A Mini-Supercell Observed During an Outbreak of Classic Supercells on 9 May 2016

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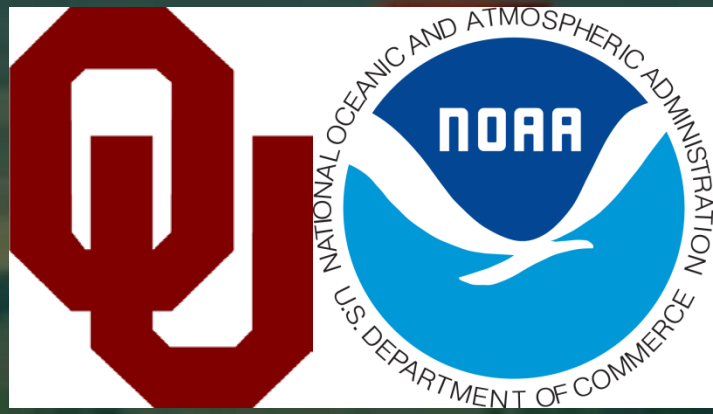
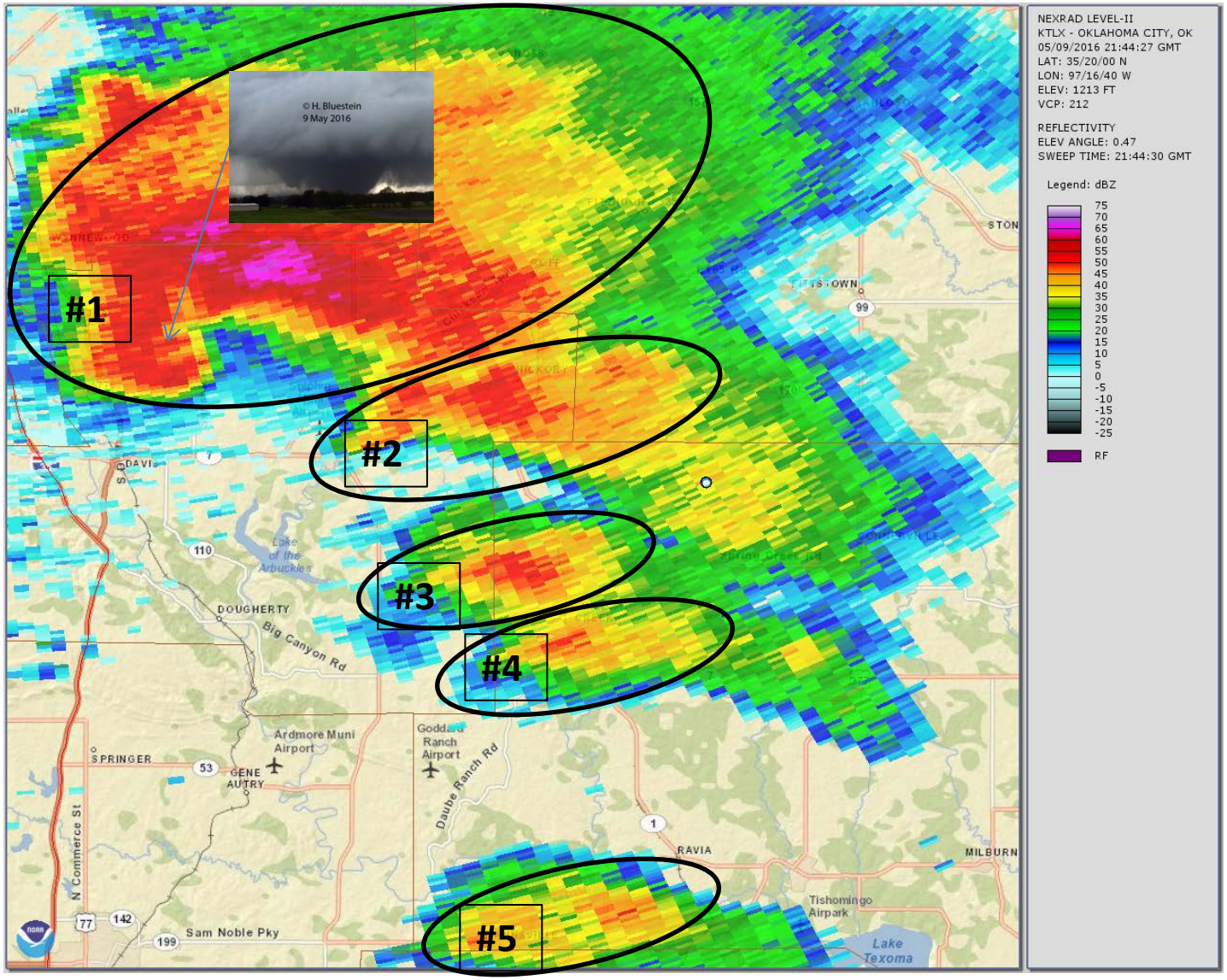


Video/Still Images of KFOR Helicopter Footage

- Tornado being filmed/shown by **KFOR** and shown live by **The Weather Channel**
- Several supercells in progress, not sure from which storm the tornado is occurring
- My rather cavalier mention of "**mini-supercell**," is the storm really a mini-supercell?
- Is something present within the storm environment of make this storm different from other supercells on this day?

