Evaluation of the Relationship between NSSL MRMS Rotation Tracks and Tornadoes in Iowa

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Goals

Evaluate the relationship of rotation tracks to the initiation point of tornadoes.

- Where do tornadoes typically initiate relative to the track?
- How long after a track develops does a tornado form?
- Is there a relationship between observed shear magnitude and tornado EF-scale rating?
- What is the shear distribution for observed tornadoes?

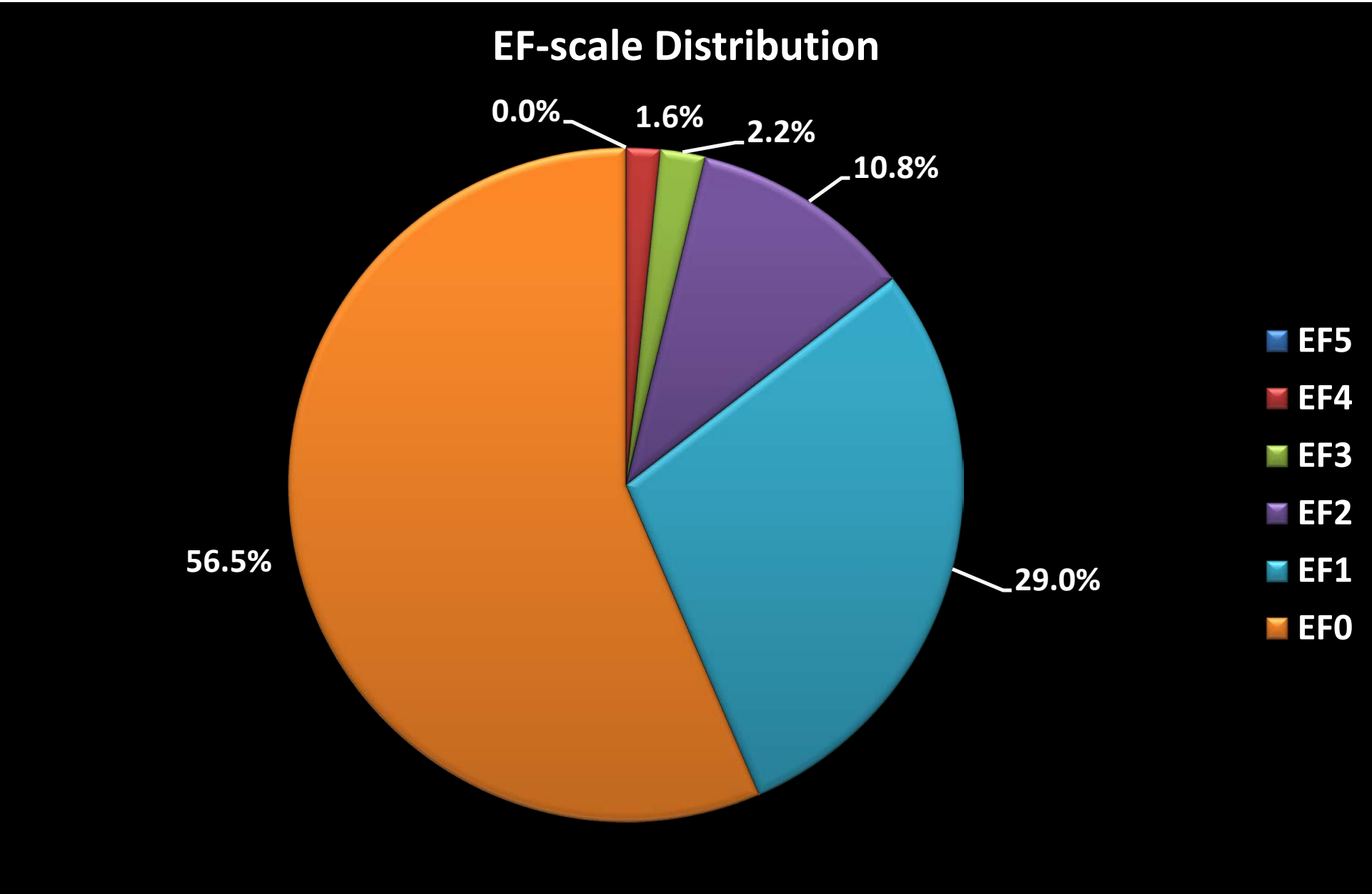
- Broaden forecaster perspective of rotation tracks from only a storm survey tool to warning decision tool.

