

TEXAS TECH UNIVERSITY TTUKA DOCUMENTATION FOR THE TORUS-LiTE FIELD PROJECT

AUTHOR/CONTACT INFORMATION:

Dr. Chris Weiss
Department of Geosciences
Texas Tech University
Box 41053, Lubbock, TX 79409
Phone: (806)834-4712
E-mail: Chris.Weiss@ttu.edu

Alex Schueth
Department of Geosciences
Texas Tech University
Box 41053, Lubbock, TX 79409
E-mail: Alex.Schueth@ttu.edu

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1.0 DATA SET OVERVIEW

This document provides information concerning the Texas Tech University mobile Ka radar deployment and data structure details from the TORUS 2023 field campaign.

DEPLOYMENT INFORMATION

2023-05-23 Muleshoe, TX					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka2	1	22:07 - 22:15	34.419019	-103.00211	311-11
Ka2	1	22:15 - 22:18	34.419019	-103.00211	301-11
Ka2	1	22:18 - 22:34	34.419019	-103.00211	311-11
Ka1	1	22:27 - 23:11	34.37142	-102.88652	280-10
Ka2	1	22:34 - 22:38	34.419019	-103.00211	321-31
Ka2	1	22:38 - 22:43	34.419019	-103.00211	331-41
Ka2	1	22:43 - 22:50	34.419019	-103.00211	351-61
Ka1	1	23:11 - 23:20	34.37142	-102.88652	260-10
Ka2	2	23:43 - 23:48	34.284886	-102.72287	251-321
Ka1	2	23:46 - 23:52	34.383131	-102.51735	222-322
Ka1	3	00:31 - 00:48	34.130185	-102.21513	267-7
Ka2	3	00:51 - 00:57	34.129785	-101.98744	-

2023-05-24 Grady, NM					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka2	1	00:13 - 00:32	34.894657	-103.354347	311-51
Ka2	2	01:02 - 01:12	34.727799	-103.214821	302-12
Ka2	2	01:12 - 01:17	34.727799	-103.214821	272-12
Ka2	2	01:17 - 01:19	34.727799	-103.214821	262-12

2023-05-26 Clovis, NM					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka1	1	00:49 - 00:54	34.475796	-103.160721	273-3
Ka1	1	00:54 - 01:06	34.475796	-103.160721	303-13
Ka1	1	01:06 - 01:31	34.475796	-103.160721	313-43
Ka1	1	01:37 - 01:47	34.475796	-103.160721	3-33
Ka2	1	01:39 - 01:40	34.462773	-103.055817	180-240
Ka1	1	01:47 - 01:51	34.475796	-103.160721	313-43
Ka2	1	01:53 - 01:55	34.462773	-103.055817	310-10

2023-05-27 Plains, TX					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka2	1	23:54 - 23:55	33.44638	-103.055186	-
Ka1	1	23:55 - 00:02	33.499253	-102.978748	216-286
Ka2	2	00:22 - 00:28	33.388671	-103.056483	261-311
Ka2	2	00:28 - 00:32	33.388671	-103.056483	261-331
Ka2	3	00:39 - 00:41	33.336702	-103.057594	262-12
Ka1	2	00:39 - 01:04	33.329095	-102.818623	249-349
Ka1	2	01:10 - 01:12	33.329095	-102.818623	269-299
Ka2	4	01:11 - 01:12	33.240832	-102.901098	305-5
Ka1	3	01:33 - 01:34	33.270168	-102.773908	220-280
Ka2	5	01:35 - 01:39	33.171103	-102.818762	310-30
Ka2	5	01:39 - 01:41	33.171103	-102.818762	270-30
Ka1	4	02:07 - 02:20	33.097145	-102.611945	238-338

2023-06-01 Colorado City, TX					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka2	1	22:44 - 22:48	32.479798	-100.998802	283-333
Ka2	1	22:48 - 22:54	32.479798	-100.998802	293-353
Ka2	1	22:54 - 22:56	32.479798	-100.998802	303-3
Ka2	1	22:56 - 23:03	32.479798	-100.998802	323-13
Ka1	1	23:04 - 23:23	32.516629	-100.870686	247-347