Overview of Southern Oklahoma Storms

KTLX, 2145 UTC



#1 is LST* Supercell with EF4 & EF3+ tornadoes

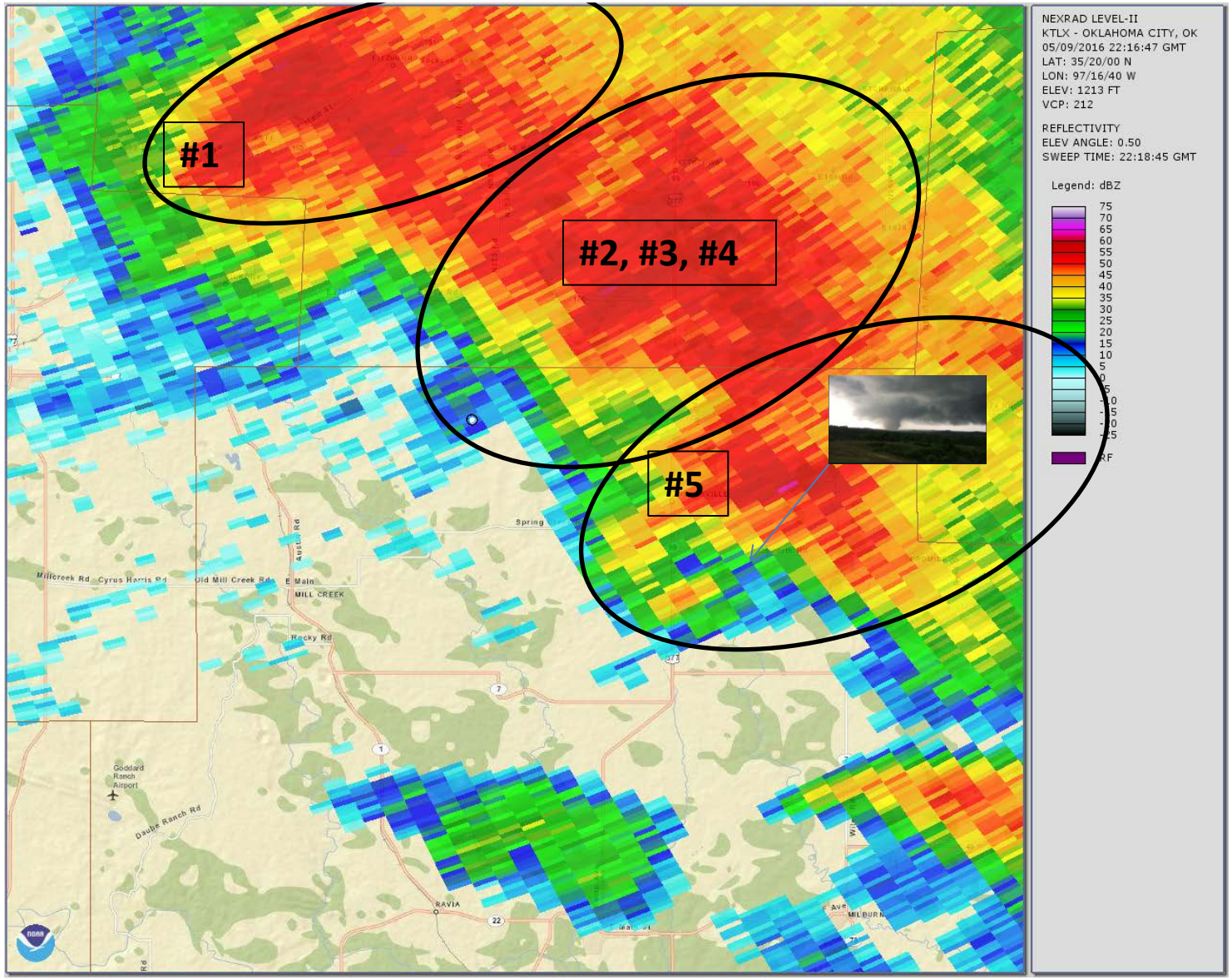
#2, #3, #4, #5 are all younger, immature storms that all either now have supercell characteristics, or will develop supercell characteristics within the next few minutes. **All will become tornadic or near tornadic during the next 30 min.**

Which one is to be the parent of our tornado of unknown location?

* Large, Strong, & Tall

Overview of Southern Oklahoma Storms

KTLX, 2217 UTC



#1 Circulation occluding, last tornado ending

#2, #3, #4 Merged together, **Mill Creek tornado in progress with remnant of #3**

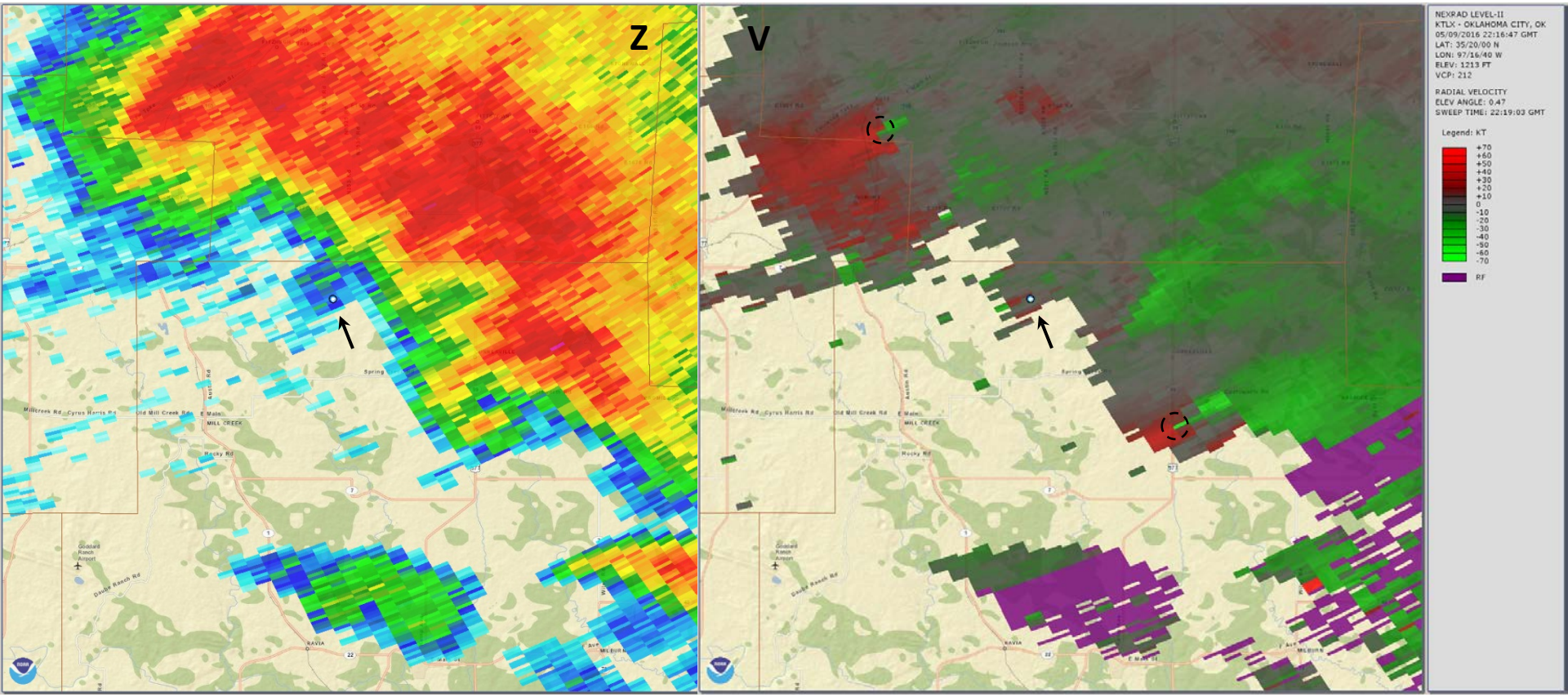
#5 Becoming an LST Supercell and will produce the EF3+ Bromide tornado in 1 minute and later the EF1+ Atoka tornado

