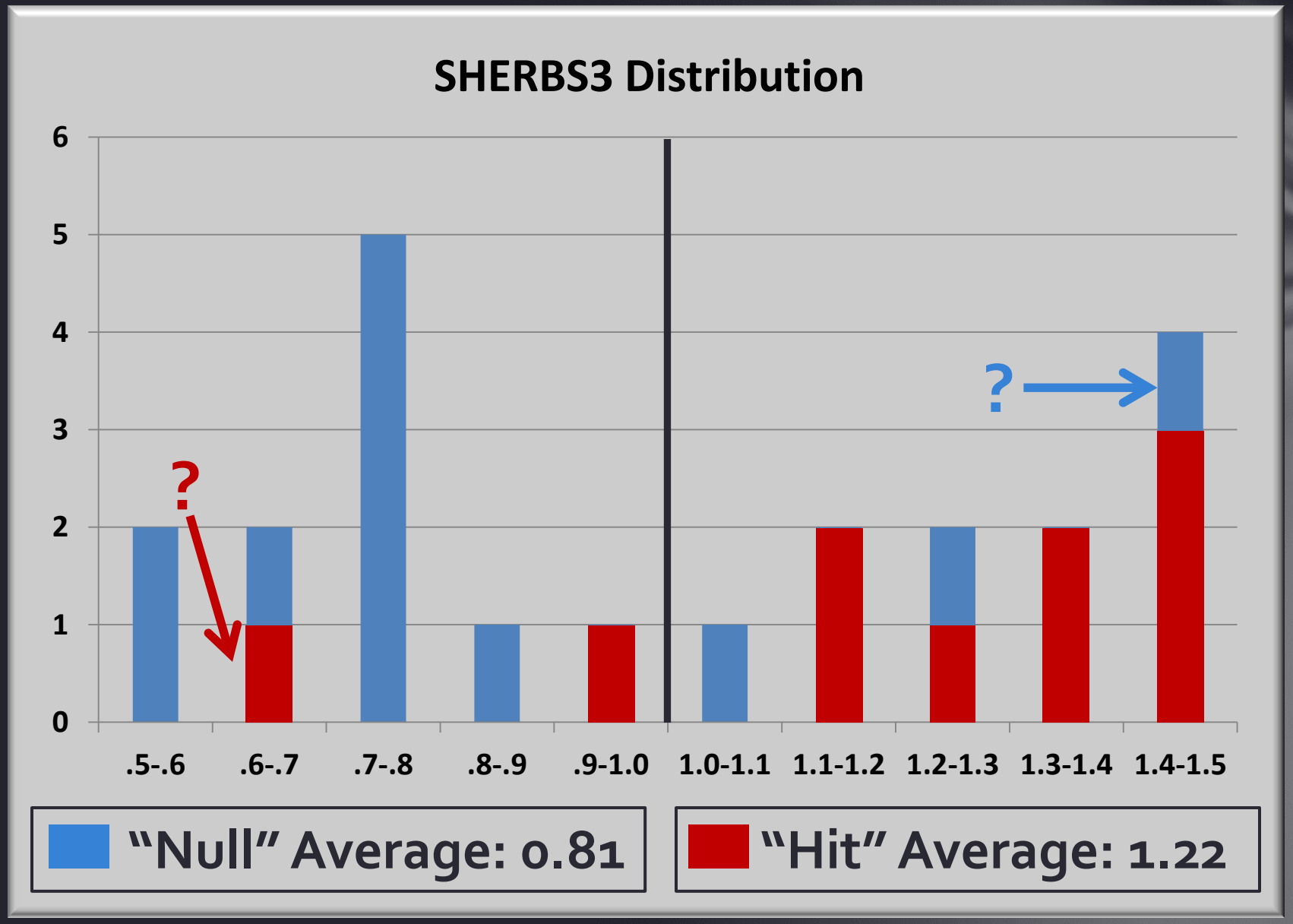


Hits

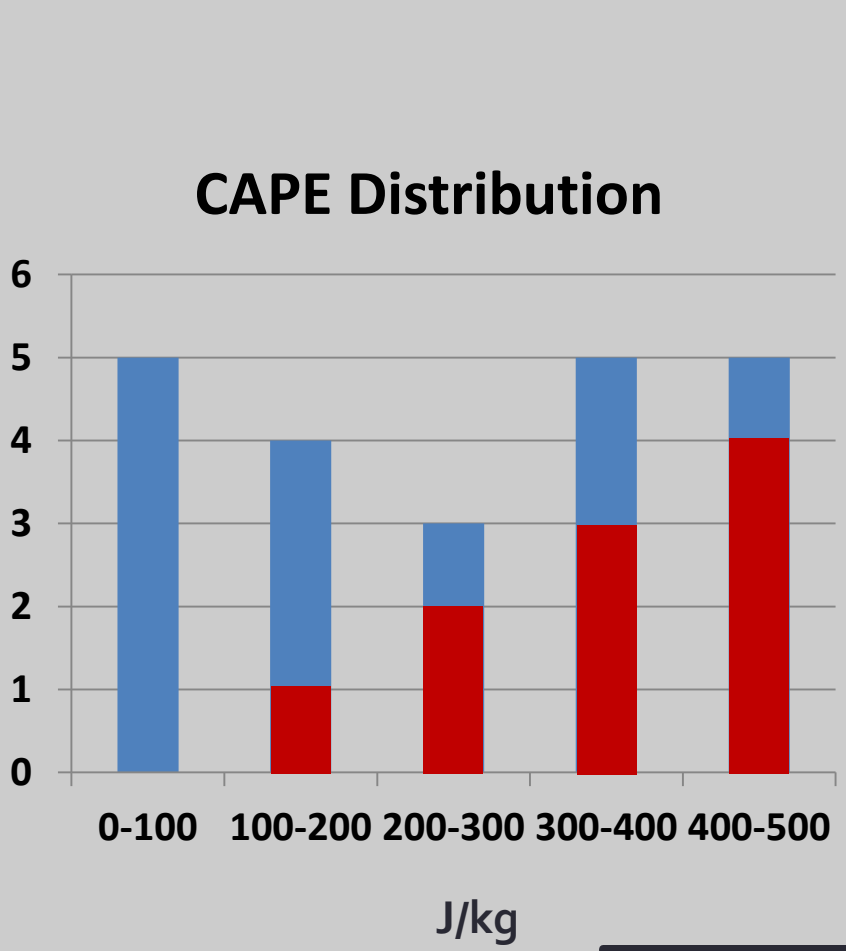


