Upsonde operations summary

J. Trapp, Purdue University

MPEX Workshop

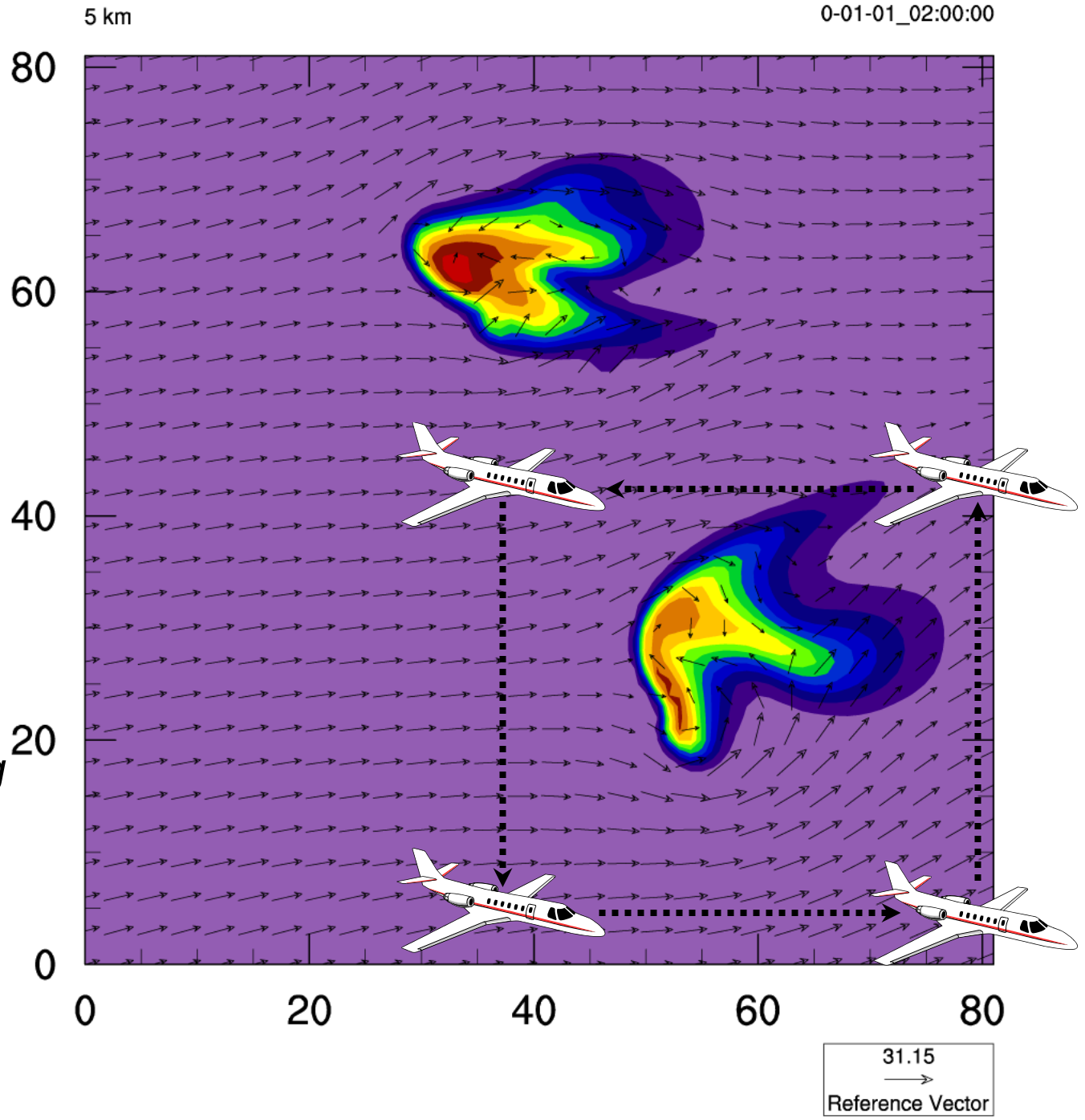
11/19/2013

NCAR, Boulder, CO

Upsondes

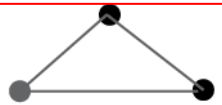
- Purpose: to pursue the fundamental scientific questions of convective storm-environmental feedbacks and predictability under MPEX Hypothesis 2.
- Per the Purdue-NSSL proposal:
  - quantify the observed environmental modifications and upscale feedbacks from deep convection, and relate these back to the characteristics of the convection;
  - evaluate model simulations of upscale feedbacks from deep convection with MPEX observations; and
  - explore the predictability of convectively disturbed atmospheres.

VORTEX2 planning meeting, Quartz Mountain, September 2003…



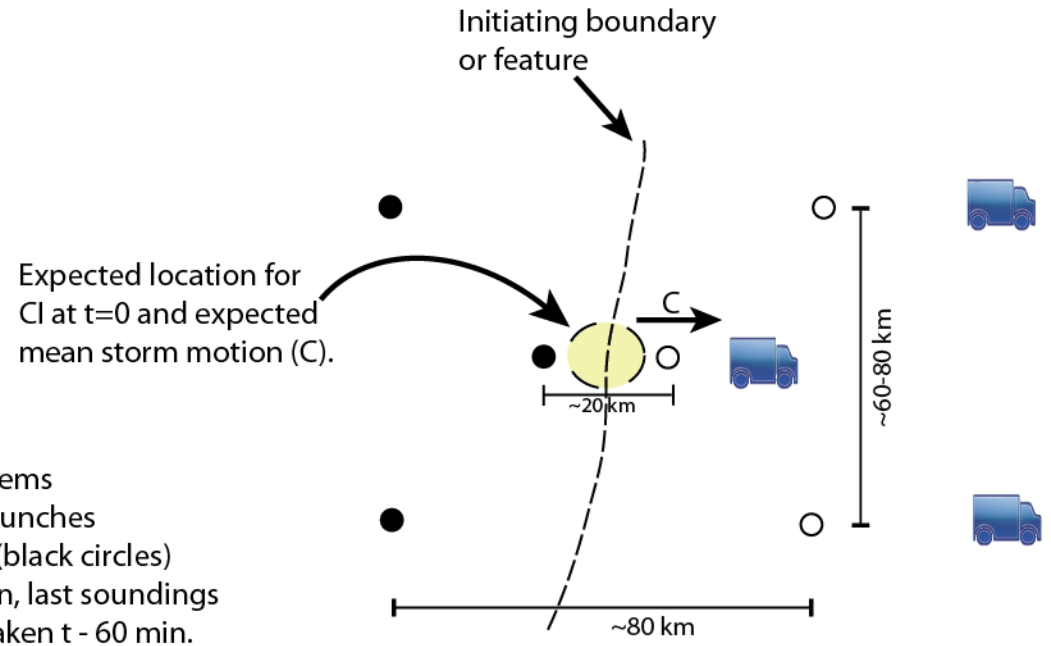
Upsondes

- two mobile units total (an NSSL unit, and a Purdue unit), each containing *two sonde systems*.
  - with two dual-channel systems, a total of 2-4 raobs possible within an hour
    - both teams used InterMet systems; some frequency issues initially limited the number of raobs
  - on average, 6-10 raobs per mission collected in and around the region of convection
- addition of CSU system (and then of TAMU system)
  - both single channel; provided 2-4 raobs per mission per team



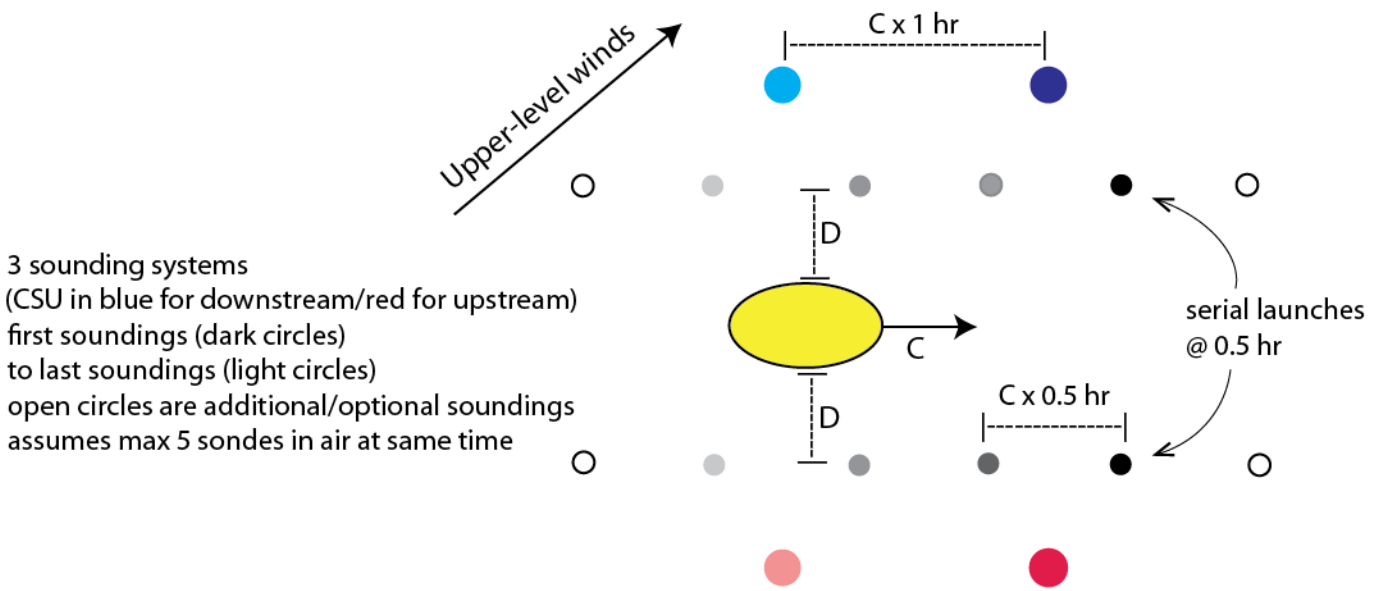
Use time-to-space and line integral methods to calculate vertical profiles of divergence and vorticity

Pre-convective sampling



3 sounding systems
simultaneous launches
first soundings (black circles) taken t - 120 min, last soundings (white circles) taken t - 60 min.