Data

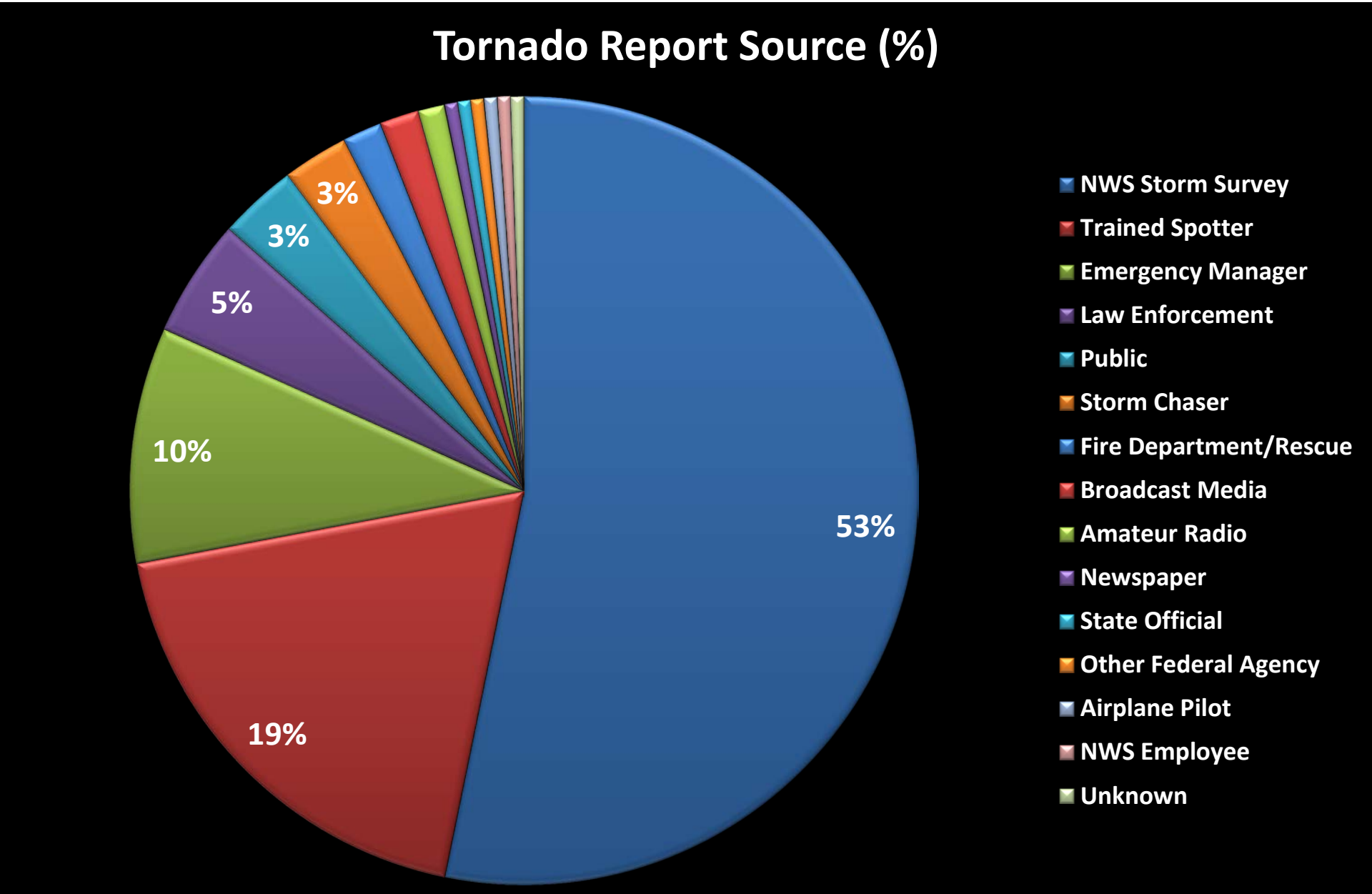
- 186 tornadoes in Iowa from 2008 - May 2014
- WSR-88D-based MRMS 0-2 km rotation tracks

- Error sources
  - Reported location of tornado
  - Reported time of tornado
  - Missed tornado or false id
  - EF scale +/- 1
  - Lead time methodology is somewhat subjective (based on rotation tracks maxima)
  - Standard radar limitations