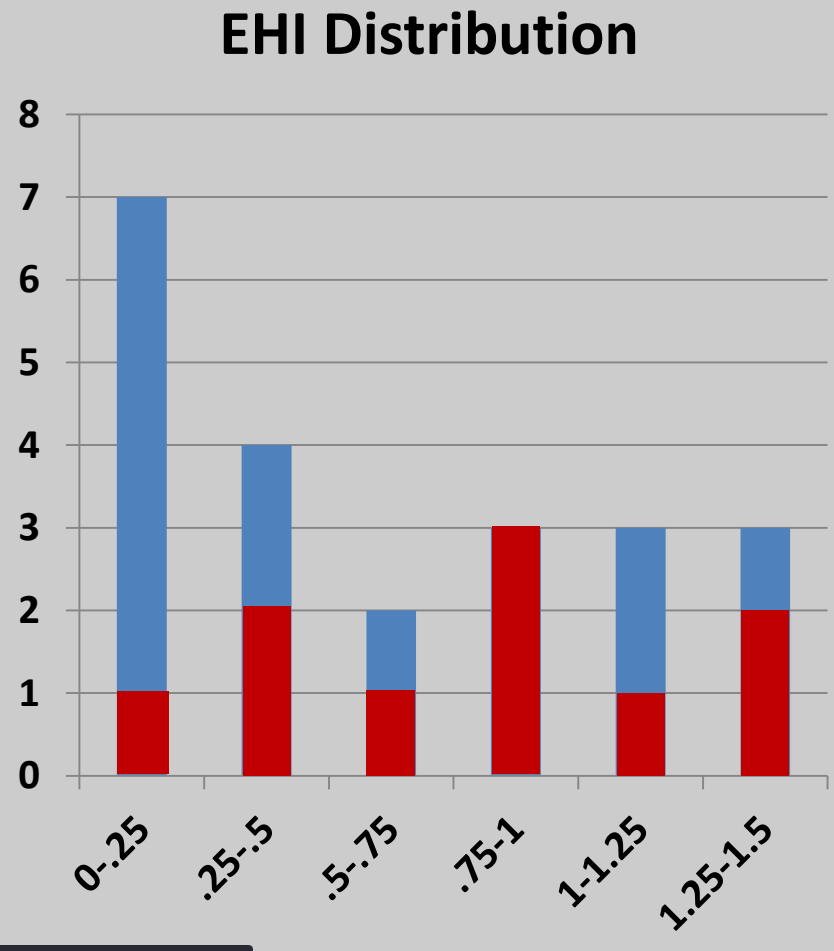
Nulls

SHERBS3 Results



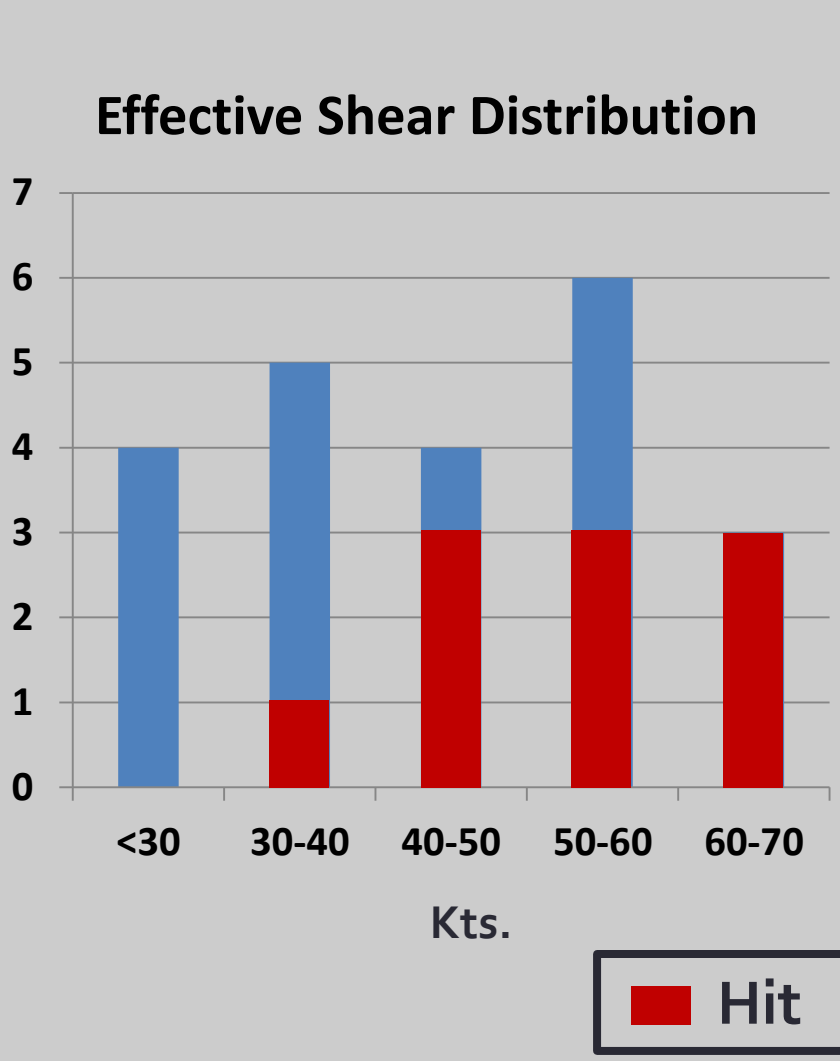
Other Severe Parameters

