



The High Shear/Low CAPE Problem: Improving Detection of Significant Severe Weather Events in Marginally Unstable Environments

Keith D. Sherburn, Matthew D. Parker

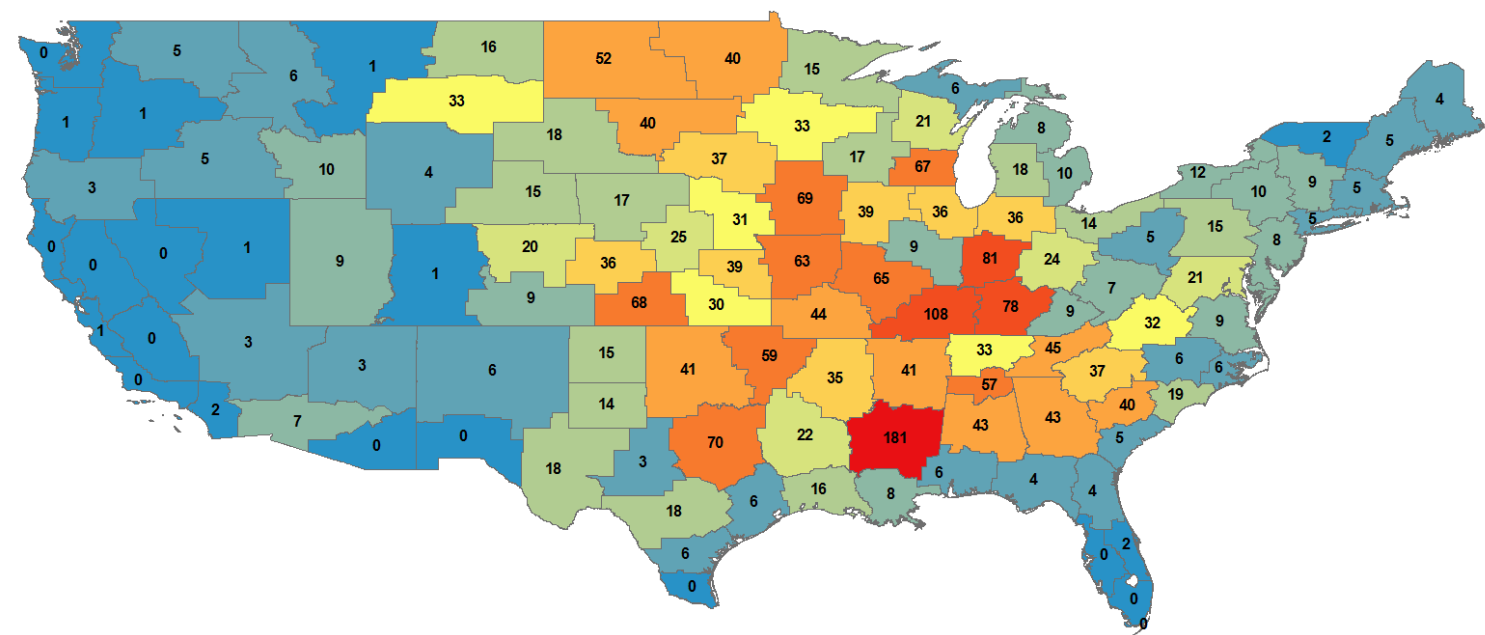
Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University