Iowa Tornadoes 2008-2014



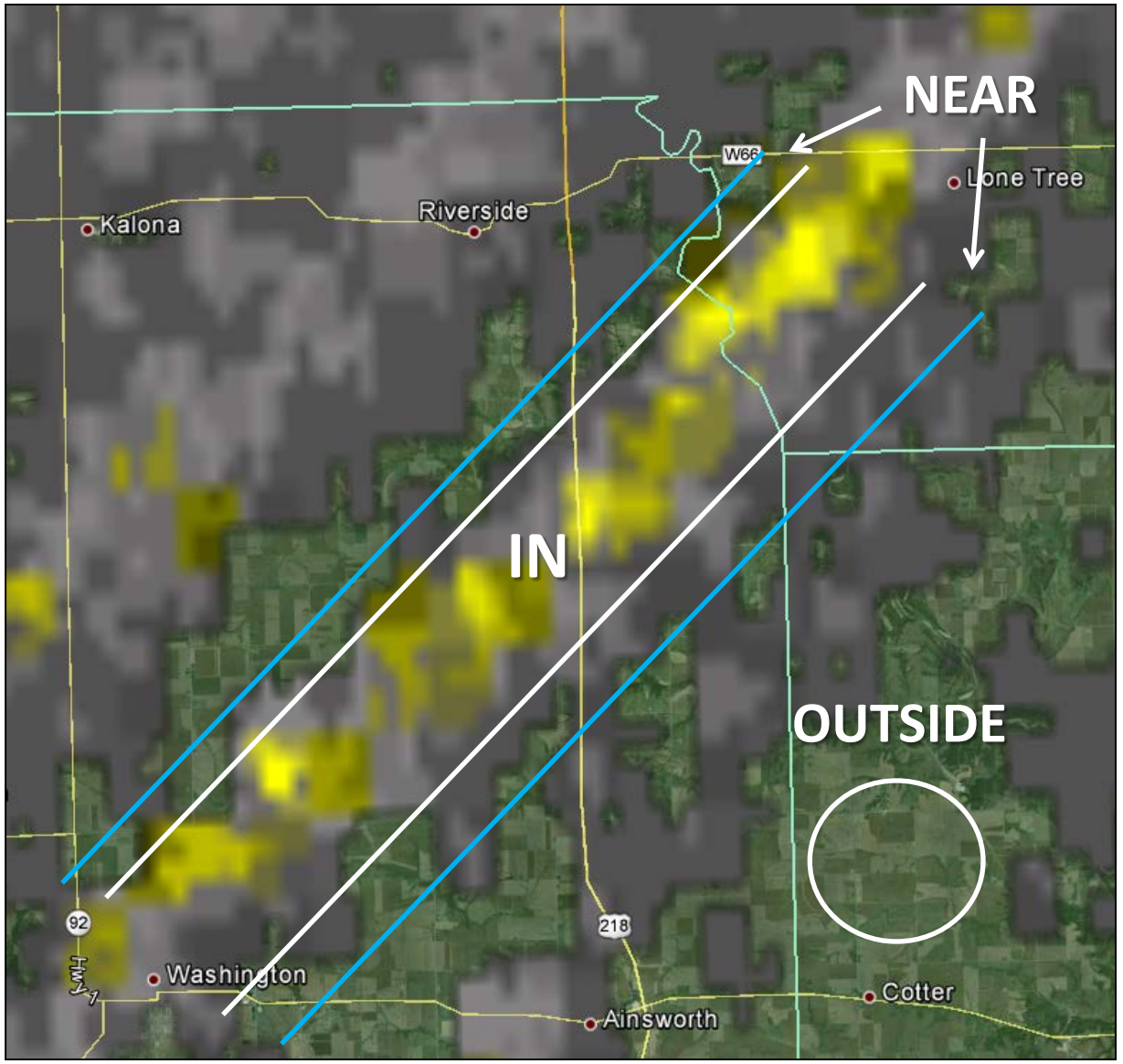
Iowa Tornadoes 2008-2014



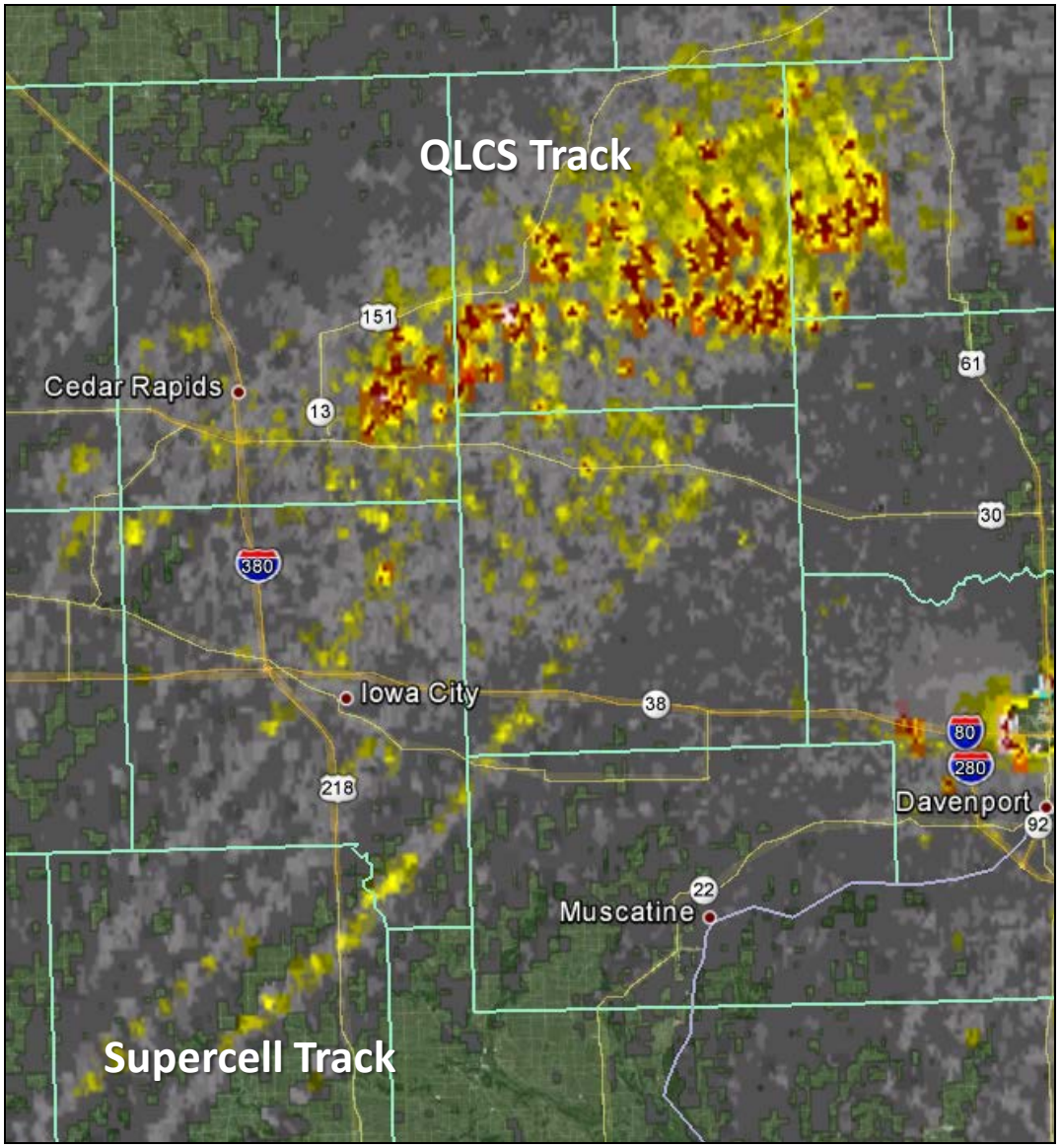
Defined Locations Relative to Tracks

