Mobile Disdrometer Deployment during VORTEX2

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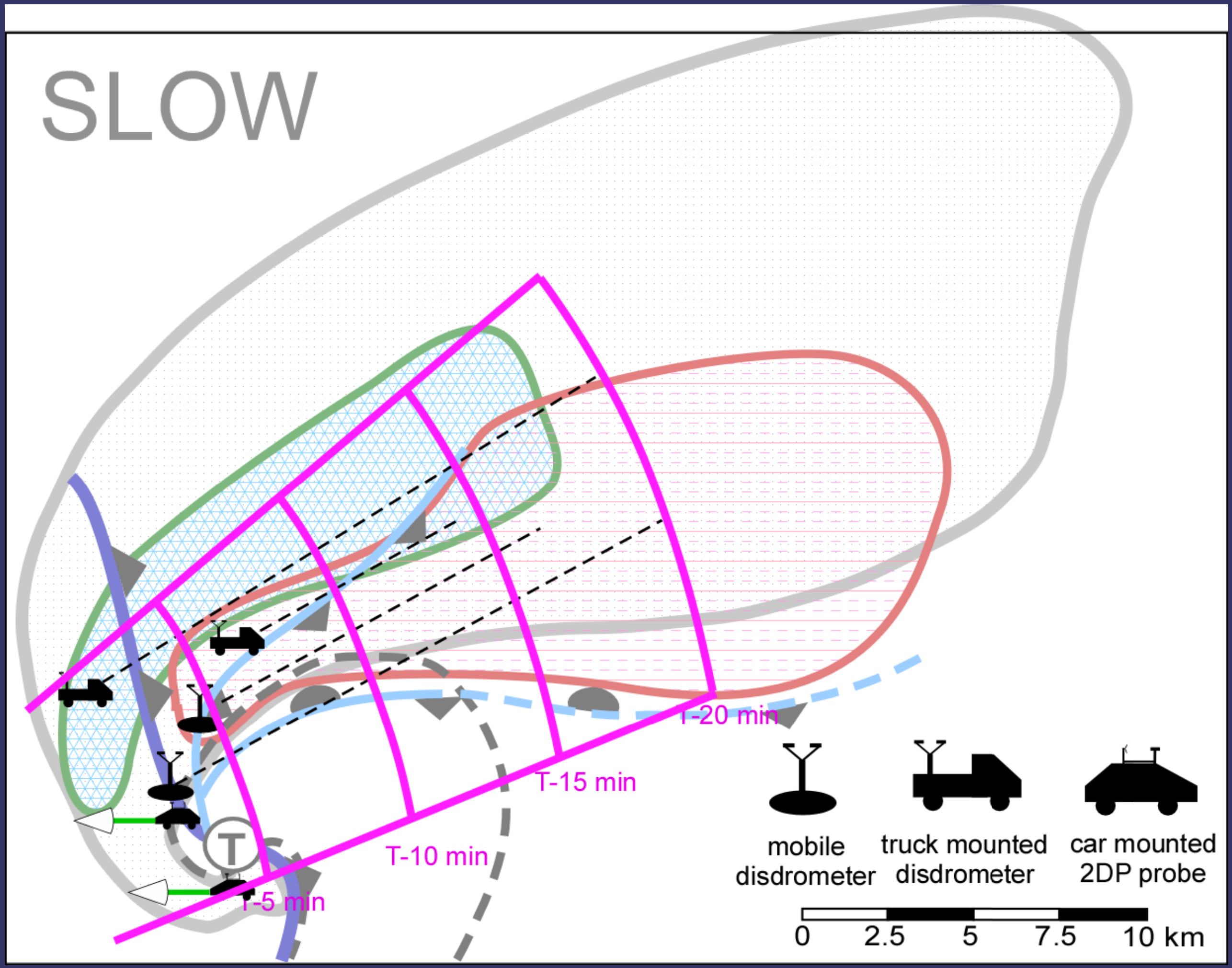
Unmanned deployment
- close to tornado
- slowly moving

Adv: higher quality
Dis: redeployment time

Truck deployment
- non-tornadic storms
- fast moving storms

Adv: Splashing, turbulence
Dis: rapid redeployment

Feb. 2009 Planning: Slow Moving Storm



Concentration toward right rear, 2DP probes focus on E-W transects through hook (data collection while westbound)

Data Collection Review

15 May: NW Oklahoma – Squall line: weak reflectivity

19 May: Sidney - Microburst: Hardly any rain

20 May (DP): Alliance, NE SC; short intense rain good NOXP + DOW7 coverage; PA deployment along radar baseline

23 May: Paxton, NE; deployed in weak rain area; good dual-pol coverage

27 May: Dallas left mover: deployed too far east, no rain at deployment site

30 May: Central NE, high-base supercell; no rain at deployment site

31 May (DD): Omaha; several deployments in rain, good NOXP DOW6 DOW7 coverage

1 June: NE Nebraska good NOXP coverage

4 June (DP): Cheyenne: several deployment within core (hail and rain): no NOXP during PA deployment, 1st deployment very good DOW6 and DOW7; 2nd deployment DOW7

5 June (DD): Chugwater; several deployments; excellent coverage from DOW6, DOW7, NOXP coverage during tornado

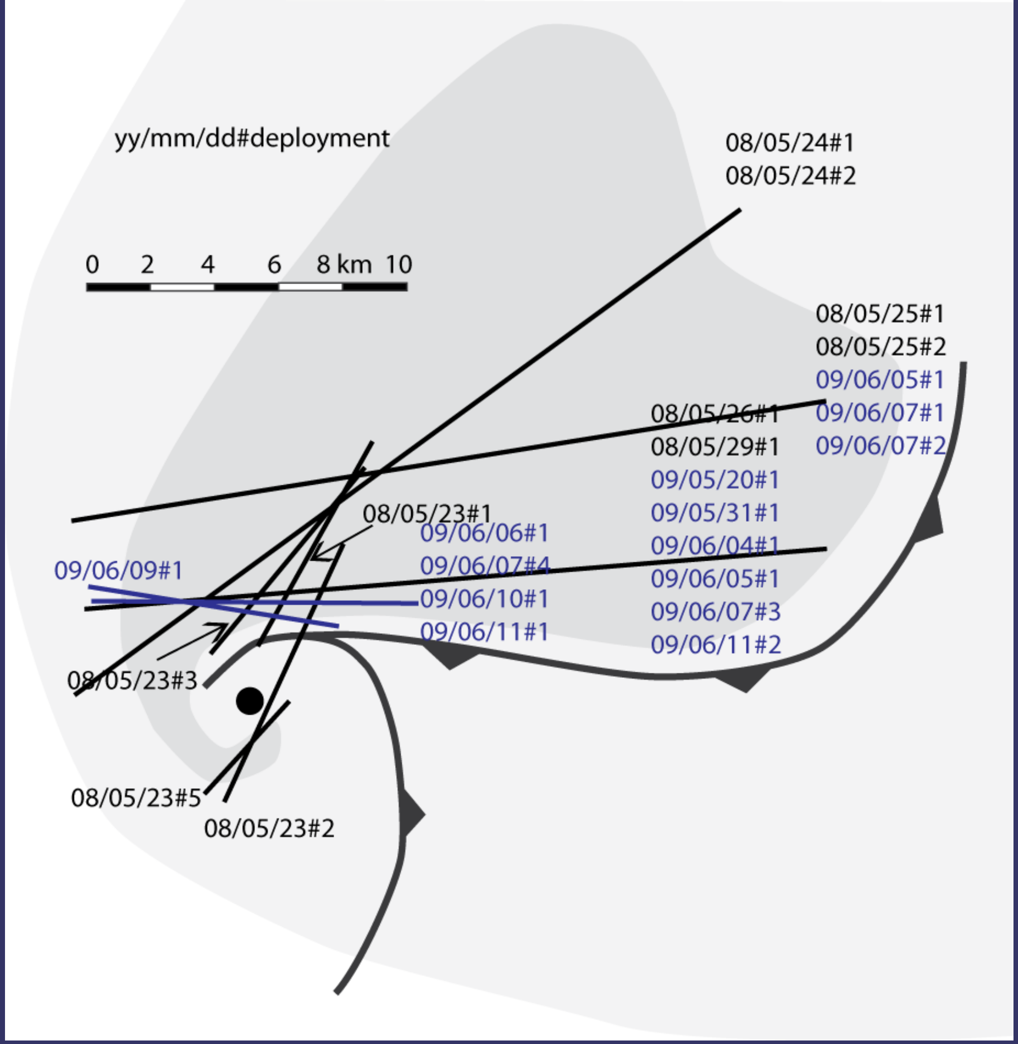
6 June: North Platte, weak SC, deployment in rain/hail good coverage1st deployment good coverage DOW6 DOW7 2nd deployment hardly any rain