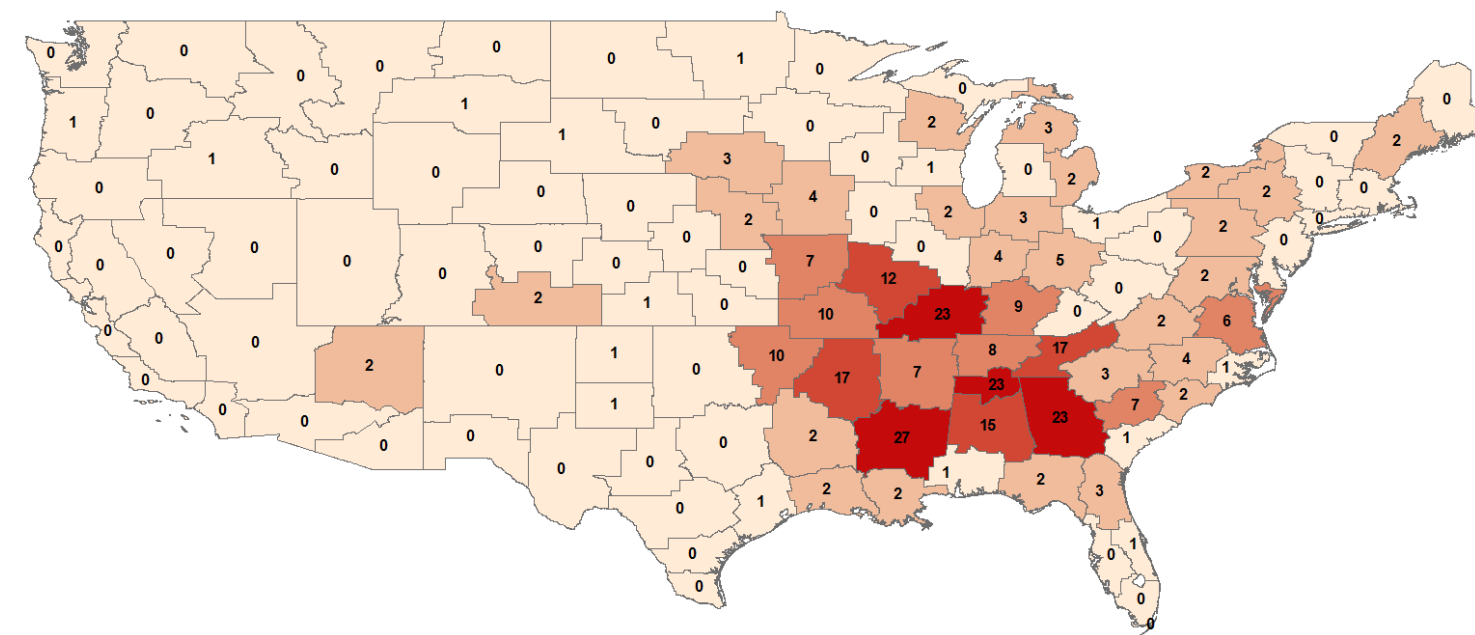
Background

- High shear, low CAPE (**HSLC**) environments are characterized by 0-6 km shear magnitudes $\geq 18 \text{ m s}^{-1}$ and surface-based CAPE values $\leq 500 \text{ J kg}^{-1}$.
- Recent observational research has indicated that in the Mid-Atlantic and southeastern U.S., among other areas, HSLC events account for a considerable fraction of total severe weather reports.
- 11 National Weather Service (NWS) Weather Forecast Offices (WFOs) in the Southeast and Mid-Atlantic joined forces with North Carolina State University to address the lack of knowledge surrounding HSLC events in an attempt to improve the understanding and forecasting of them.