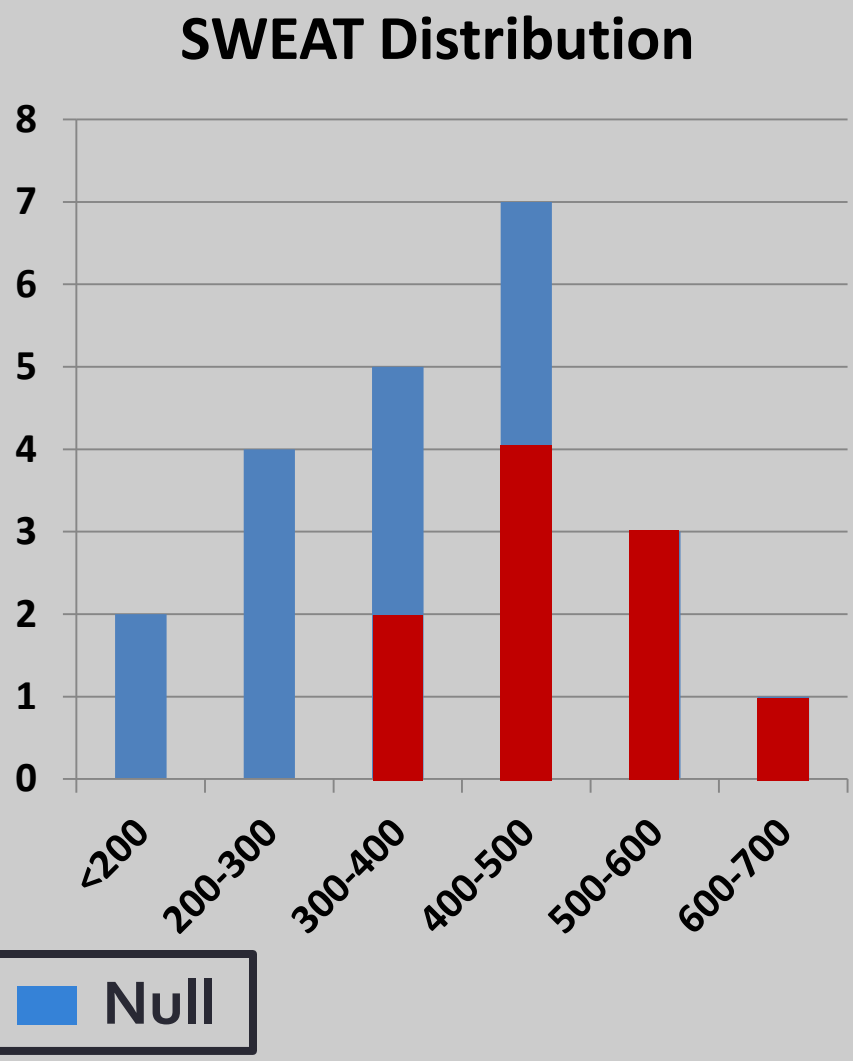




Hit Null

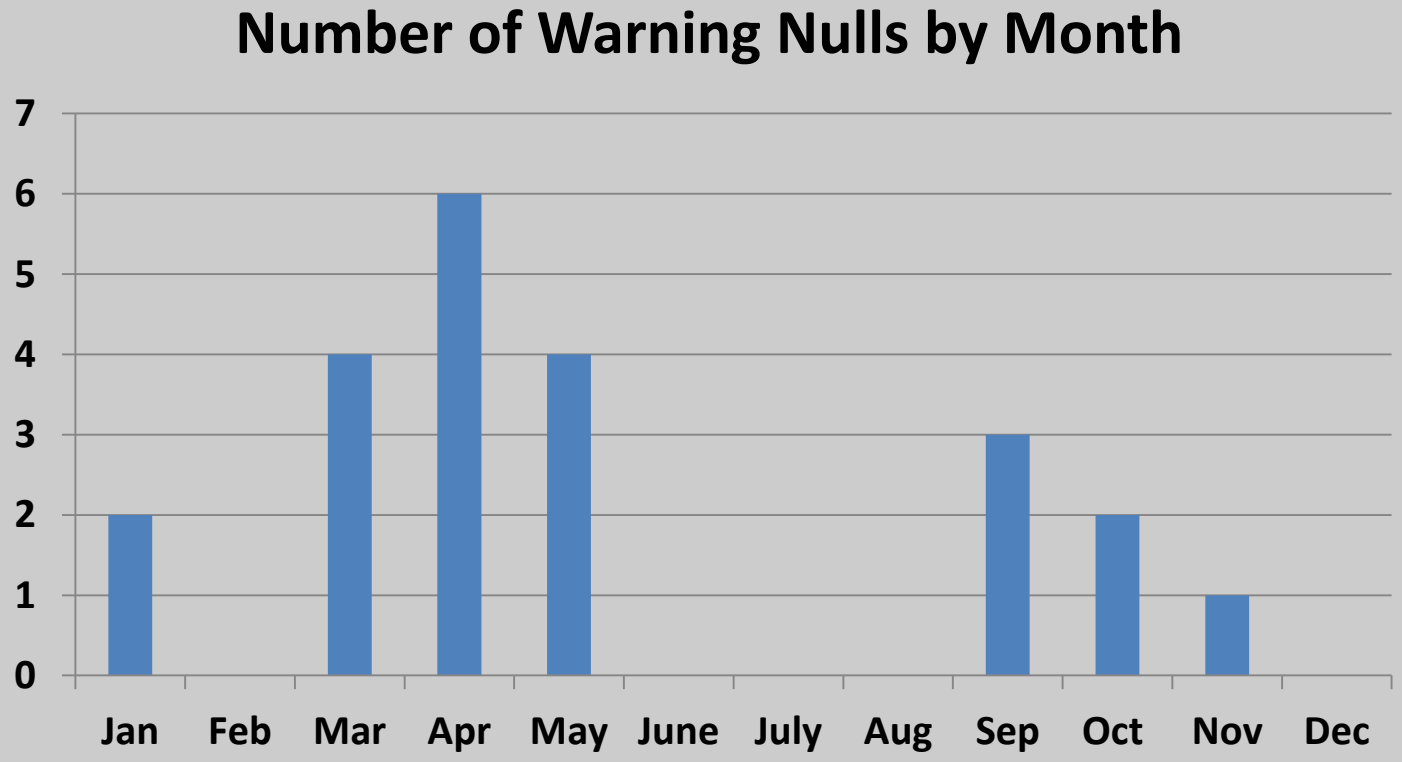
Other Severe Parameters





2nd Null Set (2005-2014)

- Any HSLC day with 100% FAR for SVR or TOR warnings (22)



