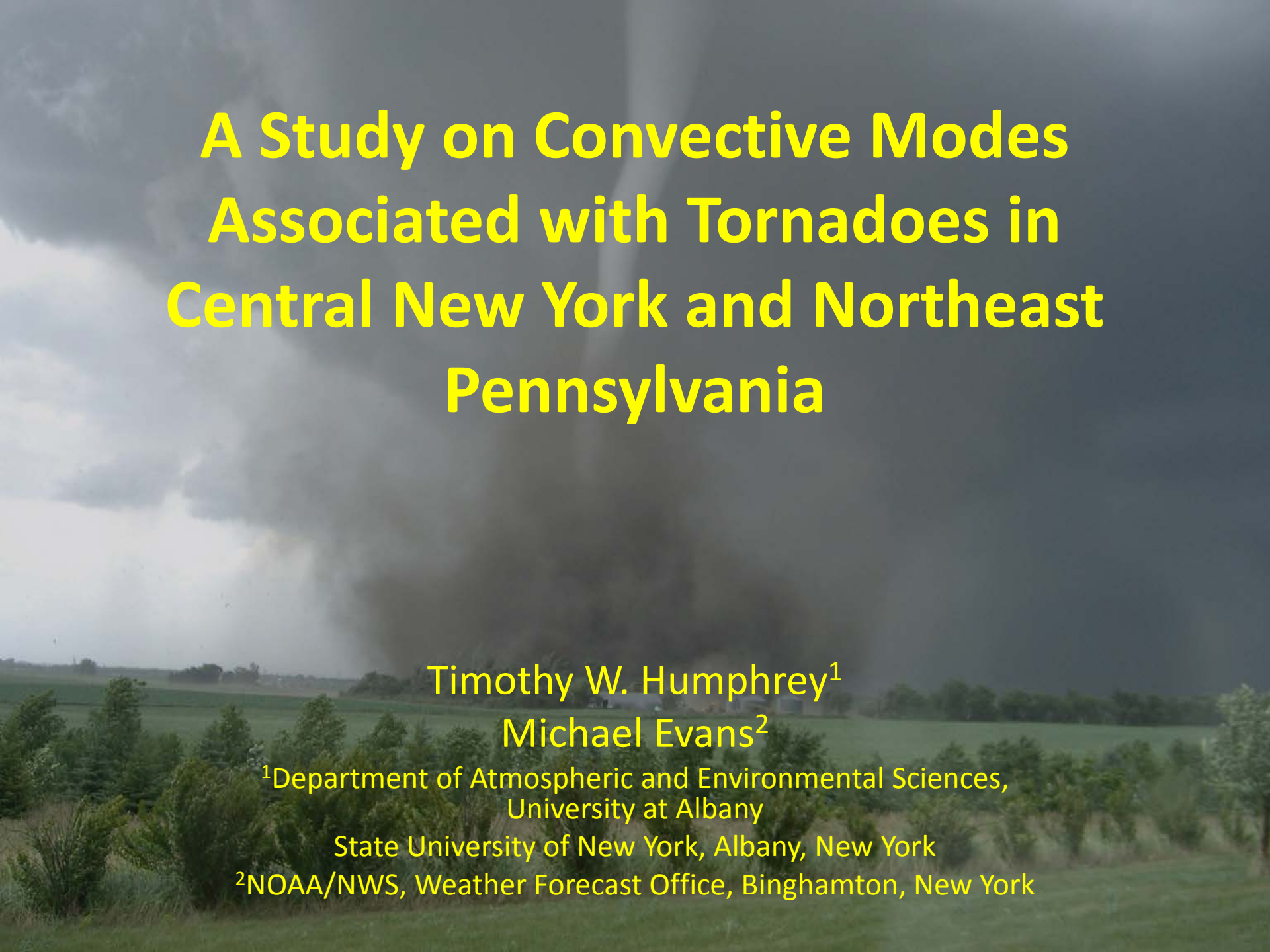

A Study on Convective Modes Associated with Tornadoes in Central New York and Northeast Pennsylvania

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Michael Evans[2]
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Outline

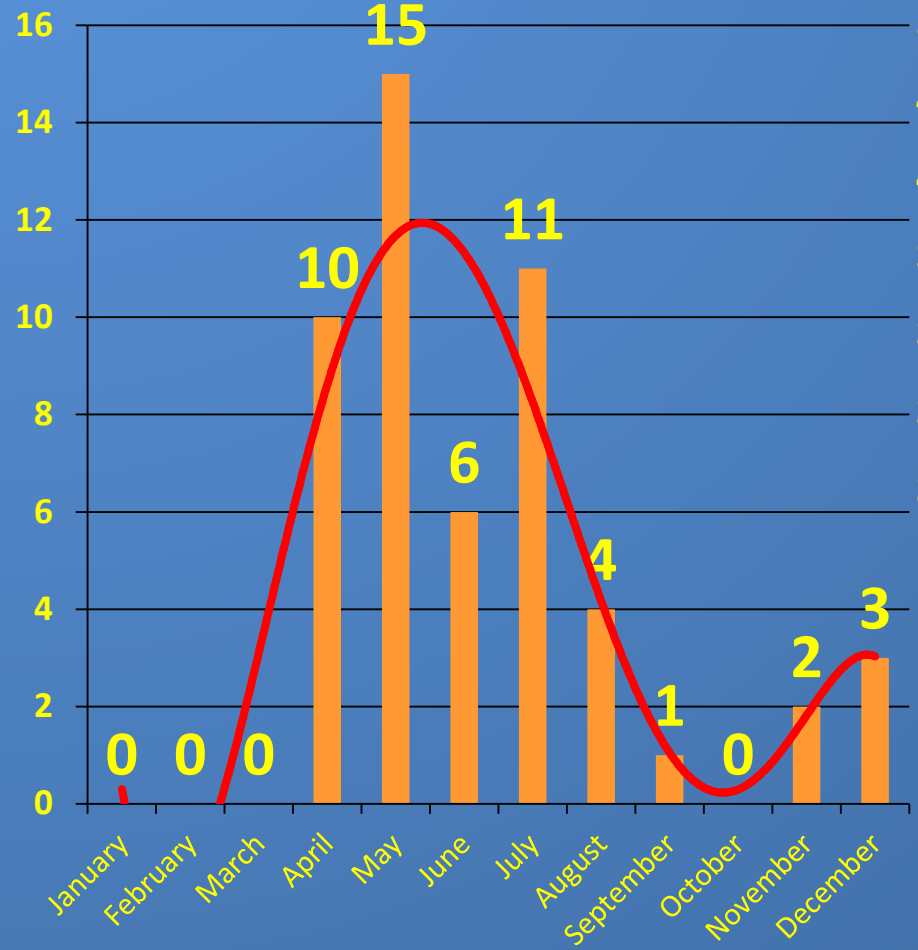
- Climatology
- Storm Environments
- Null Events
- Radar Study
- Conclusions