7 June (DD): Missouri, NOXP coverage at last PA deployment, DOWs?- good coverage during 3rd and 4th deployment

9 June (DD): Greensburg; coordinated with Glen; weakening SC; nice deployment close to hook; good coverage from DOW7 DOW6? NOXP?- Dow data missing between 2320-2344 and beyond 0012

10 June SE of Dodge City; weakening SC; good radar coverage DOW7, DOW6, NOXPDD

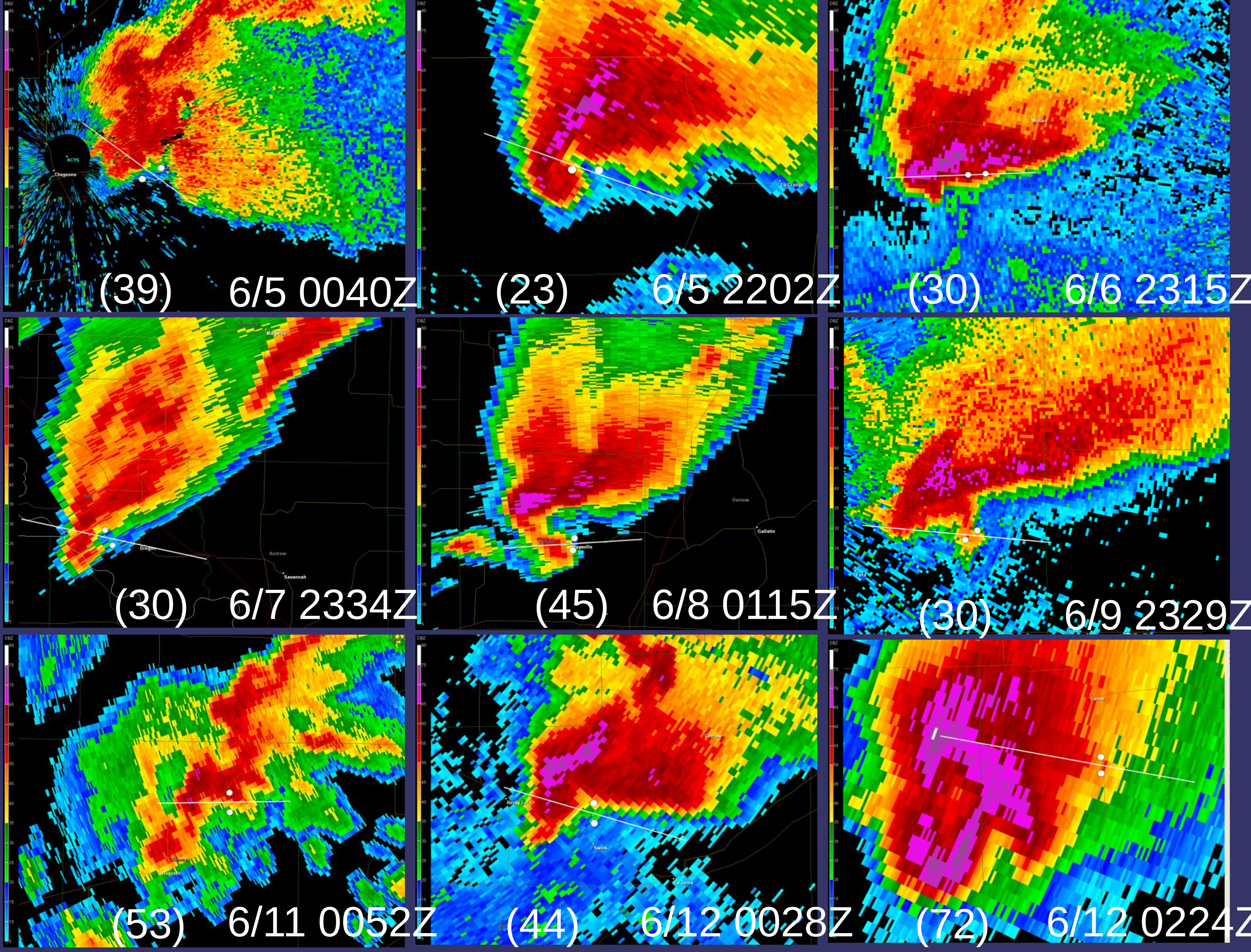
11 June (DD): Lamar, several deployment in weak SC strong SC system; NOXP? 1st & 2nd deployment good dual-Doppler coverage DOW6 and DOW71st NOXP too far away; 2nd deployment not scanning - need to be verified