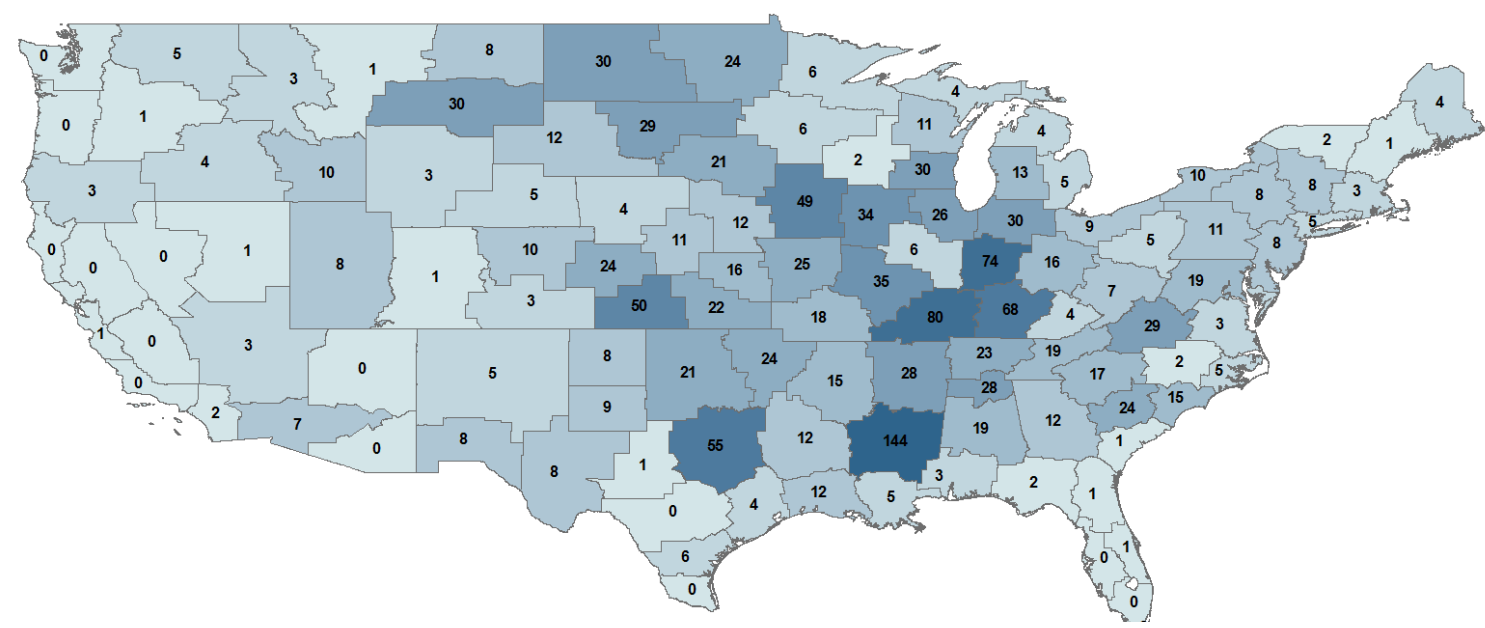
Number of HSLC Significant Severe Reports Between 2006 and 2011



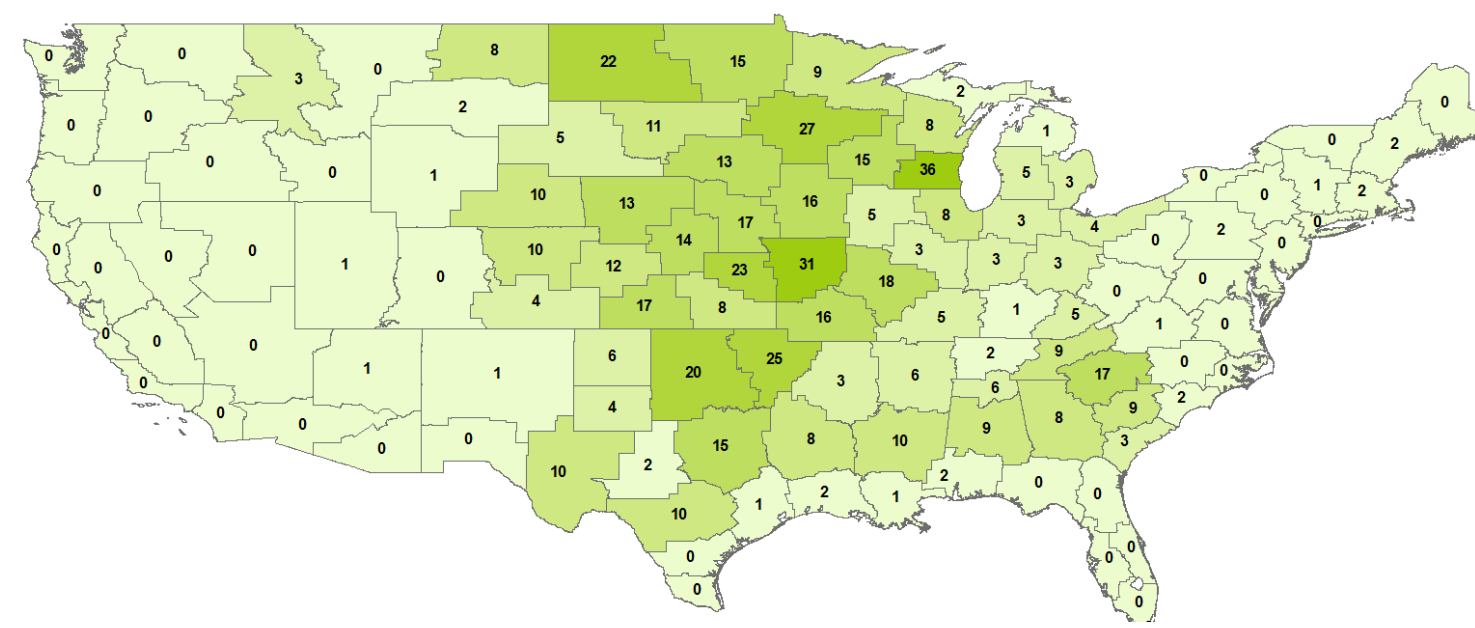
Number of HSLC Significant Tornado Reports Between 2006 and 2011