- Tornado was associated with nearest maximum at or upstream of the tornado initiation point.

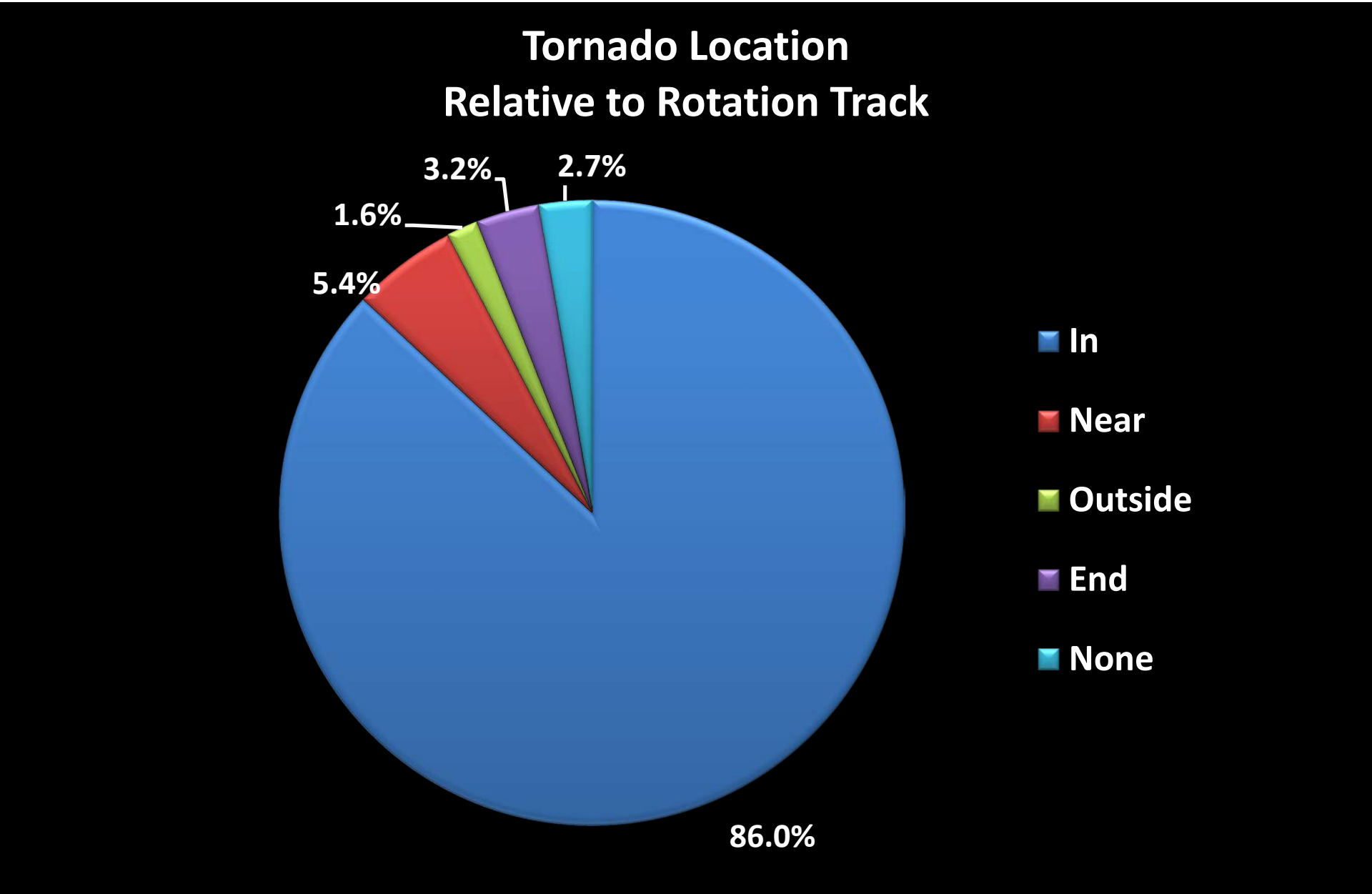
- **HIT**
  - In
  - Near
  - End
- **MISS**
  - Outside
  - None