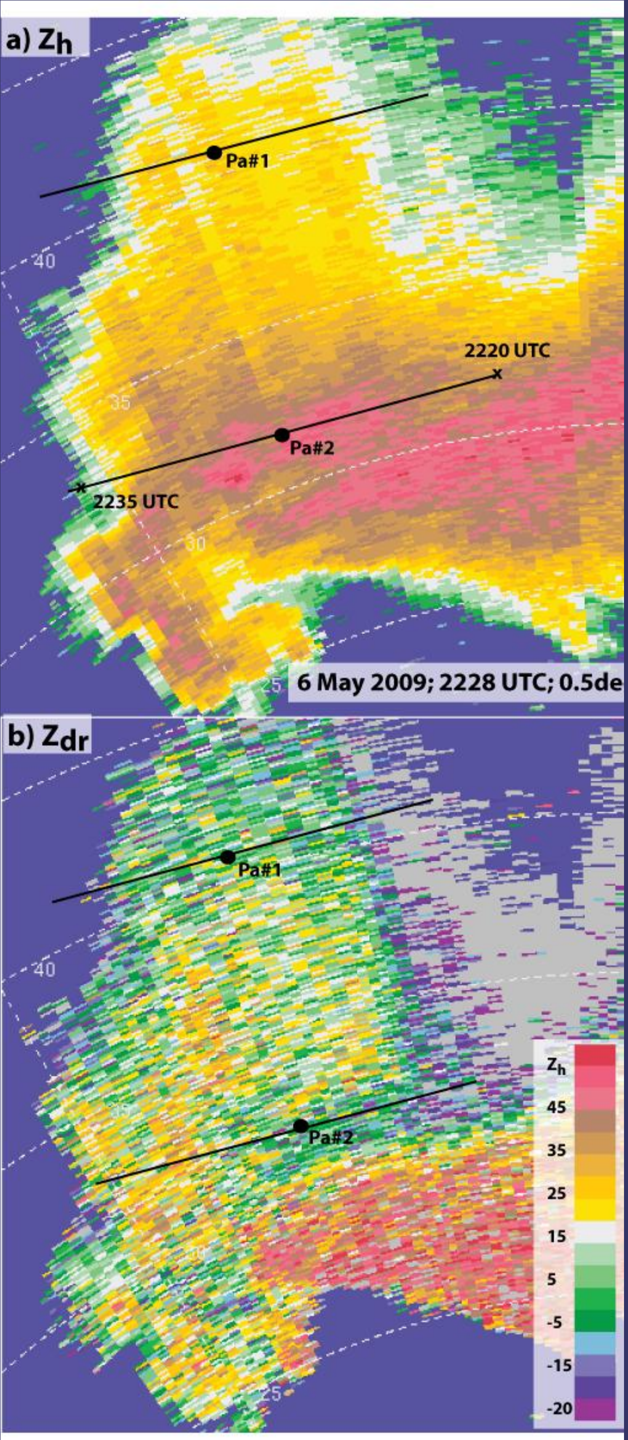
1 x Squall line:	20 May
5 x Non-tornadic supercell:	31 May, 4, 6, 7, 10 June
2 x Supercell with tornado potential:	9, 11 June
1 x Tornadic supercell:	5 June

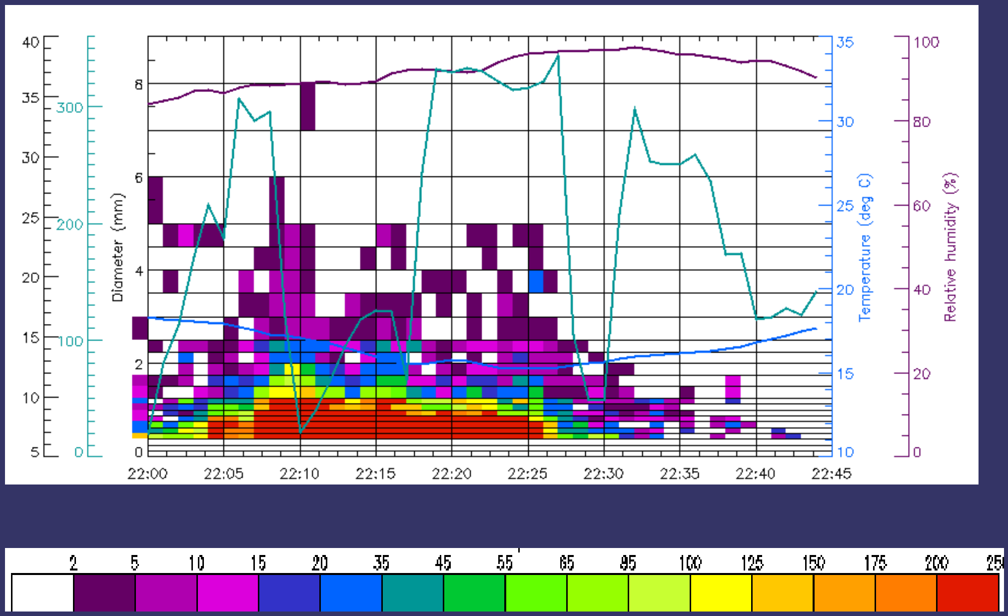
9 cases

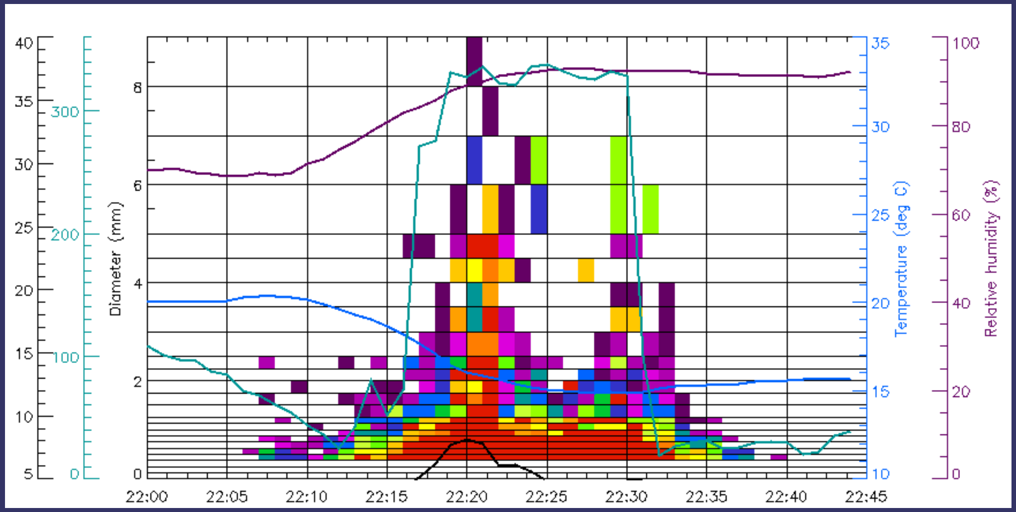
	Disd 1	Disd 2	NOXP	Dow 7	Dow 6	
20 May Alliance	2342-0028	**0000-0021**	0000-0048	2358-0048		6
31 May SE Omaha	**0044-0048, 0056-0058, 0107-0115**	**0035-0147**	0027-0128	2345-0010 0048-0120	0001-0009 0059-0108	2
4 June Cheyenne. WY	**2306-2331**, 0036-01000	**2313-2325** 0038-0055	2333-0000 0106-0139	2257-0004 0041-0119	2310-2355	7
5 June Chugwater, WY	**2138-2248**, **2324-2337,** **2345-0025**	**2158-2300**, **2322-2340,** **2345-0025**	2200-2244 2348-0008 0148-0216	2129-2219 2221-0021 0130-0142 0156-0225	2140-2234 2248-2251 2332-0007	1
6 June North Platte, NE	**2311-2338**	**2321-2343**	2300-2342 0109-0124	2304-2340 0053-0124	2300-2333 0058-0116	5
7 June NW Missouri	2317-2329, 0005-0020, **0059-0122,** 0151-0200	2317-2329, 0005-0020, **0059-0122,** 0151-0200	2335-0004 0121-0150	2242-2314 2335-2345 0052-0137	2250-2314 0051-0150	4
9 June Greensburg	2325-2346, 0020-0029, **0035-0040**	2328-2345, 0020-0029, **0035-0040**	2315-2328 2358-0026 0032-0044	2307-2346 0027-0058	2301-2320 2340-0013	8
10 June Dodge City	**2350-0005**, **0048-0100**	**2352-0008**, **0048-0008**	2331-0009 0051-0109	2300-0006 0043-0115	2314-0007 0040-0102	9
11 June Lamar, CO	**0017-0050**, **0207-0330**	**0019-0043**, **0216-0330**	0046-0130 0136-0224	0000-0049 0203-0208 0214-0228 0239-0314	2355-0033 0121-0124 0219-0314	3