2023-06-02 Seminole, TX					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka1	1	18:35 - 18:40	32.712692	-102.777243	212-322
Ka1	1	18:40 - 18:43	32.712692	-102.777243	232-322
Ka1	1	18:43 - 18:59	32.712692	-102.777243	252-342
Ka1	1	18:59 - 19:13	32.712692	-102.777243	252-2
Ka2	1	18:58 - 19:02	32.776633	-102.623132	232-272
Ka2	1	19:02 - 19:08	32.776633	-102.623132	232-282
Ka2	1	19:08 - 19:14	32.776633	-102.623132	222-282
Ka2	1	19:14 - 19:21	32.776633	-102.623132	242-322
Ka2	1	19:21 - 19:23	32.776633	-102.623132	212-292
Ka1	2	19:47 - 19:48	32.384374	-102.767902	254-344
Ka1	3	20:02 - 20:13	32.392905	-102.642048	231-341
Ka1	4	21:25 - 21:55	32.610691	-101.995108	243-343
Ka1	4	21:55 - 21:57	32.610691	-101.995108	213-313

2023-06-09 Silverton, TX					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka2	1	22:22 - 22:30	34.478431	-101.337007	271-1
Ka2	1	22:30 - 22:39	34.478431	-101.337007	291-11
Ka1	1	22:47 - 23:02	34.464244	-101.242714	328-58
Ka1	2	23:17 - 23:23	34.40694	-101.136022	316-56

2023-06-11 Kim, CO > Boise City, OK					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka1	1	22:04 - 22:16	37.169821	-103.739329	-
Ka2	1	22:07 - 22:11	37.170244	-103.739986	255-335
Ka2	1	22:11 - 22:15	37.170244	-103.739986	255-5
Ka1	2	22:28 - 22:35	37.219869	-103.611278	-
Ka2	2	22:28 - 22:34	37.213647	-103.630238	214-304
Ka2	3	01:29 - 01:36	36.673841	-102.499394	301-351
Ka1	3	01:35 - 01:42	36.70465	-102.3922	311-351
Ka2	3	01:36 - 01:43	36.673841	-102.499394	341-31
Ka1	3	01:42 - 01:50	36.70465	-102.3922	321-351
Ka2	3	01:43 - 01:51	36.673841	-102.499394	11-61
Ka1	3	01:50 - 01:54	36.70465	-102.3922	1-41
Ka1	4	02:05 - 02:08	36.704618	-102.255063	271-1

2023-06-12 Nara Visa, NM					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka1	1	21:31 - 22:08	35.92826	-103.695924	331-31
Ka2	1	21:52 - 22:11	35.999073	-103.560871	261-321
Ka1	2	23:09 - 23:17	35.660905	-103.125586	250-340
Ka1	2	23:17 - 23:20	35.660905	-103.125586	260-290
Ka2	2	23:18 - 23:27	35.578526	-103.141647	308-358
Ka2	2	23:27 - 23:37	35.578526	-103.141647	308-48
Ka1	3	23:34 - 23:44	35.591091	-103.124246	298-38
Ka2	2	23:37 - 23:42	35.578526	-103.141647	318-68
Ka2	2	23:42 - 23:45	35.578526	-103.141647	338-88
Ka2	2	23:45 - 23:48	35.578526	-103.141647	8-58
Ka2	3	00:15 - 00:20	35.5545	-103.17487	263-323
Ka1	4	00:27 - 00:34	35.530496	-103.207953	297-7

2023-06-13 Cactus, TX > Stinnett, TX					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka1	1	22:13 - 22:20	36.169023	-102.240727	307-17
Ka1	1	22:20 - 22:24	36.169023	-102.240727	327-37
Ka1	1	22:24 - 22:27	36.169023	-102.240727	347-57
Ka1	2	23:37 - 23:41	35.916603	-101.440748	247-207
Ka1	2	23:41 - 23:42	35.916603	-101.440748	287-347

2023-06-15 Arnett, OK					
Radar	Deployment #	Time [UTC]	Latitude	Longitude	RHI Azimuths 10 deg increments [north relative]
Ka1	1	23:19 - 23:22	36.042634	-99.755395	260-360
Ka1	2	23:32 - 23:40	36.042634	-99.755395	260-360
Ka1	3	00:19 - 00:21	35.569868	-99.673439	281-21
Ka2	1	00:35 - 00:40	35.521004	-99.37318	301-351
Ka1	4	00:38 - 00:43	35.392635	-99.64851	263-3
Ka2	1	00:40 - 00:42	35.521004	-99.37318	321-21
Ka1	4	00:43 - 00:45	35.392635	-99.64851	243-343

2.0 INSTRUMENT DESCRIPTION



Texas Tech maintains two mobile Ka-band radars that have been operated in several field projects for more than 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

Note: Ka2 waveguide became dislodged somewhere in the 6-11-2023 timeframe, therefore, had reduced sensitivity after this time.

3.0 DATA COLLECTION AND PROCESSING

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 GPS heading, followed by an adjustment to align with ground clutter targets identified in a 0° 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

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

Access and view data with:

Radx: 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 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

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.*