



Insights into Severe Thunderstorm Dynamics Afforded by Radar and In-situ Observations



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Texas Tech StickNet



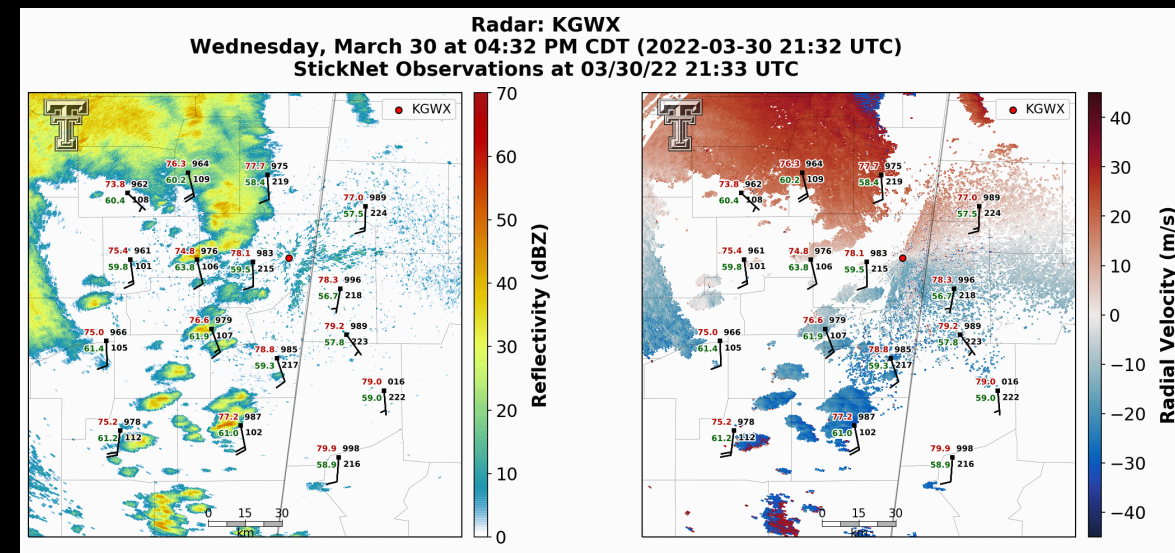
Courtesy: William Faletti (Texas Tech)

- 48 ruggedized surface weather stations
- High-frequency (10 Hz) sampling of temperature, humidity, pressure and wind
- Rapidly deployable (~2-3 min)
- Four outfitted trailers used to deliver, recharge and download data from StickNet probes



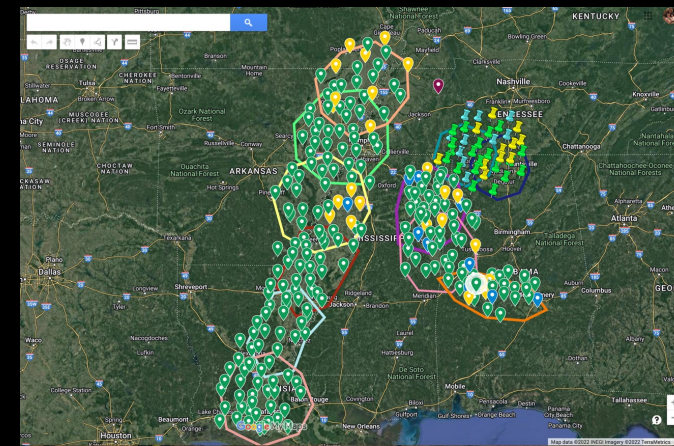


VORTEX-SE/USA



WSR-88D / StickNet composite for PERiLS IOP2 (30 Mar 2022)