(39) 6/5 0040Z
(23) 6/5 2202Z
(30) 6/6 2315Z
(30) 6/7 2334Z
(45) 6/8 0115Z
(30) 6/9 2329Z
(53) 6/11 0052Z
(44) 6/12 0028Z
(72) 6/12 0224Z

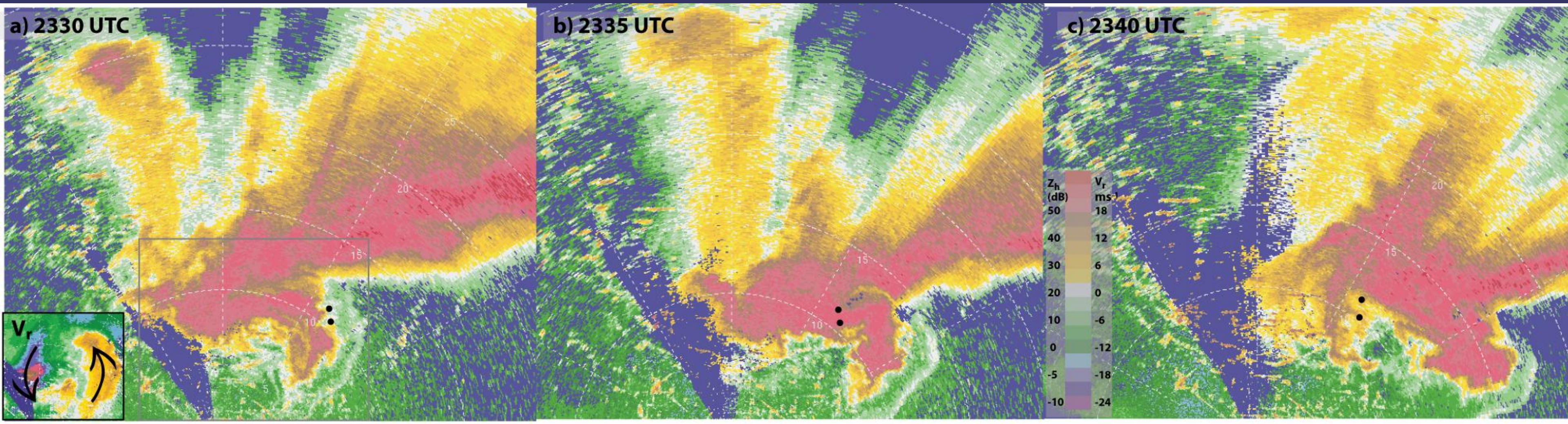
5 June (Chugwater, Tornadic SC)