Surround Strategy (Upstream and Downstream Effects)

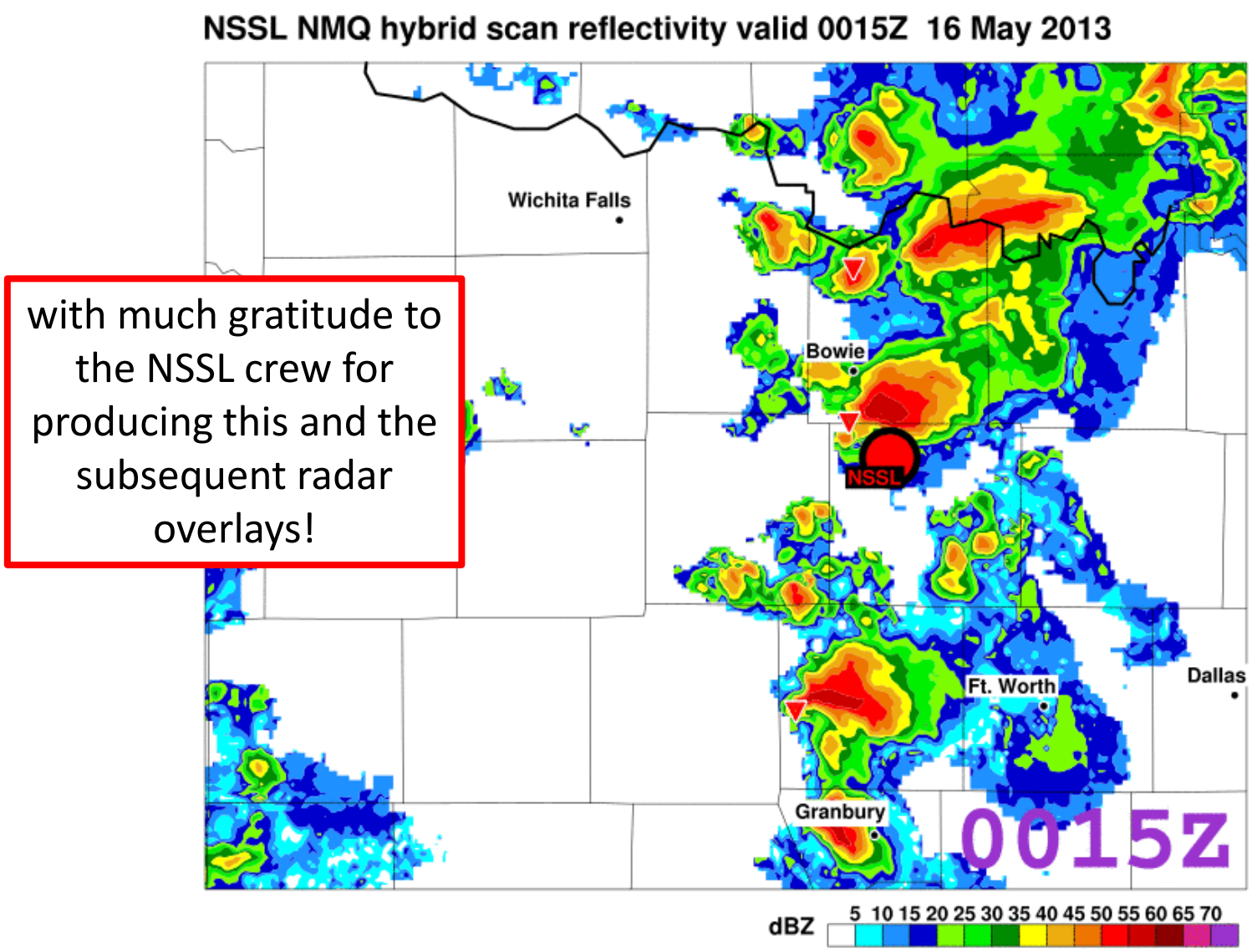


Distance D from storm path could be varied if enough cases sampled.

Nominal D used in operations ranged from ~5 km to ~15 km;

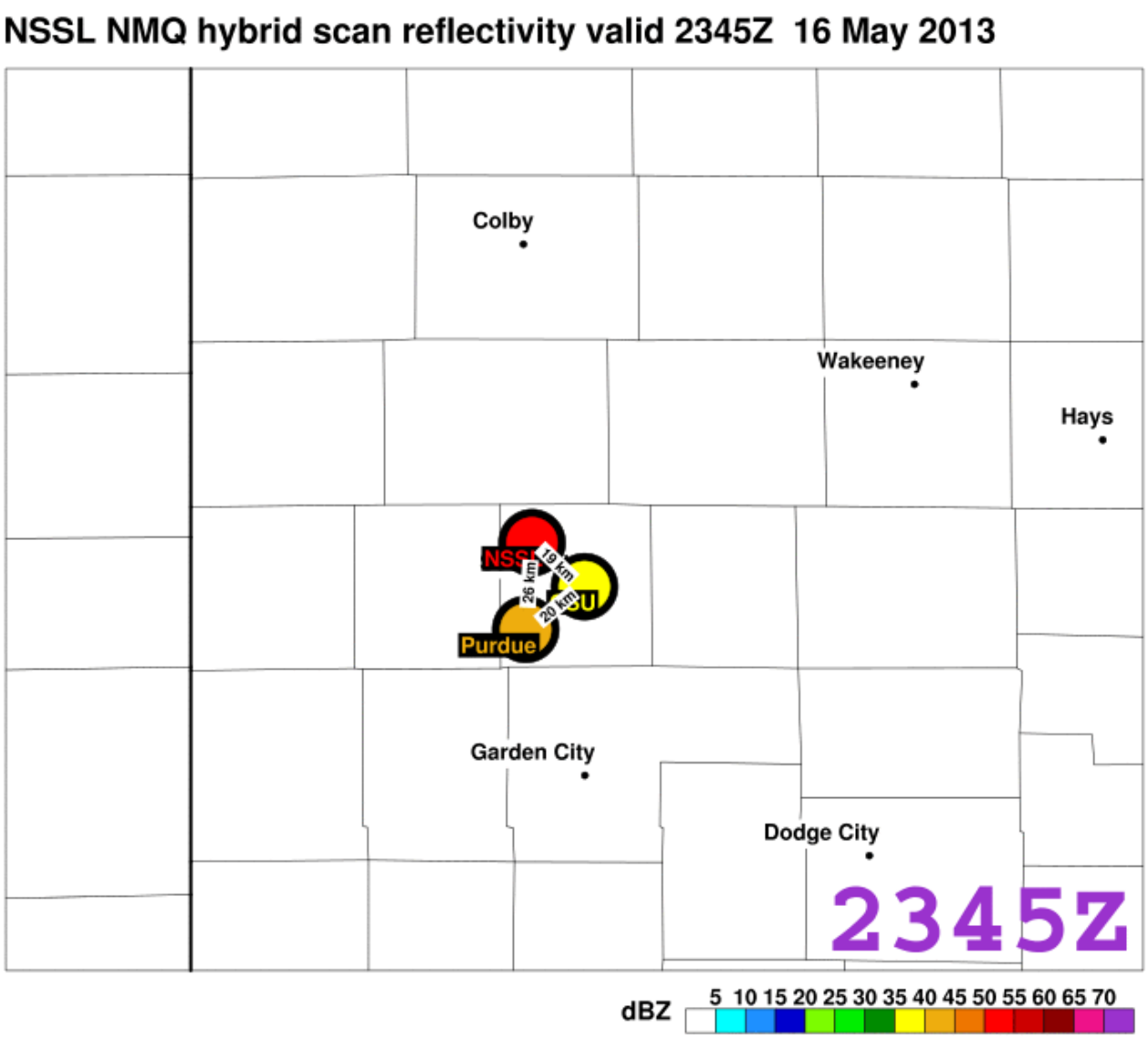
Upsonde summary

- 17 days of operations
- ~290 total raobs collected
- sampled 6 tornadic supercells, ~4 nontornadic supercells, 2 bow echoes, 2 MCSs, and other less organized convective cells/lines

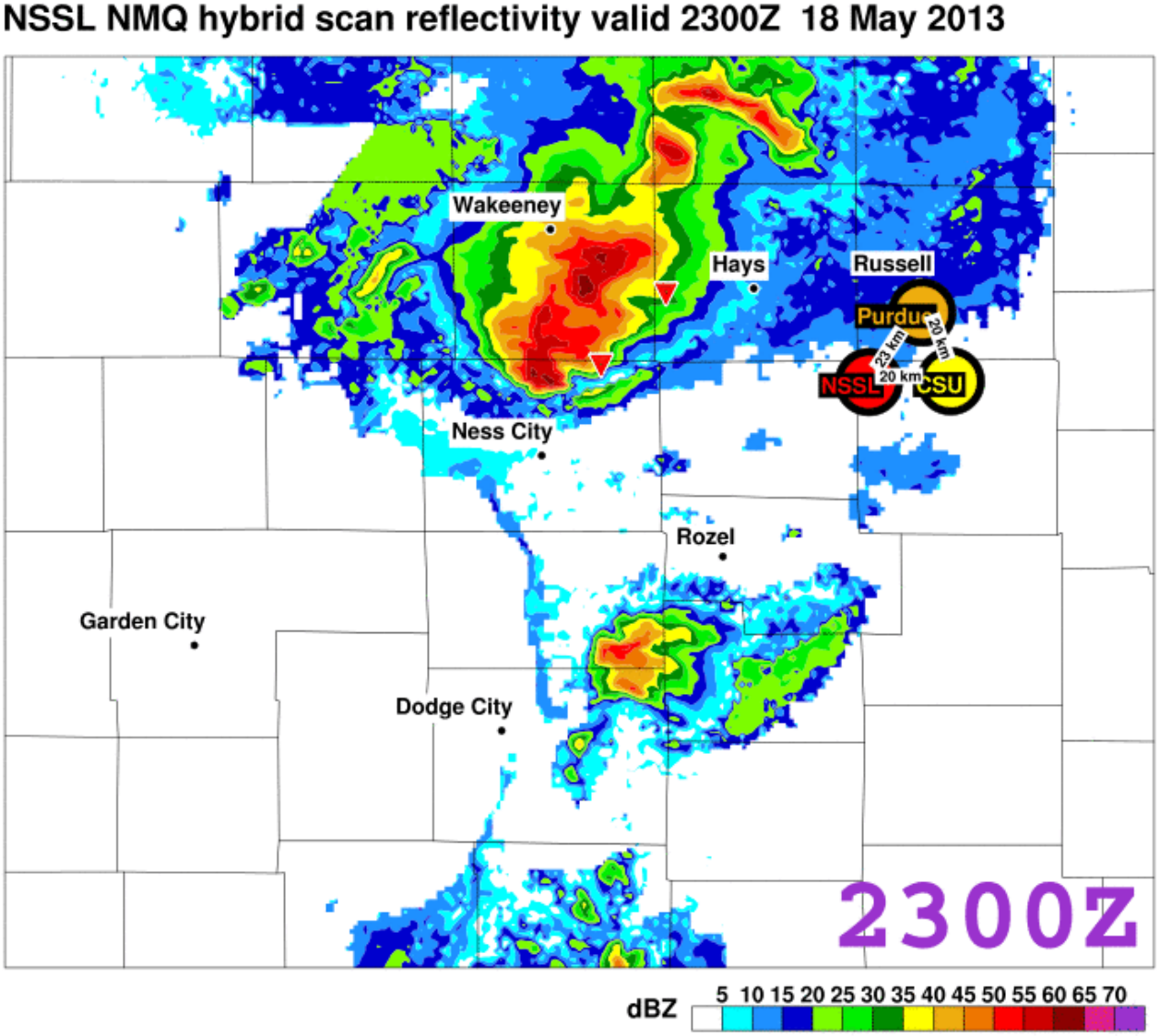


with much gratitude to the NSSL crew for producing this and the subsequent radar overlays!