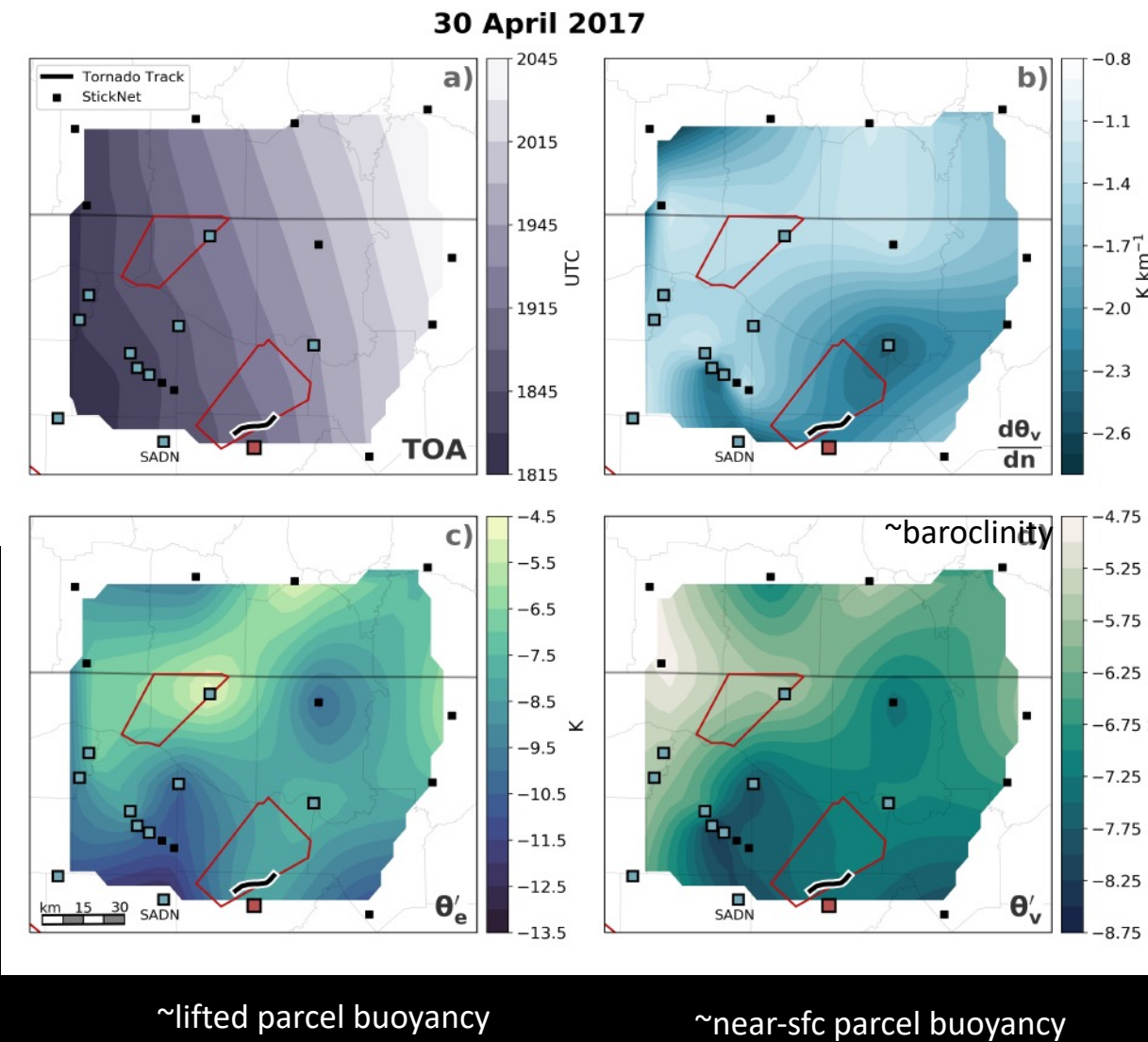
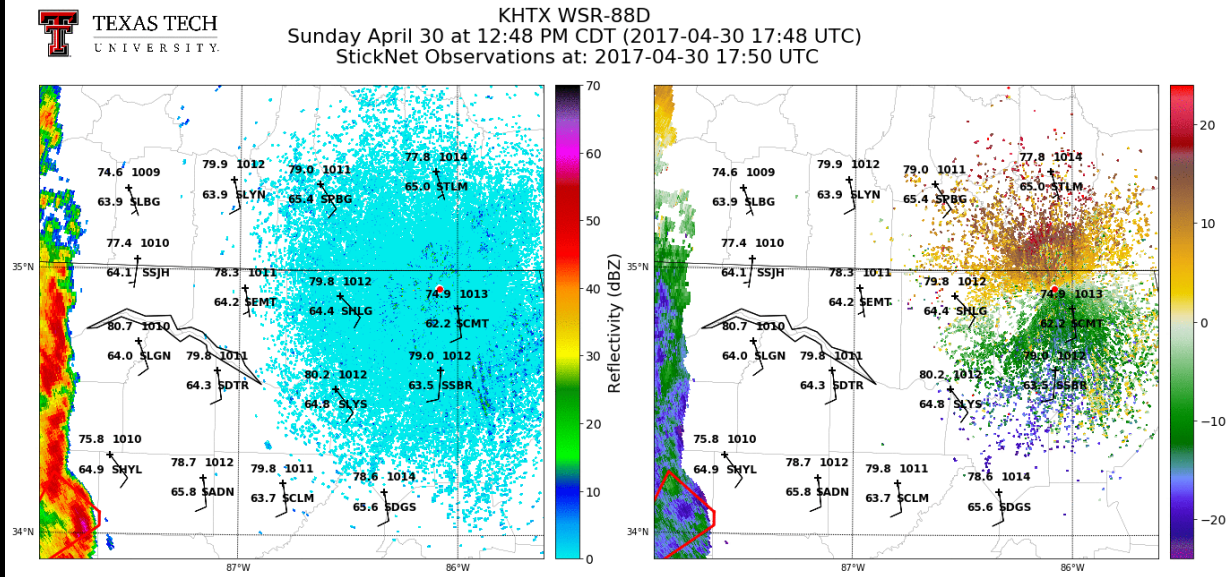
- 24 StickNet platforms have been dedicated to multiple VORTEX-SE/USA field efforts:
 - 2016, 2017 (TN River Valley)
 - Meso18-19 (TN River Valley / central AL)
 - PERiLS (multiple domains)
- Primary objectives are to assess:
 - Cold pool magnitudes and shapes
 - Environmental heterogeneity
 - The spatiotemporal evolution of low-level vertical vorticity tied to both of the above