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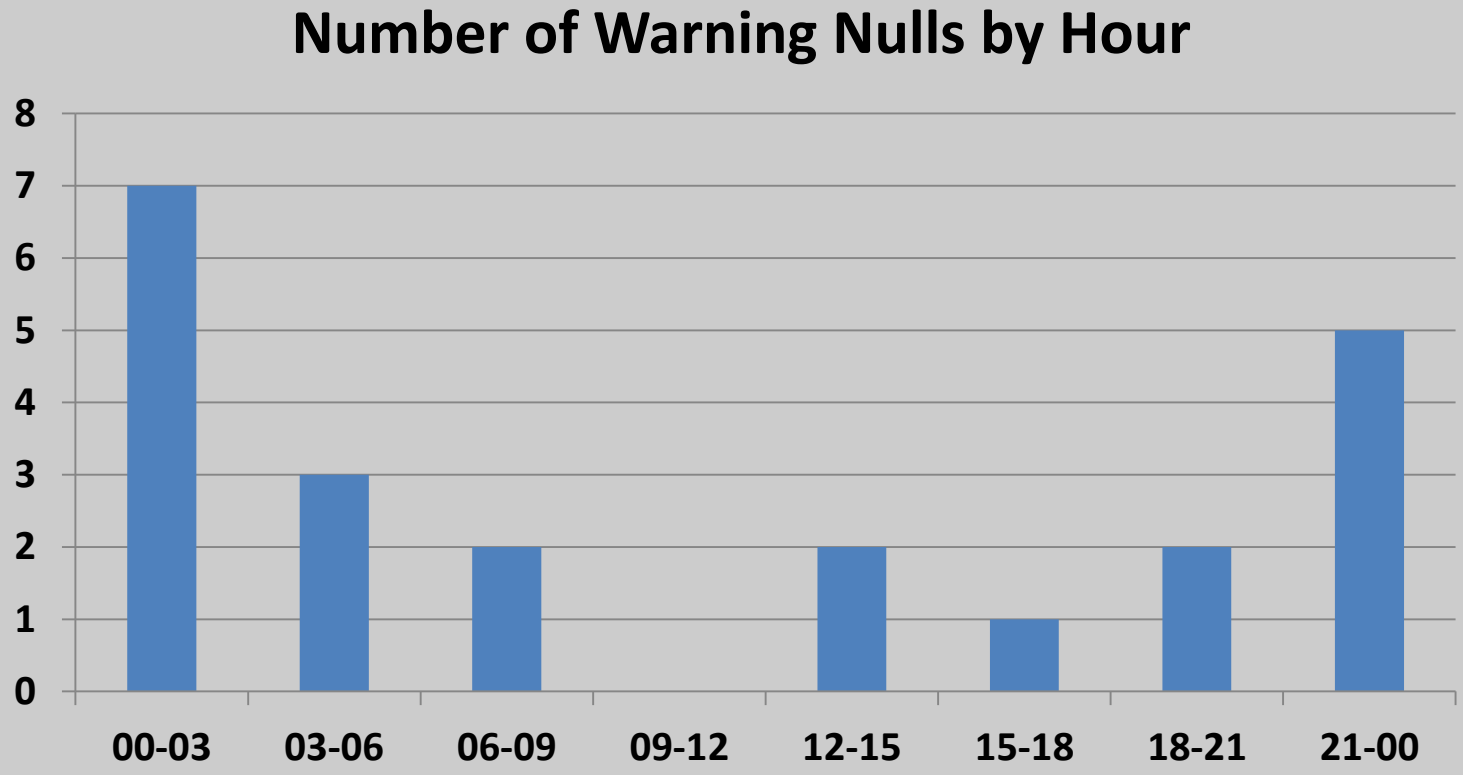