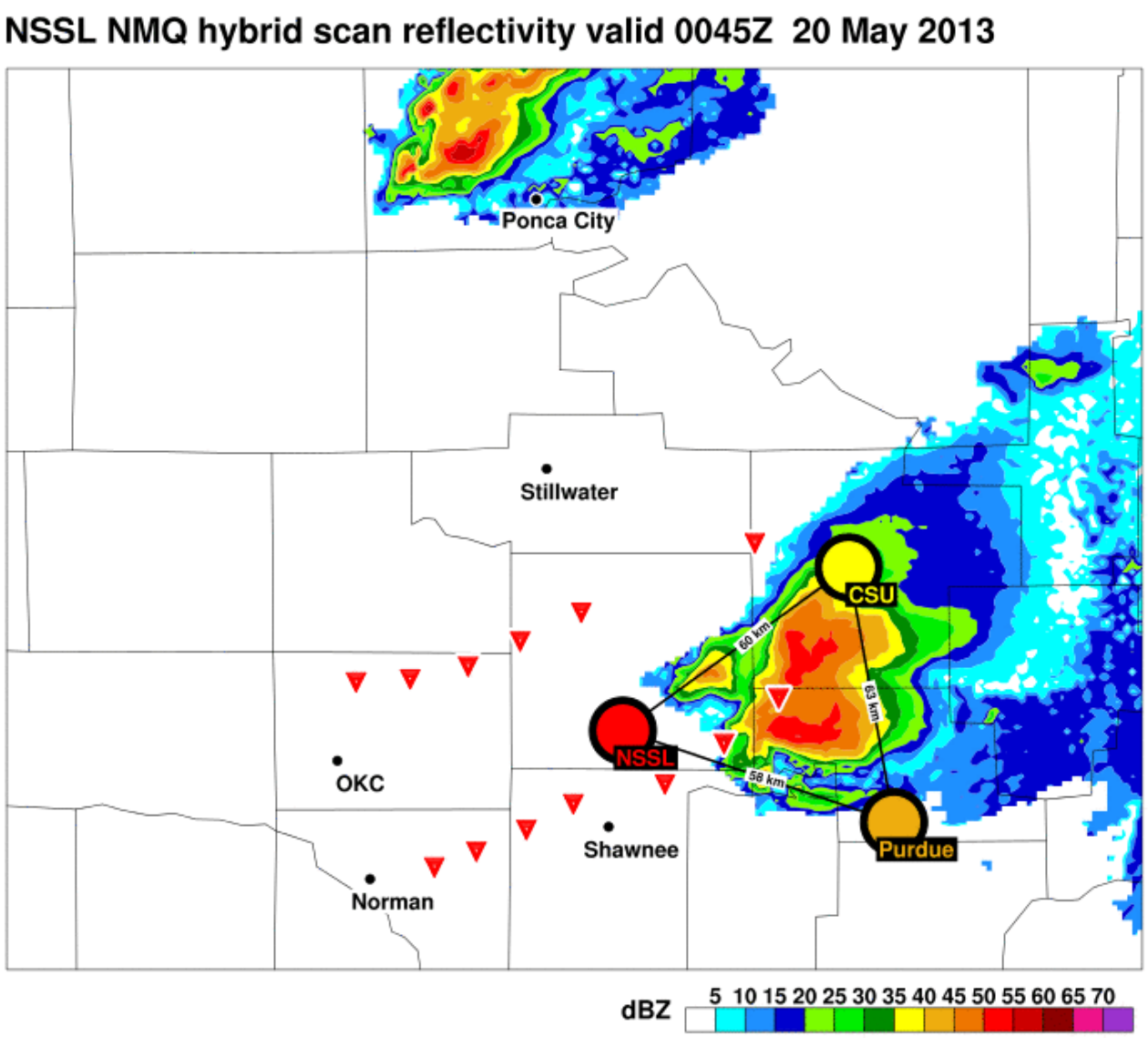
5/15; NSSL only deployment; inflow/upstream of tornadic supercell, + CI-environment