Scouted StickNet locations for PERiLS



Establishing the Association of QLCS Baroclinity and Vorticity



- McDonald and Weiss (2021) sought to observationally establish an association between cold pool properties/placement and vertical vorticity (mesovortex and tornado)
- Principal findings:
 - Lateral gradients in air density associate with tornadic / nontornadic mesovortex distinction, but not the deficits themselves (in contrast to prior supercell studies (e.g., Markowski 2002; Weiss et al. 2015).
 - QLCS cold pool deficits are intermediate between linear systems and supercells



TTUKa Mobile Doppler Radars



TTUKa intercept of a supercell storm near Imperial, NE during TORUS 2019

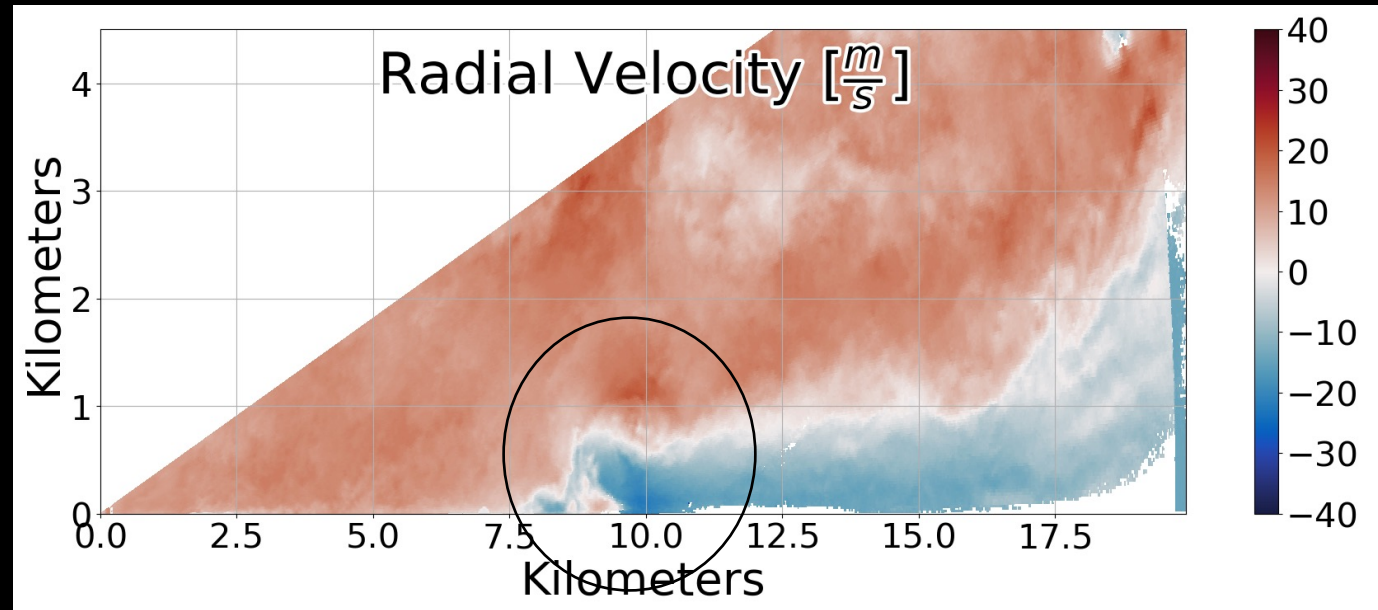
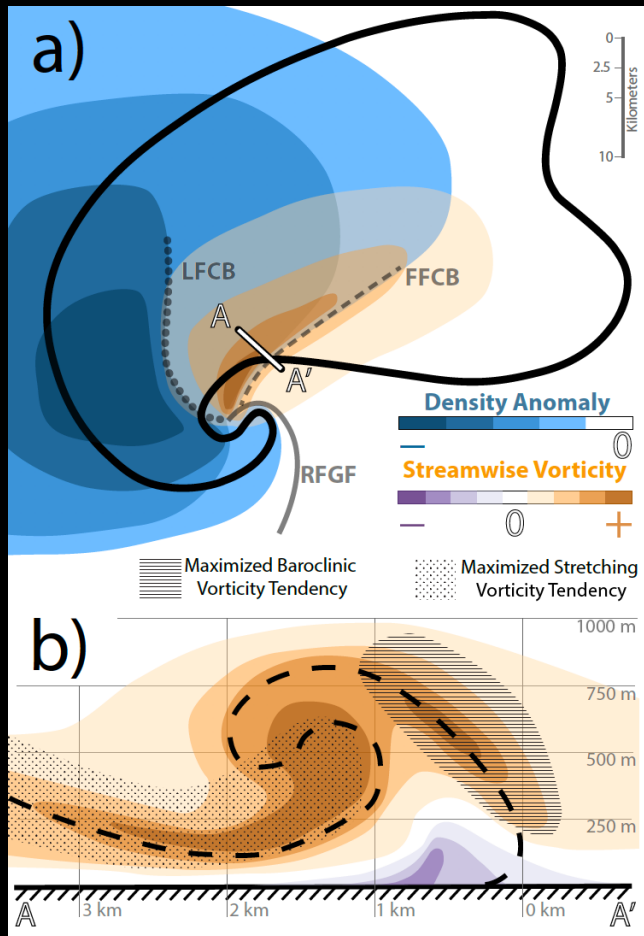
TTUKa Specifications

Transmit Frequency	35 GHz
Transmit Power	200 W
Transmitter Type	TWTA
Antenna 3dB beamwidth	0.33 deg
Polarization	Linear (HH)
Gate spacing	12 m

Priority: High azimuthal/range resolution to resolve fine-scale structure near the surface