Climatology

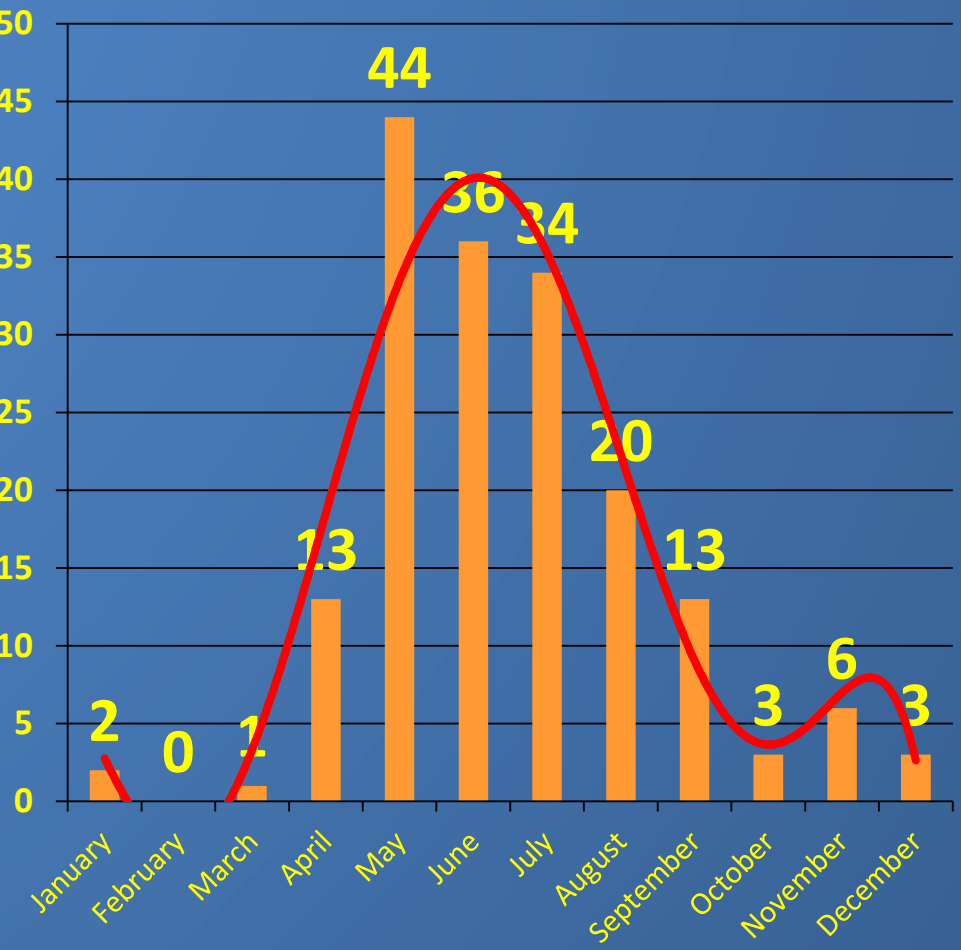
52 Tornadoes

2000 – May 2011

Month of Tornado Occurrence 2000 - 2011



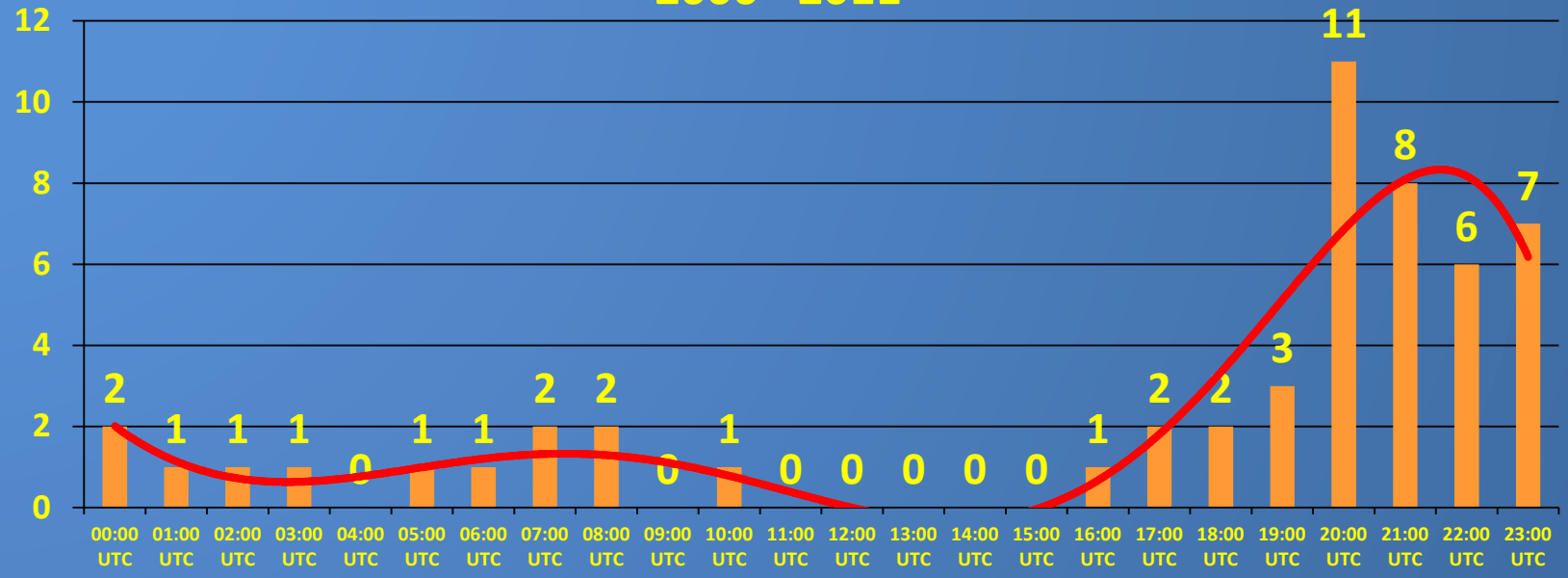
Month of Tornado Occurrence 1950 - 2011



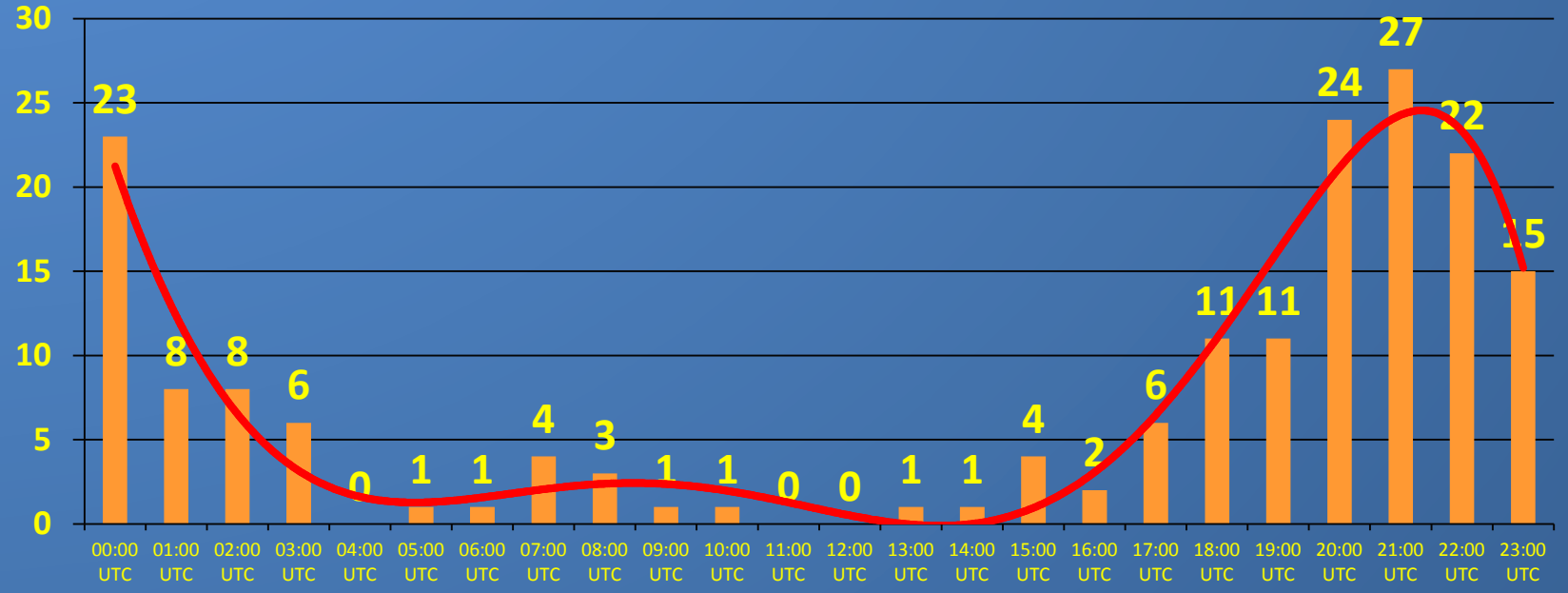
Number of Tornadoes

Time of Tornado Occurrence

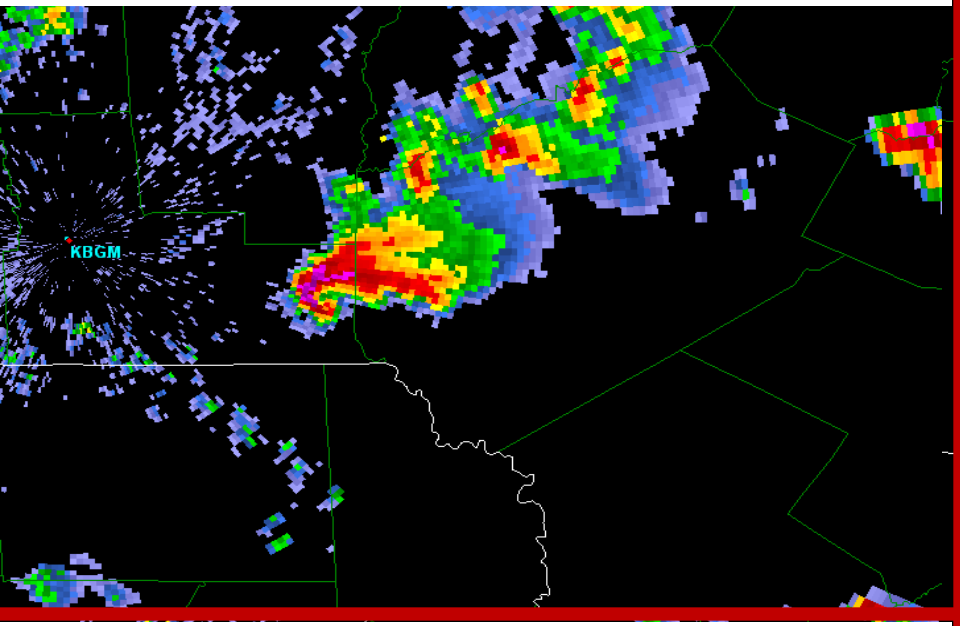
2000 - 2011



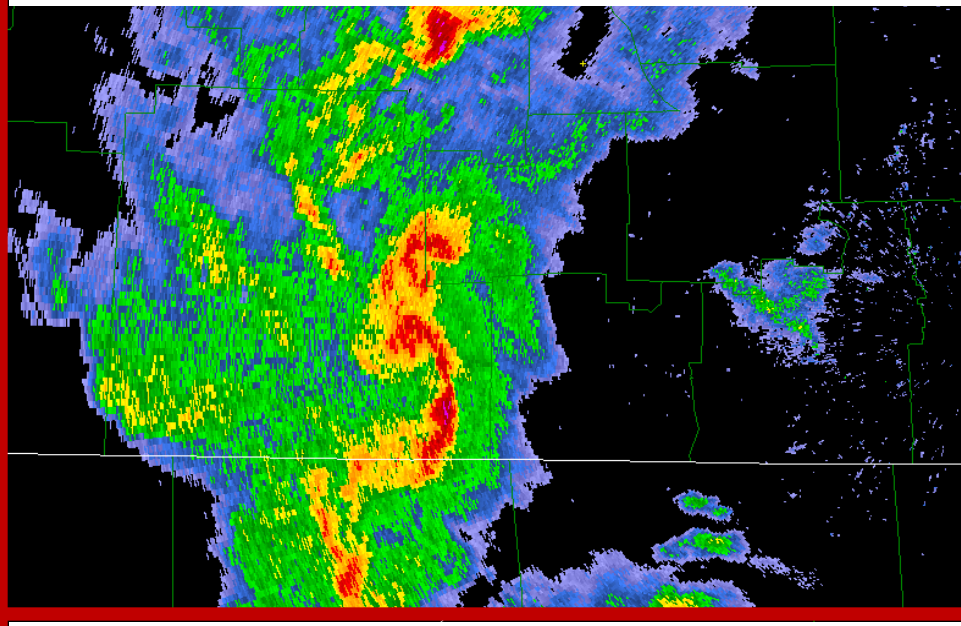
1950 - 2011



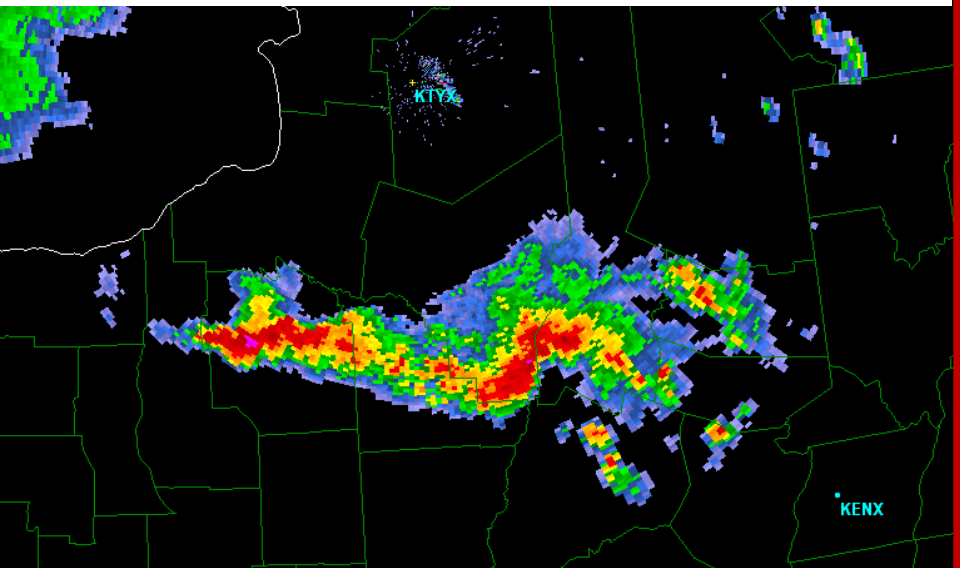