Supercell vs. QLCS track

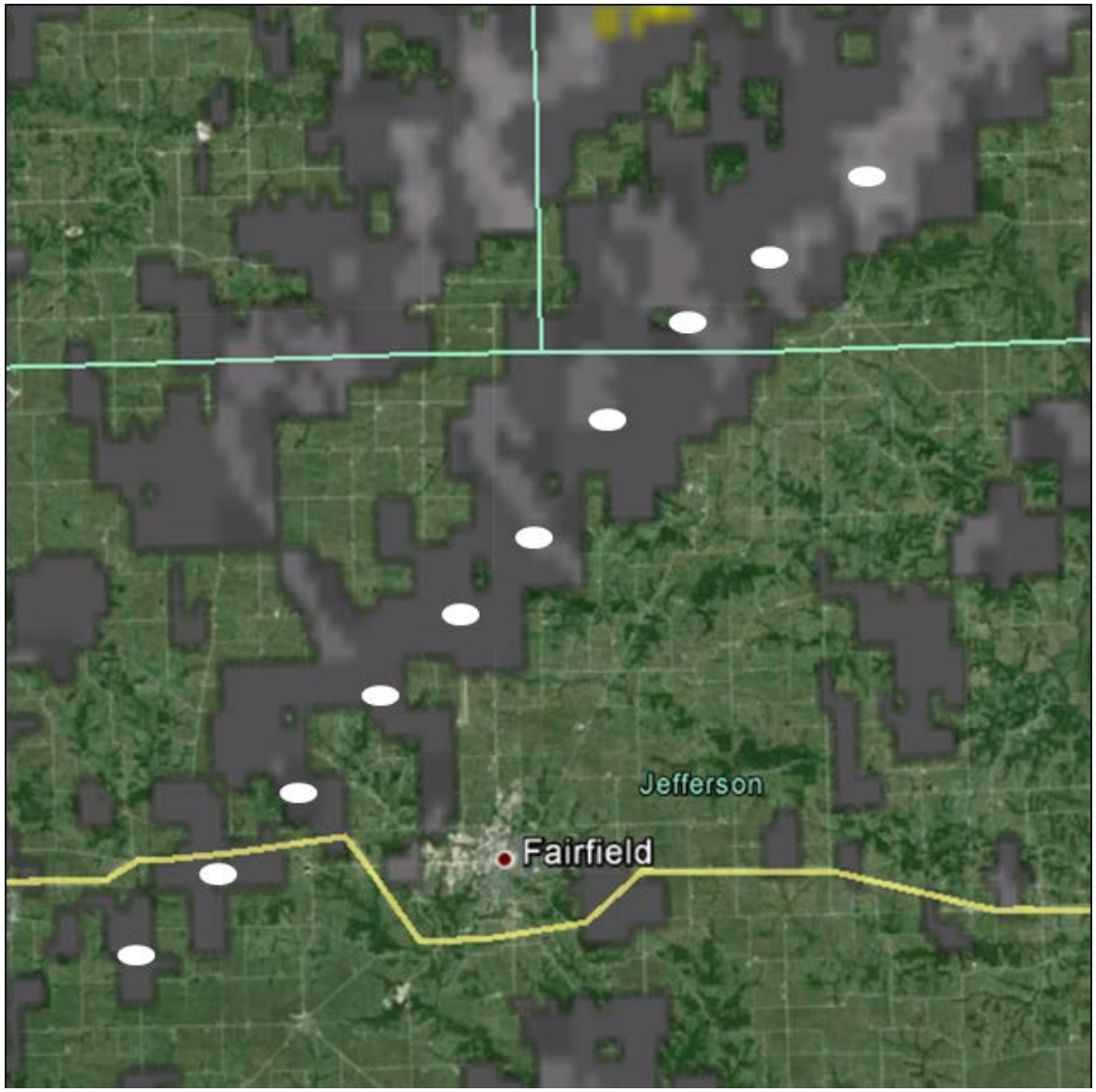


94.6% of Tornadoes Associated with Tracks

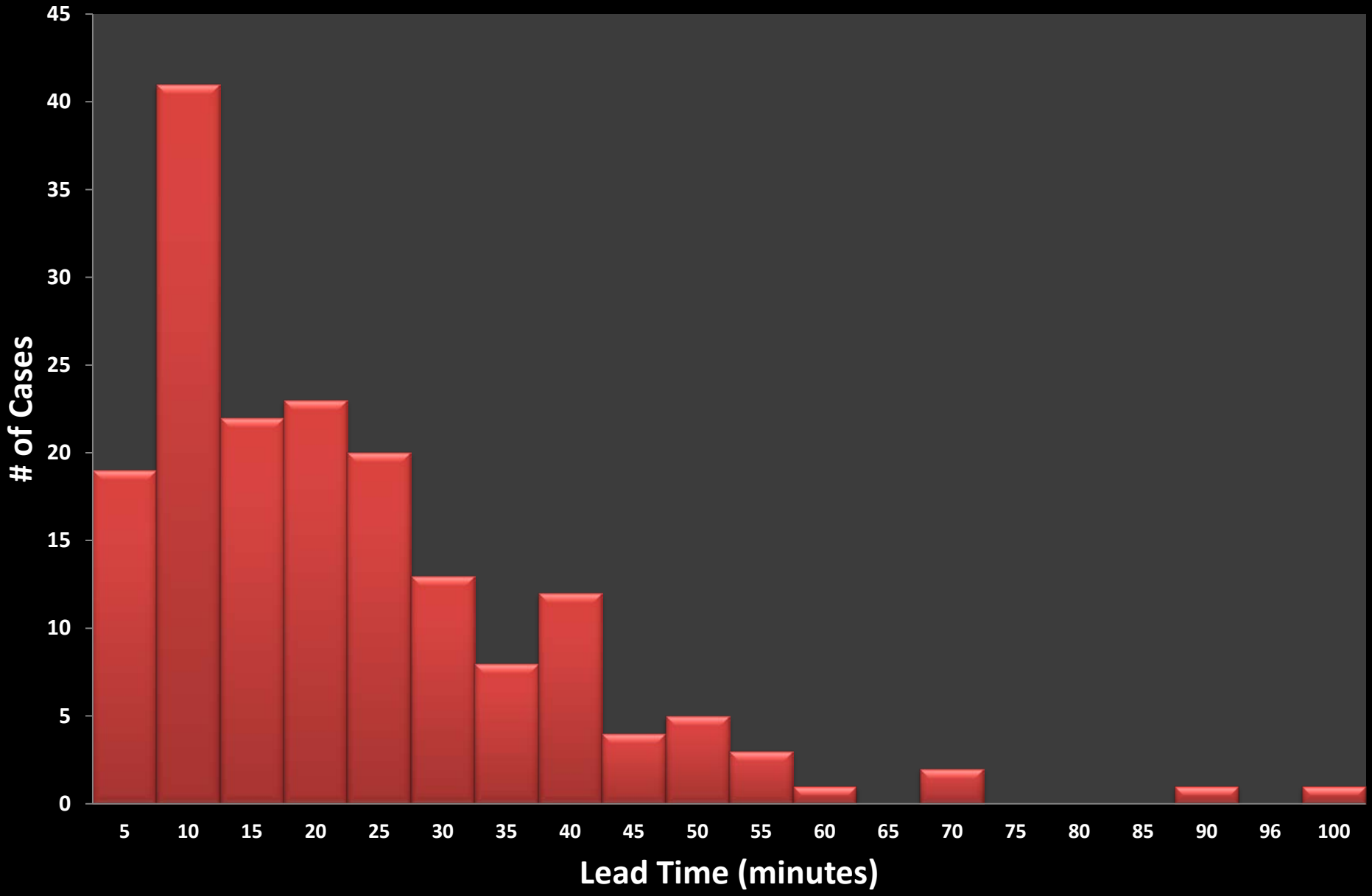


Lead Time Calculation