TORUS: Observations of the Streamwise Vorticity Current



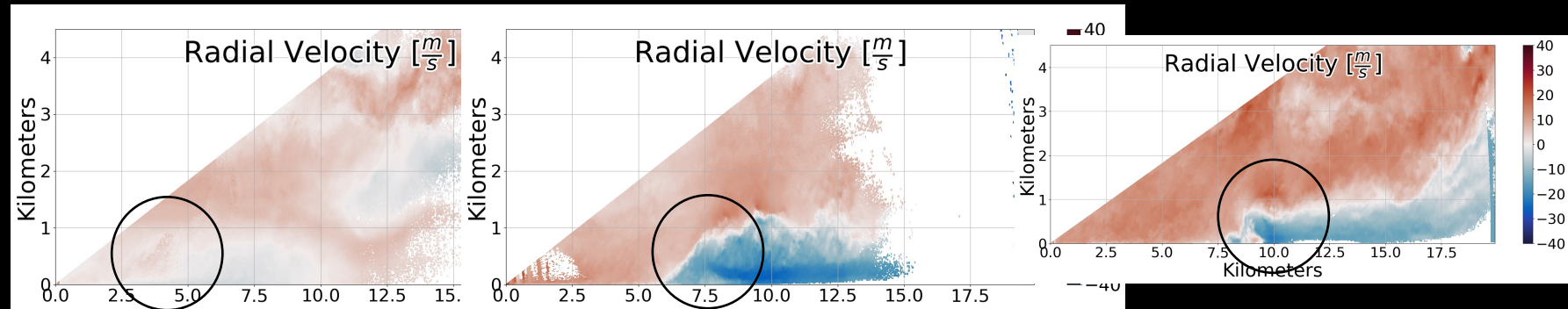
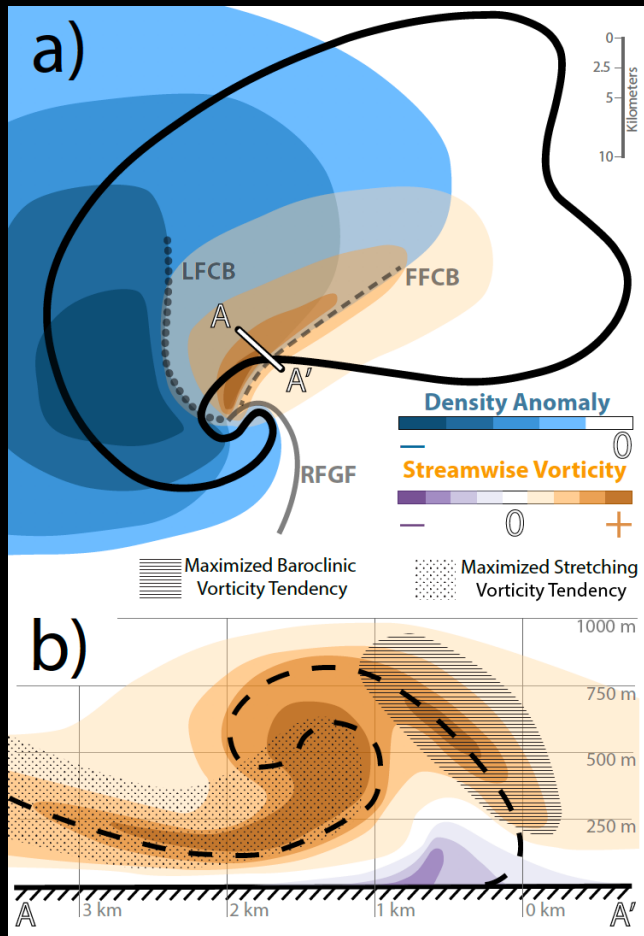
SVC observed by TTUKa during TORUS

- Over 3500 PPI/RHI sweeps of supercell forward/left/rear flank boundaries during TORUS 2019
- Features similar to the SVC were seen in multiple instances

SVC simulations
(Schueth et al. 2021)