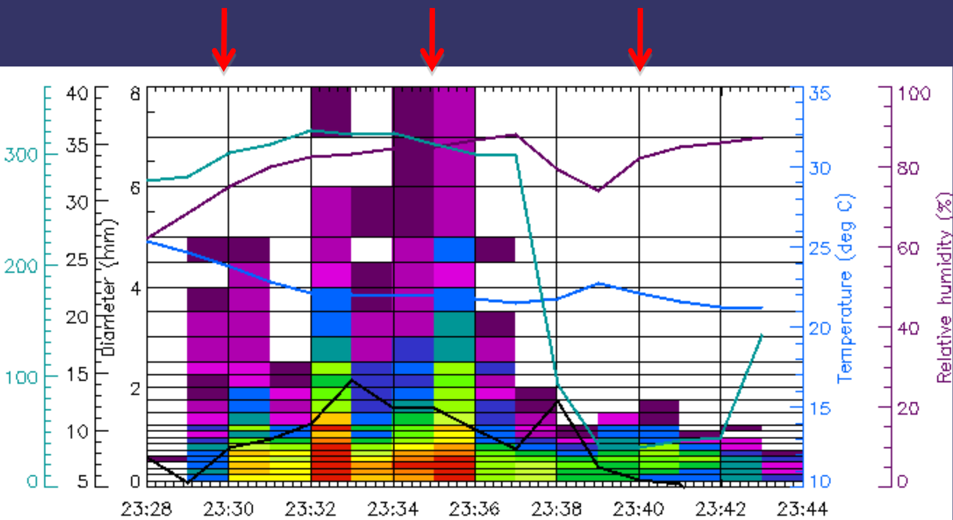


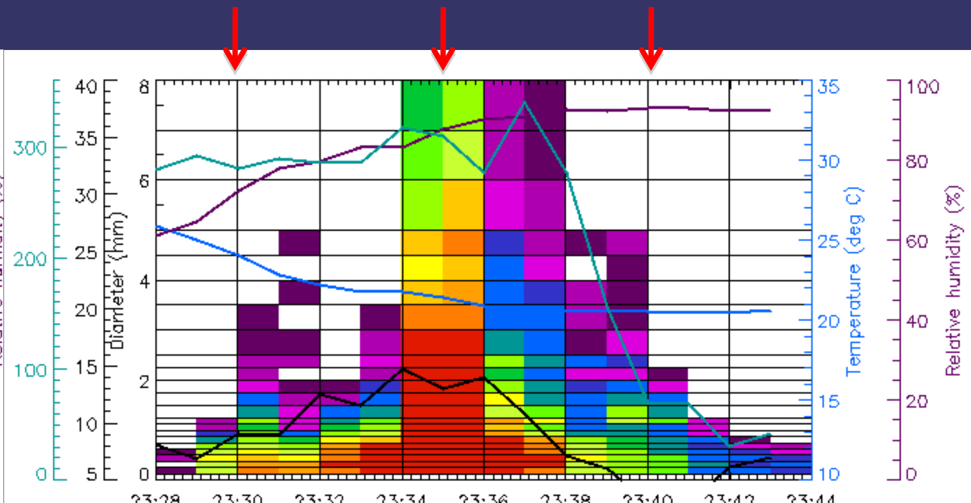




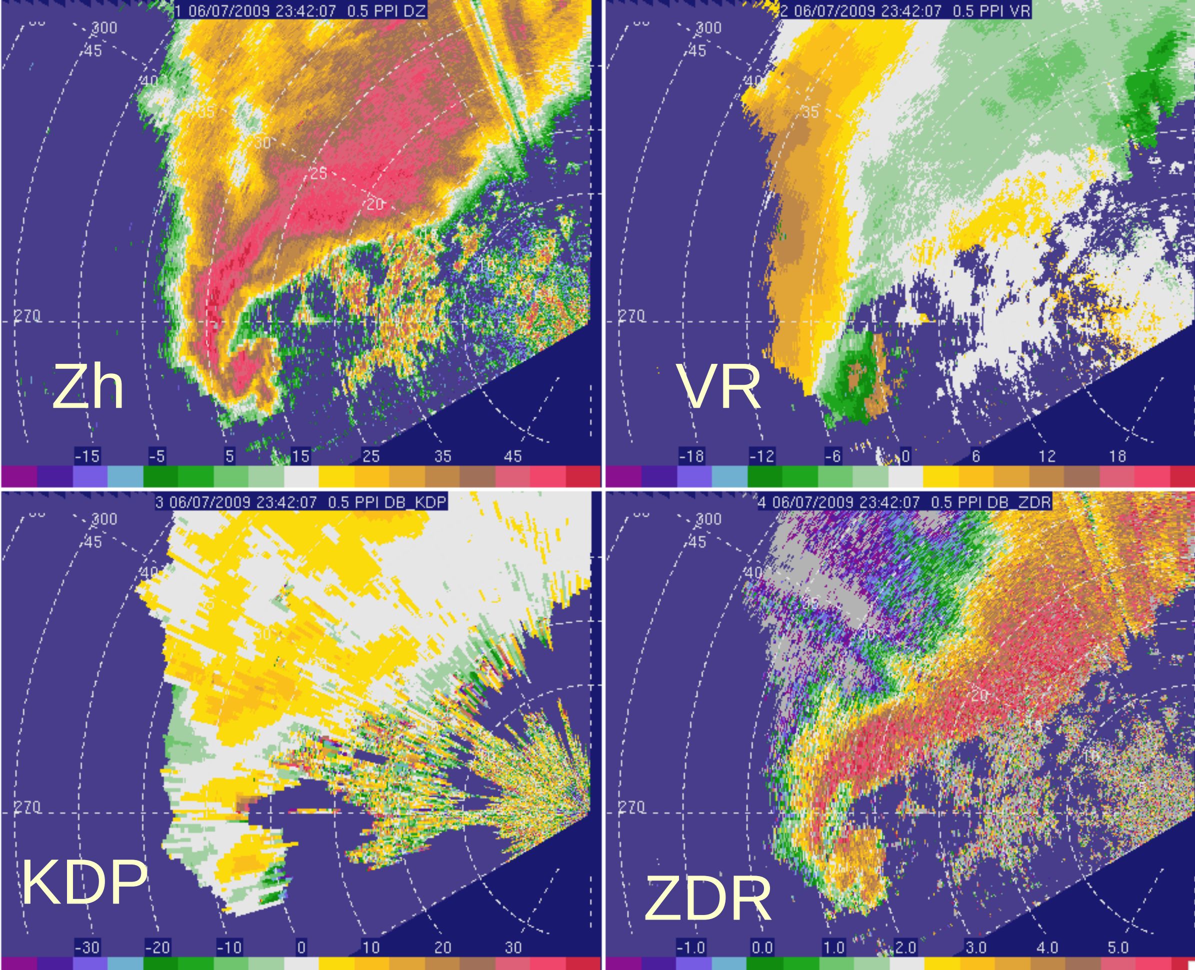
9 June (SC, Greensburg, KS)