Radar and Analysis Information

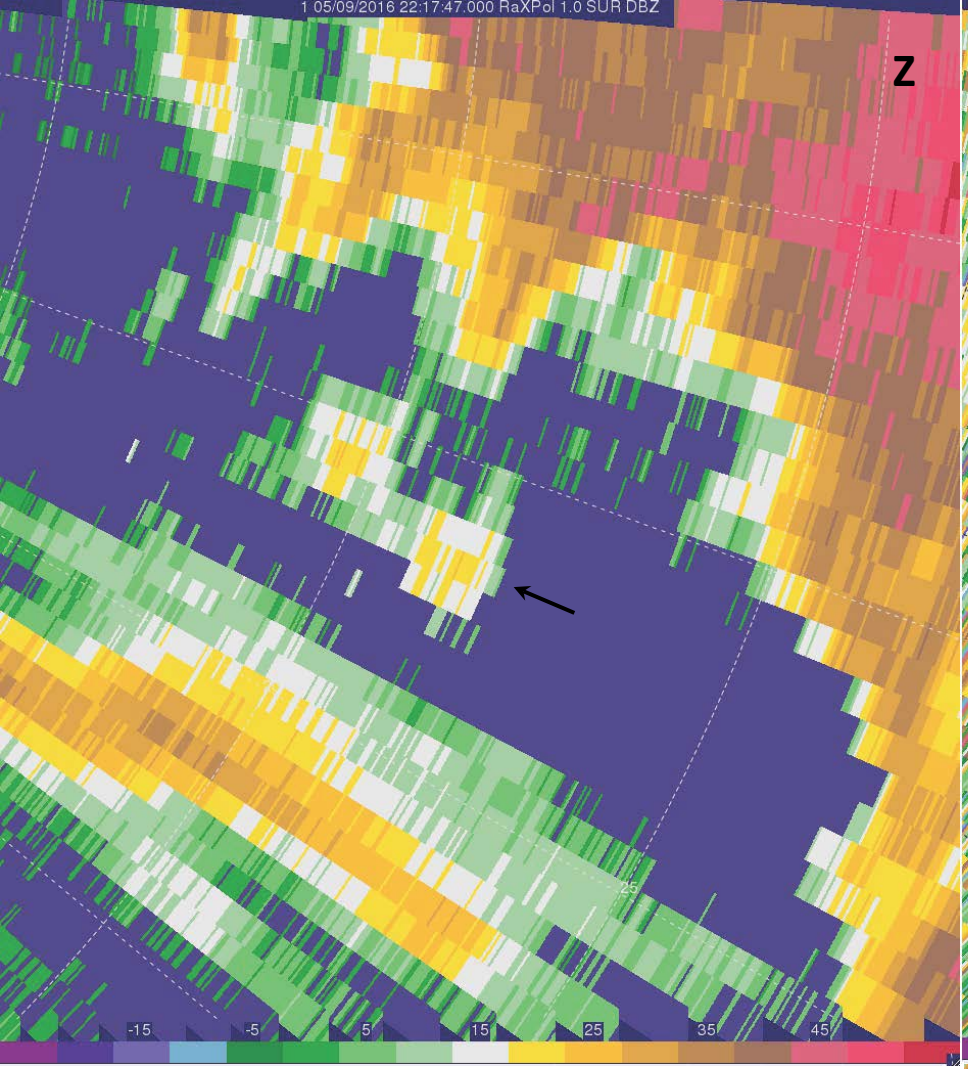
	WSR-88D	RaXPol
Wavelength	S-Band	X-Band
Peak Power	750 KW	20 KW
E. Beamwidth	1.08^{o}	1.48^{o}
Gate Length	250 m	75 m
Dual Pol	Simultaneous T.	Simultaneous T.
May 9 Range	~105 km	~20 km
VCP	0.5-19.5^{o}/6.5 min	0-10.0^{o}/ 25 sec
Pulse Volume Size	9.1 x 10^{8} m^{3}	1.3 x 10^{7} m^{3}

