# MRMS Product Distributions for NWS Warning Polygons

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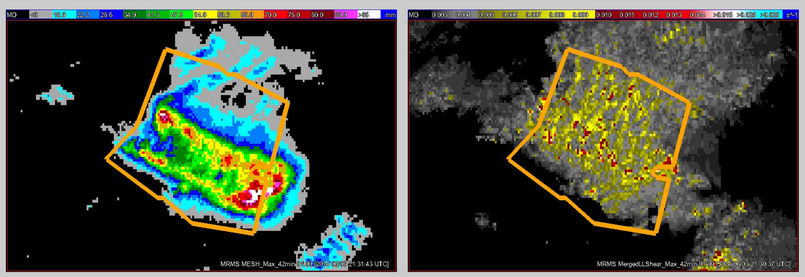
## Background and Motivation

The Multi-Year Reanalysis for Remotely Sensed Storms (MYRORSS) is a large database of Multi-Radar, Multi-Sensor (MRMS) data for the years 1998 through 2011. Since 1 October 2007, the National Weather Service (NWS) standardized the issuance of polygon severe storm warnings (below) across its Weather Forecast Offices. The geospatial nature of both MRMS grids, including near-storm environment (NSE) data, and the NWS storm-based warning polygons allow for data mining of the MRMS data within NWS warnings. By utilizing MRMS products to characterize storms within NWS warnings, we can stratify the warning verification system beyond a simple hit/false alarm by determining the potential of a storm to produce a verified severe event. Forecasters could, therefore, issue faster, more accurate warnings during severe weather events in real time.



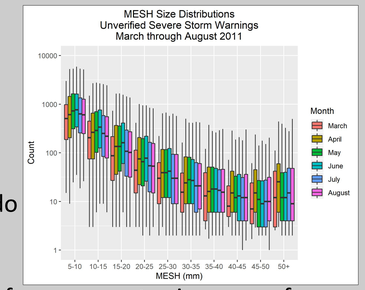

KOAX radar images of MESH (left) and MergedLLShear (right) within an NWS severe thunderstorm polygon warning on 3 June 2014.

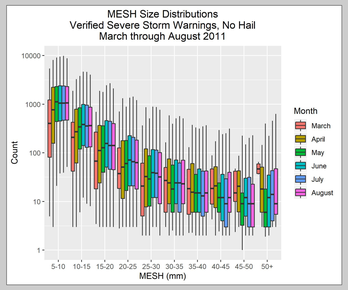
## Data and Methods

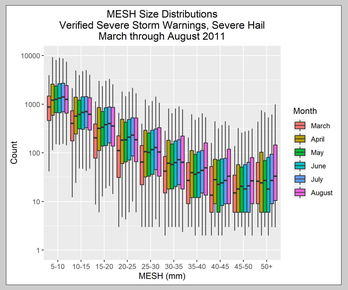
The data was obtained within NWS severe thunderstorm warning polygons as applied to the standard MRMS grid of 0.01° by 0.01° resolution. For each day in a 6-month period from March to August 2011, MRMS and NSE variables were computed, in this case by pixel count, within this grid during the entire lifetime of a severe thunderstorm warning. From these various products, MESH (Maximum Expected Size of Hail) and MergedLLShear (Merged Low-Level Azimuthal Shear) were deemed as significant indicators of severe weather, particularly since severe thunderstorms are verified either by maximum hail size, maximum wind speed, or whether a tornado was produced. By separating MESH and MergedLLShear into magnitude intervals, the intensity of storms across the 6-month period in 2011 were verified against storm report data and classified by the following verification methods: unverified, verified with no hail, verified with severe hail, verified with sig. severe hail, verified with no wind, verified with severe wind, and verified with sig. severe wind.

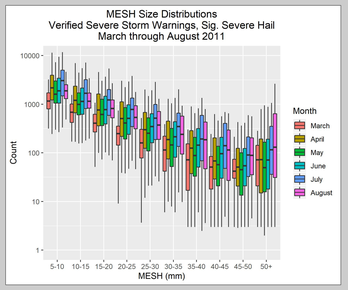
## Results

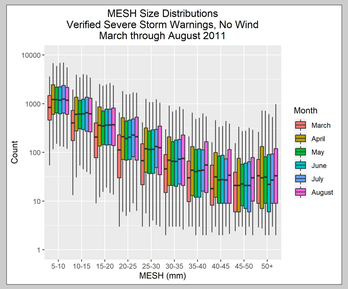
For the MESH boxplots (right), the median size of hail shifts upward with increasing intensity in wind and hail. Note that seasonal trends do not appear to be significant. Also note the dramatic increase from severe to sig. severe for both report methods.