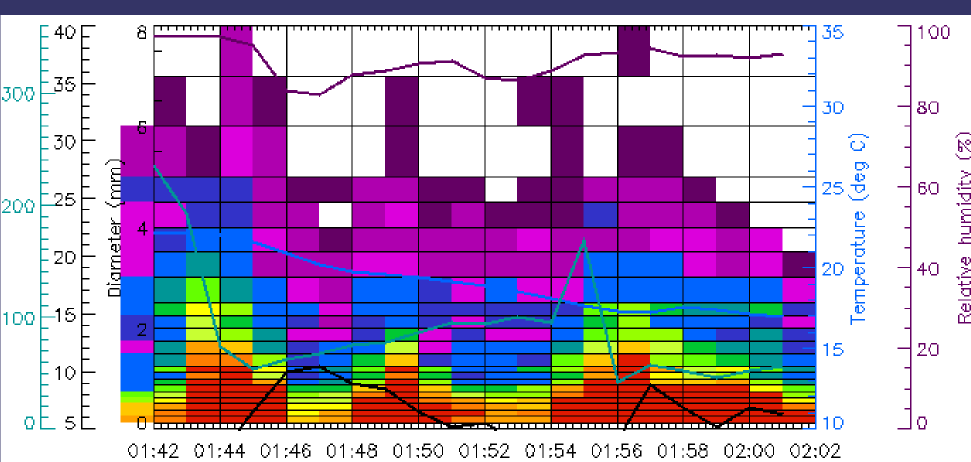


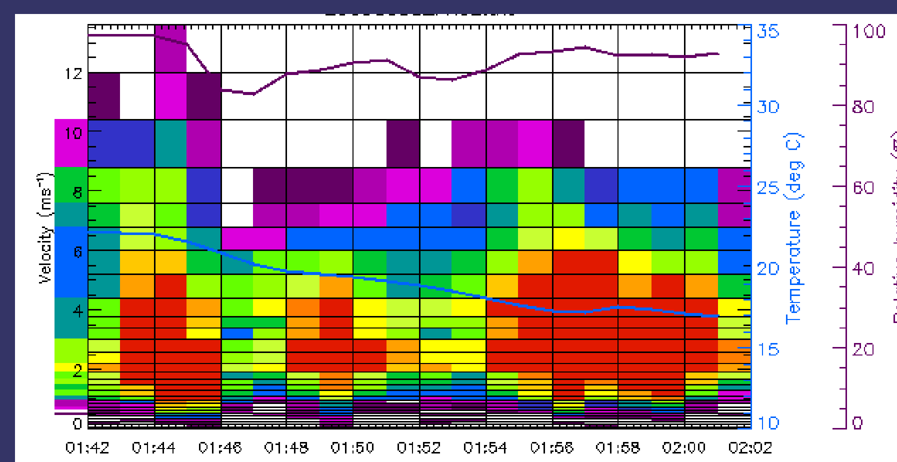




31 May (Supercell NW Missouri)



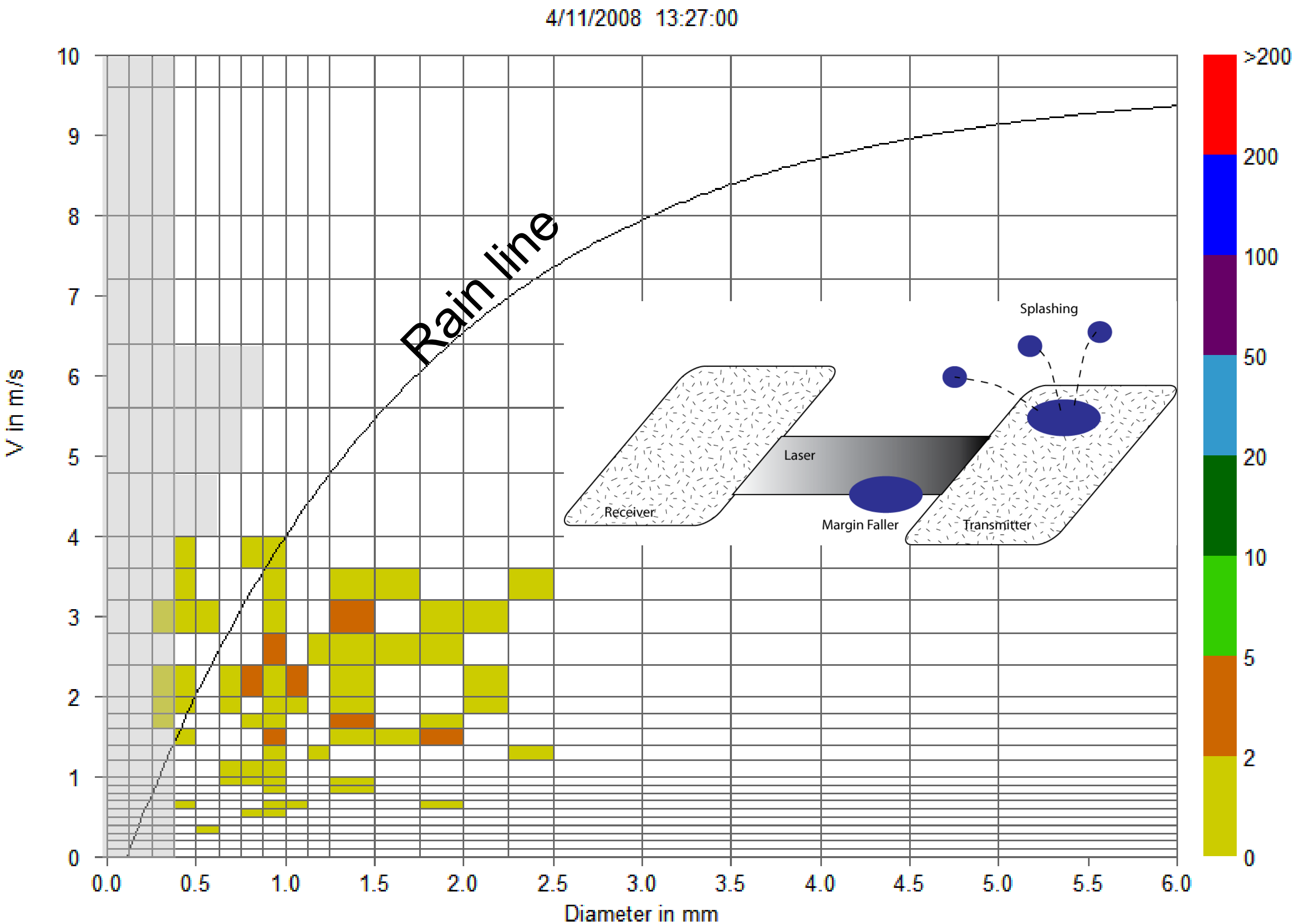




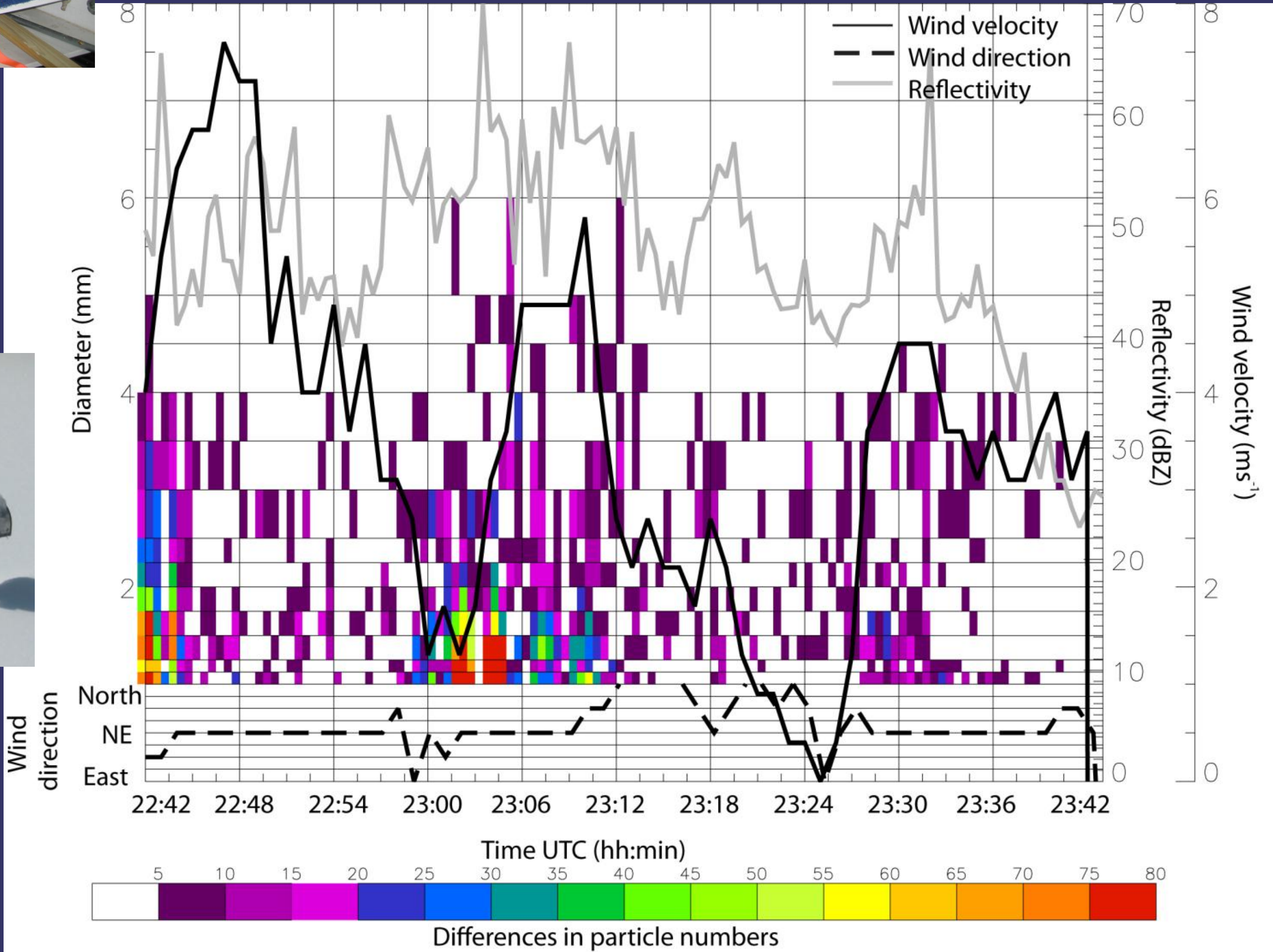
Research Goals – next steps

1. Quality control
   - Margin faller
   - Total number
2. Radar post-calibration
3. Derive PSD parameter
   - Mean diameter
   - Slope, intercept
4. Compare PSD within/between storms