5/16; coordination test; environmental sampling

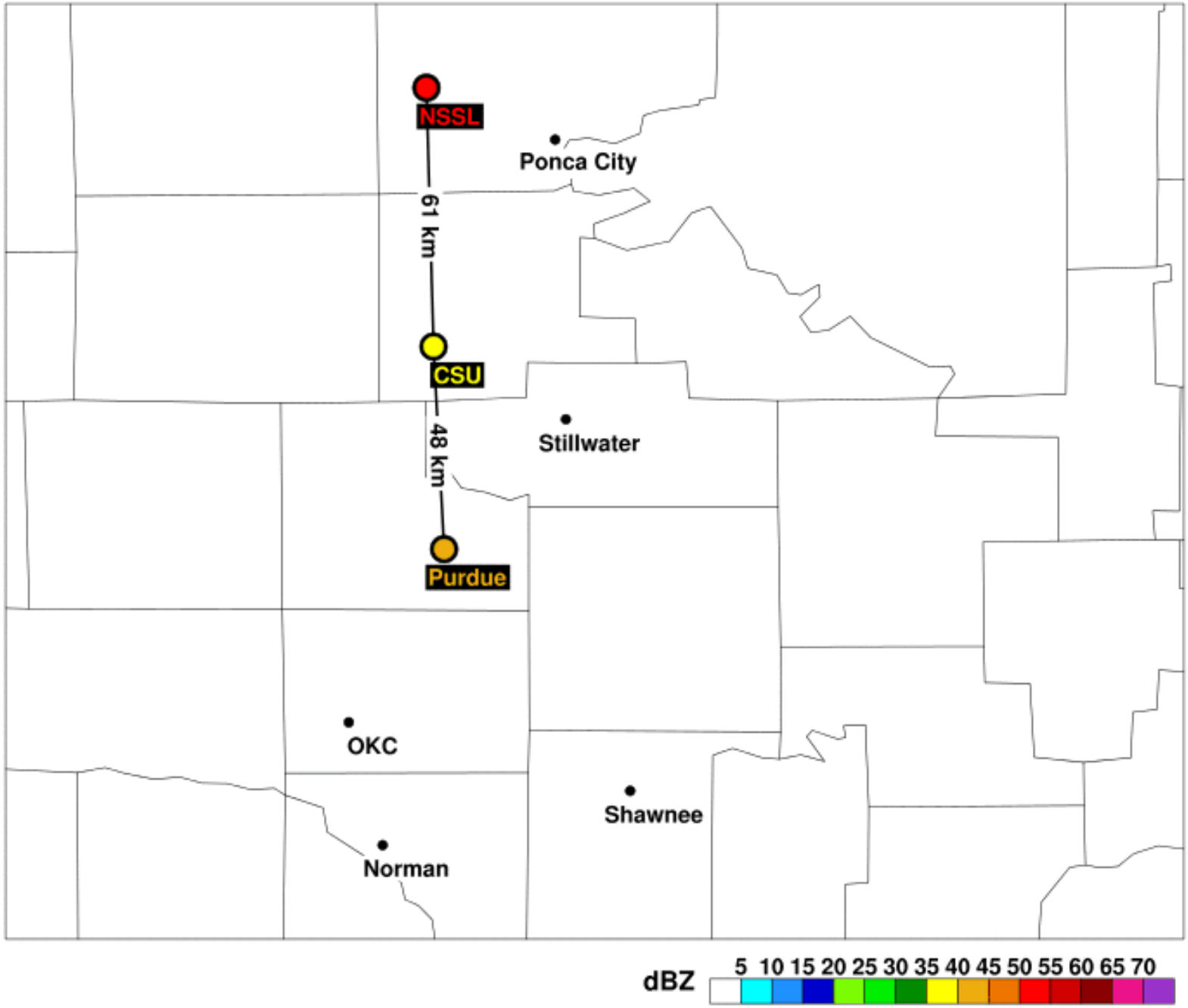


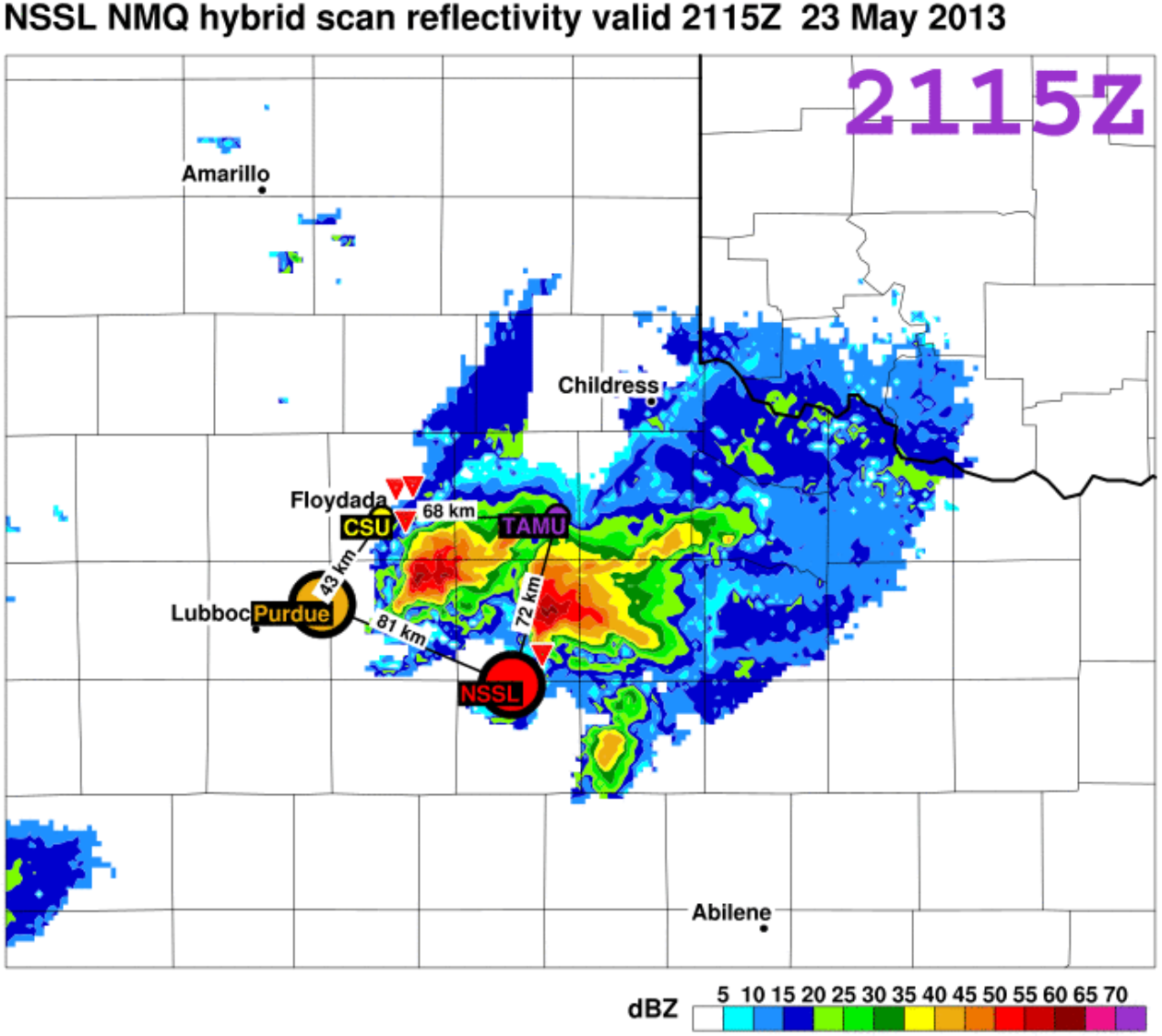
5/18; tornadic supercell; pre-CI, then upstream sampling; additional sampling (inflow, cold pool) of QLCS



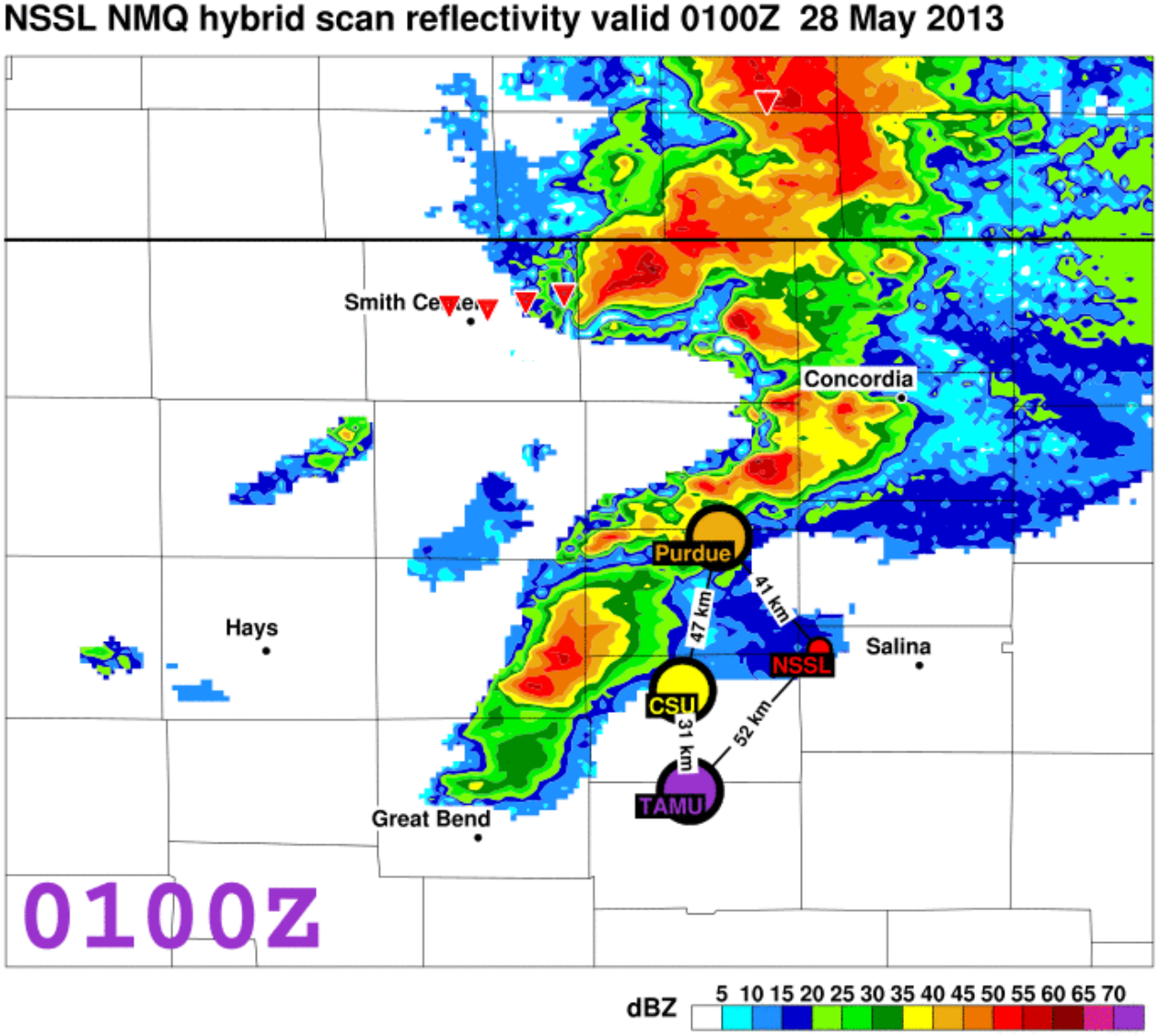
5/19; two tornadic supercells; pre-CI, upstream/downstream sampling, and surround sampling

