

# **TEXAS TECH UNIVERSITY TTUKA DOCUMENTATION FOR THE TORUS FIELD PROJECT**

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## 1.0 DATA SET OVERVIEW

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This document provides information concerning the Texas Tech University mobile Ka radar deployment and data structure details from the TORUS 2019 field campaign.

### DEPLOYMENT INFORMATION

<b>2019-05-17 McCook-Lexington, Nebraska</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka1	1	22:36 - 22:57	40.4227	-100.2102	203-283
Ka1	2	23:10 - 23:54	40.4825	-100.2307	228-358
Ka2	1	23:20 - 23:55	40.3580	-100.4210	270-30
Ka1	3	00:10 - 00:56	40.5591	-100.2382	260-30

<b>2019-05-18 north of Enid, Oklahoma</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	23:07 - 23:20	36.8987	-98.3651	209-279
Ka1	1	23:08 - 23:13	36.9558	-98.2995	
Ka2	2	23:54 - 00:13	36.5909	-98.2657	241-321
Ka1	2	00:29 - 00:57	36.5803	-98.0130	268-38

<b>2019-05-20 Gould, Oklahoma - Truscott, Texas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka1	1	21:08 - 22:08	34.6667	-99.6666	240-350
Ka2	1	21:15 - 22:17	34.6677	-99.6666	
Ka1	2	22:12 - 22:17	34.6692	-99.6666	350-40
Ka1	3	00:46 - 00:55	33.7676	-99.8000	252-12
Ka2	2	00:49 - 00:56	33.7680	-99.8002	

<b>2019-05-23 Lipscomb, Texas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	22:30 - 23:14	36.1033	-100.8212	194-324
Ka1	1	22:38 - 23:30	36.1013	-100.7302	242-2
Ka2	2	23:59 - 01:13	36.1716	-100.2248	195-15
Ka1	2	00:35 - 01:29	36.3033	-100.1365	209-359

<b>2019-05-24 Roaring Springs, Texas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka1	1	20:22 - 20:41	33.8733	-100.8652	243-13
Ka2	1	20:22 - 20:41	33.9338	-100.8468	261-351

<b>2019-05-25 Hale Center, Texas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	19:32 - 20:13	33.9531	-101.9930	252-32
Ka2	2	23:19 - 23:33	33.9647	-101.9929	347-77

<b>2019-05-26 Lamar, Colorado</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka1	1	21:19 - 21:27	38.2393	-102.7240	228-328
Ka1	2	21:31 - 22:21	38.2672	-102.7239	202-22

<b>2019-05-27 Ft. Morgan, Colorado - Imperial, Nebraska</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	20:24 - 21:14	40.2279	-103.8302	251-121
Ka1	1	20:43 - 21:30	40.2995	-103.5936	263-43
Ka1	2	23:46 - 00:06	40.5857	-102.0798	
Ka2	2	23:50 - 00:13	40.3928	-102.2884	237-347
Ka1	3	00:20 - 00:52	40.5378	-101.9151	241-341
Ka1	4	01:12 - 01:23	40.5683	-101.6289	234-14

<b>2019-05-28 Beloit, Kansas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	22:36 - 23:05	39.4957	-98.1166	265-315
Ka1	1	22:41 - 23:29	39.5039	-98.0411	238-358
Ka2	2	23:17 - 23:29	39.4083	-98.1216	329-29

<b>2019-06-08 Goodland, Kansas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka1	1	20:37 - 22:00	39.2642	-101.7279	
Ka2	1	21:09 - 22:03	39.2932	-101.7296	272-2
Ka2	2	00:08 - 01:16	39.3948	-101.6767	2-182
Ka1	2	00:13 - 00:26	39.3425	-101.5028	255-355
Ka1	3	00:38 - 01:13	39.2945	-101.3538	269-359
Ka1	4	01:28 - 01:44	39.1218	-101.3590	320-60
Ka1	5	01:54 - 02:29	39.0494	-101.3527	329-69