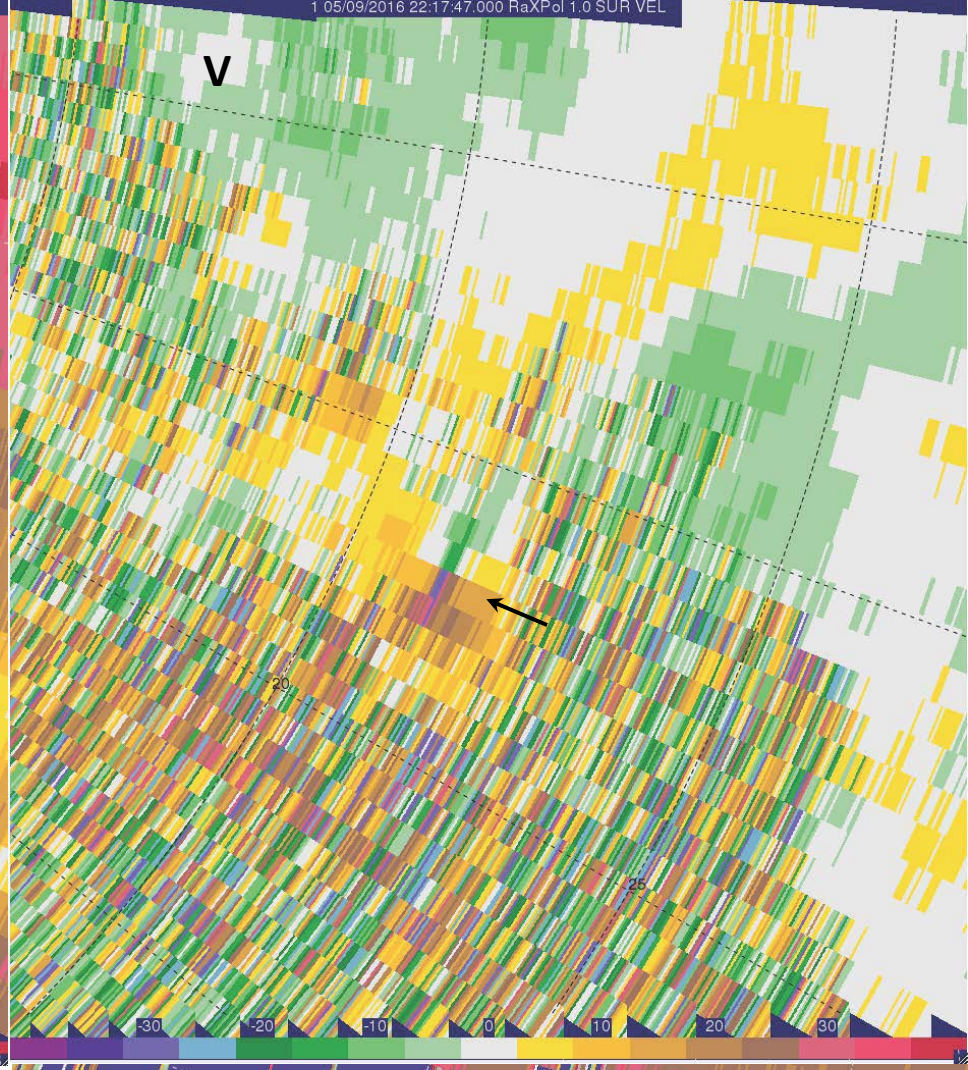
- Data displayed with WDSSii and NCEI Tool Kit
- Data thresholded by reflectivity factor and spectrum width
- Velocity features quantified by velocity difference (Delta-V) across single-Doppler couplets:
  - Mesocyclone (3-5 km c.d.)
  - Tornado Cyclone (1-3 km c.d.)
  - TVS (<1 km core diameter)
- RaXPol data noisy because of low SNR and increasingly overlaid 2nd trip echo.

KTLX Data for the Mill Creek Storm
~2219 UTC, 0.5° elev, 1.6 km AGL



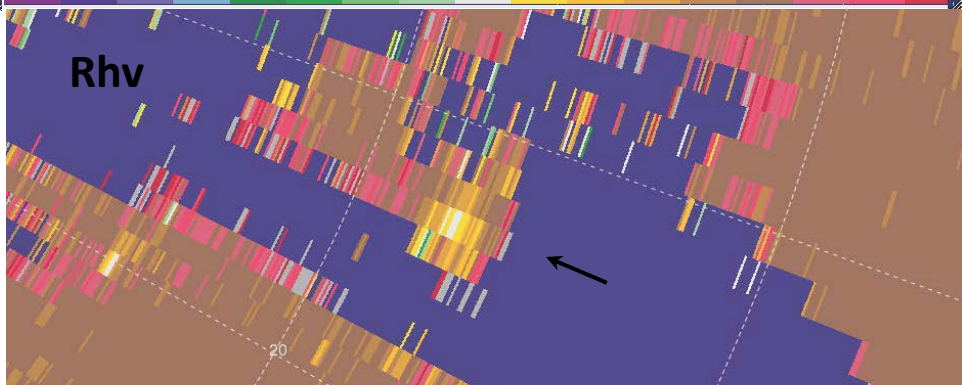
Reflectivity (Z) and Radial Velocity (V). Mill Creek tornado location (white dot) marked by black arrow. Rotation couplets with Sulphur and Bromide tornadoes marked with dashed circles.