NSSL NMQ hybrid scan reflectivity valid 1845Z 19 May 2013

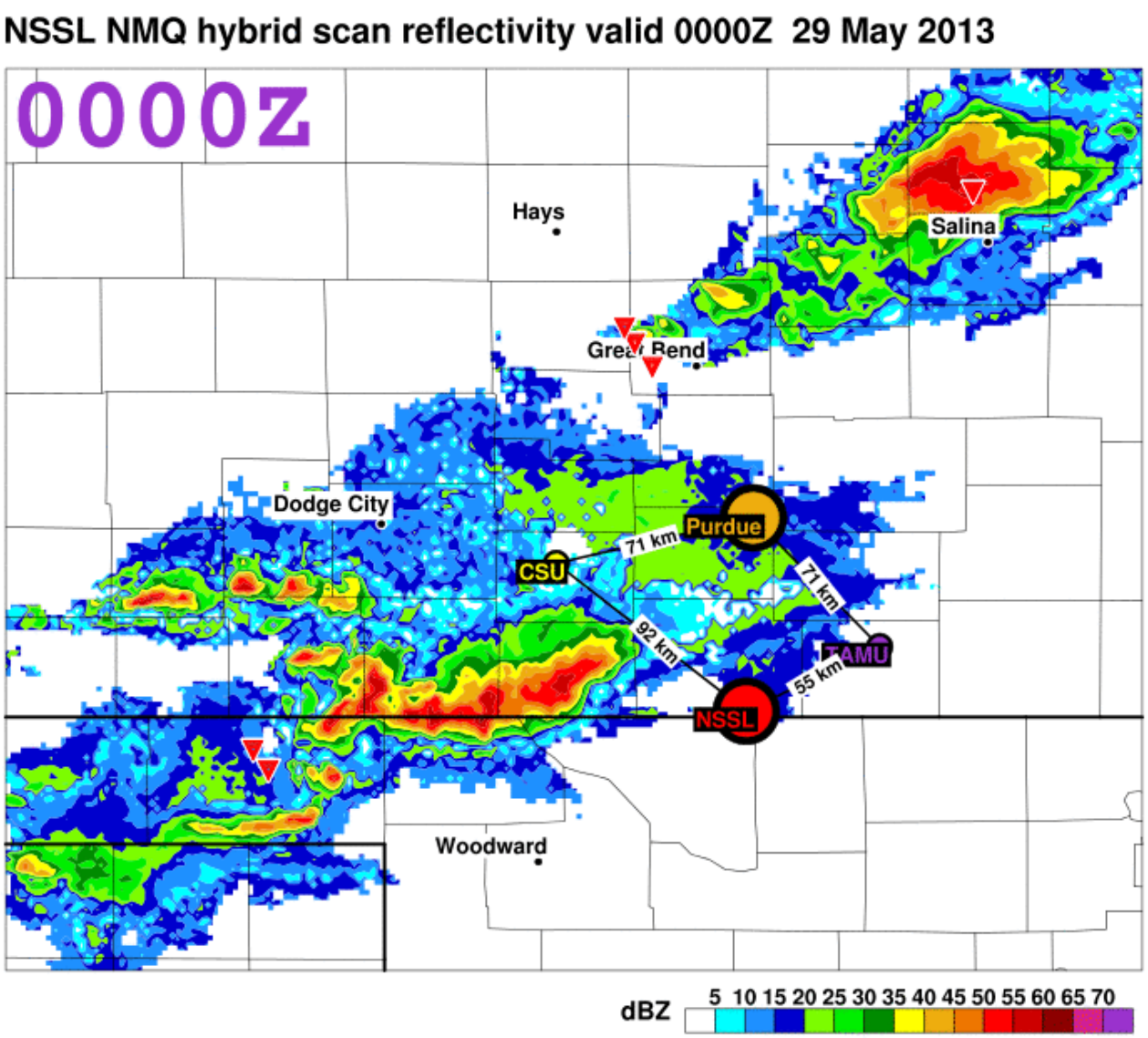




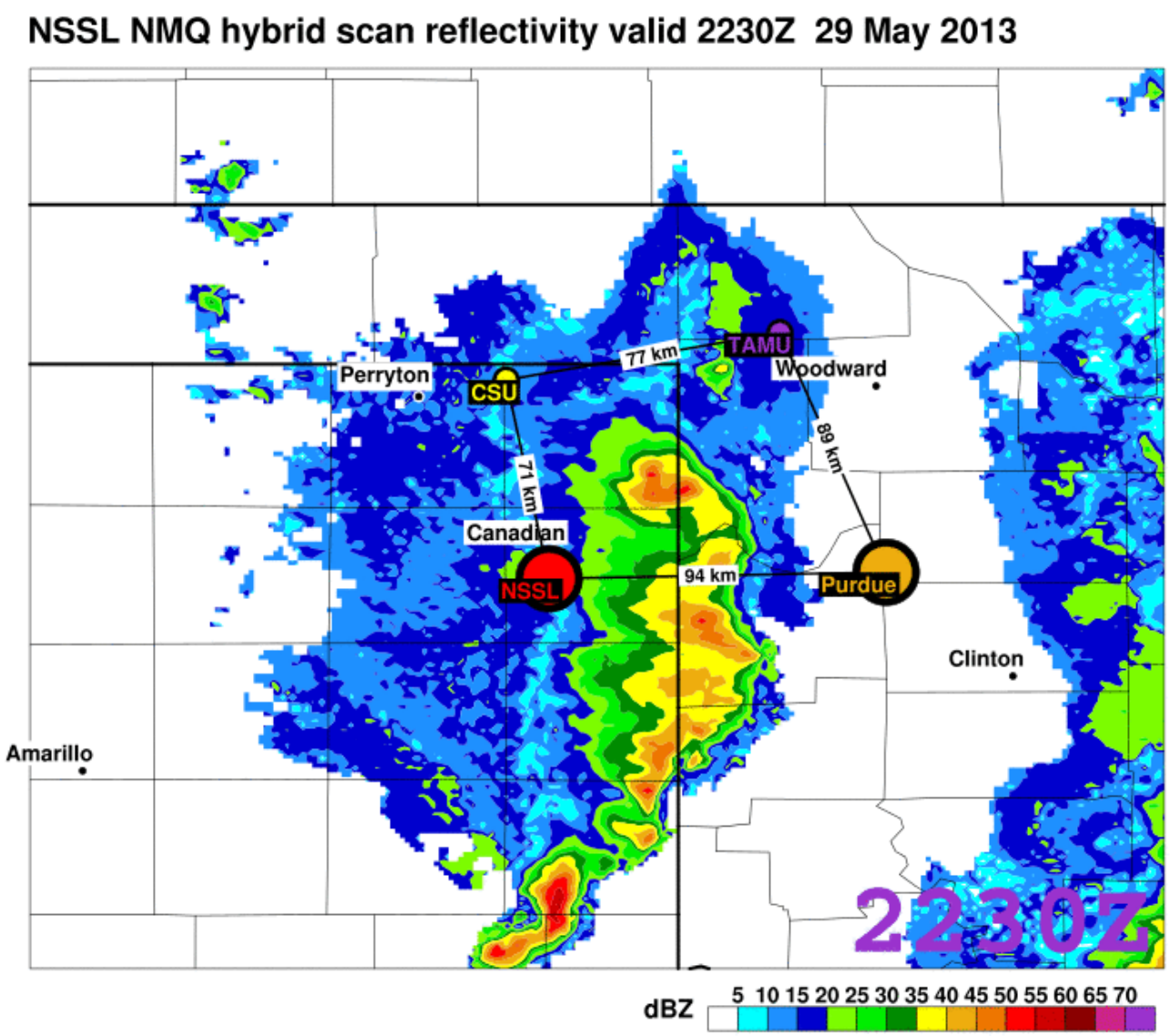
5/23; tornadic supercell; pre-CI, then surround with 4 teams; incl. wake/cold pool soundings, and some inflow soundings into developing MCS



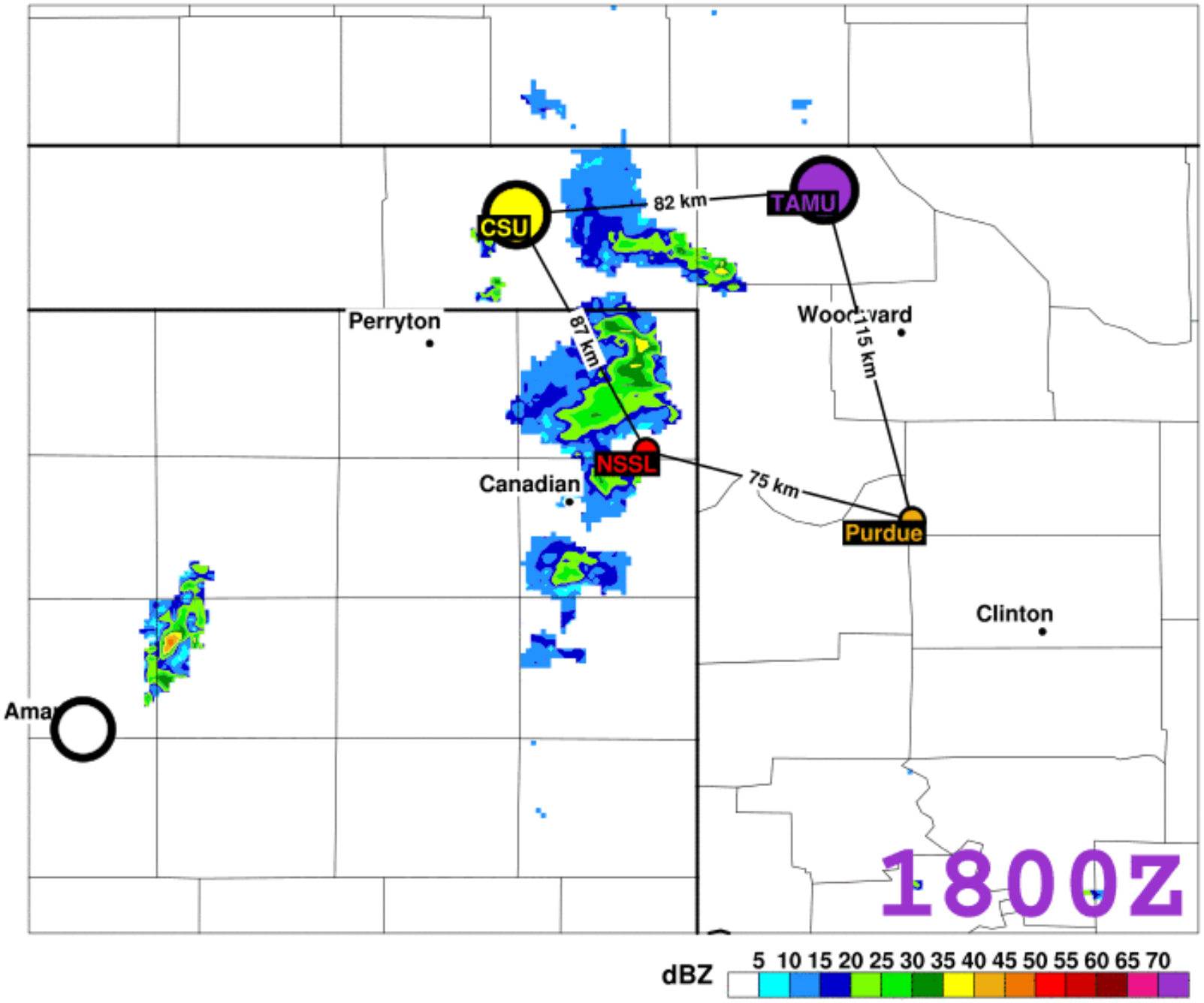
5/27; intense cell with some supercell characteristics; pre-CI, then upstream/downstream with 4 teams