<b>2019-06-11 Liberal, Kansas - Greensburg, Kansas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	20:44 - 21:32	36.9397	-101.0177	131-211
Ka1	1	20:51 - 21:33	36.8632	-100.9274	270
Ka1	2	00:05 - 00:36	37.7769	-99.3199	310-50
Ka2	2	00:25 - 01:35	37.6089	-99.2319	312-122

<b>2019-06-13 Boise City, Oklahoma</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka1	1	00:51 - 01:44	36.6758	-102.7335	220-350

<b>2019-06-14 Perryton, Texas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	21:19 - 22:38	36.4219	-100.7283	229-289
Ka1	1	21:24 - 21:45	36.4692	-100.8191	137-197

<b>2019-06-15 Adrian, Texas</b>					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths [north relative]
Ka2	1	22:17 - 22:27	34.9834	-102.4205	252-322
Ka2	2	22:32 - 22:53	34.9821	-102.3675	2-102
Ka1	1	22:51 - 23:29	35.0283	-102.5176	110-210
Ka2	3	23:16 - 23:27	35.1017	-102.6060	131-191
Ka2	4	23:38 - 23:51	35.0328	-102.7109	182-272
Ka1	2	23:53 - 00:12	35.1314	-102.6568	141-241
Ka2	5	00:09 - 00:31	35.2492	-102.6560	144-204

## 2.0 INSTRUMENT DESCRIPTION

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Texas Tech maintains two mobile Ka-band radars that have been operated in several field projects over the last 10 years (Weiss et al. 2009). These radars operate in the millimeter wavelength range, and with a small beamwidth and high range resolution, can resolve fine scale details of atmospheric phenomena like supercells. More information may be found here: <https://www.depts.ttu.edu/ttuhr/Instrumentation/TTUKa.php>

### TTUKA DETAILS

Frequency	~35 GHz
Peak/Average Power	200/100 W
Beamwidth	0.33 deg
Gate Spacing	15 m

## 3.0 DATA COLLECTION AND PROCESSING

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TTUKa data include two corrections:

- Truck heading – all data are rotated to be north-relative. The correction is a combination of a first guess, obtained via a compass-measured heading, and, when present, adjustment to align with ground clutter targets identified in a  $0^\circ$  surveillance scan conducted at the beginning of every deployment.

- Removal of RHI jitter – Due to the nonlinear accelerations of the TTUKa antenna at the endpoints of individual RHIs, a small elevation angle error is often introduced. A manual correction was applied to every RHI, such that the 0 deg elevation angle is in line with the surface.

## 4.0 DATA FORMAT

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These radar data were processed with Py-ART and stored in a Cfradial file format as described here: <http://ncar.github.io/CfRadial/>

The metadata are stored within the netcdf data standard. The correct longitude, latitude, heading correction, and jitter correction have all been applied.

## 5.0 DATA REMARKS

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Access and view data with:

Radx: [https://www.ral.ucar.edu/projects/titan/docs/radial\\_formats/radx.html](https://www.ral.ucar.edu/projects/titan/docs/radial_formats/radx.html)

Solo3: <https://www.eol.ucar.edu/software/solo3>

Py-ART: <https://arm-doe.github.io/pyart/>

Outstanding data issues:

While the radar deployment heading and jitter were corrected, outstanding issues remain in these data. These radial velocity data remain aliased with a Nyquist velocity of approximately  $15 \text{ m s}^{-1}$  for most deployments. Additionally, multiple trip echoes exist in many of the RHIs and PPIs. Users can employ the software listed above to manually edit these artifacts.

## 6.0 REFERENCES

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Weiss, C. C., Schroeder, J. L., Guynes, J., Skinner, P. and Beck, J., 2009: The TTUKa Mobile Doppler Radar: Coordinated Radar and In Situ Measurements of Supercell Thunderstorms during Project VORTEX2. *34th Conf. on Radar Meteorology, Amer. Meteor. Soc.*