Supercell



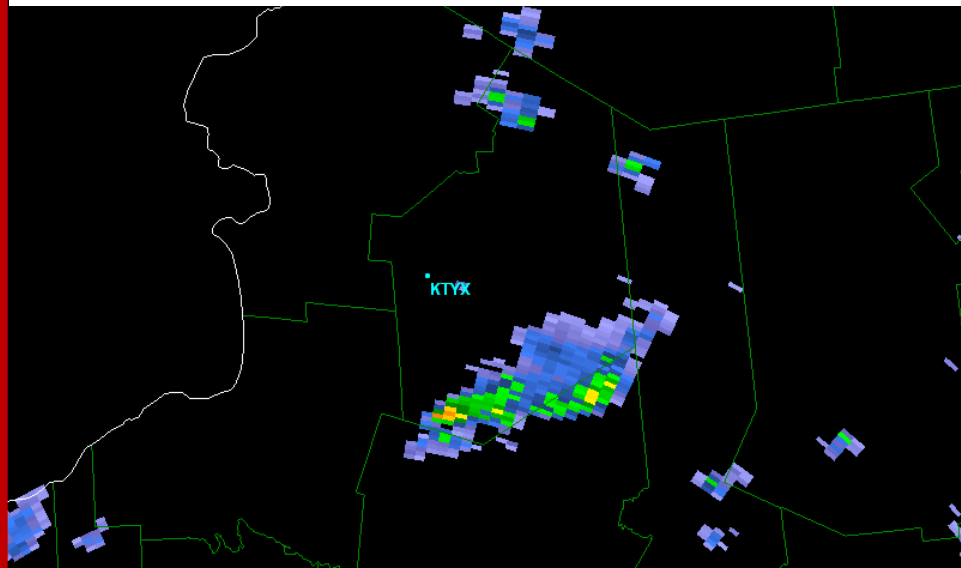
QLCS



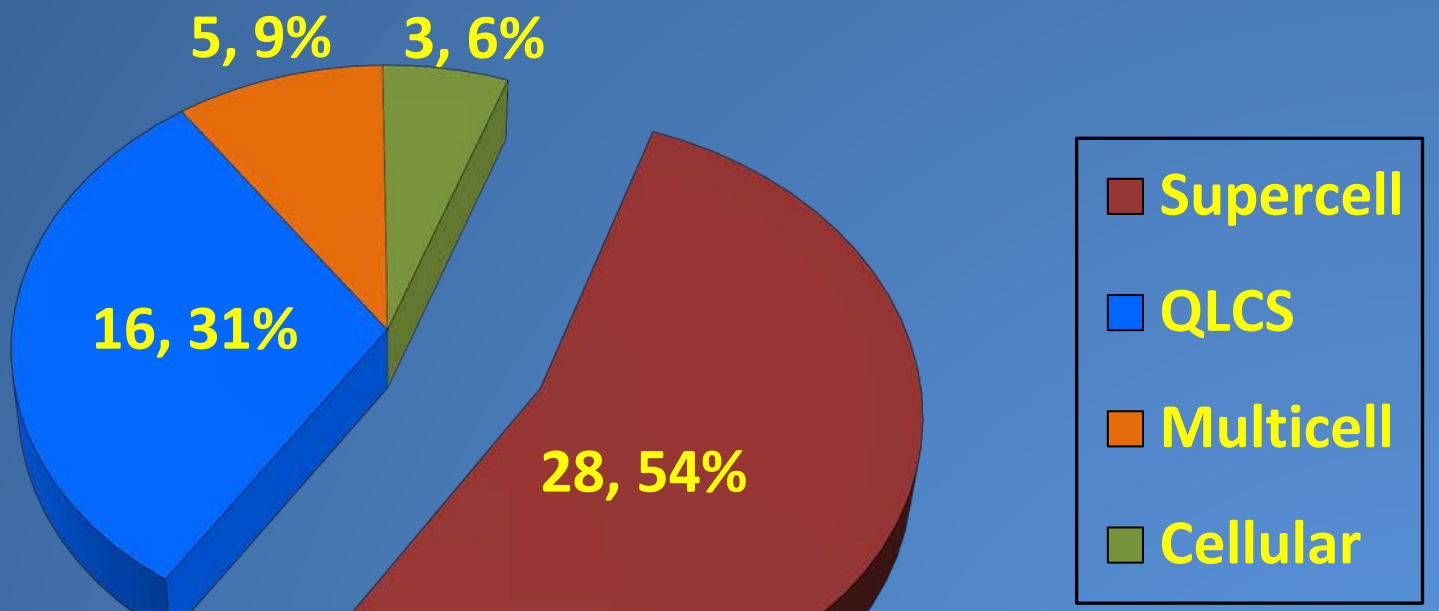
Multicell



Cellular



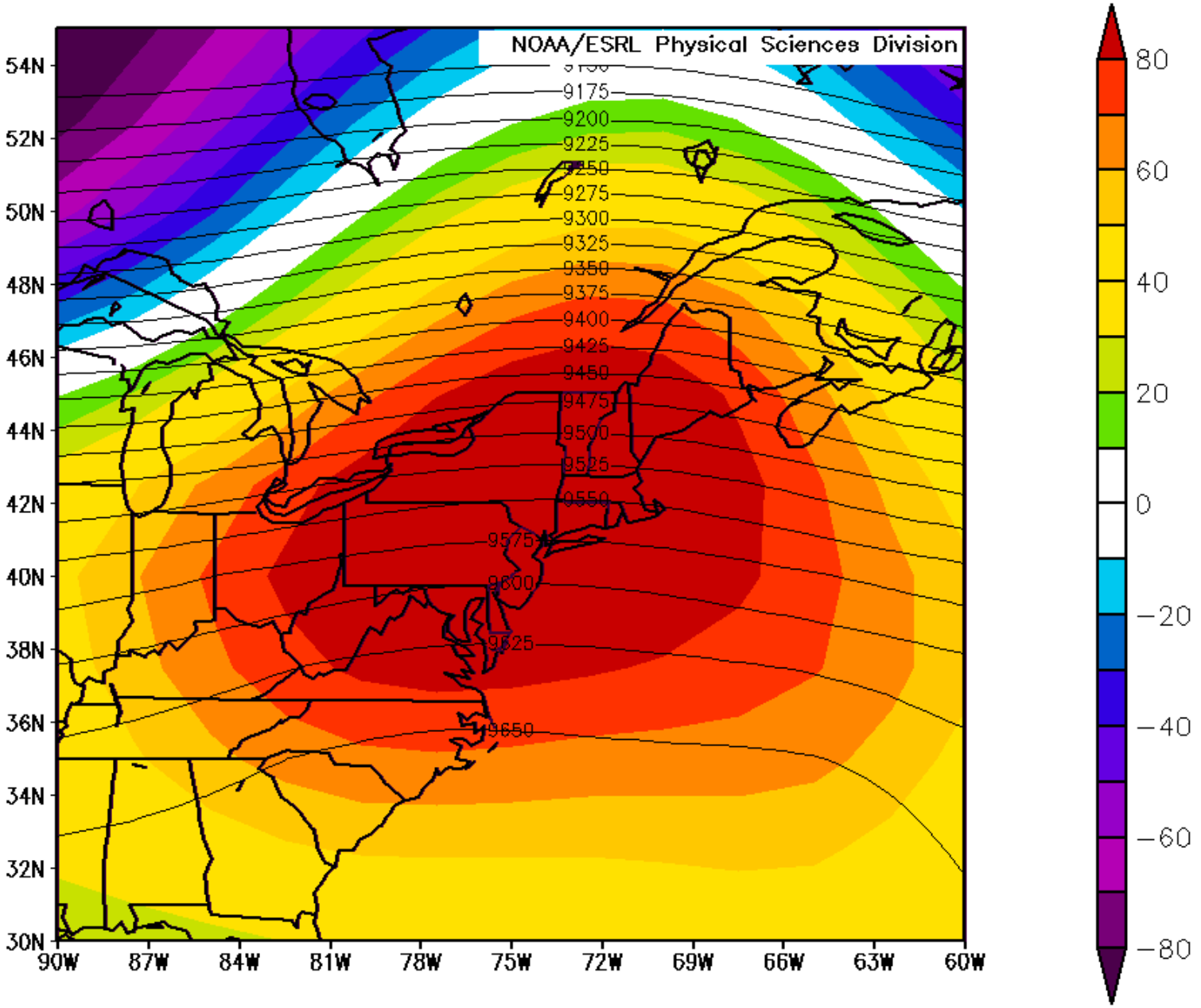
Tornadoes by Convective Mode
2000 - 2011



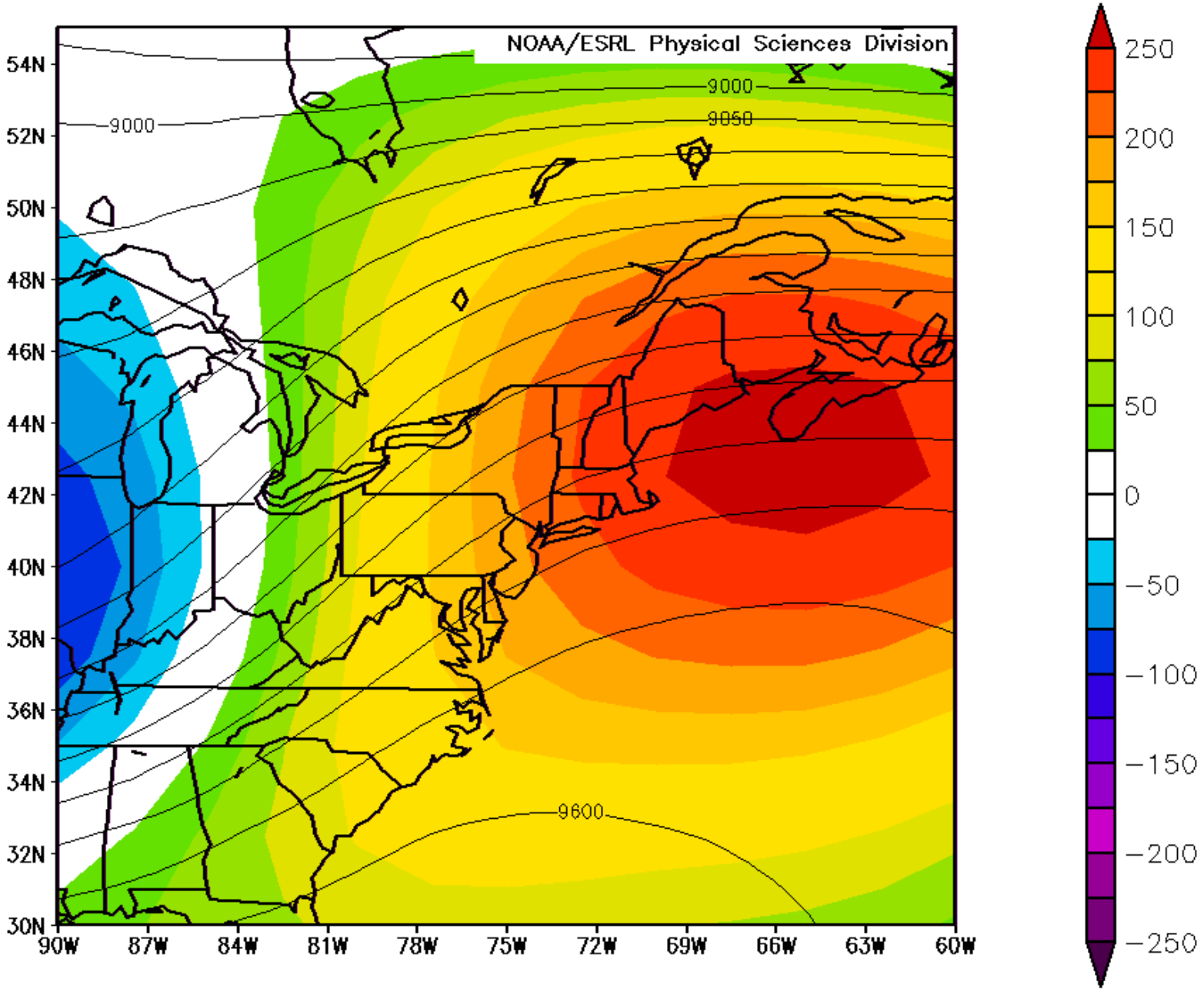
Storm Environment

- Synoptic Environment (2000 – 2011)
  - NOAA Earth System Research Laboratory
- Mesoscale Environment (2005 – 2011)
  - Storm Prediction Center (SPC) Mesoanalysis Archive