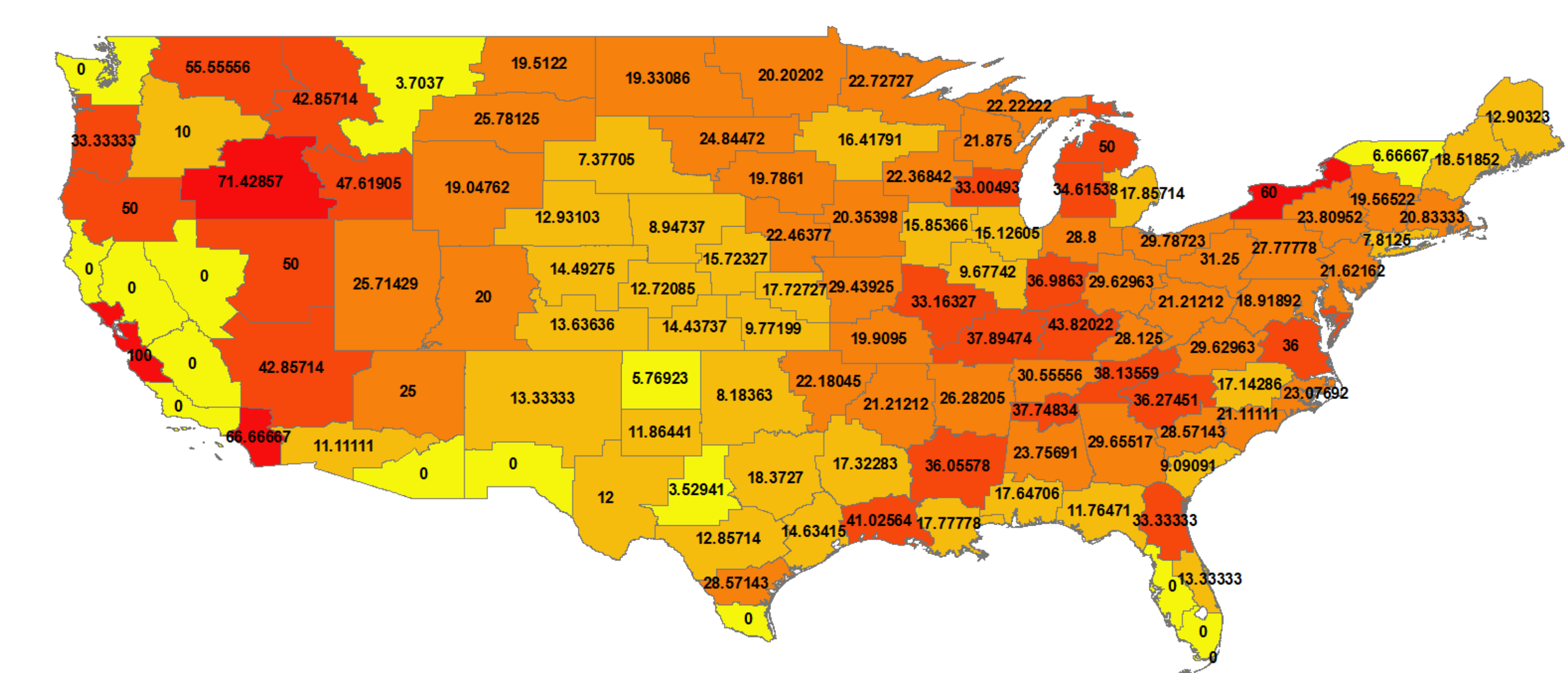
Number of HSLC Significant Wind Reports Between 2006 and 2011



