P6.2 HIGHLIGHTS OF THE STORM-SCALE RADAR DATA FROM VORTEX2 - 2010

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1. VORTEX2

The second Verification of the Origins of Rotation in Tornadoes Experiment (VORTEX2) is the largest project to study tornadoes in history. The four main foci of VORTEX2 are:

i. Tornadogenesis,
ii. Near-ground wind field in tornadoes,
iii. Relationship between supercell storms and their environment, and
iv. Storm-scale numerical weather prediction (VORTEX2 SPO 2007).

More than one hundred scientist in over fifty research vehicles took to the road to collect observations that will improve the current knowledge and understanding in these areas. The fieldwork concluded in June 2010. Much of the ongoing and upcoming data analyses require storm-scale (kms to tens of kms) radar observations, especially studies on supercell dynamics, supercell evolution and interactions, and storm-scale forecasting. The storm-scale radar observations will also provide context for the finer scale observations obtained from the other observational platforms, e.g., the mobile mesonets, sticknets, UAVs, mesocyclone- and tornado-scale radars. This presentation provides an overview of the storm-scale radar data collected during 2010, the second year of VORTEX2.

2. SMART-RADAR DATA

The two C-band Shared Mobile Atmospheric Research and Teaching (SMART) radars (Biggerstaff et al. 2005) were used to collect storm-scale observations. Ideally, the radars would be positioned on the south side of the "target" storm with the baseline between the radars parallel to the storms motion. Achieving the ideal operation scenario required having a storm to target and was limited by several factors including the forecasted location and timing of storms, the ability to identify a target storm, the predictability of the storm and it's motion, the road network and radar sighting. Despite the many challenges a great deal of meaningful data was collected. During the seven weeks of data collection in 2010, eighty-four hours of storm-scale observations were collected on thirty-one data collection days. These observations included a variety of cases including tornadogenesis, tornadogenesis failure, storm mergers, and upscale growth into mesoscale convective systems containing strong circulations. The SMART radar data chart (Table 1) exhibits the body of storm-scale radar data that is available for future collaborative research projects.

Ongoing and upcoming research projects making use of this storm-scale data set will address the following scientific objectives:

i. vorticity dynamics associated with low-level rotation in supercells,
ii. the role of angular momentum transfer on tornadogenesis,
iii. precipitation physics and thermodynamics of the rear-flank downdraft,
iv. the impact of environmental heterogeneity (including boundaries) on storm evolution,
v. the role of cell mergers on tornadogenesis, and
vi. improvements in the analysis and forecasting of tornadic storms through the use of ensemble Kalman-filtering data assimilation.

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	Date (2010)	Location	Data collection times SR1	SR2	Length of DD (min)	Tornadoes?	Notes
1	May 6	Wakeeny, KS (NW KS)	22:02-22:41 00:34-01:23	00:30-01:41	40	no	small supercell, no low-level rotation
2	May 10	Central OK	21:26-23:32	20:57-21:39 22:33-23:36	0	yes	sampled tornadic supercell storms, but they were far away
3	May 11	Western OK	23:03-23:21 01:00-02:24	00:57-02:00	0	no	short lived ordinary cell, one storm had weak rotation, SR2 had problems with its sensitivity
4	May 15	Artesia, NM	23:50-01:16	-	0	no	good deployment, ordinary storm
5	May 17	Artesia, NM	19:33-20:08 22:25-23:13	-	0	no	elongated supercell, hailer
6	May 18	Dumas, TX	22:26-01:27	-	0	yes	long, continuous data set of a supercell
7	May 19	Central OK	20:32-22:05 22:12-22:20 01:15-01:50	21:45-22:23	65	no	DD of a supercell storm merger
8	May 21	NE/WY border, NW of Scottsbluff	00:12-01:32	00:18-00:44	26	no	supercell storm, intensity decreased after 1 UTC, additional unorganized convection developed
9	May 23	Western KS	00:37-01:29	23:09-23:32 00:21-01:29	50	no	supercell storms moved quickly to the north
10	May 24	Ogallala, NE	21:32-22:19 22:27-22:54 00:06-00:49	18:57-19:05 21:22-22:55	42, 28	no	squall line with embedded rotation
11	May 25	Tribune, KS	23:27-01:04	22:20-01:04	55	yes	SR2 captured supercell storm intensification, tornado within DD lobe, SR1 captured storm decay
12	May 26	NE Colorado	22:18-23:56 00:45-01:32	22:27-23:44 00:45-01:32	70, 45	no	DD of isolated, slow moving supercell, two DD deployments
13	May 29	Cherry County, NE	22:22-23:34	21:36-23:32	68	no	multicell storms, mesocyclone development in DD lobe
14	May 31	Bassett, NE (NC NE)	23:17-00:08	22:51-00:11	50	no	DD of low-topped pulsing supercell
15	June 2	NE/KS border, Oberlin, KS	23:15-23:57	0:15	0	no	decaying supercell
16	June 3	Creighton, NE (NE NE)	01:54-02:47	01:28-02:47	53	no	messy radar appearance, multiple updrafts, cyclonic shear persisted