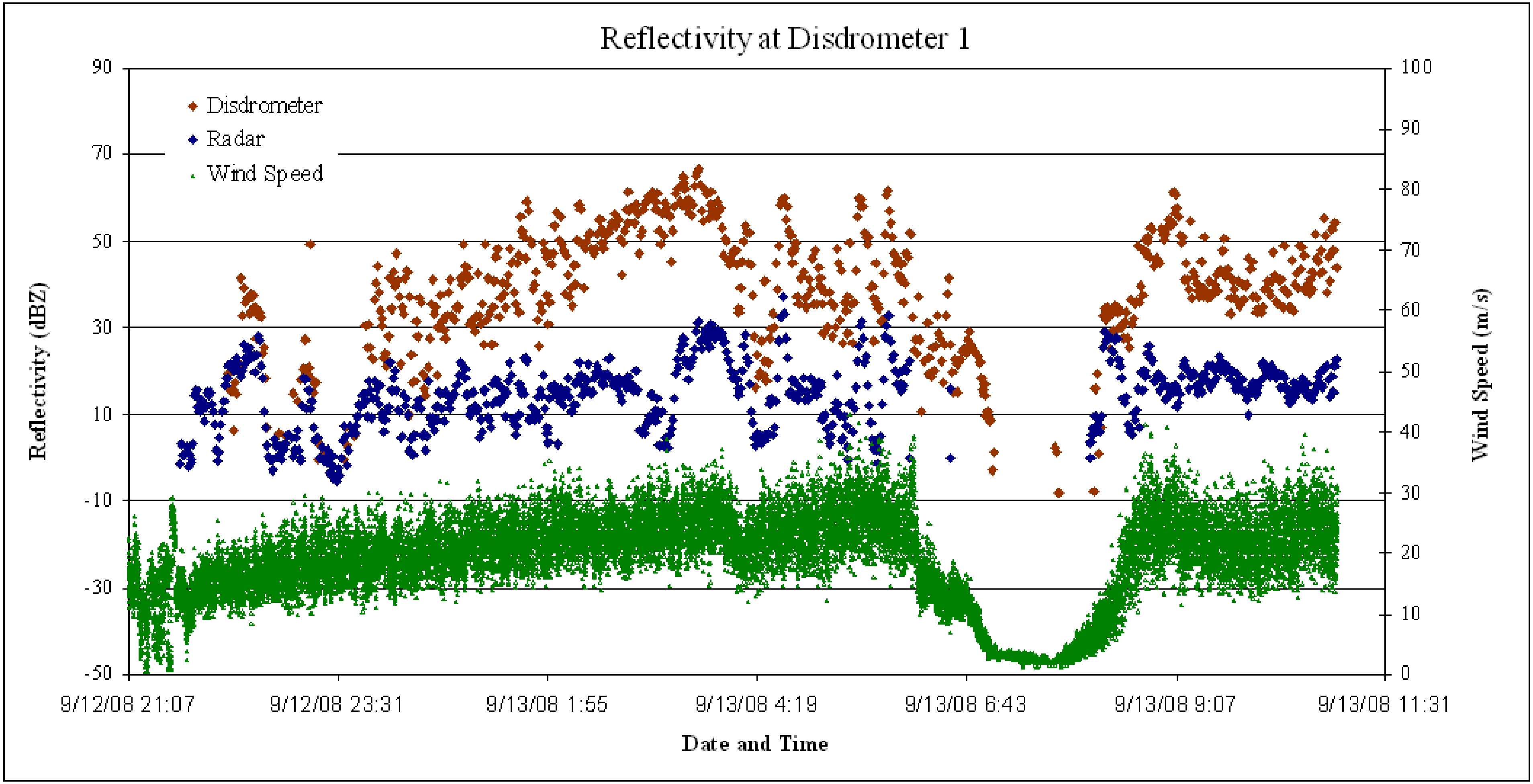
1. Quality control
(Splashing/Margin fallers)



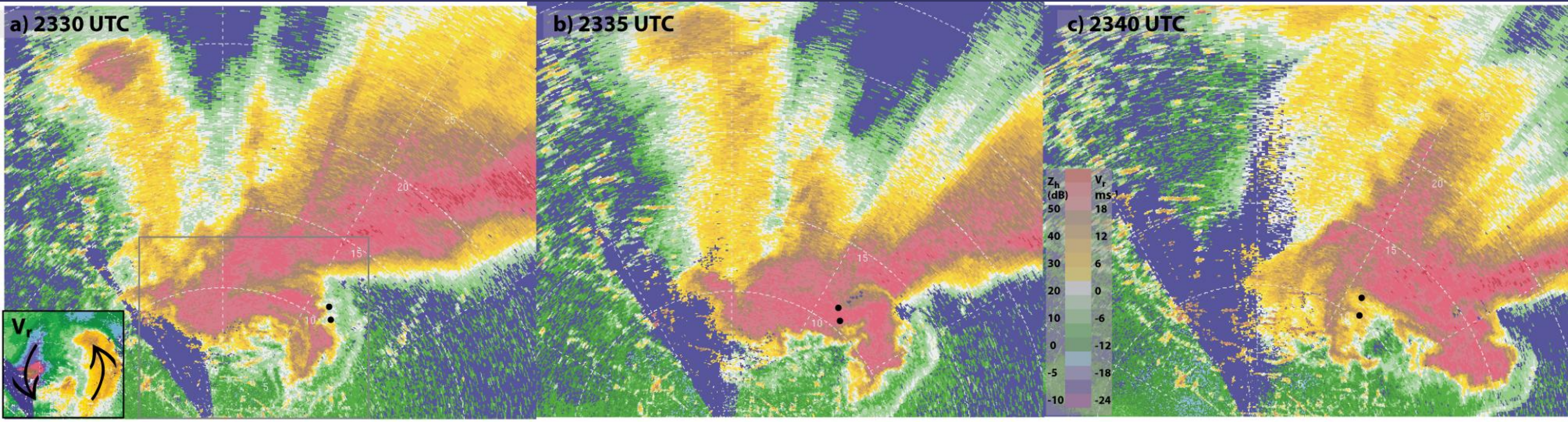
1. Quality control
(Wind direction/Turbulence)