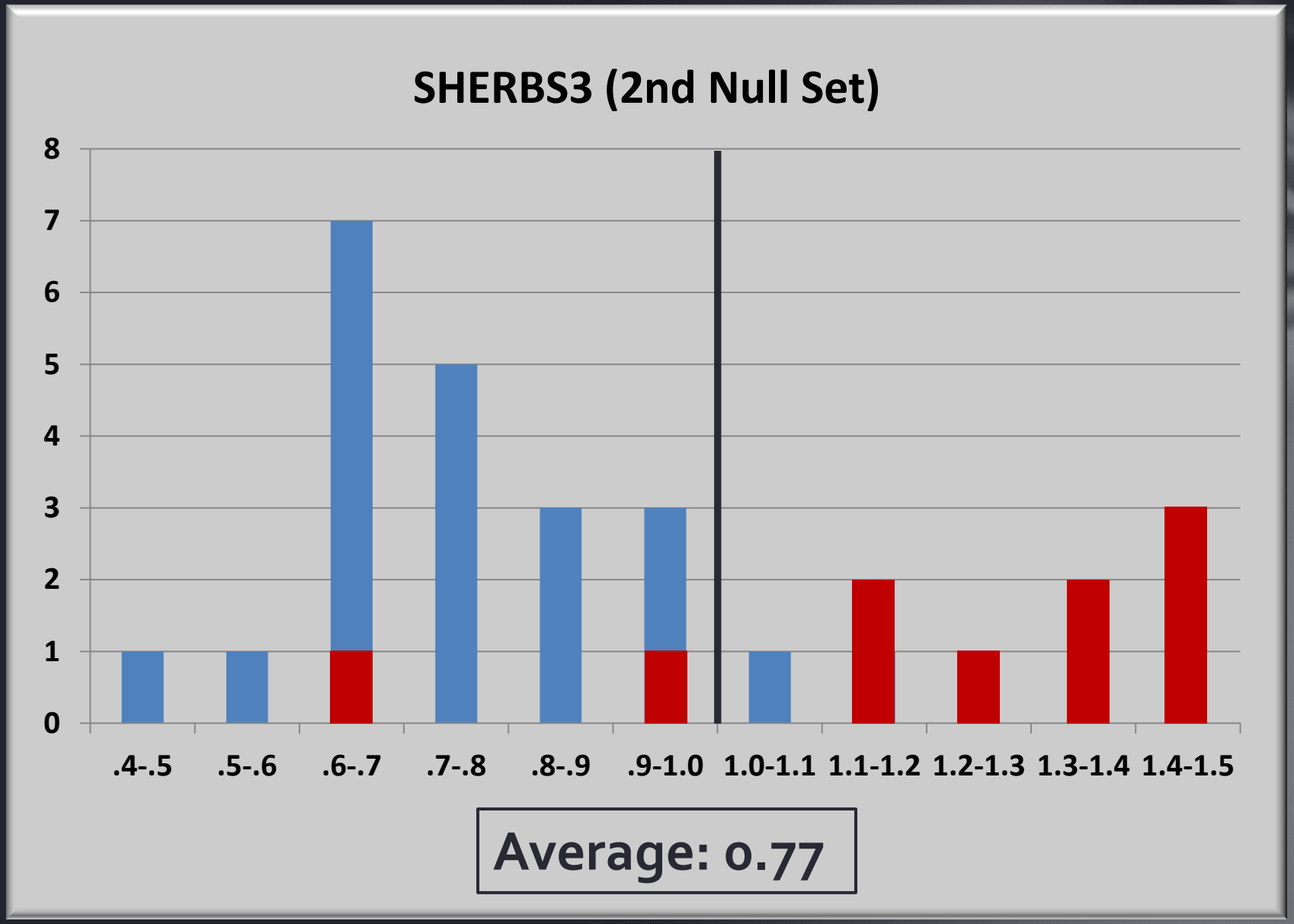
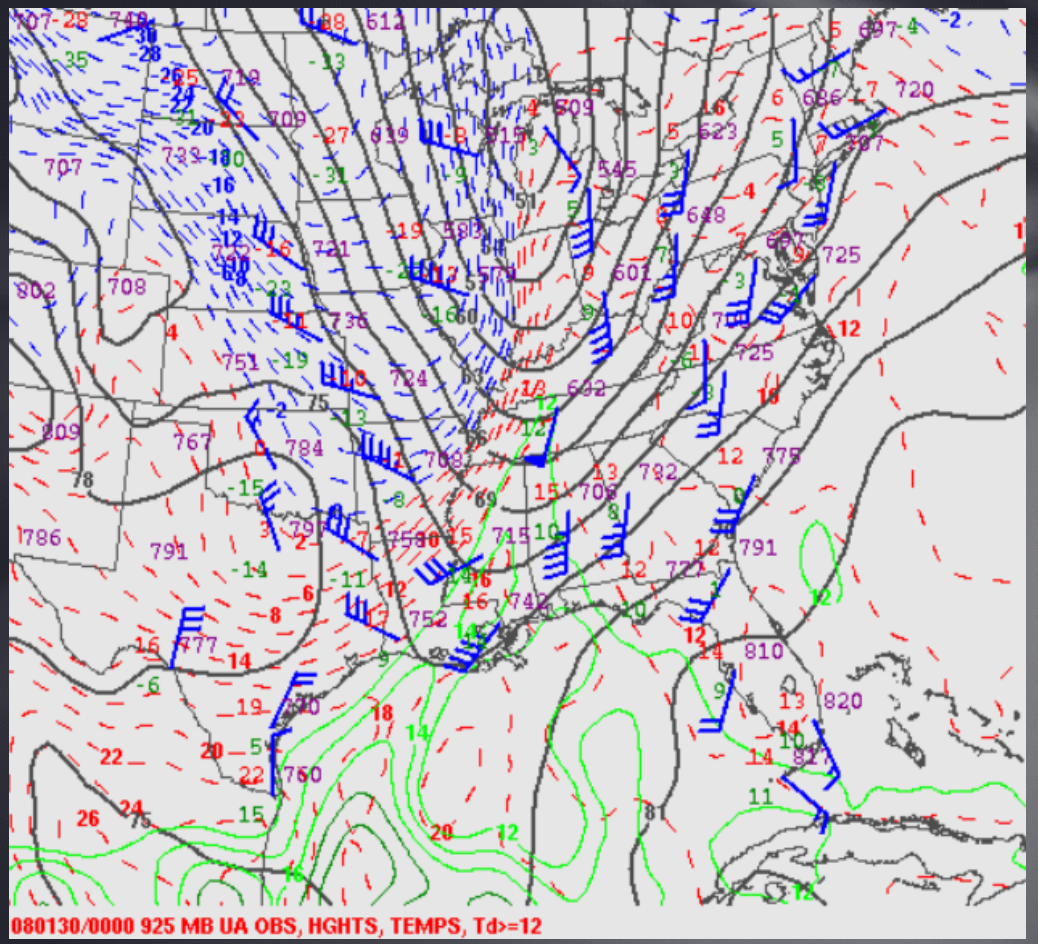