Supercell 300 hPa Height and Anomaly



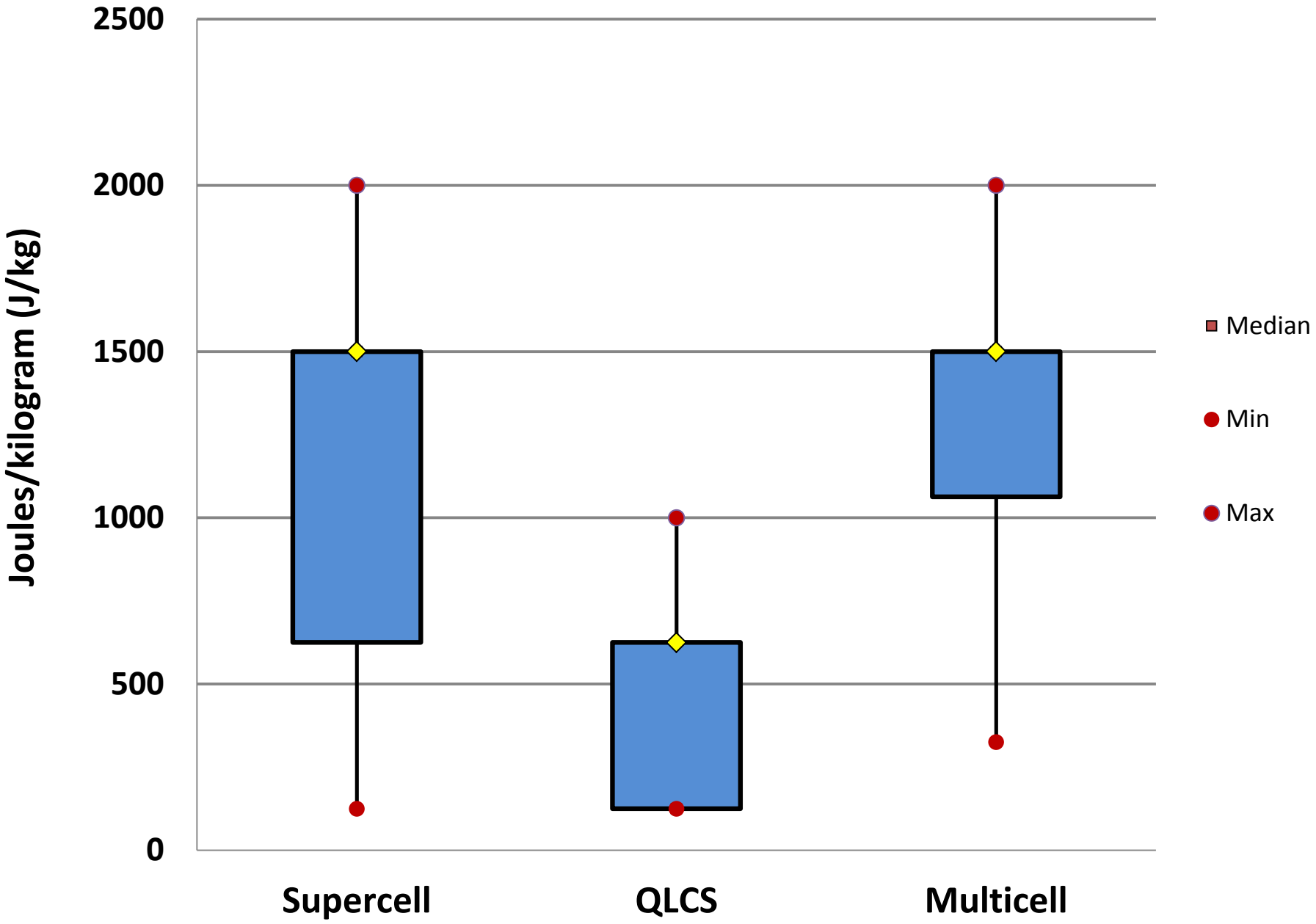
QLCS 300hPa Height and Anomaly



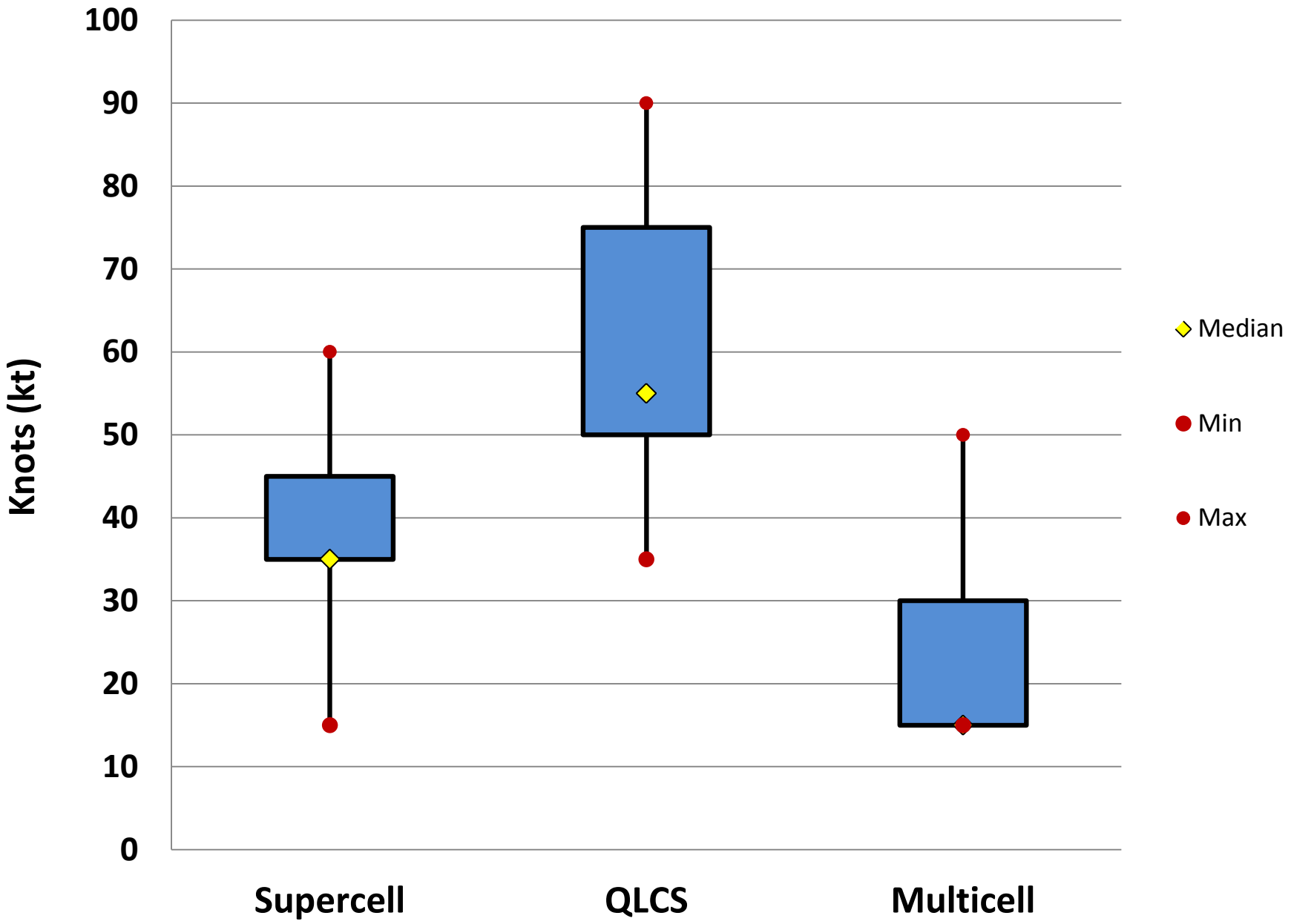
Mesoscale Environment

- SPC Mesoanalysis Archive (2005-2011)
- **36** Tornado Events
- **19** Thermodynamic, Shear, & Composite Parameters

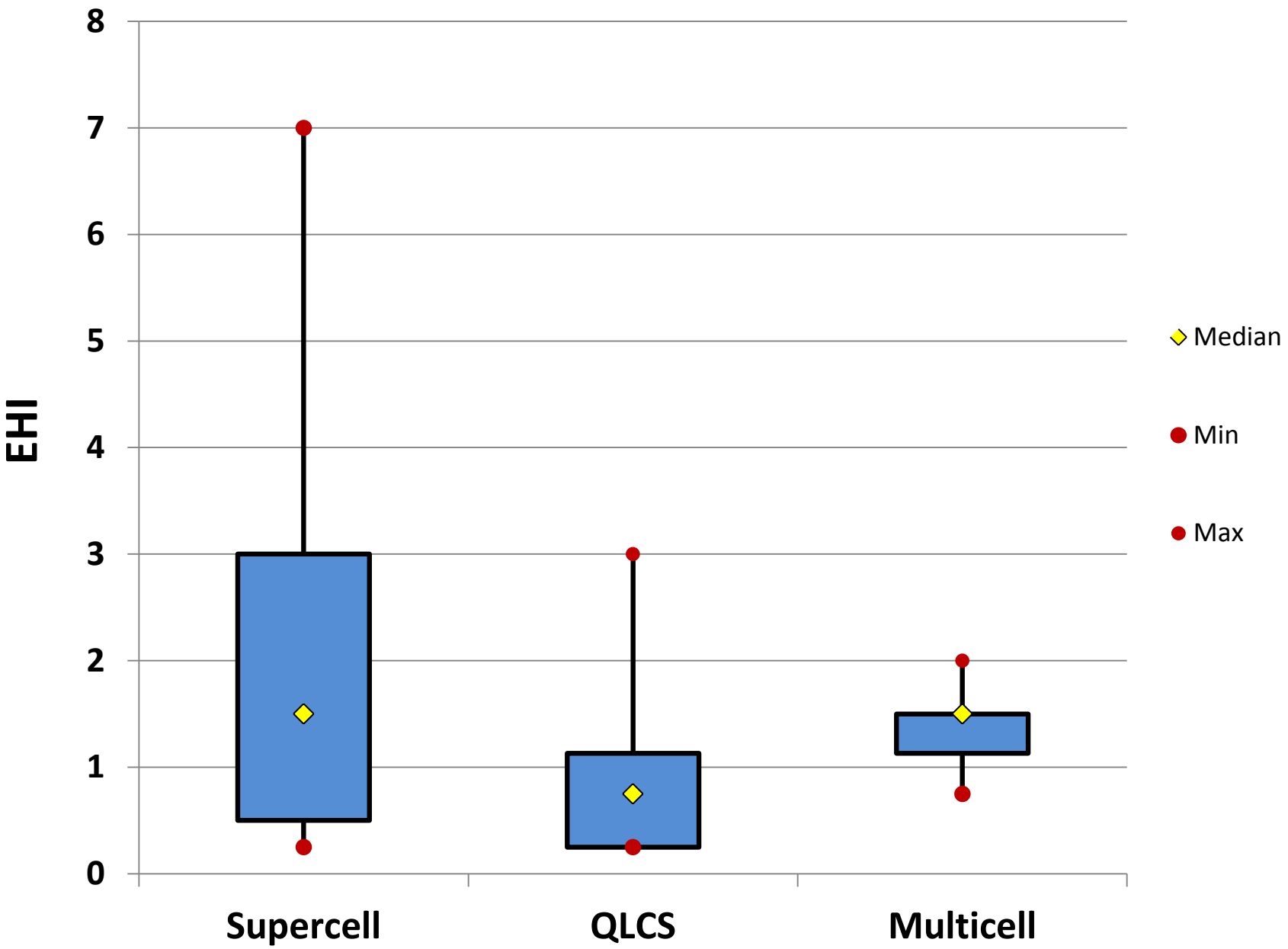
Surface Based CAPE By Convective Mode



0 – 6 km Bulk Shear



0 – 3km Energy-Helicity Index (EHI)