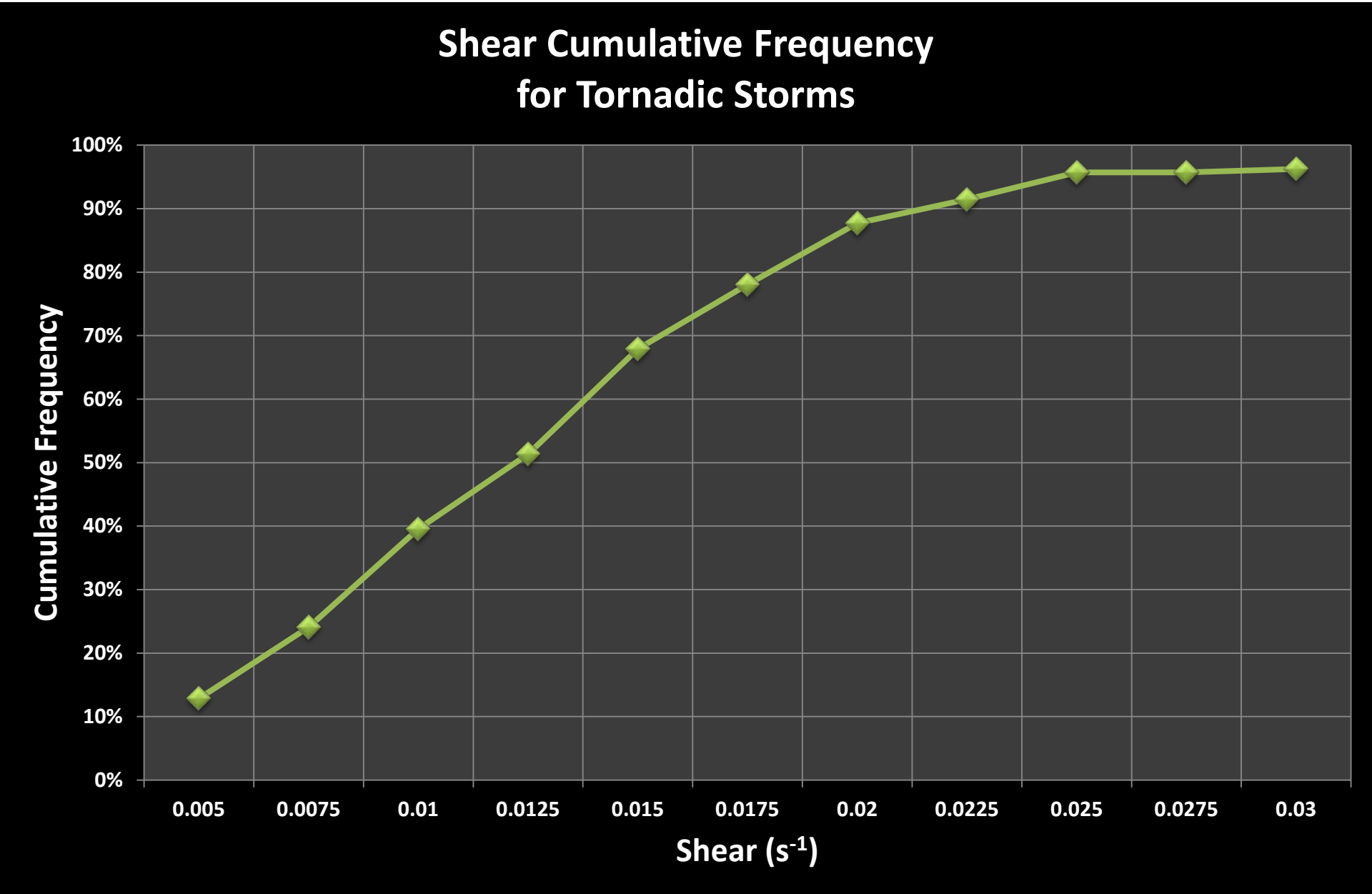
- Begin at shear = 0.002 s^{-1}
- 2 minute interval between maxima
- NOT to be confused with NWS tornado warning lead time
- Subjectivity