Number of HSLC Significant Hail Reports Between 2006 and 2011

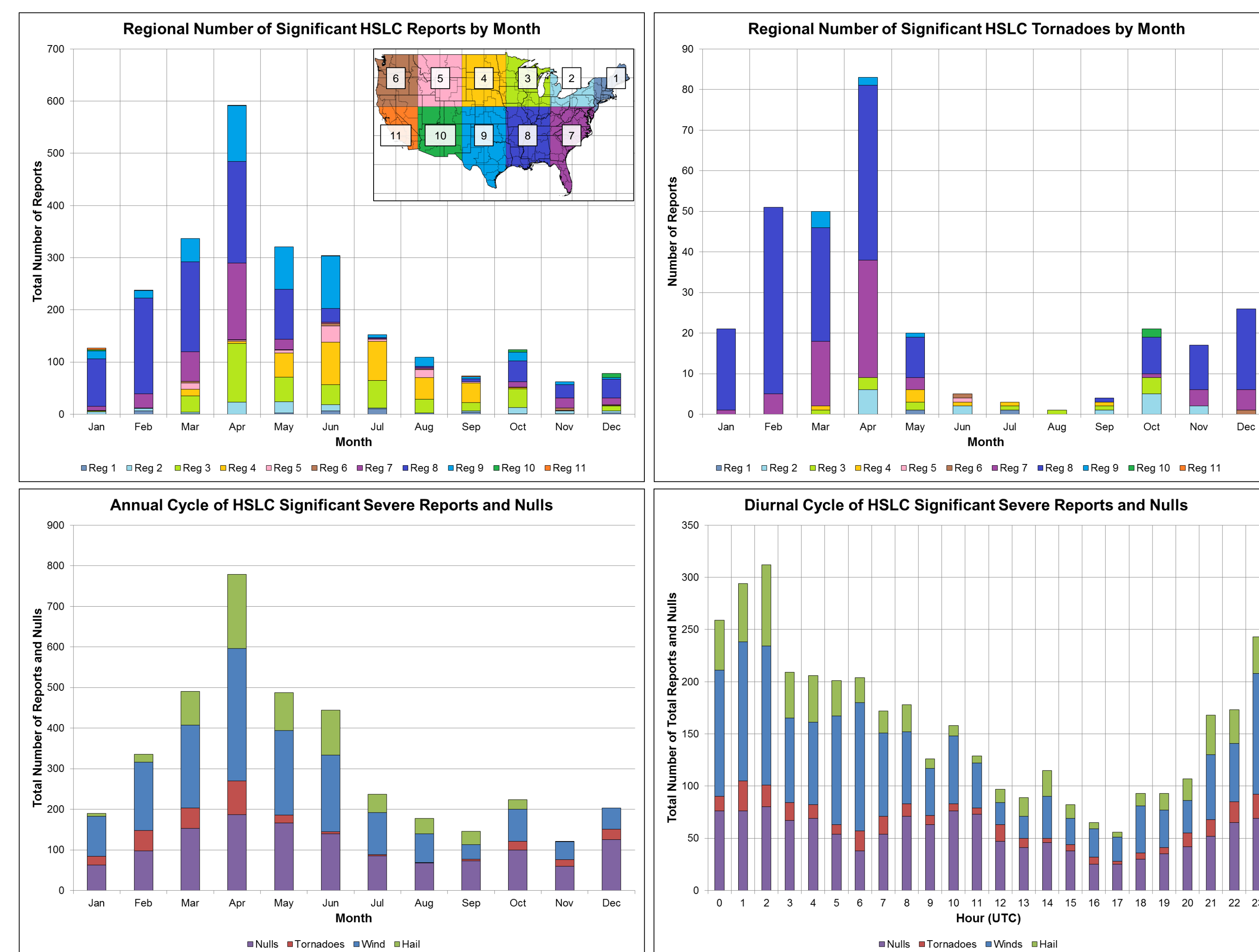


Percent of Significant Severe Reports Which are HSLC Between 2006 and 2011



HSLC Climatology

- HSLC events occurred in nearly every NWS county warning area between 2006 and 2011, with a notable peak stretching from the Southeast and Ohio Valley through the Plains.
- Annually, HSLC events peak in the spring, with another local maximum in October, though this is subject to considerable regional variability, as is the diurnal cycle and primary hazard associated with HSLC events.