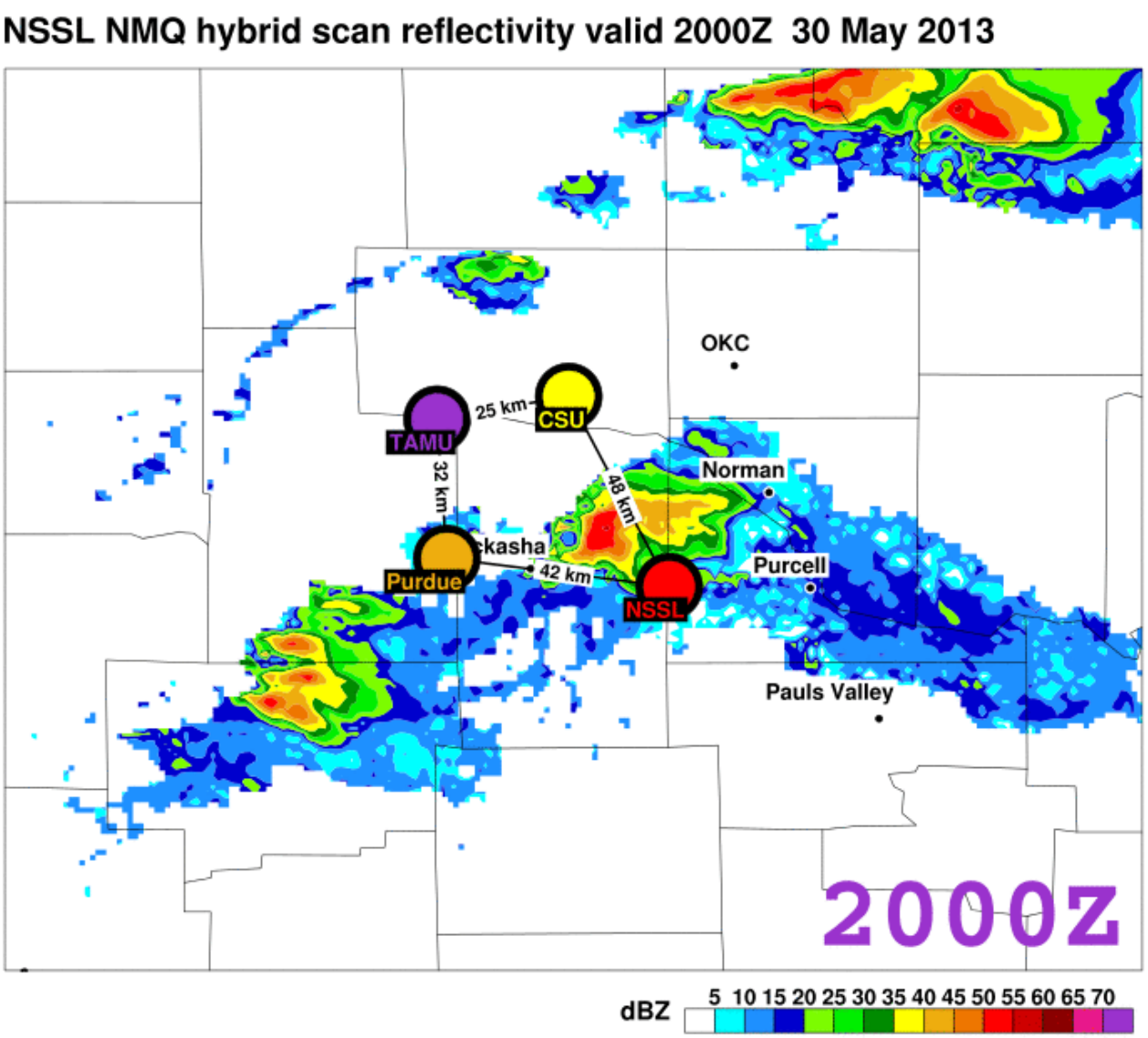


5/28; demise of intense cell; pre-CI, then environment/ downstream with 4 teams

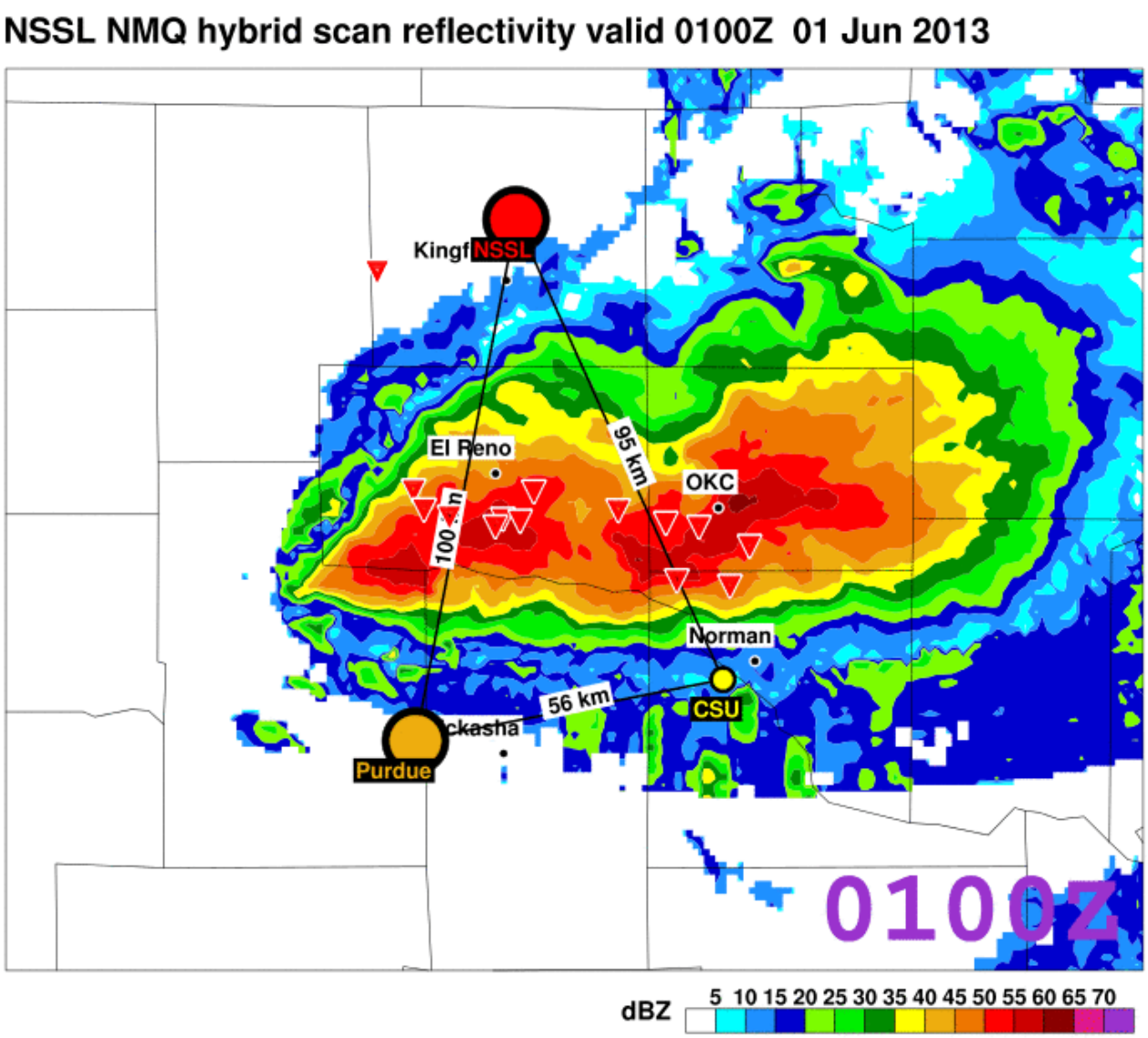


5/29; pre-CI; surround sampling of the northern bookend vortex, with additional sampling of cold pool and inflow of QLCS

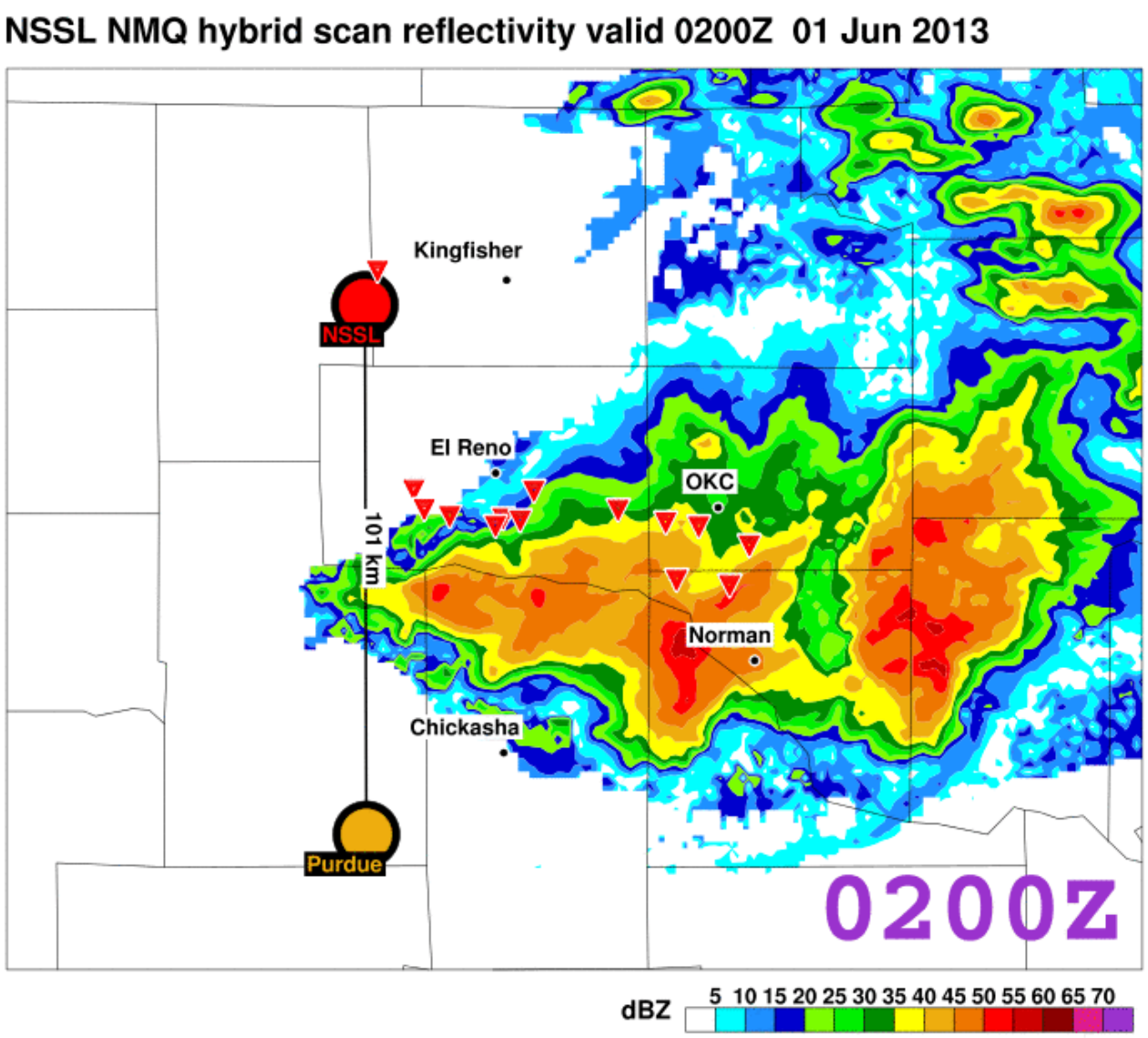

NSSL NMQ hybrid scan reflectivity valid 1800Z 29 May 2013
CSU
82 km
TAMU
Perryton
87 km
115 km
Woodward
NSSL
Canadian
75 km
Purdue
Clinton
Amar
1800Z
dBZ
5 10 15 20 25 30 35 40 45 50 55 60 65 70