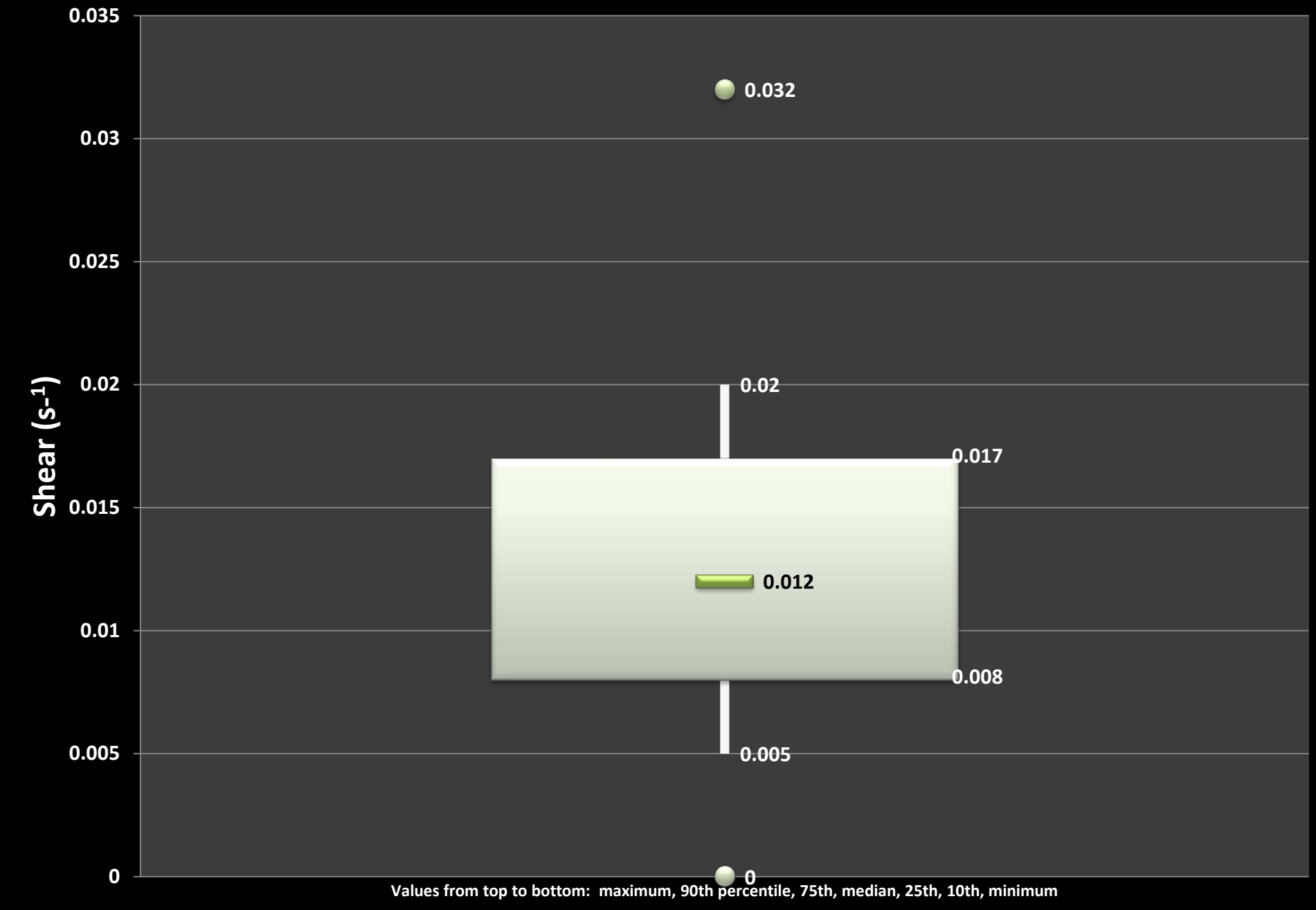
Tornado Lead Time
Relative to Track Inception