Storm Environment

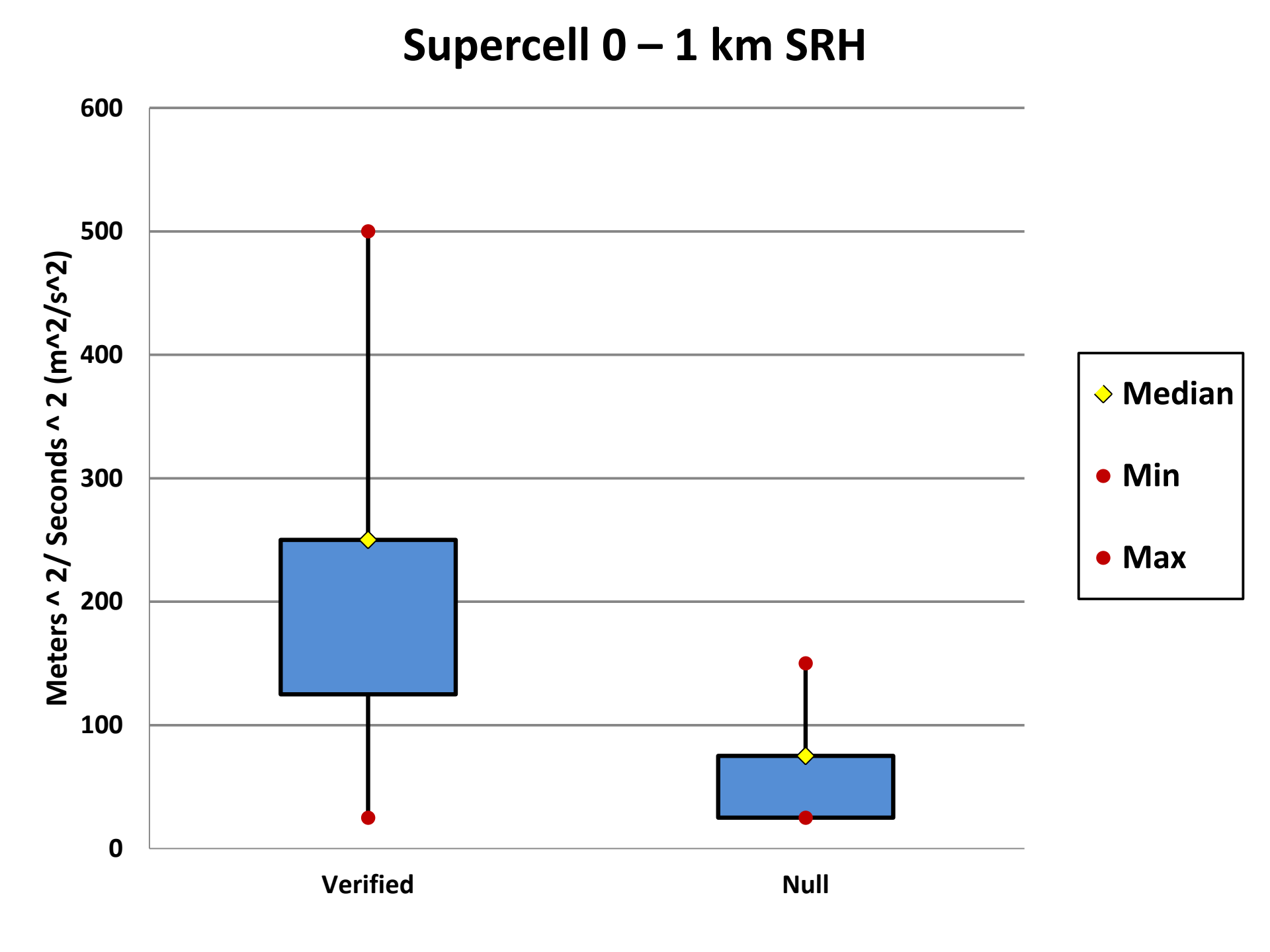
	CAPE	LCL Height	Shear	Helicity
Supercell	Moderate	Low	Moderate	Moderate
Multicell	Moderate	Low	Low	Moderate
QLCS	Low	Low	High	High

Null Events

Iowa Environmental Mesonet

(IEM) Cow Application

21 Null Events


Supercell 0 – 1 km SRH
600
500
400
300
200
100
0
Meters ^ 2/ Seconds ^ 2 (m^2/s^2)
Verified
Null
Median
Min
Max

Radar Study

Rotational Velocity (Vr)