SHERBS3 Results (2nd Null Set)



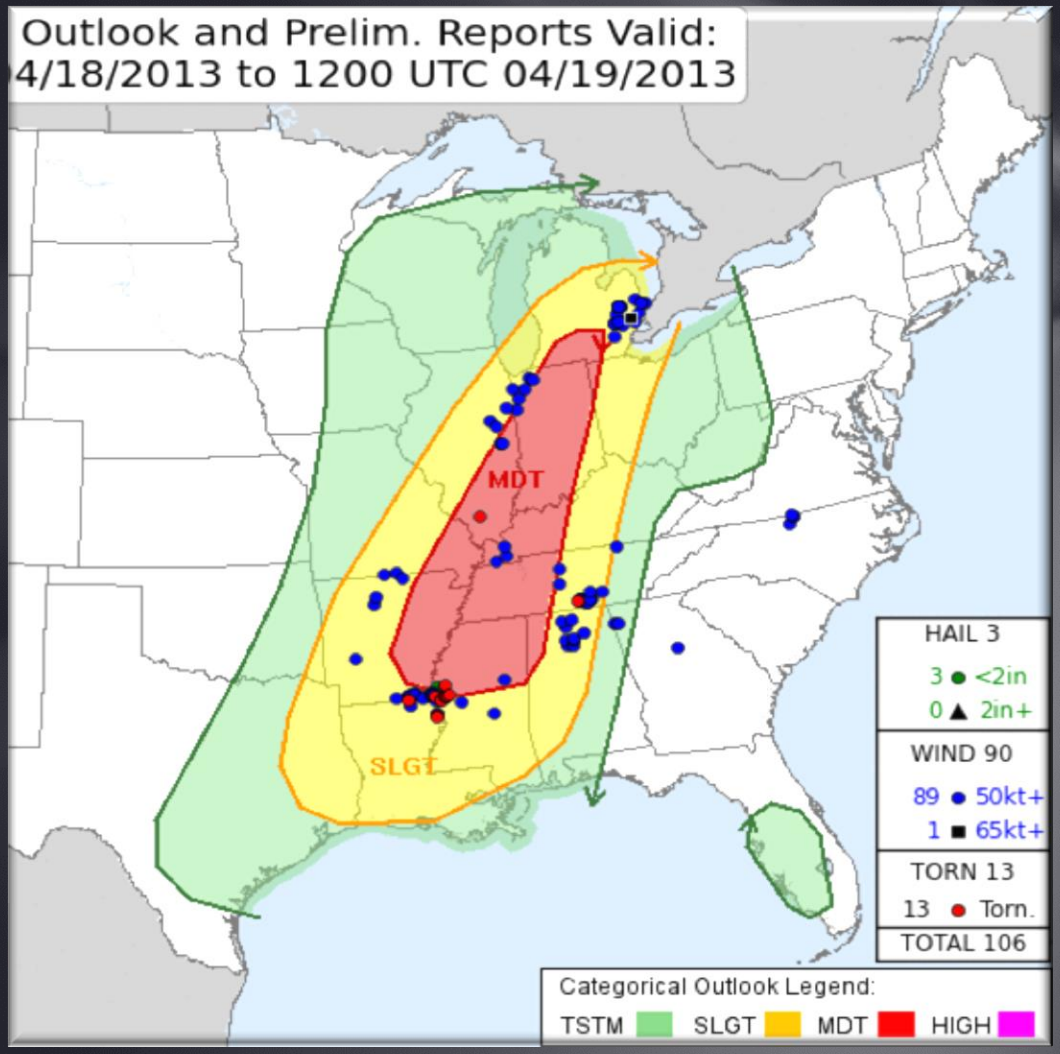
January 29th, 2008

- Only 4 severe wind reports in IWX
- Better instability & SHERBS3 just to our south (though still low)
- Strongly forced