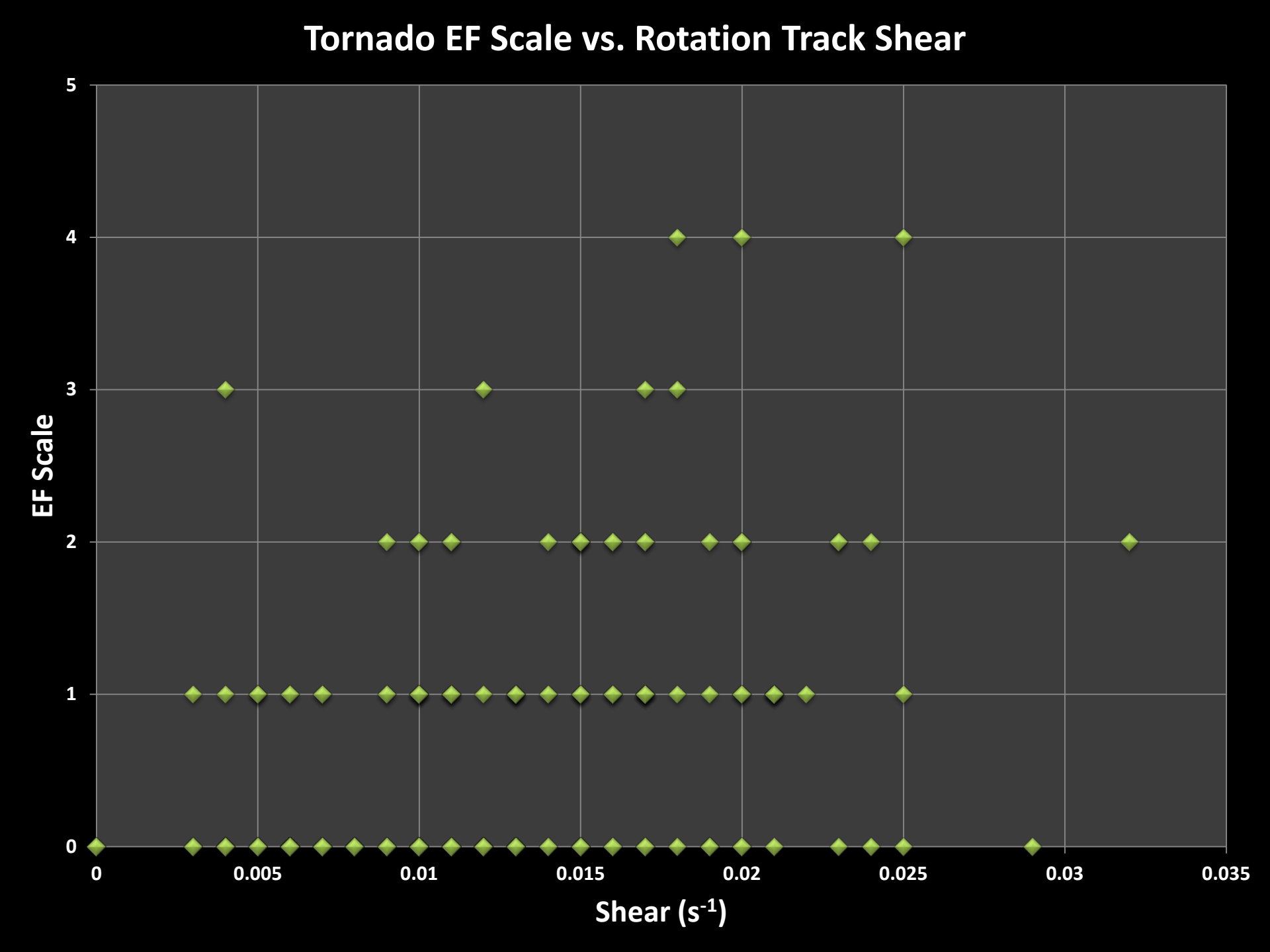


Cumulative Shear Frequency



Shear Distribution for Tornadic Storms




Tornado EF Scale vs. Rotation Track Shear
EF Scale
5
4
3
2
1
0
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
Shear (s-1)

Conclusions

- MRMS rotation tracks data should prove useful as an operational tool for anticipating and tracking tornadoes in real-time warning operations.

- Operational experience suggests data should be monitored in concert with single radar data, especially with the advent of SAILS.

- Low-level rotation tracks should also monitored with respect to mid-level data, particularly for supercell events where traditional downward development of rotation tends to occur. This is not as critical for QLCS events.

Future work

- Expand to Missouri and Illinois – cold season events
- Evaluate potential relationships with storm mode
- Frequency of tracks with straight-line wind damage and no tornadoes?
- Frequency of tracks with no tornadoes?