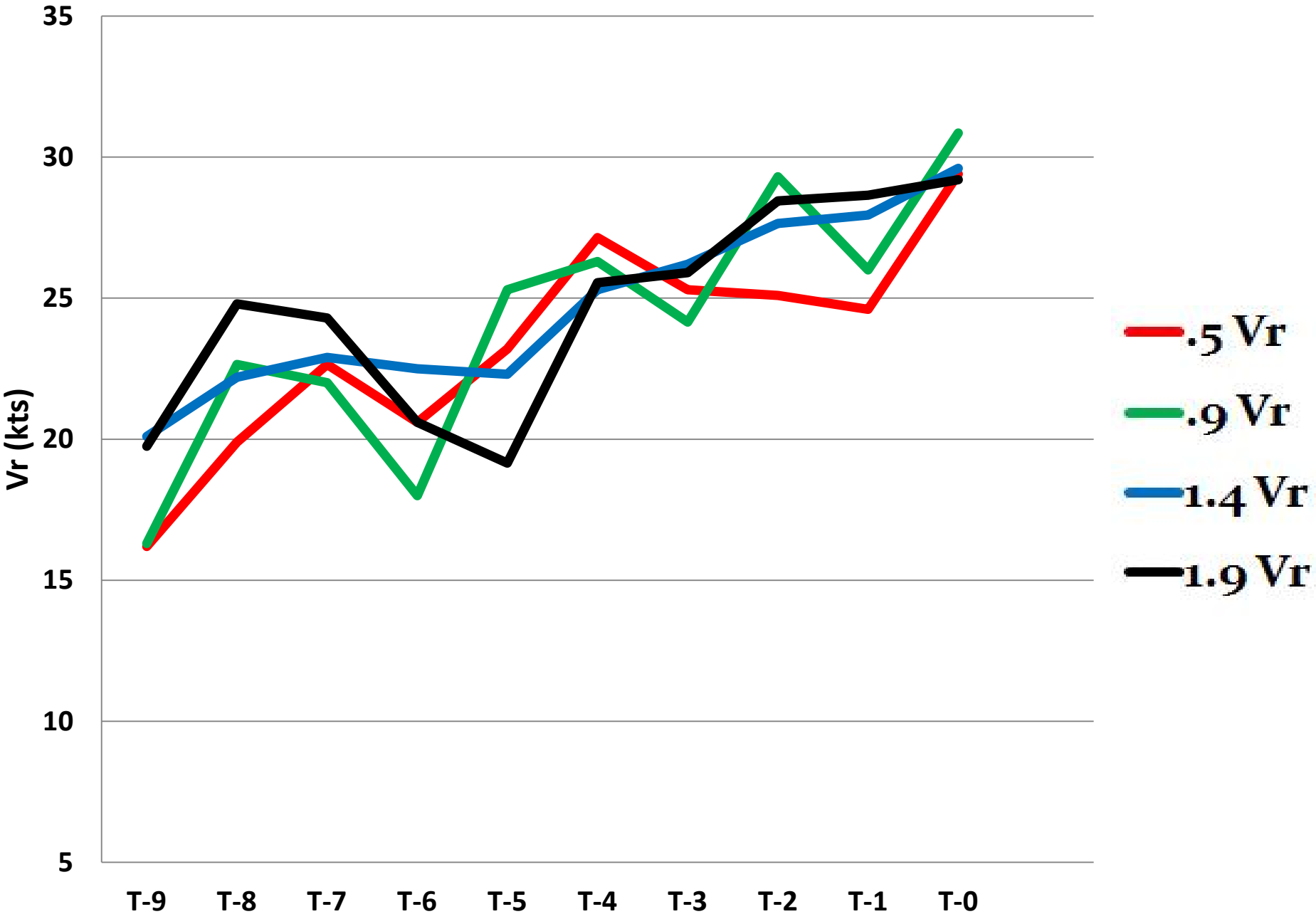
Shear

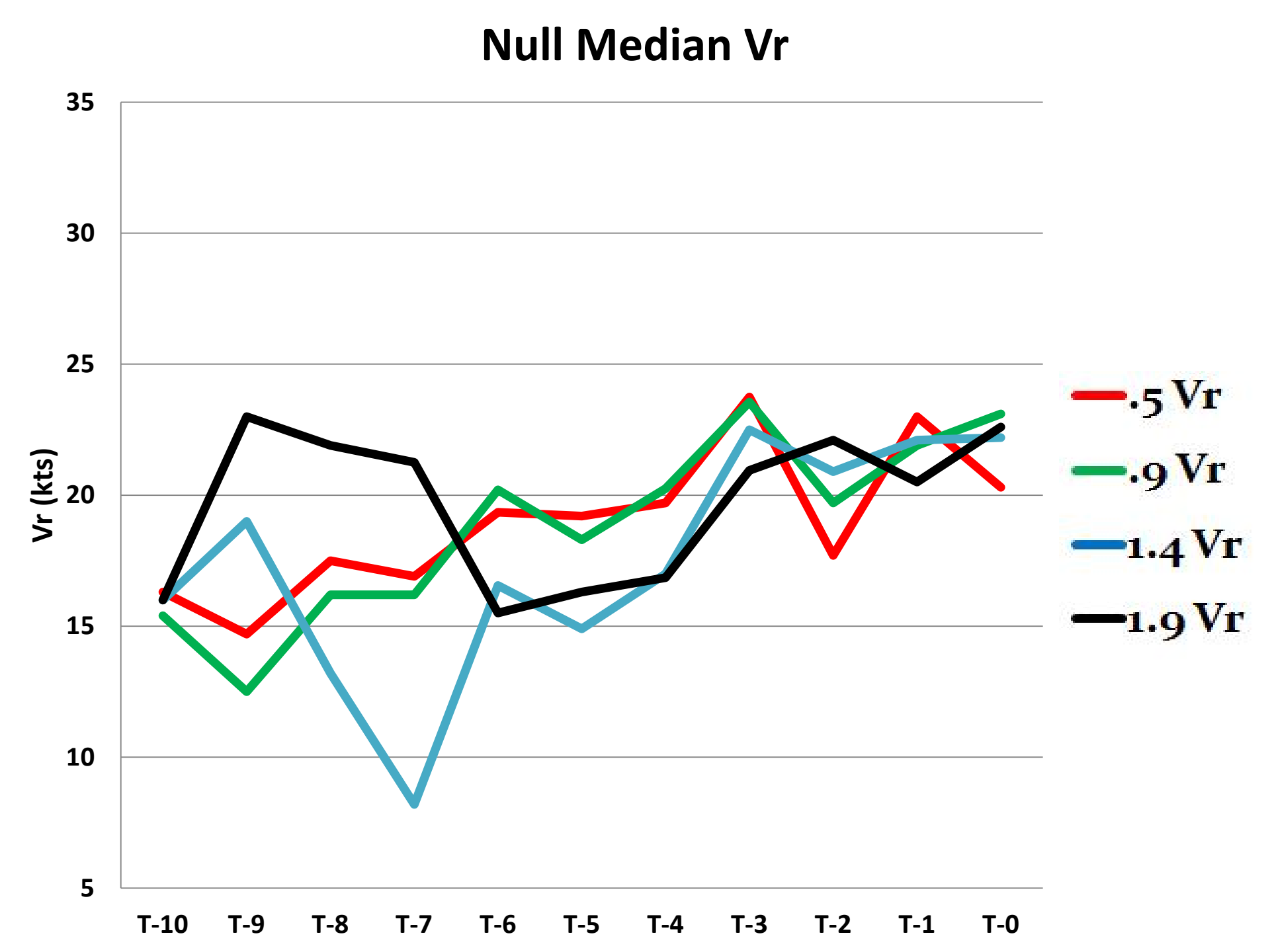
Spectrum Width

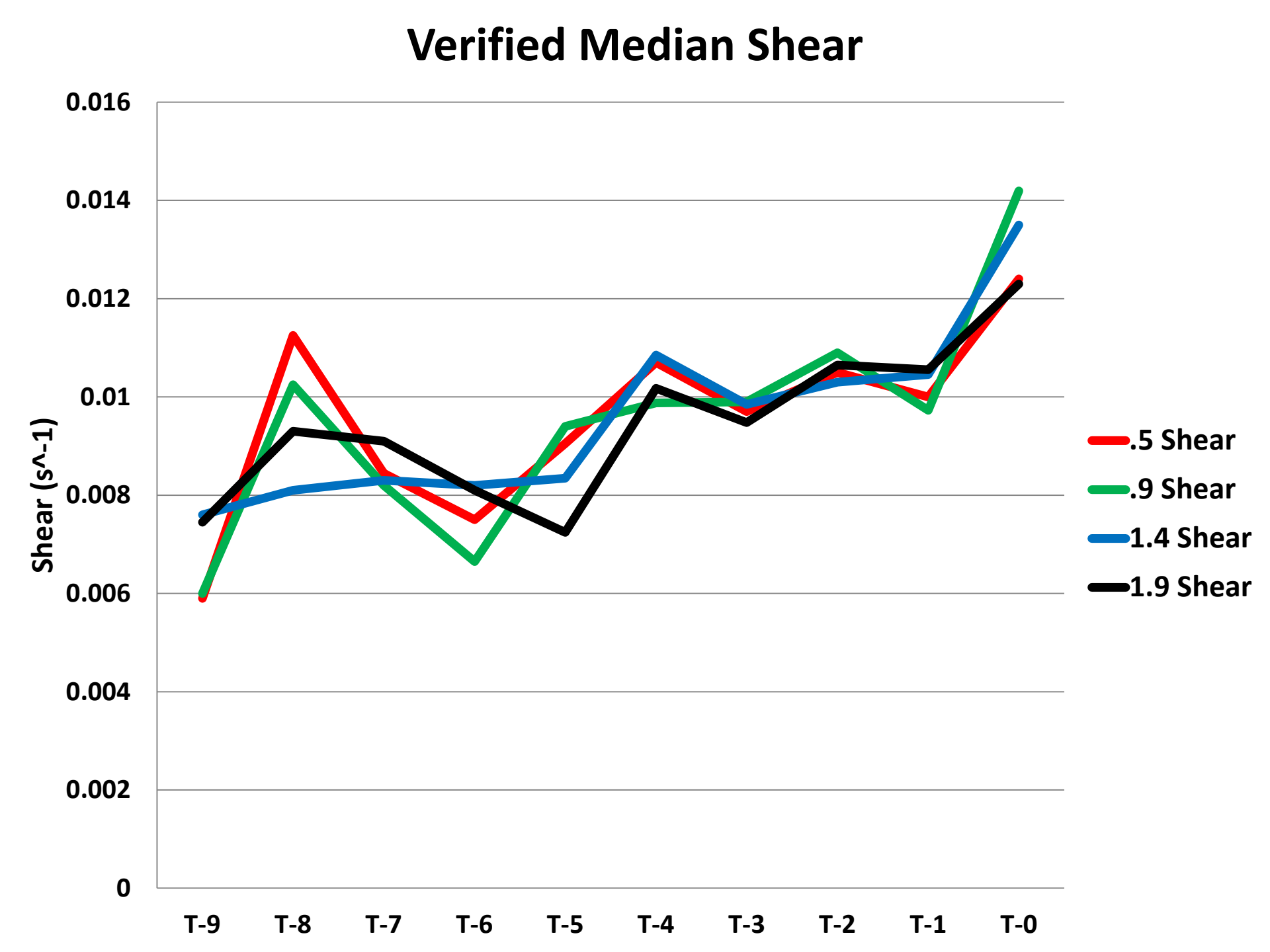
Normalized Rotation (NROT)

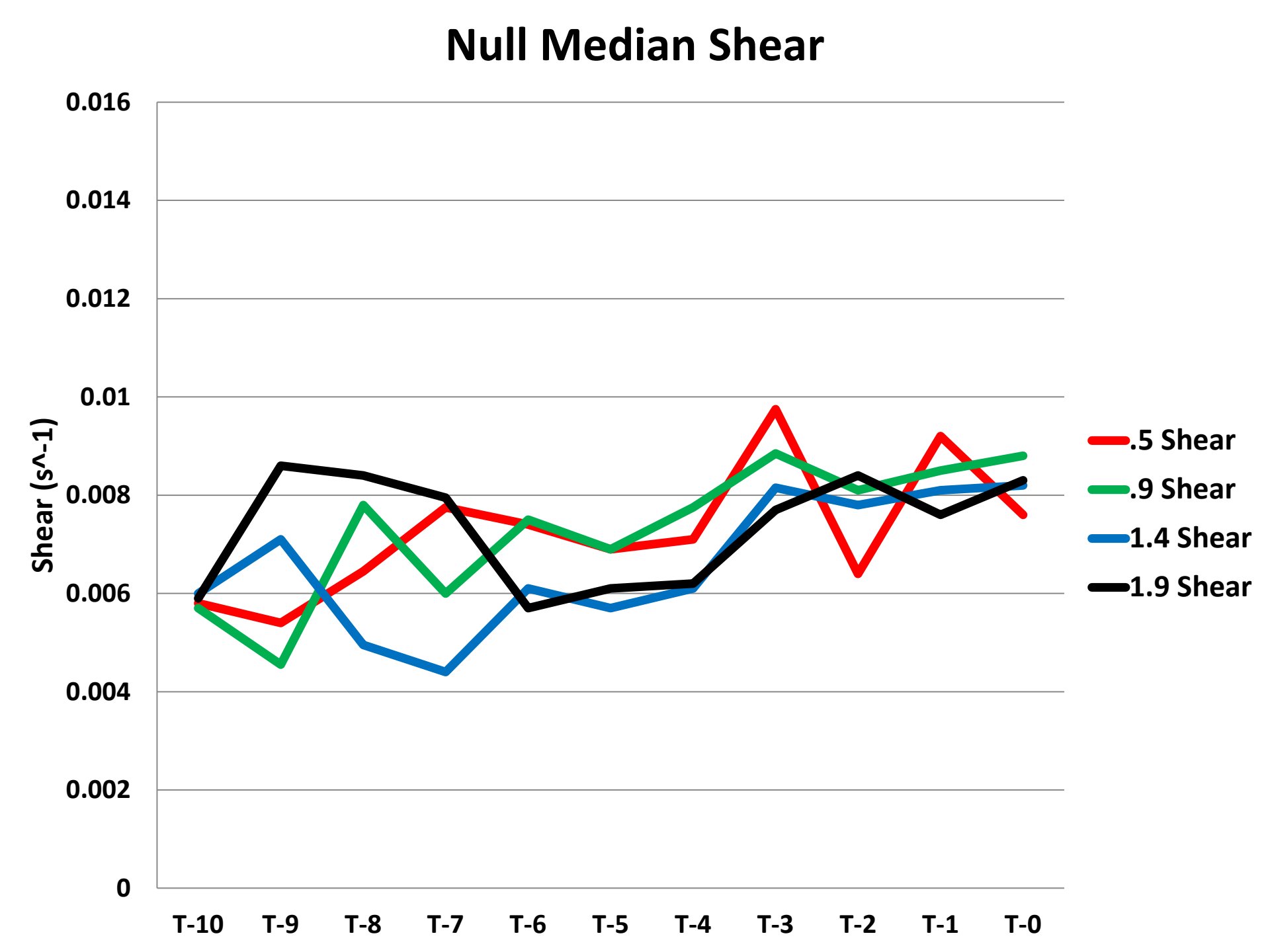
Supercells

Verified Median Rotational Velocity (Vr)