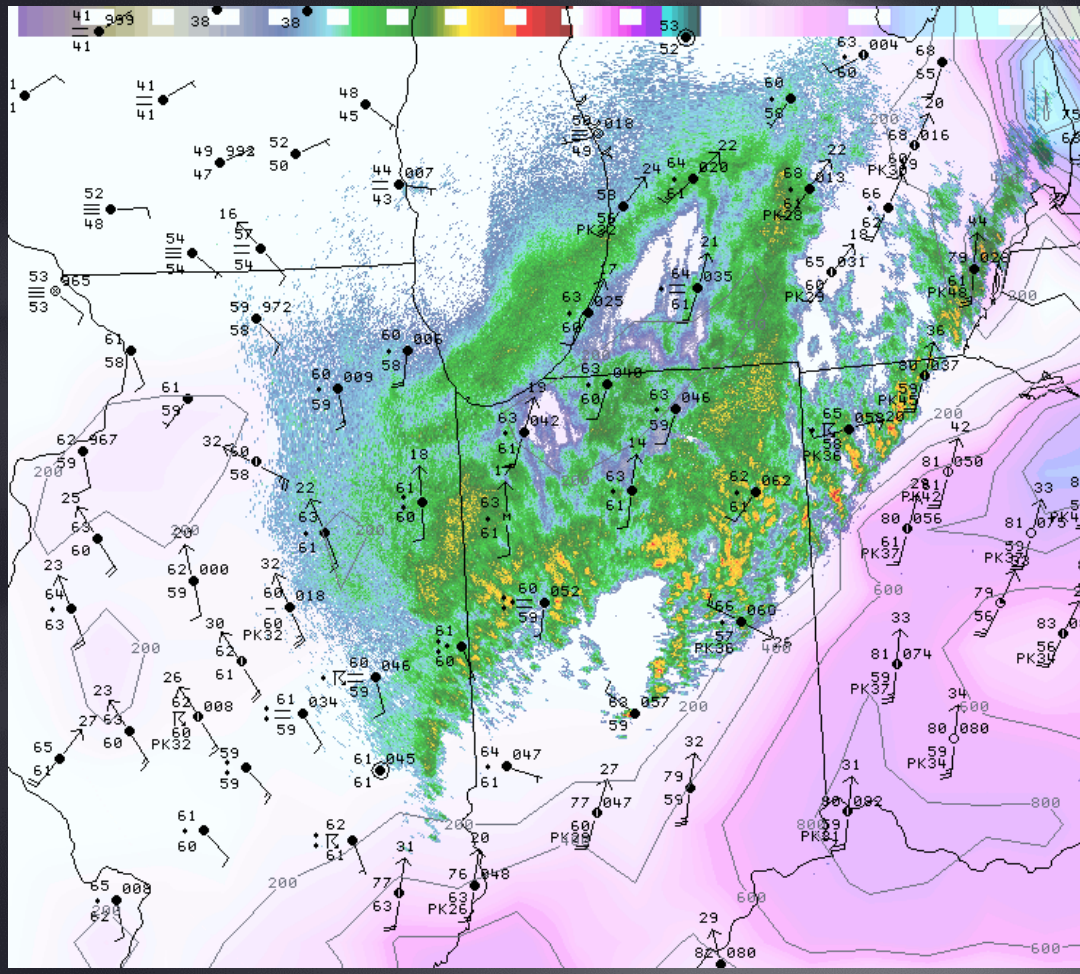
April 18th, 2013

- SHERBS3 (and most other parameters) suggested high threat
- MDT risk and PDS TOR Watch
- Bust for IWX



April 18th, 2013

- Several rounds of rain early
- Very limited instability
- Elevated (weak) convection
- Outflow dominant



Summary

- **SHERBS3 shows some skill over traditional parameters for differentiating severe vs. null HSLC events**
- **Limited number of events & some notable exceptions**
- **As always, requires holistic approach**
- **Conveying confidence, while difficult, is crucial**

Questions/Comments?

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Sherburn, K. D., and M. D. Parker, 2014: Climatology and ingredients of significant severe convection in high shear, low CAPE environments. *Wea. Forecasting*, 29, 854-877.