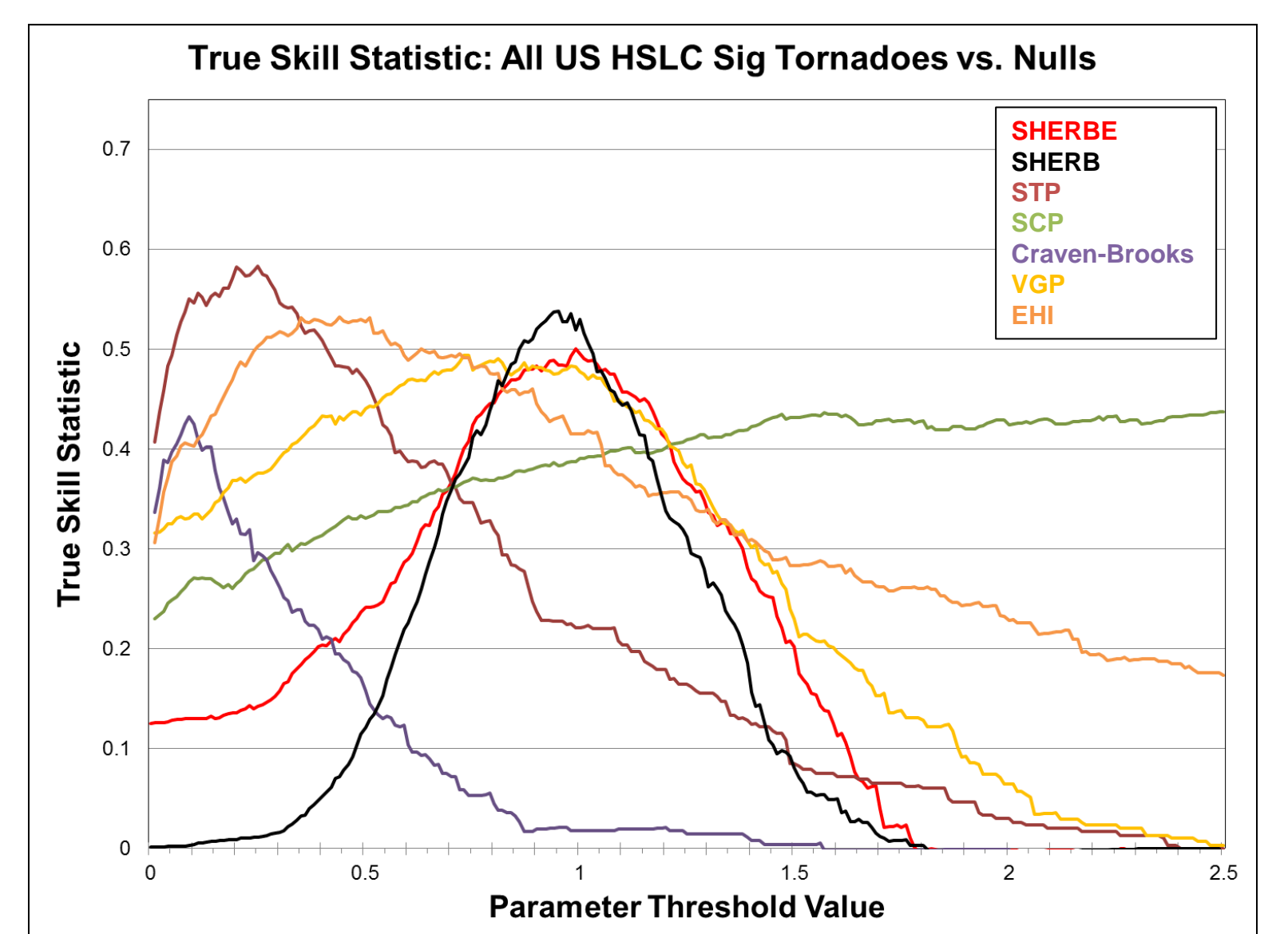
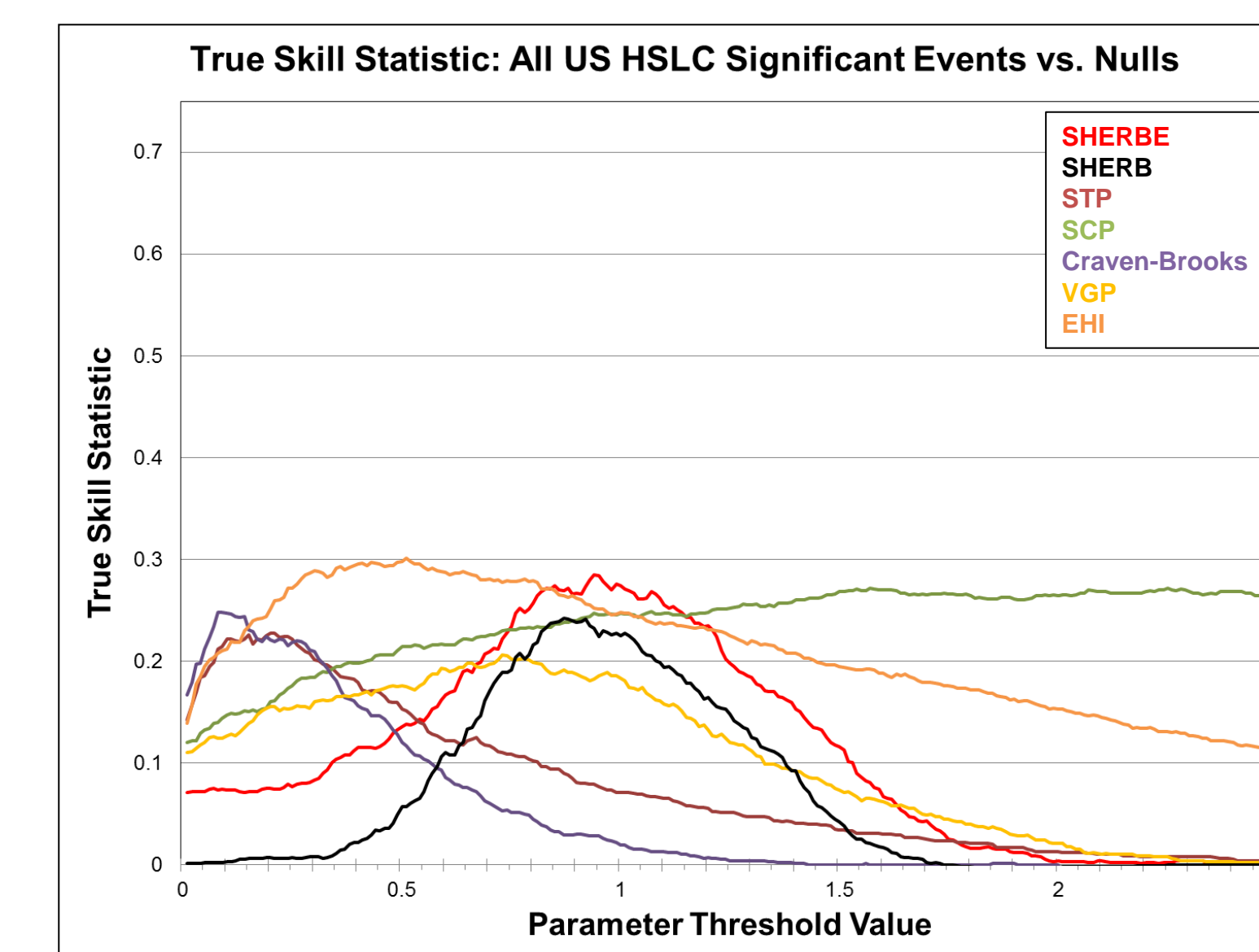
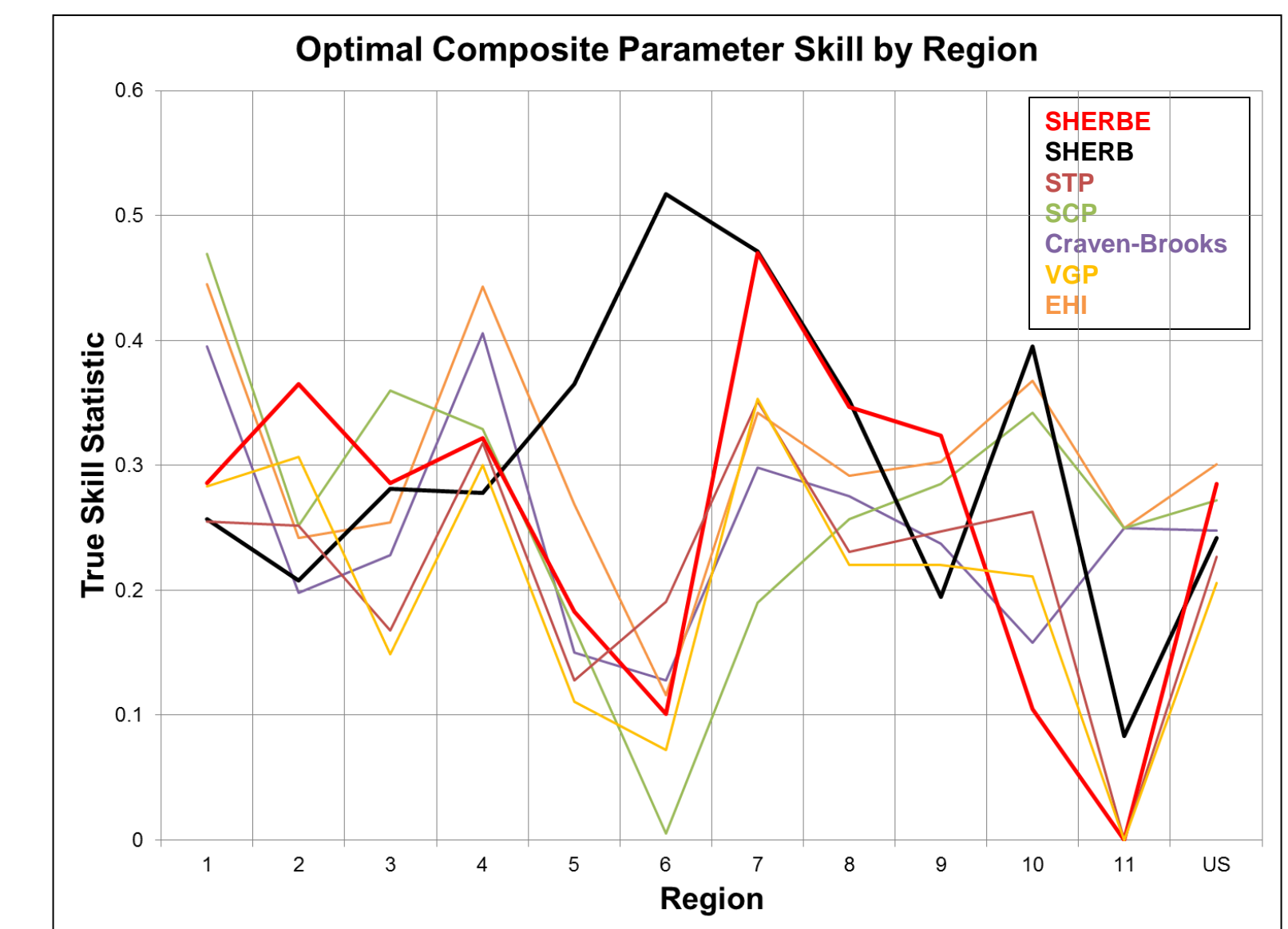
Performance of Existing Forecast Tools

- Most forecasting parameters include CAPE in their formulation, which can lead to underestimation of risk in HSLC environments.
- Operational forecasters have noted the poor performance of conventional parameters in HSLC events.

Development of New Techniques

- Through statistical analysis of HSLC significant severe events—subjectively identified by collaborating WFOs—and non-severe events (unverified warnings), the most skillful parameters in diagnosing favorable environments for HSLC significant severe weather were determined.

- Severe Hazards in Environments with Reduced Buoyancy parameter
- Product of 0-3 km lapse rate, 700-500 mb lapse rate, and either 0-3 km shear (**SHERB**) or effective shear magnitude (**SHERBE**)



Conclusions

- HSLC events are a nationwide phenomenon, accounting for over 20% of all significant severe reports between 2006 and 2011.
- Existing composite parameters demonstrate skill in diagnosing regions favorable for significant severe weather, but this skill is maximized at thresholds lower than previously deemed operationally useful.
- The Severe Hazards in Environments with Reduced Buoyancy parameter, either the 0-3 km shear version or the effective shear version, exhibits an increase in skill in discriminating between HSLC significant severe and non-severe convection in many regions.
- However, future research must address regional variability of HSLC events to improve forecasting nationwide.

Acknowledgements

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