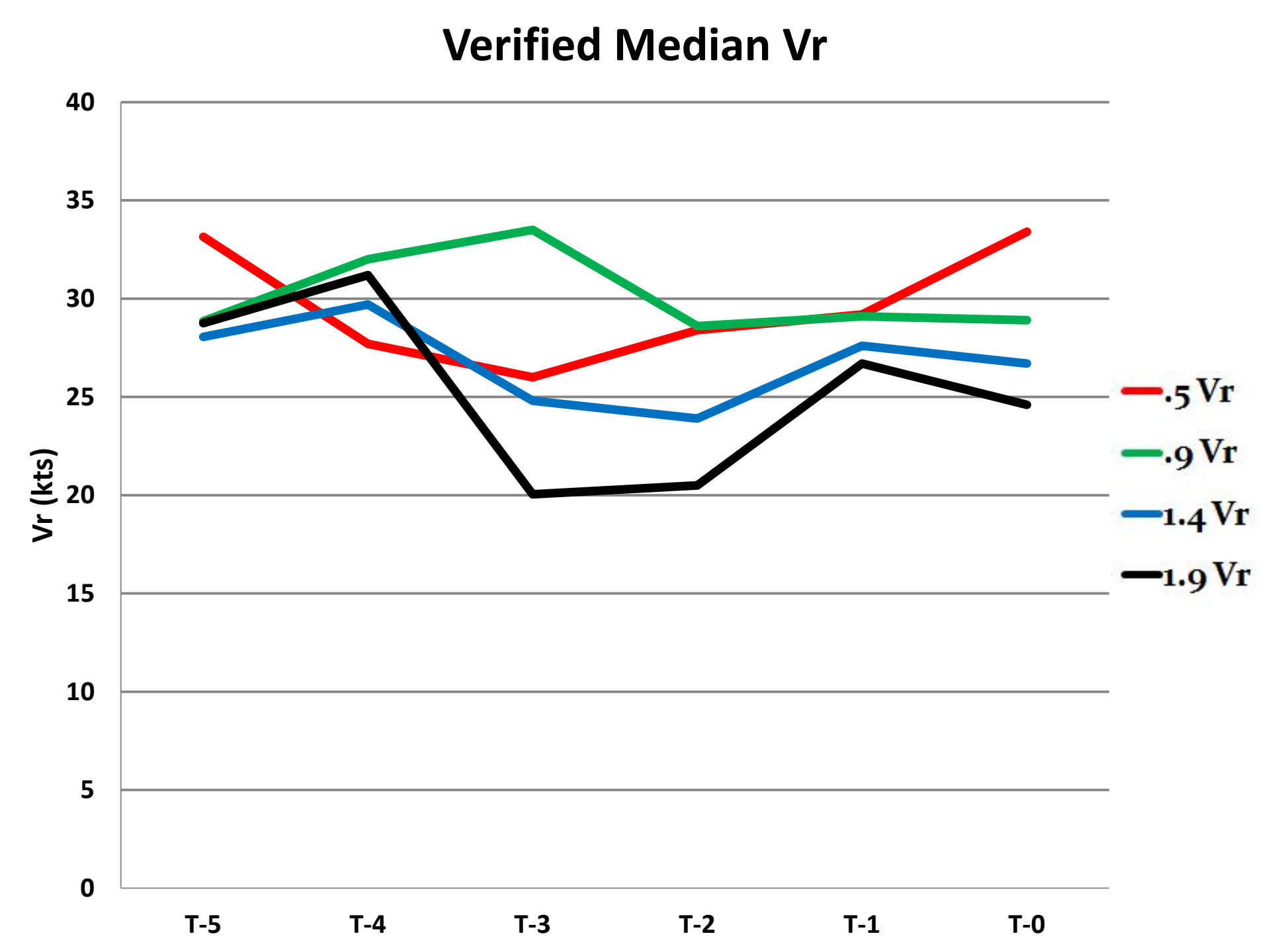


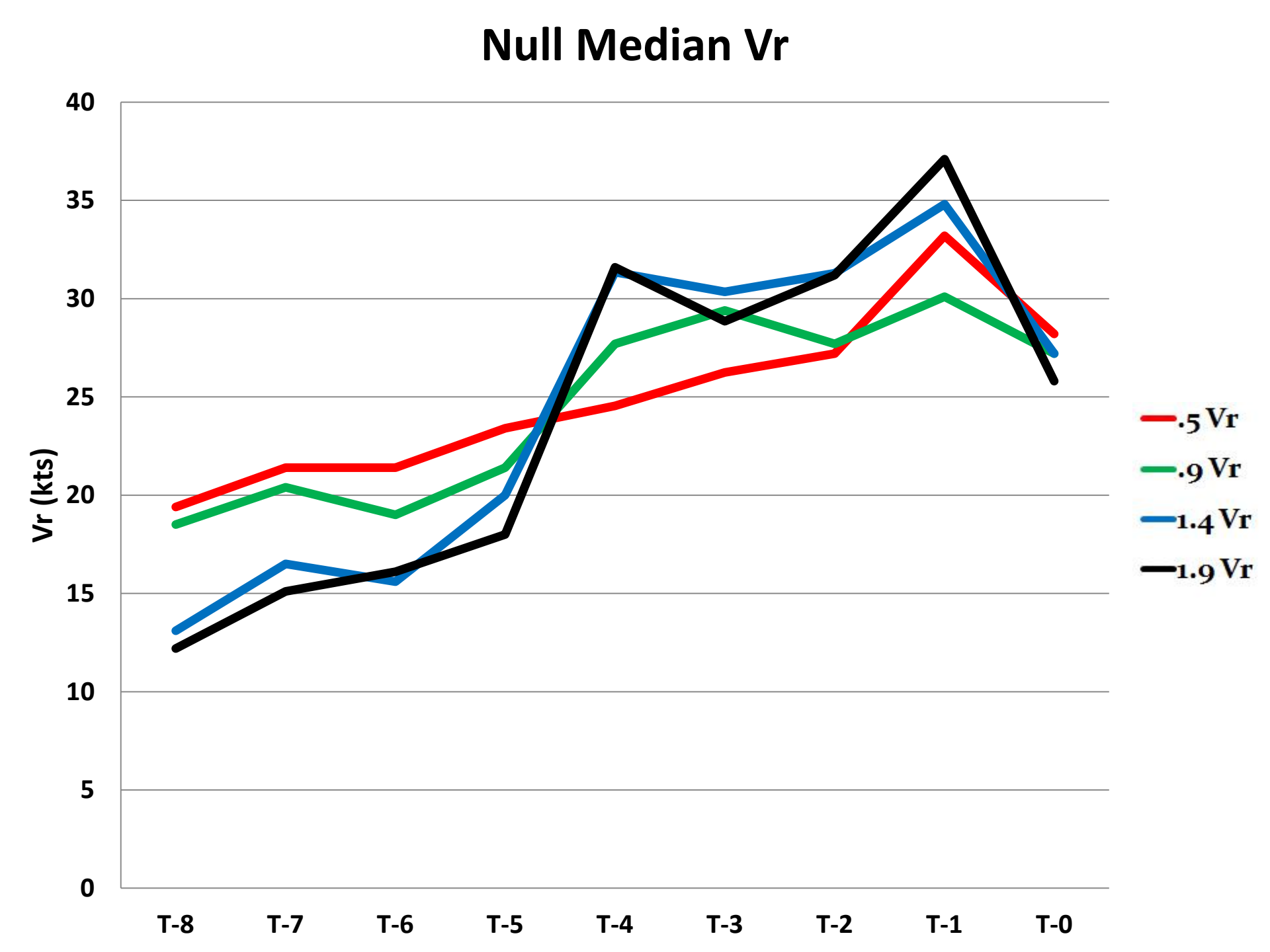

Null Median Vr
35
30
25
20
15
10
5
Vr (kts)
T-10
T-9
T-8
T-7
T-6
T-5
T-4
T-3
T-2
T-1
T-0
.5 Vr
.9 Vr
1.4 Vr
1.9 Vr

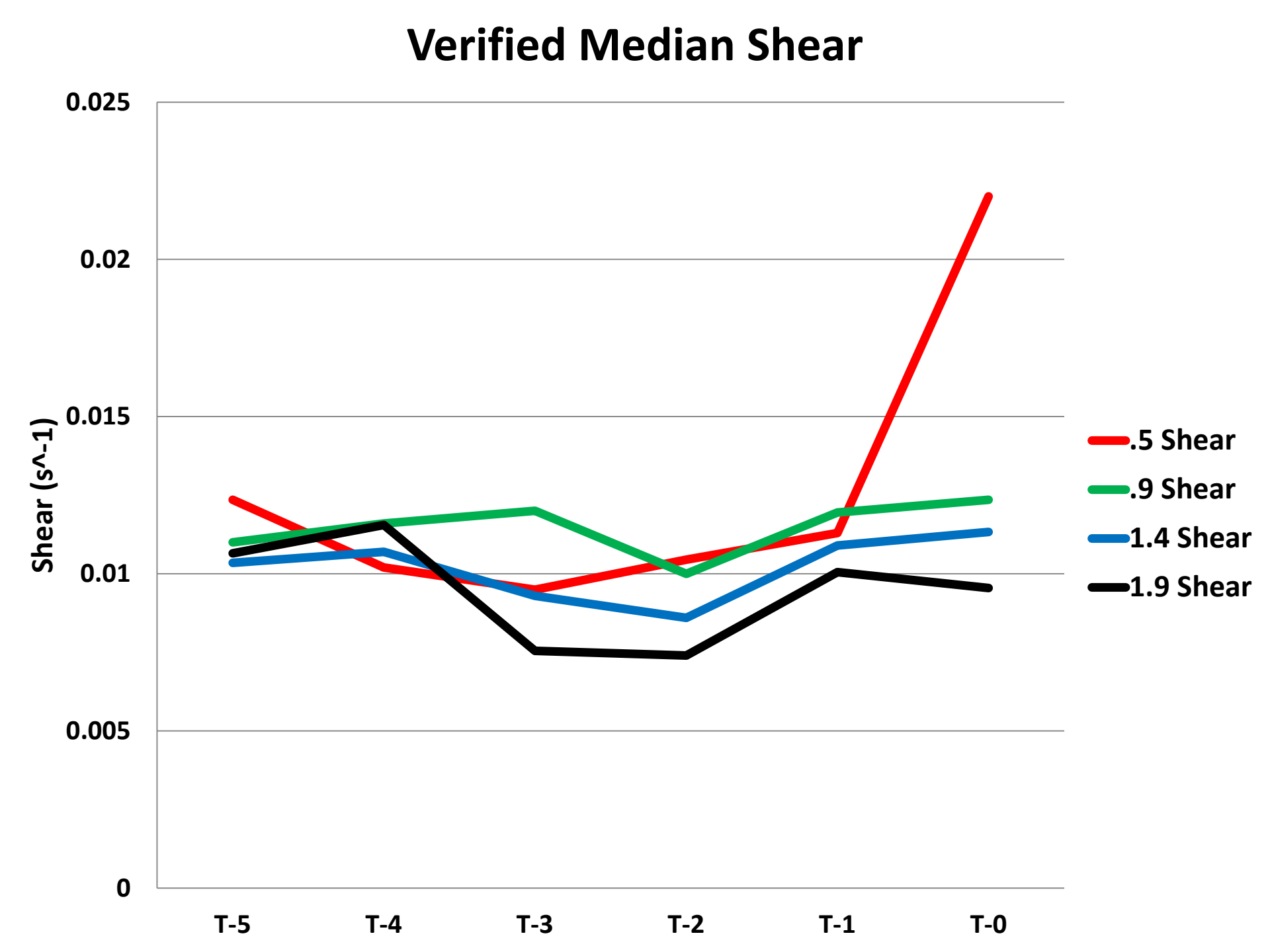

Verified Median Shear
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
Shear (s^-1)
T-9
T-8
T-7
T-6
T-5
T-4
T-3
T-2
T-1
T-0
.5 Shear
.9 Shear
1.4 Shear
1.9 Shear

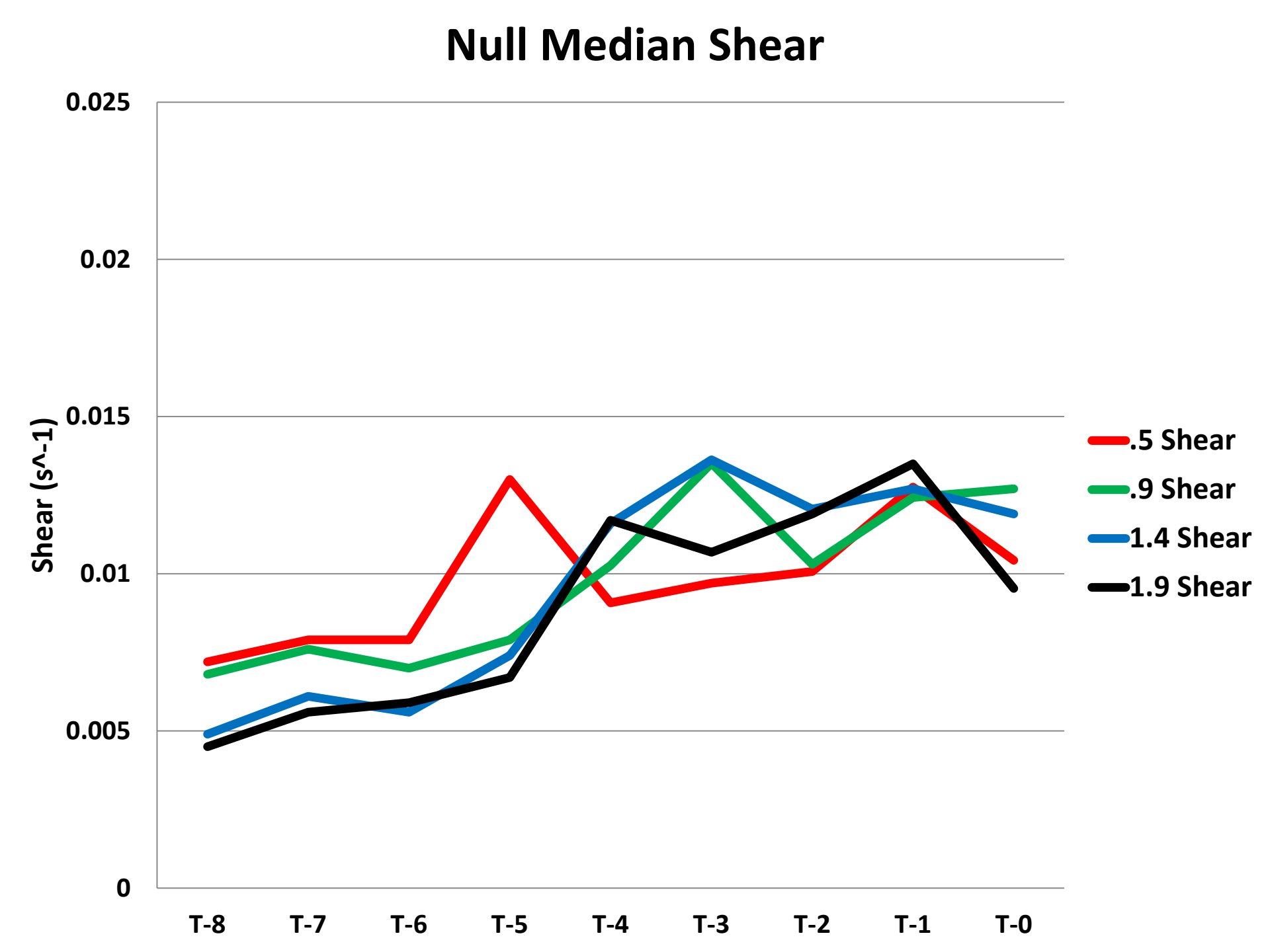

Null Median Shear
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
Shear (s^-1)
T-10
T-9
T-8
T-7
T-6
T-5
T-4
T-3
T-2
T-1
T-0
.5 Shear
.9 Shear
1.4 Shear
1.9 Shear

QLCSs


Verified Median Vr
40
35
30
25
20
15
10
5
0
Vr (kts)
T-5
T-4
T-3
T-2
T-1
T-0
.5 Vr
.9 Vr
1.4 Vr
1.9 Vr