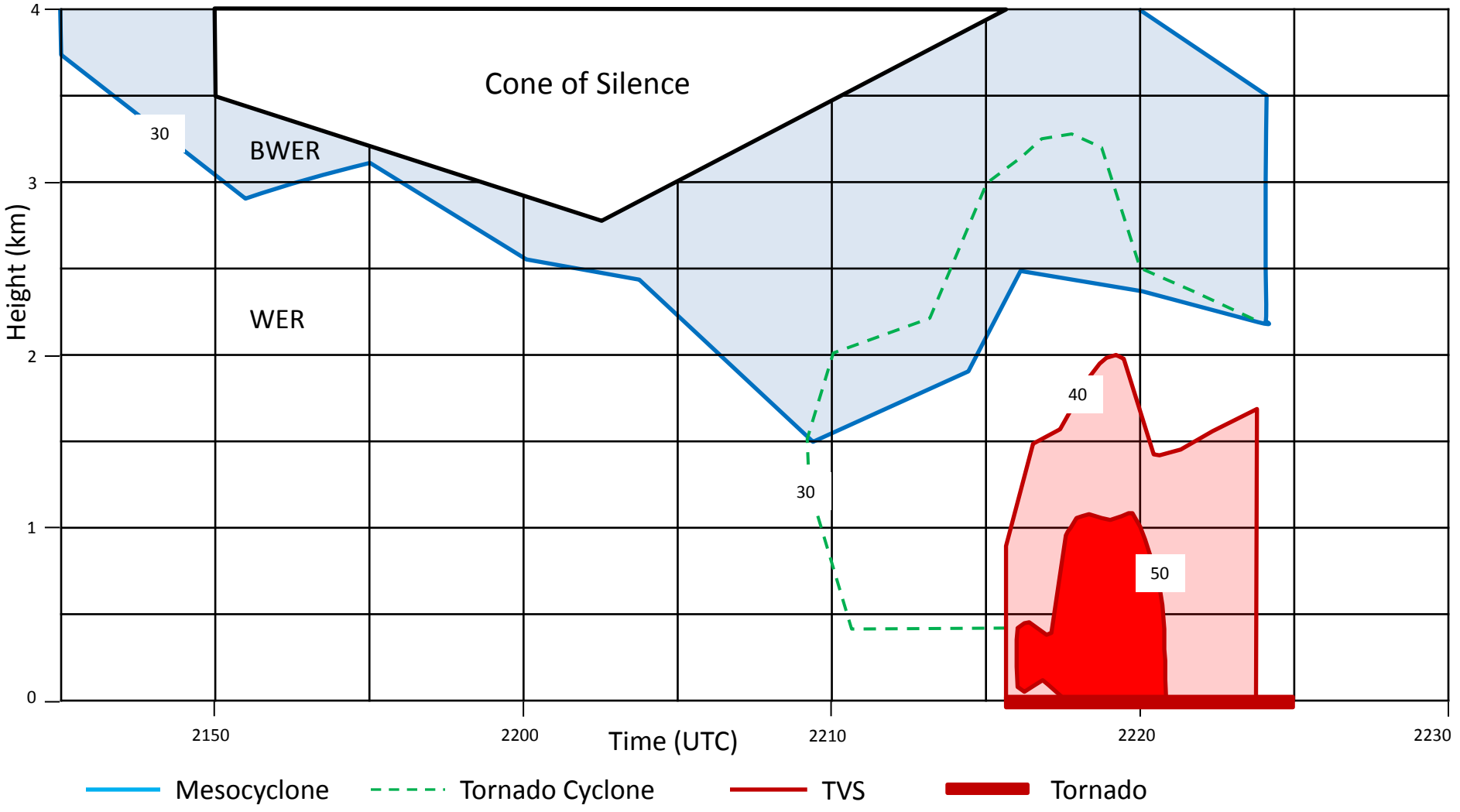


RaXPol Data for the Mill Creek Tornado

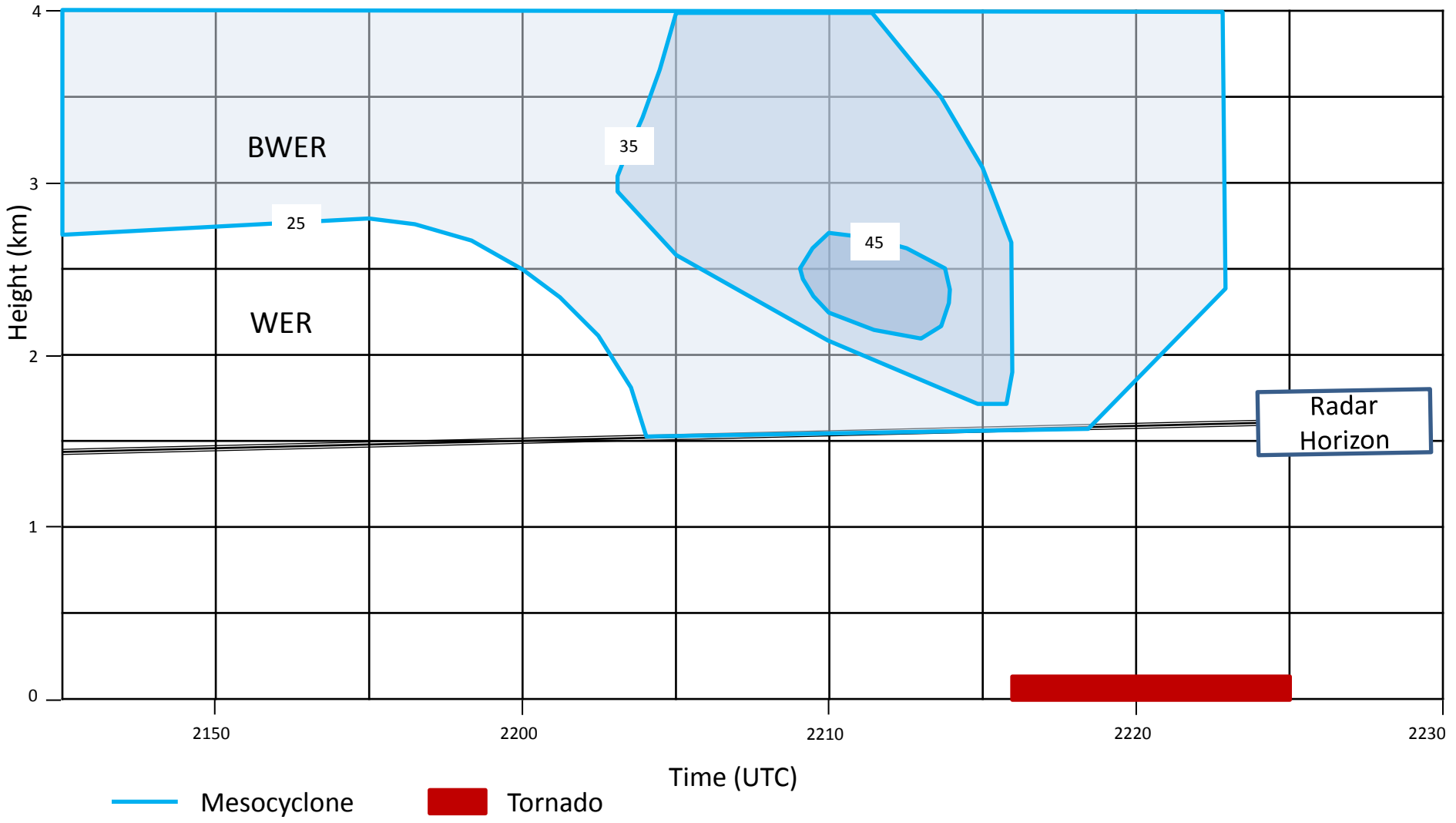
~2218 UTC, 1.0^{o} elev, 0.4 km