TORUS: Observations of the Streamwise Vorticity Current



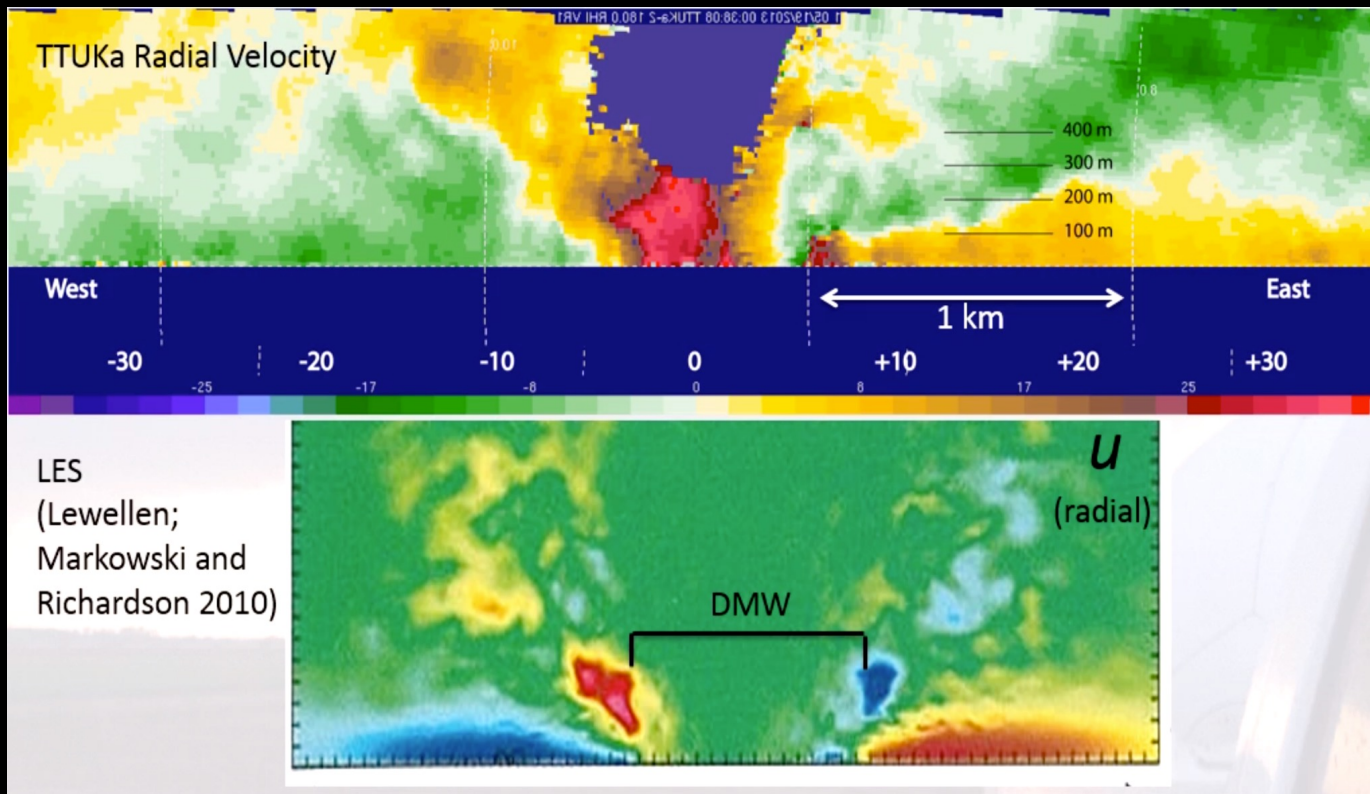
Spectrum of forward-flank RHI observations by TTUKa during TORUS

SVC simulations
(Schueth et al. 2021)

- Over 3500 PPI/RHI sweeps of supercell forward/left/rear flank boundaries during TORUS 2019
- Features similar to the SVC were seen in multiple instances ...but not ubiquitous by any stretch!



Low-level Tornado Wind Field



Rozel, KS– 18 May 2013

(top) TTUKa RHI observations of low-level flow near tornado
(bottom) Simulated RHIs of core flow (Lewellen)

- VORTEX2 and subsequent ad hoc projects yielded occasional measurements of low-level tornado wind field
- Objectives relating:
 - components of swirl ratio to observed single-cell / multiple-vortex tornado mode
 - proper tornado wind-speed reduction through surface layer



Always interested in ideas for collaboration!



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