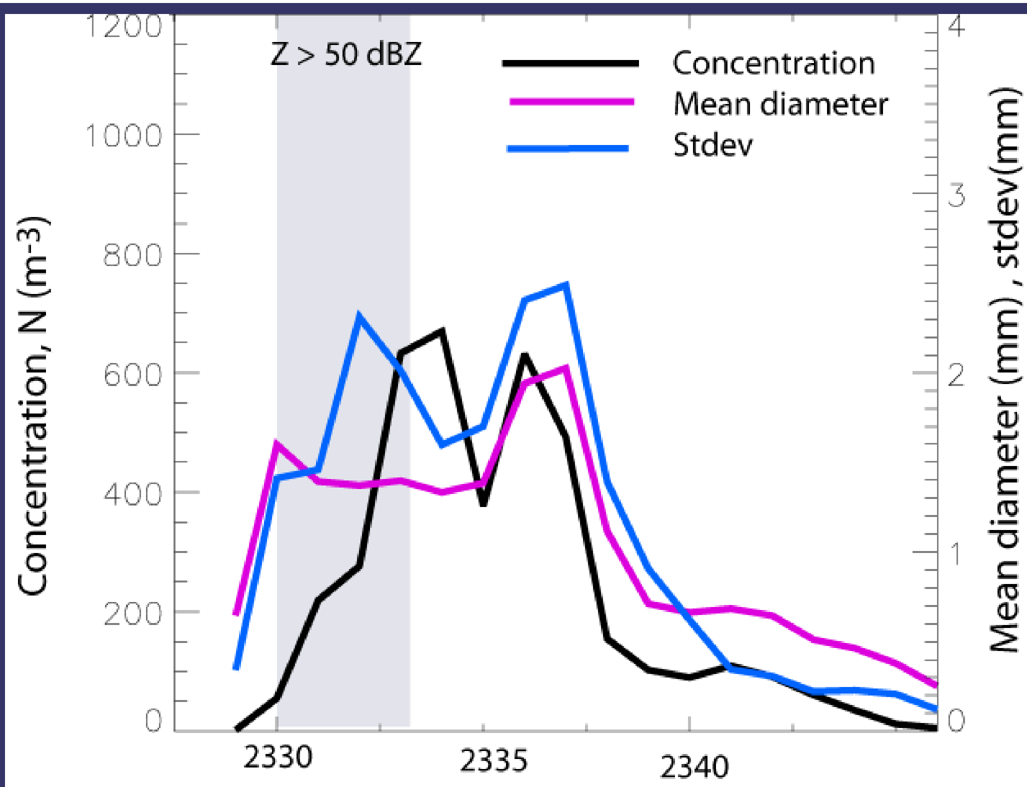


2. Radar calibration

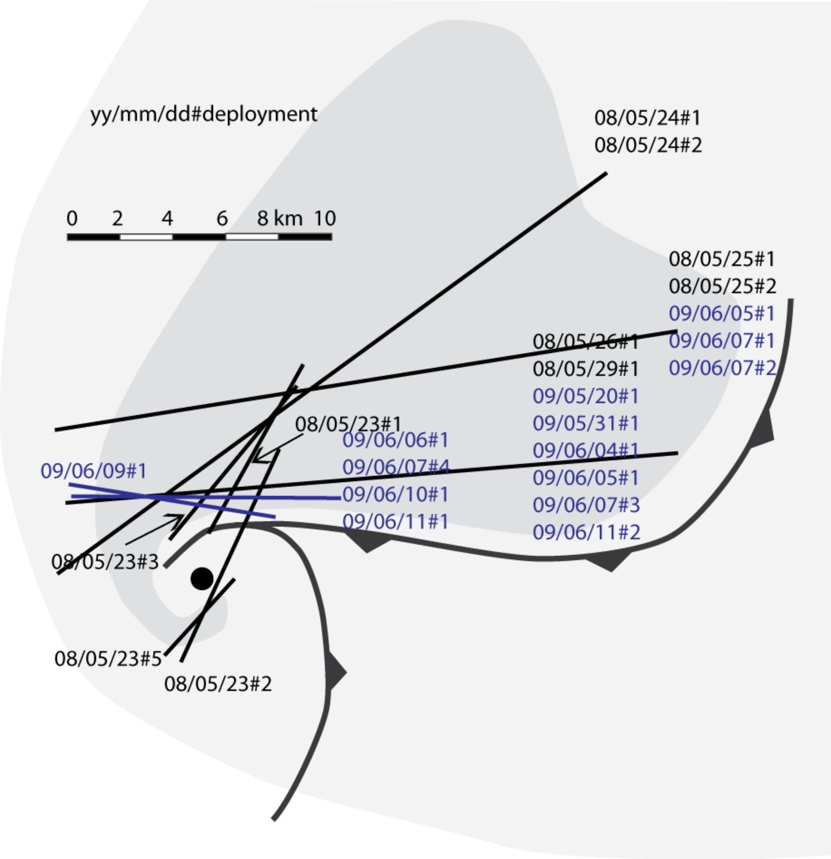


3. PSD parameters





4. Compare PSD



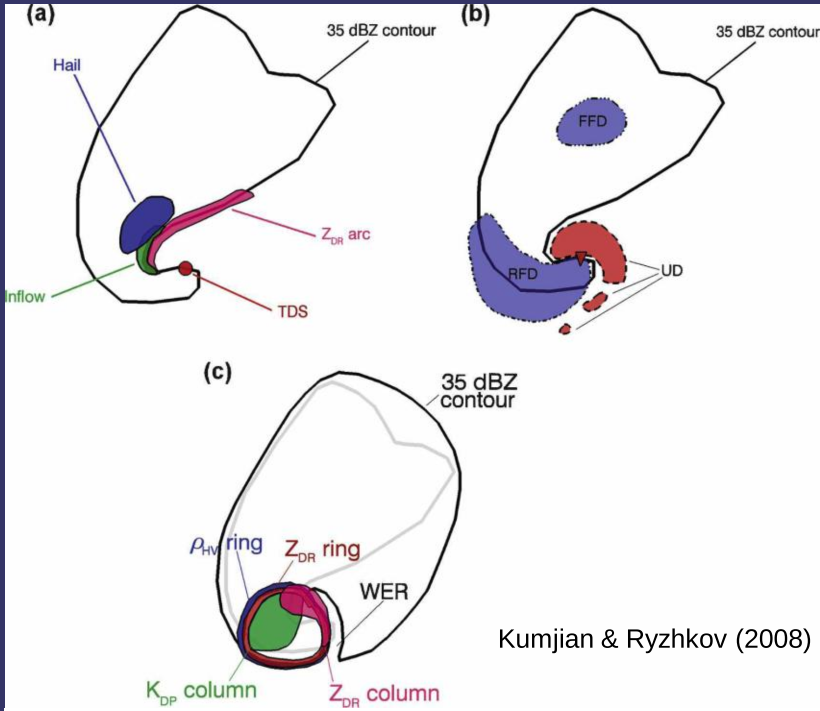


FIG. 1. Schematics of supercell thunderstorms with the locations of features in (a) the polarimetric variables at low levels (<1 km), (b) vertical velocities (adapted from Lemon and Doswell 1979), and (c) polarimetric variables at midlevels (~5 km). In (a), "TDS" is the tornadic debris signature, "hail" is the low-level signature of hail reaching the ground, "inflow" is the low-level inflow signature, and the thick black line is the 35-dBZ contour. In (b), downdrafts are indicated by blue shading and updrafts with red shading. The tornado is indicated by the red triangle. In (c), "WER" is the weak-echo region and the gray outline shows the location of the low-level 35-dBZ contour.

Kumjian and Ryzhkov (2007) hypothesized that size sorting of the raindrops must occur in these regions, i.e., the vertical increase in wind velocity and the veering of the wind causes smaller raindrops to be advected farther away from the source while larger raindrops and hail having higher fall velocities will fall along the southern edge of the FFD.

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Research objectives

Analyze PSD, fall velocity, and surface observations in conjunction with dual-polarization Doppler radar measurements to

- Characterize PSD and fall velocities in different areas of the storm and at various lifetimes of supercell thunderstorms,
- Create a PSD-parameter data base for understanding microphysical processes within supercell thunderstorms and evaluating storm-scale numerical model outputs, and
- Studying steady-state and intermittent microphysical processes relevant for ice production and determine the effect of the evaporative cooling between tornadic and non-tornadic storms by additionally analyzing 3-dimensional dual-polarization and dual-Doppler radar data.

Type of Data Needs

- Rapid dual-polarization and dual-Doppler measurements
- Disdrometers (proposal submitted Sept. 09; no NSF feedback)

Data Collection Needs

- Fast deployment of radars
- Better continuous coverage
- If possible by at least two radars
- Better coordination with NOXP