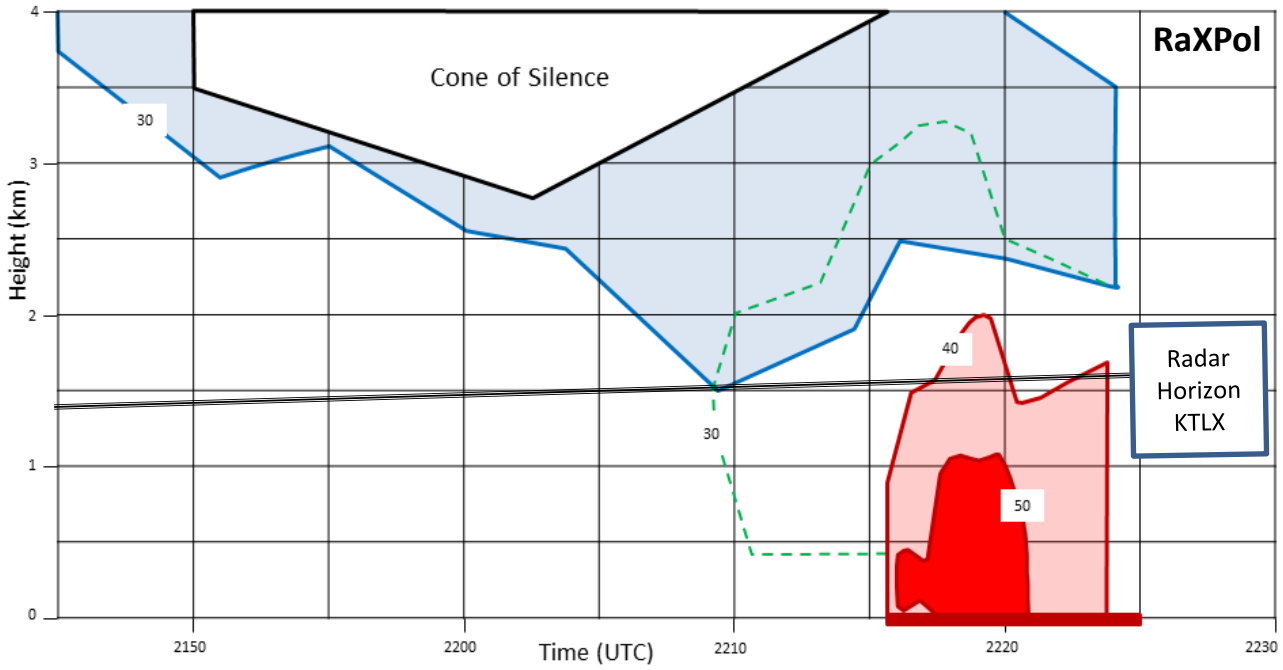
RaXPol Time/Height Plot of Delta-V (m/s)

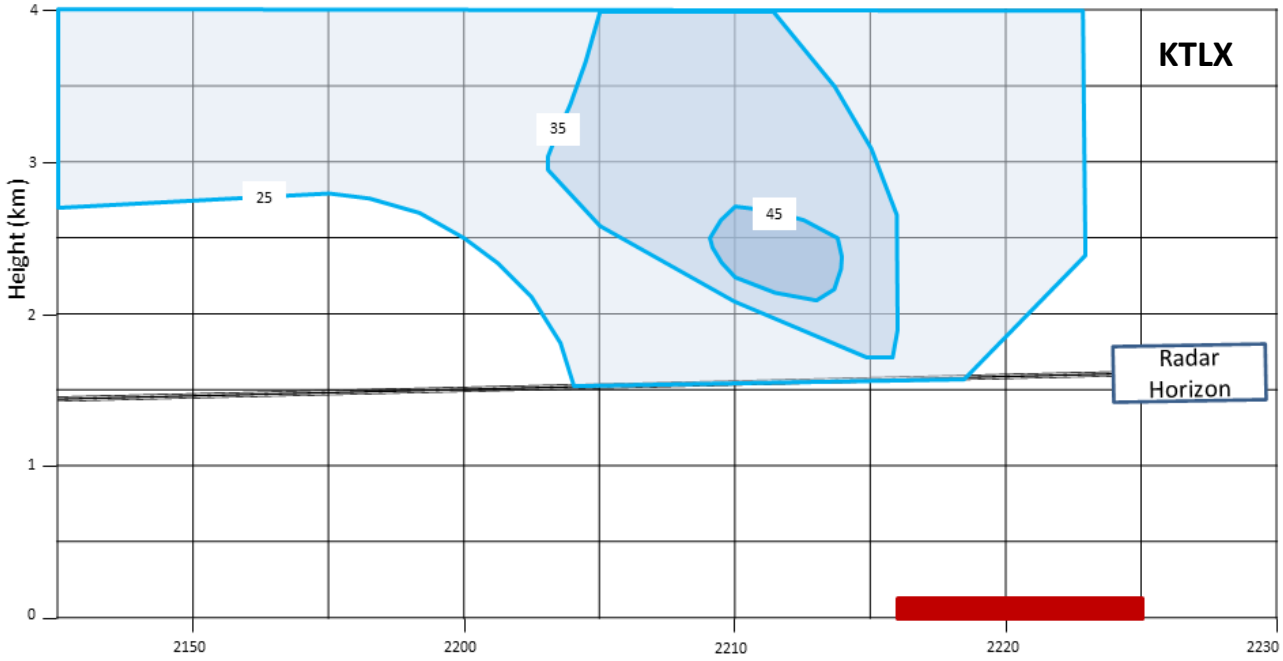


KTLX Time/Height Plot of Delta-V (m/s)