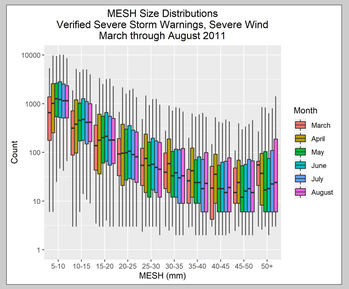


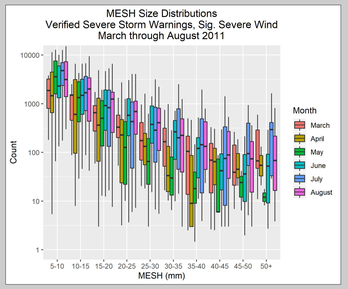



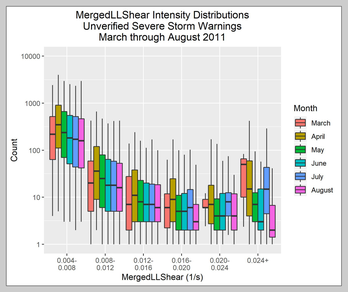



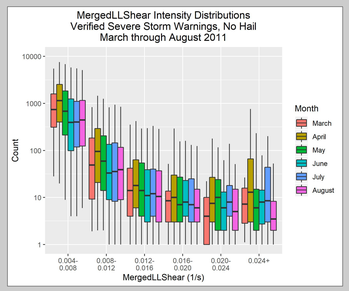



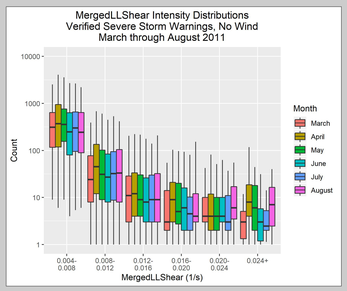



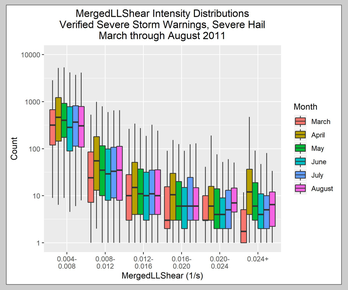



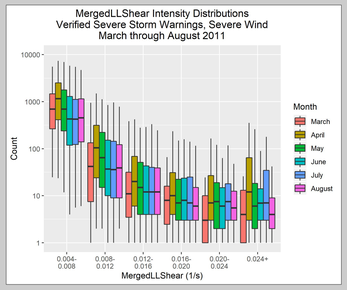

For each of the MergedLLShear boxplots (below), the median shear also shifts upward with increasing intensity in wind and hail, though the wind increase is more apparent.

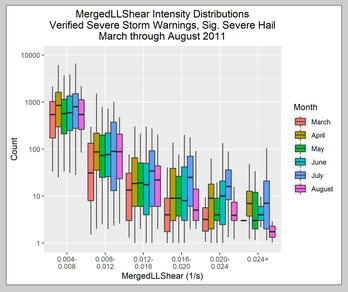


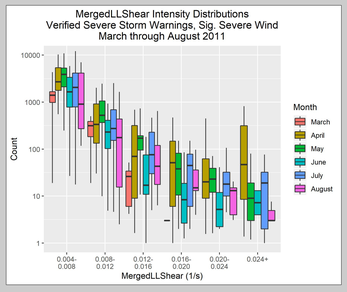




## Conclusions

Monthly trends, even in "storm season," are not useful indicators of storm intensity on radar, as seen by the relative sizes of the monthly boxplots within the MESH and MergedLLShear intensity intervals. However, MRMS products highlight a clear, considerable difference between unverified and sig. severe thunderstorms such that with increasing storm intensity via verified storm reports, the amount of an MRMS variable within the polygon also increased.

## Future Work

- Introducing population and land use data will allow for a further stratification of severe thunderstorm polygon warnings. Since forecasters consider the impact to human life and property when issuing severe storm warnings, this geospatial data can lead to the investigation of unverified storms or "false alarms." Storms within these polygon warnings can be identified as either true false alarms or storms that had little chance of verifying.
- Examining the MRMS and NSE characteristics of NWS tornado polygon warnings would be useful since tornadoes spawn from severe thunderstorms yet are more difficult to warn on radar.

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