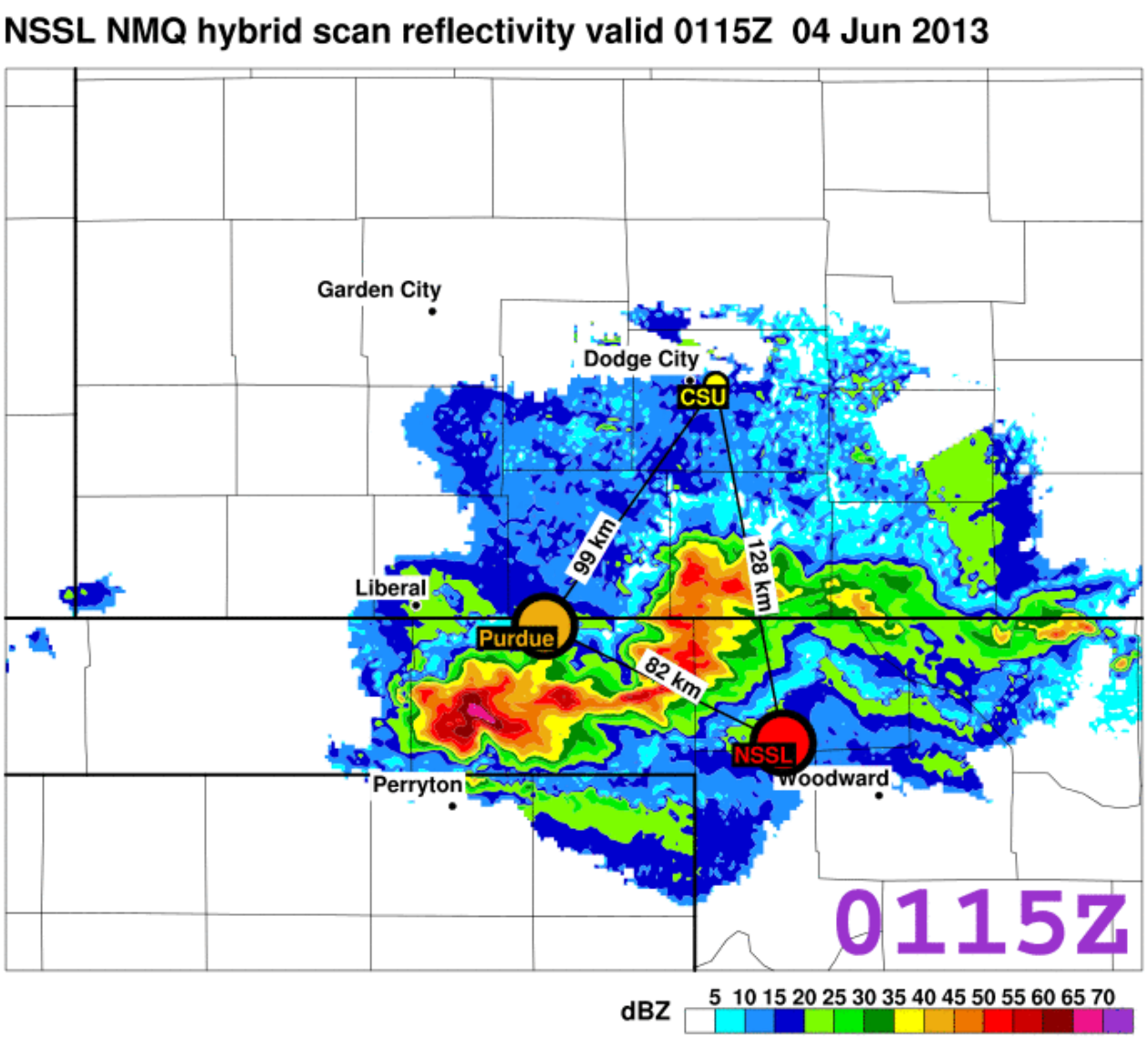
5/30; pre-CI; surround sampling of nontornadic supercell, with additional wake/downstream sampling (Purdue only) of another supercell



5/31; pre-CI; surround sampling and wake of tornadic supercell;



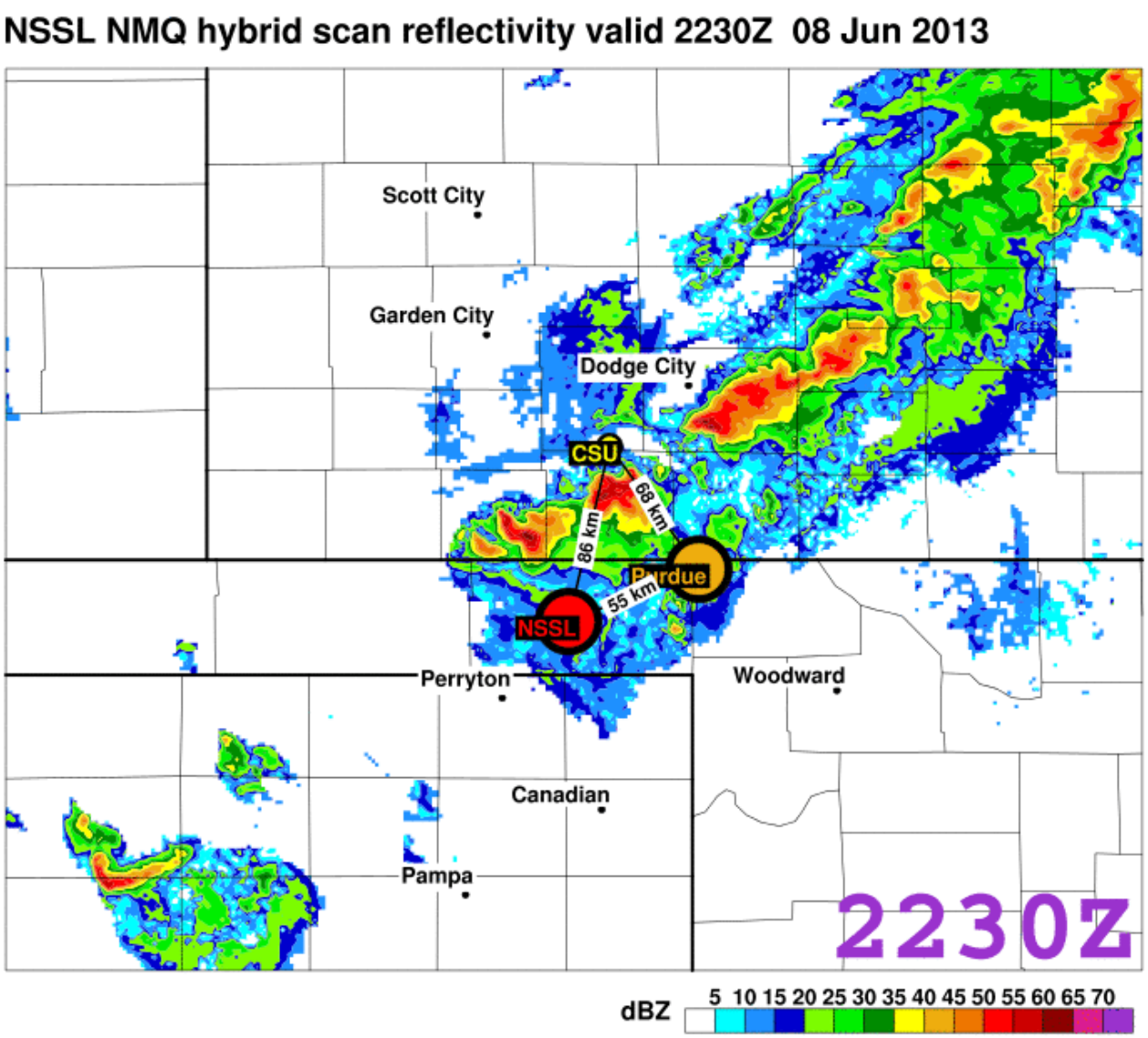
5/31 cont'd; pre-CI; surround sampling and wake of tornadic supercell;



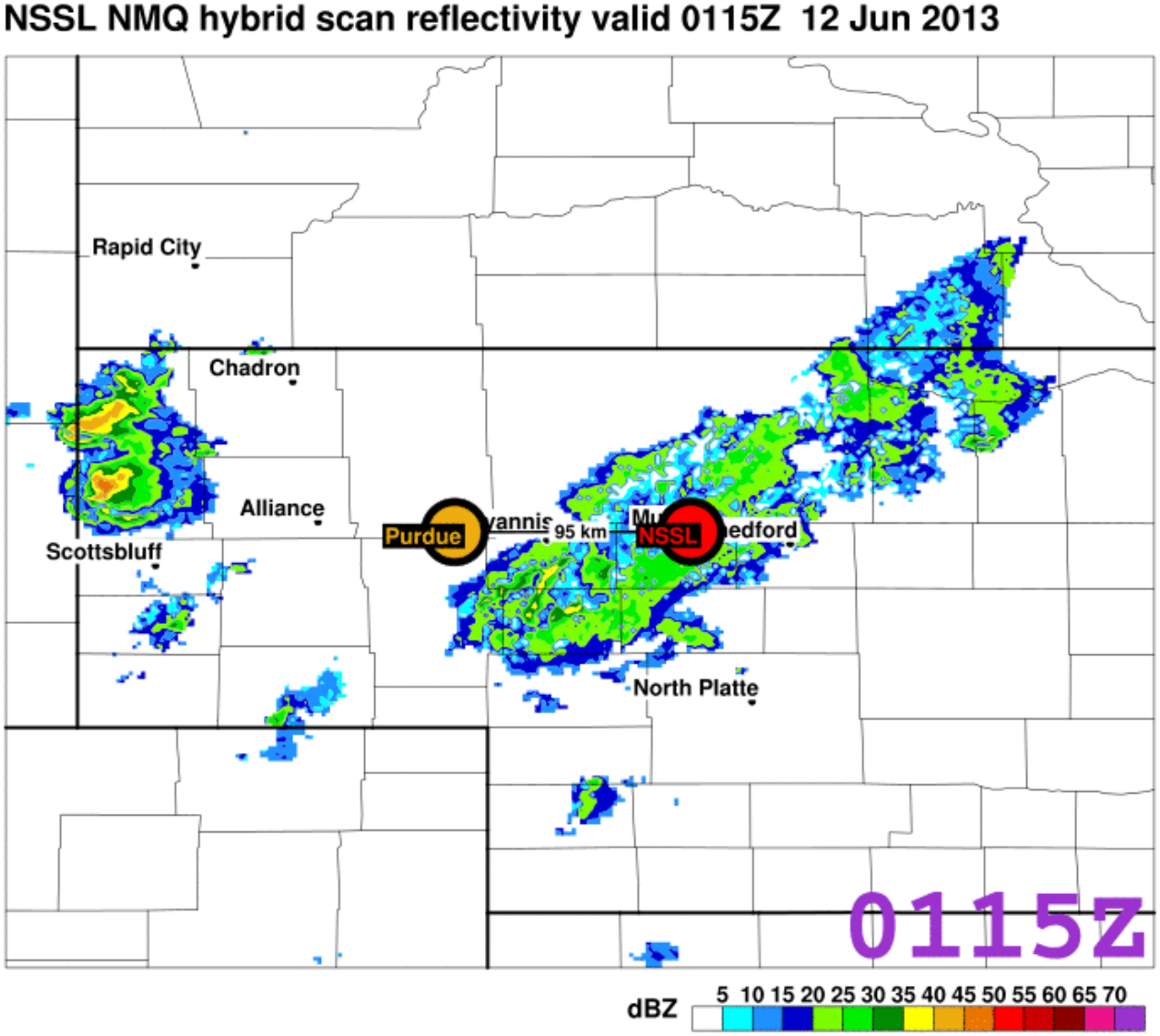
6/3; pre-CI; surround sampling of intense cell with some supercell characteristics, and transition to bow echo

mesoscale environment sampling:

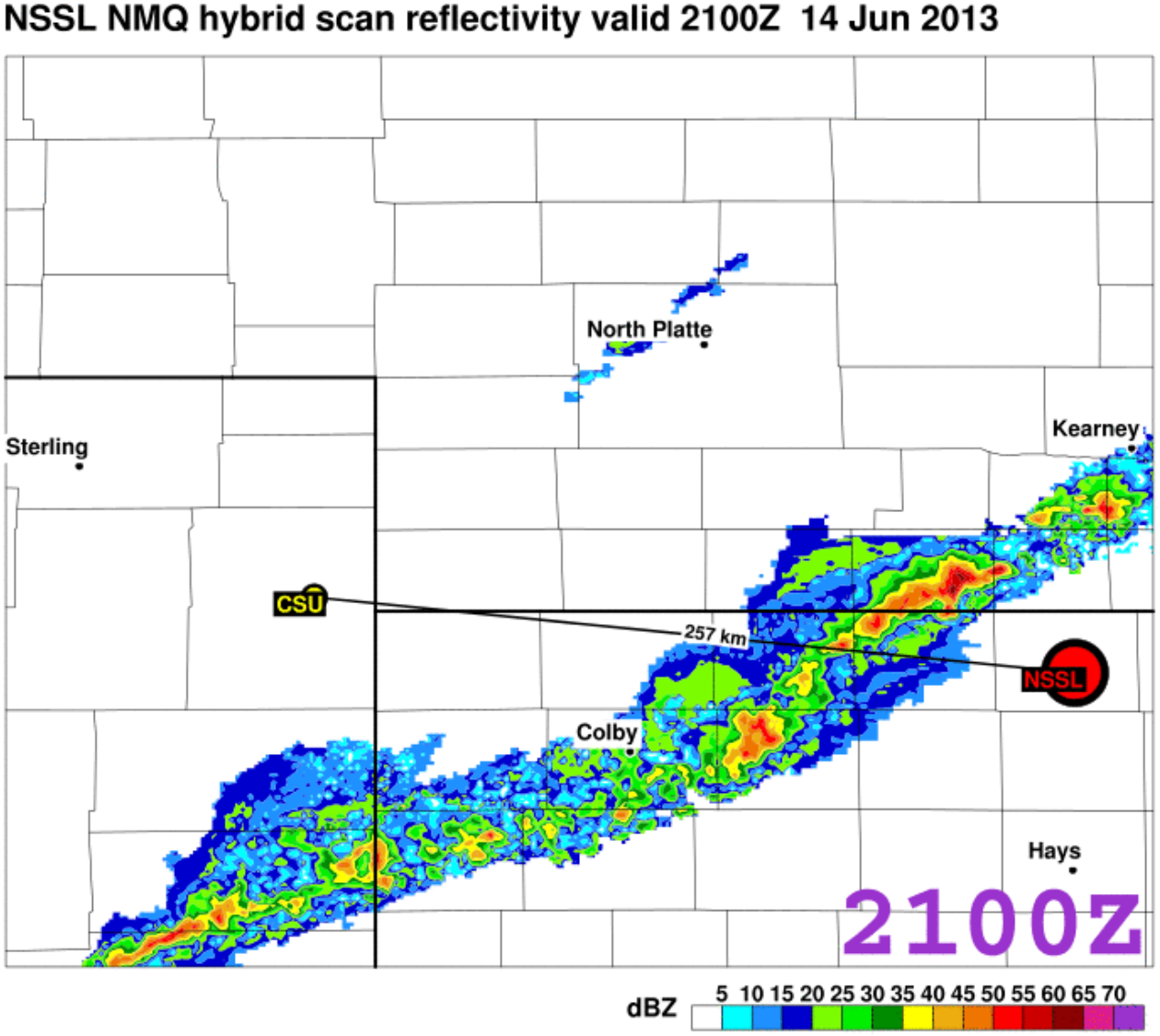
6/4
6/12



6/8; pre-CI; surround sampling of intense cell with some supercell characteristics, and transition to bow echo



6/11; pre-CI; sampling of weak convection and environment of intense cell



6/14; pre-CI; wake/inflow sampling of weak convective line

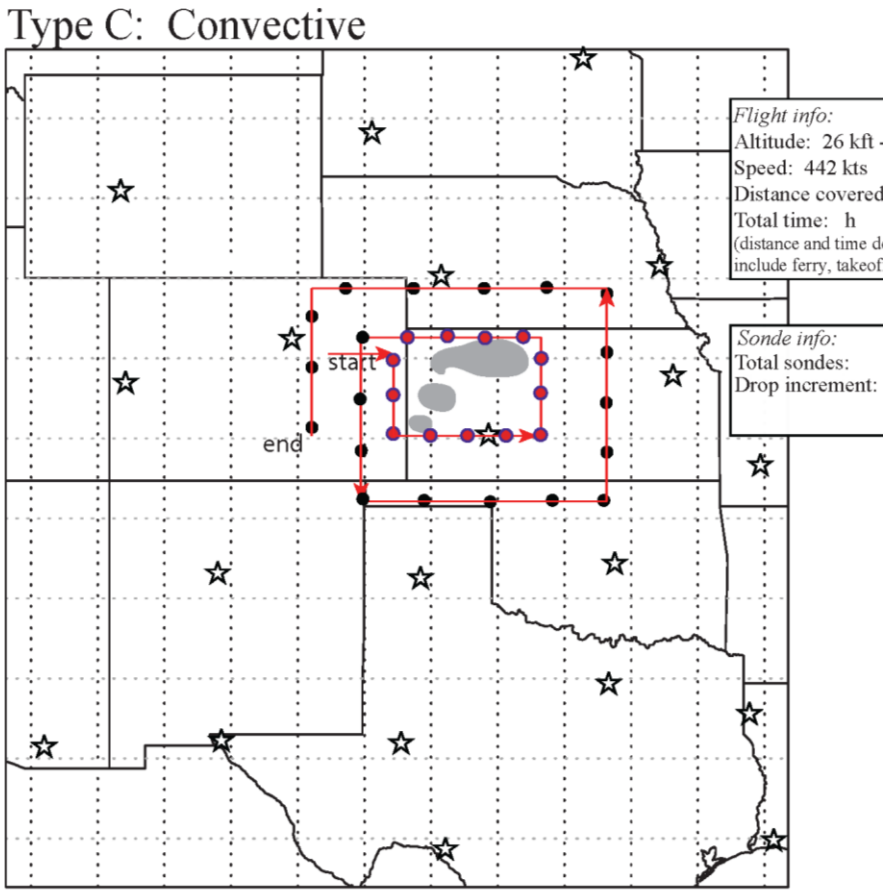
Date	Brief description	Strategy	Purdue	NSSL	CSU	TAMU
515	NSSL-only deployment: tornadic supercell in northern Texas	CI-environment, upstream	0	5	0	0
516	southwestern Kansas, convective cells; mostly coordination test	CI-environment	2	2	2	0
518	west-central Kansas tornadic supercell	pre-CI, upstream	7	5	4	0
519	central Oklahoma, two tornadic supercells	pre-CI, upstream/ downstream, surround	7	6	4	0
520	central Oklahoma, tornadic? supercell	pre-CI, surround	6	8	4	0
523	northwestern Texas, tornadic supercell, surround (incl. wake/cold pool soundings), and some inflow soundings into developing MCS	pre-CI, surround, wake/cold pool, inflow	7	8	4	4
527	central Kansas, intense cell with some supercell characteristics	pre-CI, upstream/ downstream	7	7	4	4
528	south central Kansas, demise of intense cell	pre-CI, environment/ downstream	5	5	4	4
529	western Oklahoma/eastern Texas Panhandle, developing bow echo, with surround sampling of the northern bookend vortex, with additional sampling of cold pool and inflow of QLCS	pre-CI, surround	6	6	4	4

*some of these totals may (or may not) include faulty sondes, premature balloon burst, etc.

530	south-central Oklahoma, non-tornadic supercell (all teams), and some Purdue-only sampling of wake of additional non-tornadic supercell	pre-CI, surround, wake/cold pool	9	10	3	4
531	central Oklahoma, tornadic supercell	pre-CI, surround, wake/ cold pool	7	7	3	0
603	Oklahoma Panhandle, southwest Kansas, intense cells with some (HP) supercell characteristics, surround strategy, then additional sampling of developing bow echo	pre-CI surround, wake/cold pool, inflow	6	8	3	0
604	eastern Texas Panhandle, mesoscale environment	pre-CI	7	4	4	0
608	soutwest Kansas, Oklahoma Panhandle, intense cell within line	pre-CI, surround	8	11	3	0
611	western Nebraska, weak convection and additional cell	pre-CI, environment	10	8	3	0
612	eastern Wyoming, mesoscale environment	pre-CI	10	5	4	0
614	Kansas-Colorado, weak convective line	pre-CI, wake / inflow	0	6	2	0
Totals			104	111	55	20

Upsonde data status, additional information

- Purdue, NSSL, CSU data uploaded; TAMU estimated completion by end of week
  - conversion into common format by NCAR/EOL
  - contact individual teams (and/or consult README files) for additional information
- sonde inter-comparisons
  - conducted by M. Coniglio and collaborators:
  - https://ams.confex.com/ams/26SLS/webprogram/Paper212328.html

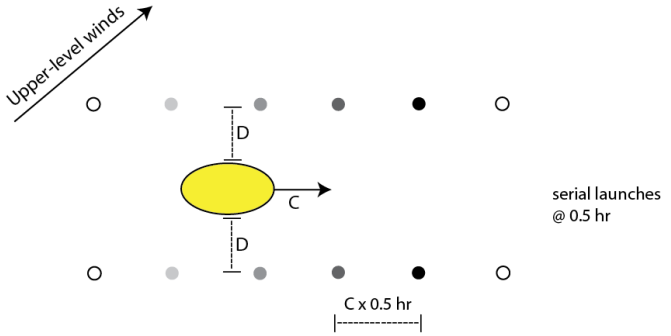


November 2011

Evolution of deployment strategy…

November 2012

Surround Strategy (Upstream and Downstream Effects)



2 mobile vans
simultaneous launches
first soundings (black ●)
to last soundings (light gray ●)
assumes max 4 sondes in air at same time

Distance D from storm path could be varied if enough cases sampled.