Time/Height Plots

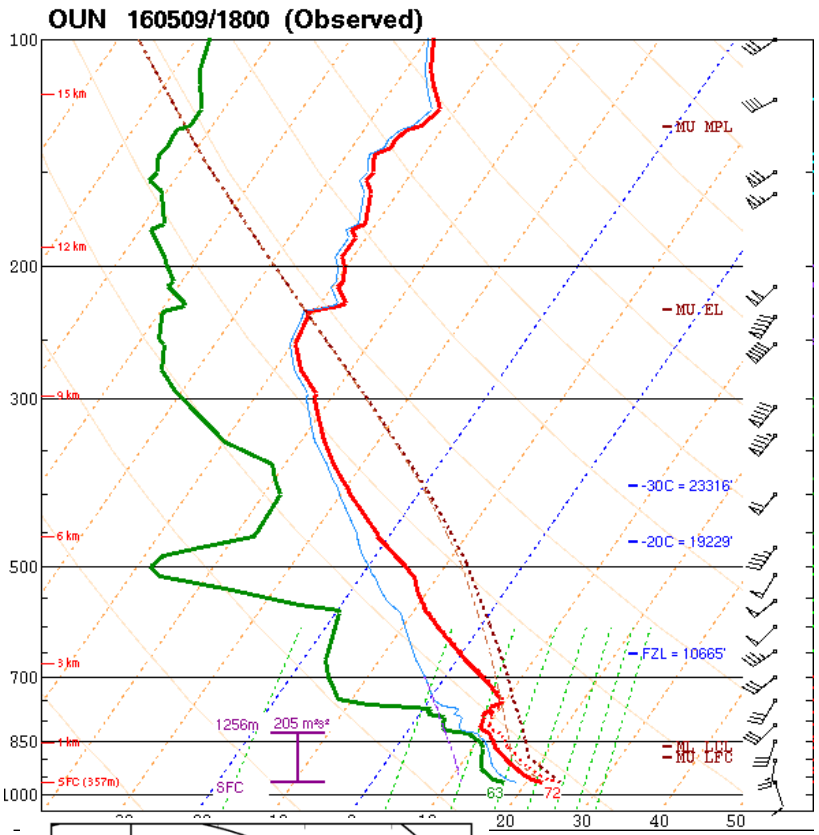


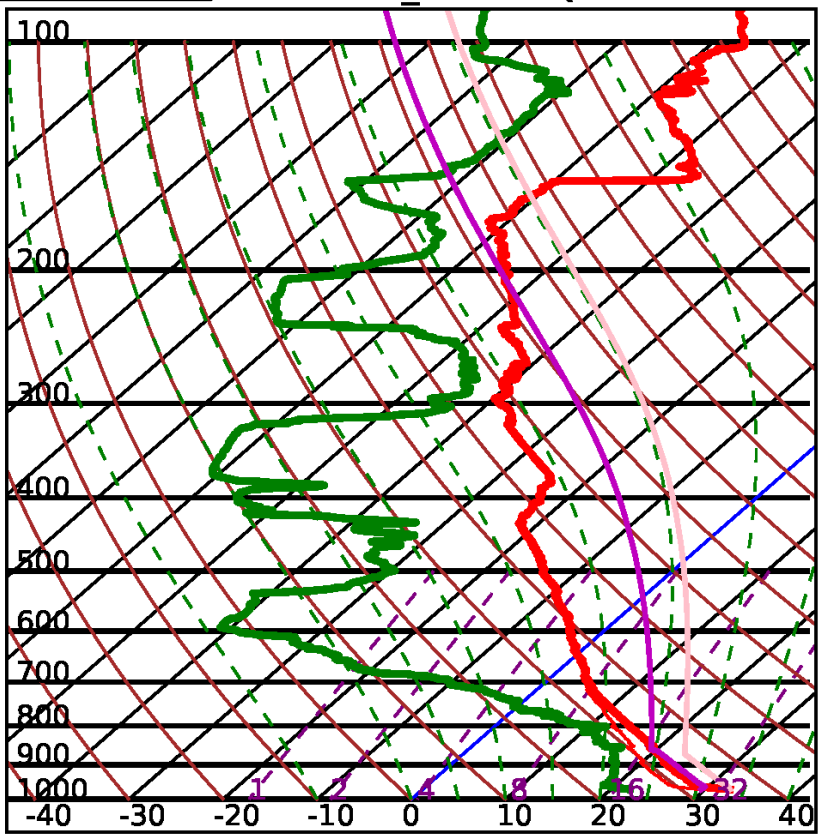


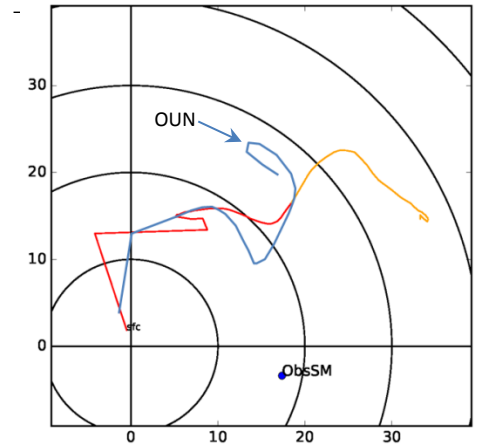
- KTLX misses TVS because of range (sample size & horizon)
- KTLX misses extension of stronger mesocyclone during early part of tornado life because of long volume scan time
- By the end of the tornado circulation weakening & contracting in size; hard to detect by either radar