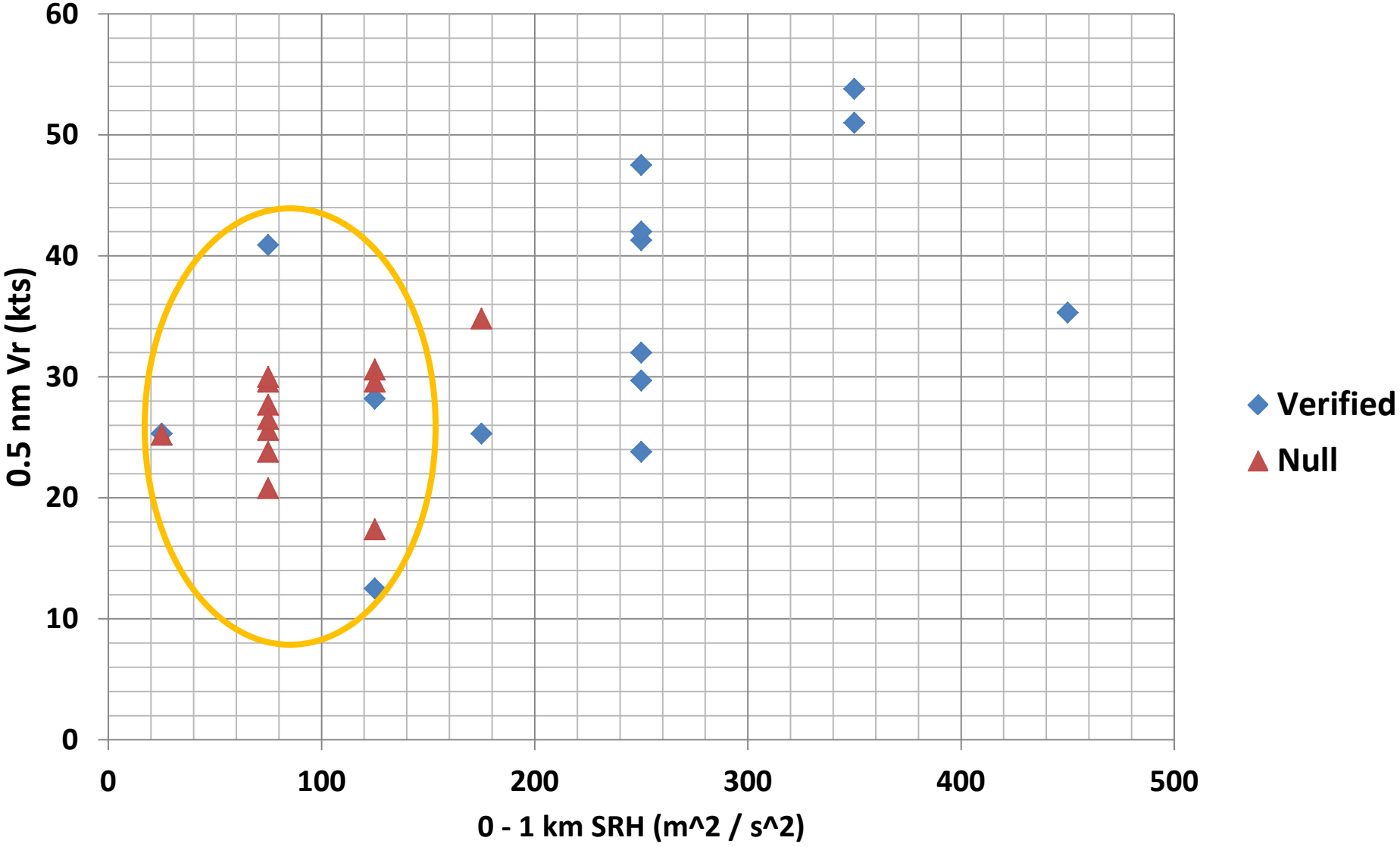

Null Median Vr
Vr (kts)
40
35
30
25
20
15
10
5
0
T-8
T-7
T-6
T-5
T-4
T-3
T-2
T-1
T-0
.5 Vr
.9 Vr
1.4 Vr
1.9 Vr


Verified Median Shear
0.025
0.02
0.015
0.01
0.005
0
Shear (s^-1)
T-5
T-4
T-3
T-2
T-1
T-0
.5 Shear
.9 Shear
1.4 Shear
1.9 Shear

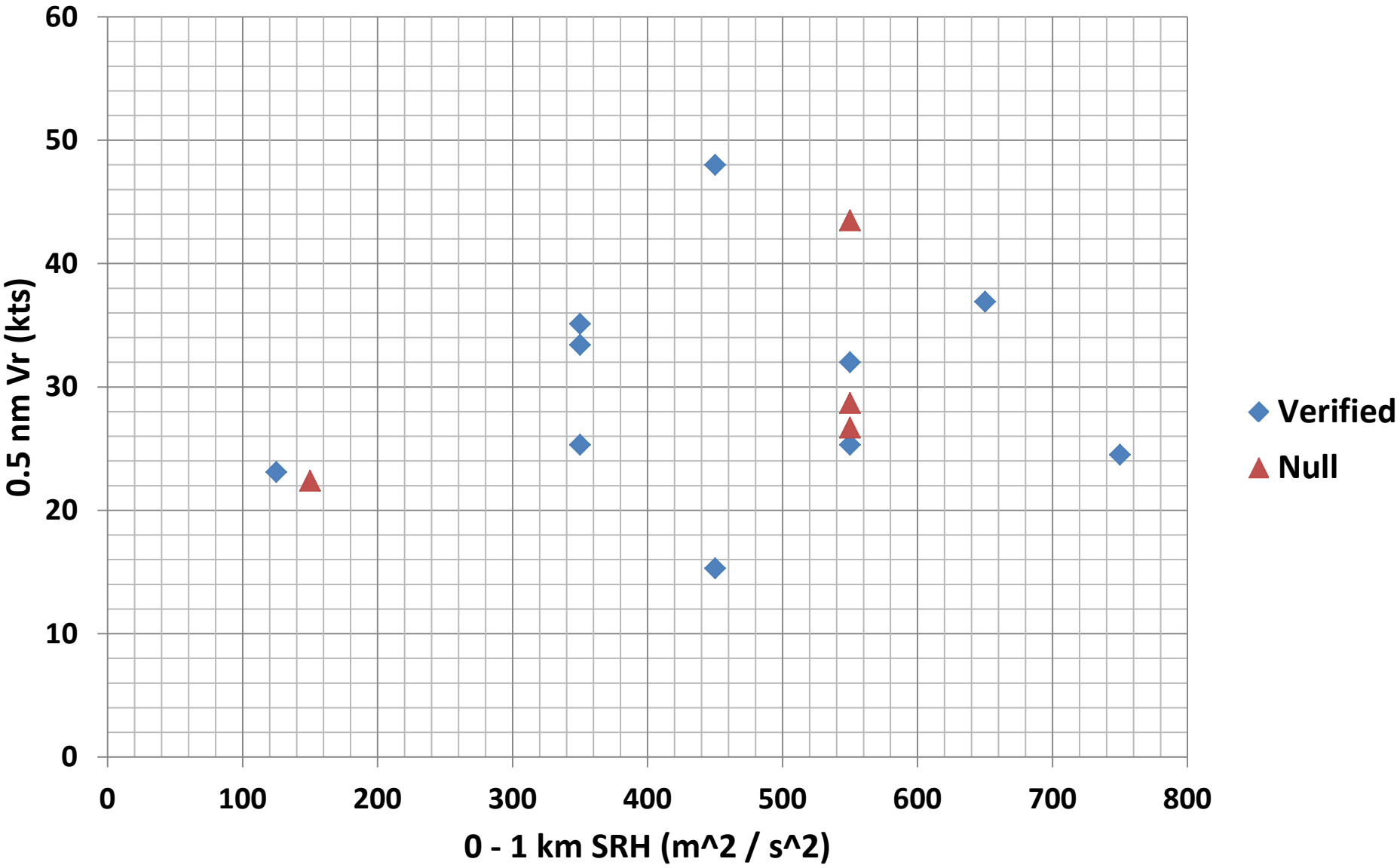

Null Median Shear
0.025
0.02
0.015
0.01
0.005
0
Shear (s^-1)
T-8
T-7
T-6
T-5
T-4
T-3
T-2
T-1
T-0
.5 Shear
.9 Shear
1.4 Shear
1.9 Shear

Supercells	QLCSs
Rotation “spins down” to the surface	Rotation “spins up” from surface
Uniform shear in lowest elevation angles	Spikes in shear in lowest elevation angles
Low level rotation: ~20 min	Low level rotation: ~12 min

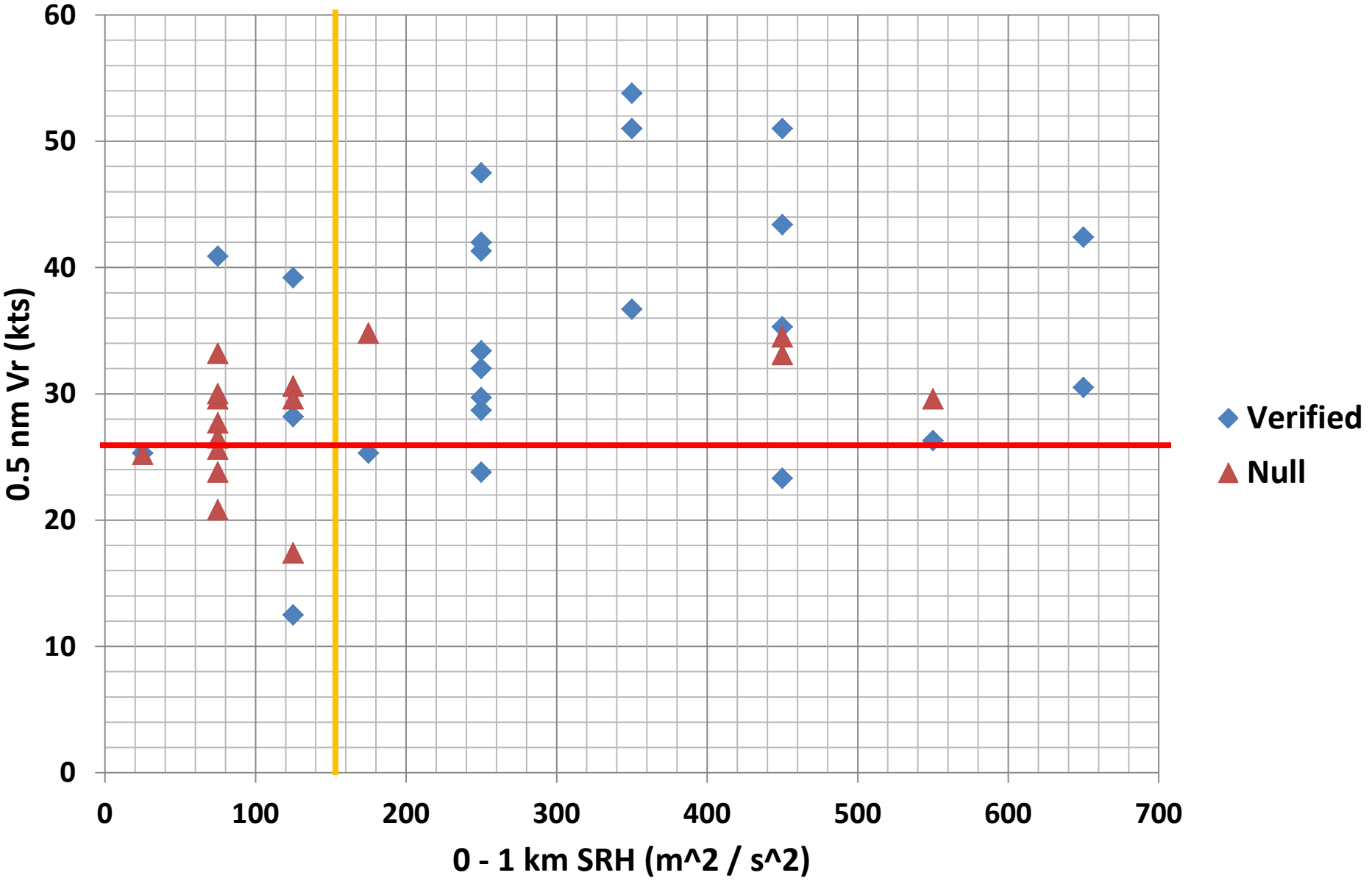
Supercell Rotational Velocity (Vr)



QLCS Rotational Velocity (Vr)



Supercell/QLCS Vr



Conclusions

- Majority of tornadoes associated with supercells
- Supercell tornadoes appeared dependent on mesoscale conditions
- QLCS had little difference in mesoscale conditions
- Low level helicity a good discriminator between verified and null events

References:

Thompson, R.L., R Edwards, J.A. Hart, K.L. Elmore, and P. Markowski, 2003: Close proximity soundings within supercell environments obtained from the Rapid Update Cycle. *Wea. Forecasting,* ***18, 1243-1261.***

Trapp, R.J., S. A. Tessendorf, E. S. Godfrey, and H. E. Brooks, 2005: Tornadoes from squall lines and bow echoes. Part I: Climatological distribution. *Wea. Forecasting,* ***20, 23–34.***


Questions?
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