	Date (2010)	Location	Data collection times SR1	Data collection times SR2	Length of DD (min)	Tornadoes ?	Notes
18	June 6	SW Nebraska	01:55-03:35	02:30-03:39	65	yes	possible weak tornado, supercell transition to linear system
19	June 7	Scottsbluff, NE	23:45-01:09 01:27-01:32 01:55-02:41	00:12-01:17 02:21-03:02	55	yes	DD of tornadogensis, upscale growth to MCS
20	June 9	NE/WY border, SW of Scottsbluff	01:13-02:14	22:32-22:59 01:30-01:39	0	no	decaying supercell and steady supercell
21	June 10	Last Chance, CO	00:03-01:00 01:06-01:09 01:15-01:19 01:27-01:38 01:58-02:41	00:06-00:39 01:43-02:35	30, 35	yes	DD of 1st supercell, high-res data of 2nd supercell leading up to tornadogenesis, data of the 2nd tornado, DD of 2nd supercell
22	June 11	Limon, CO	23:39-01:32 02:16-02:56	23:54-02:14	38	yes	fast evolution from supercell to multicell, tornado cyclone develops
23	June 12	Perryton, TX	22:07-22:26 23:03-00:02	22:33 23:30-23:57	0	no	broken line of convection with messy radar appearance, rotation embedded
24	June 13	Perryton, TX	18:16-21:11 22:11-22:26 23:20-23:32	19:09-19:57 20:54-21:17 22:15-22:29 22:54-23:32	48, 23, 11, 12	yes	numerous mesocyclone cycles observed, storm intensifies to have a tornado cyclone
25	June 14	Tahoka, TX	19:43-20:42	19:29-20:43	47	yes	supercell gust front with strong blowing dust, larger scale wrap up, flooding
26	June 16	Oshkosh, NE	23:04-00:20	23:01-00:17	71	no	LP supercell, slow evolution, weak rotation
27	June 17	Albert Lea, MN	00:59-02:20	00:30-02:20	80	yes	powerful supercell, circulation on multiple scales
28	June 18	SC Iowa	22:55-00:03	23:57-00:03	6	no	circulation embedded in multiple updraft storm, circ decreases intensity as storm grows upscale
29	June 19	Concordia, KS	23:19-01:11 01:30-02:26	23:21-02:26	110, 53	yes	DD of tornadogensis, upscale growth to squall line
30	June 20	Northern Kansas	-	22:50-23:13	0	no	quick evolution to a linear mode prevented quality data collection
31	June 21	Yuma, CO	23:19-23:54 00:34-02:20	23:39-23:54 00:57-02:20	9, 18, 71	yes	2 supercells merge and become large HP, DD of tornadogenesis

Table 1. SMART radar data collected during VORTEX2. The “Tornadoes ?” column indicates if tornadoes were observed according to preliminary SPC reports.

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VORTEX 2 Scientific Program Overview 2007, http://www.vortex2.org/Documents/vortex2-spo-2007-0131.pdf