May 9 Storm Environment Soundings

Gene Autry and Mill Creek Soundings from Mini-MPEX





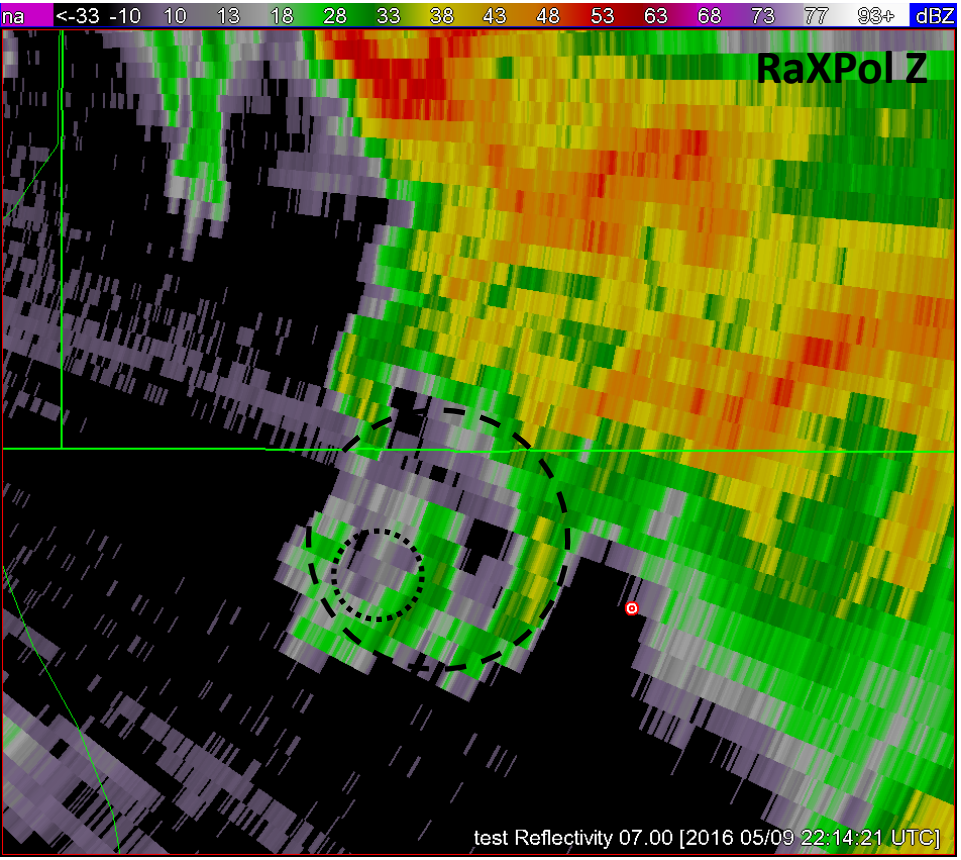


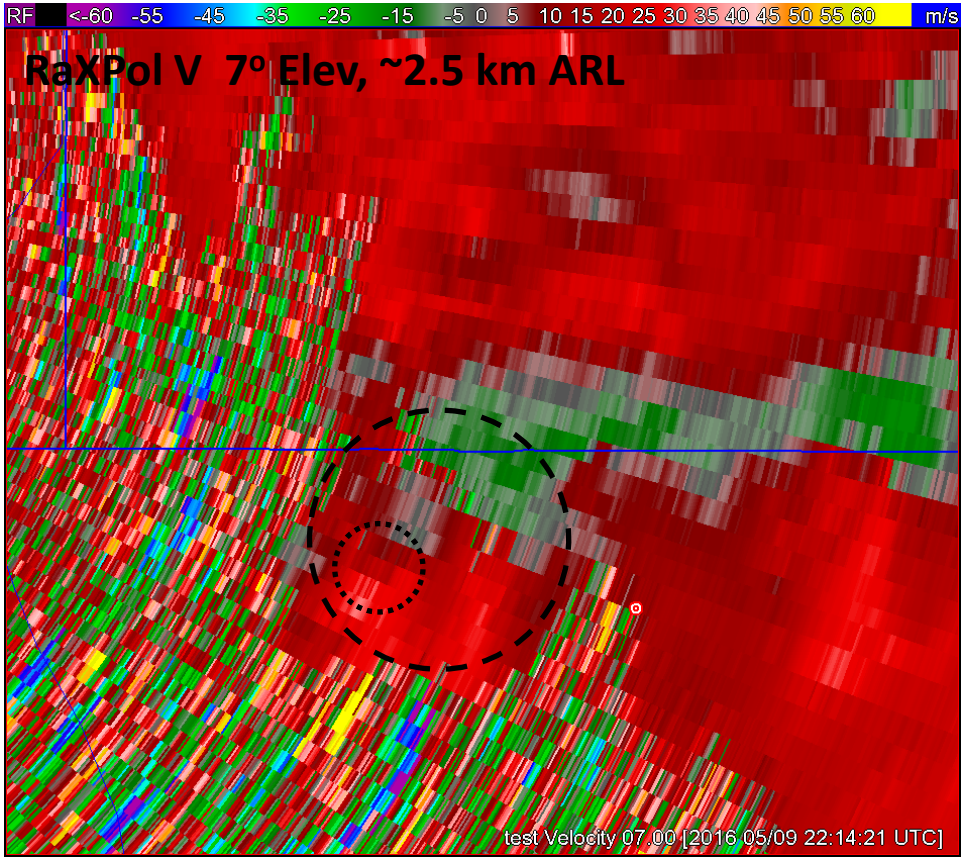
	OUN	Gene Autry	Mill Creek
MLCAPE (jl/kg)	994	2267	
MLCIN (jl/kg)	-33	-4	
0-1 km SRH (m^2/s^2)	178		237
0-1 km Shear (m/s)	12.4		12.2
0-6 km Shear (m/s)	23	42	

Conclusions

- Mill Creek Storm was not a Mini-Supercell, but instead was a developing supercell that never matured into a Large, Strong, Tall supercell
- RaXPol was able to observe tornadic supercell characteristics whereas KTLX couldn't because of:
  - sample volume size and radar horizon advantages (function of range)
  - Volume Coverage Pattern (revisit times of 25 sec for RaXPol vs 6.5 min for KTLX above lowest elevation angle)
- WSR-88D radar users should be aware that, under certain conditions, circulations with supercell tornadoes at 100 km range may not be detectable

Difference Between Mesocyclone and Tornado Cyclone





- Mesocyclone is ~3-5 km in diameter, and extends to above 5 km height
- Tornado Cyclone is ~1-2 km in diameter, and is found in 1-3 km layer
- Mesocyclone covers all of the BWER region
- Tornado Cyclone is found with the hook echo in the southwest portion of the BWER
- Tornado Cyclone has been seen in a number of other cases that used high-resolution mobile radars, some in VORTEX2