

VARANAL domain for IOPs

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LLNL

IOP information from <http://catalog.eol.ucar.edu/pecan/tools/missions>

LLJ

IOP2 (41.09N, 99.13W)

6/3/2015 0000-0600UTC

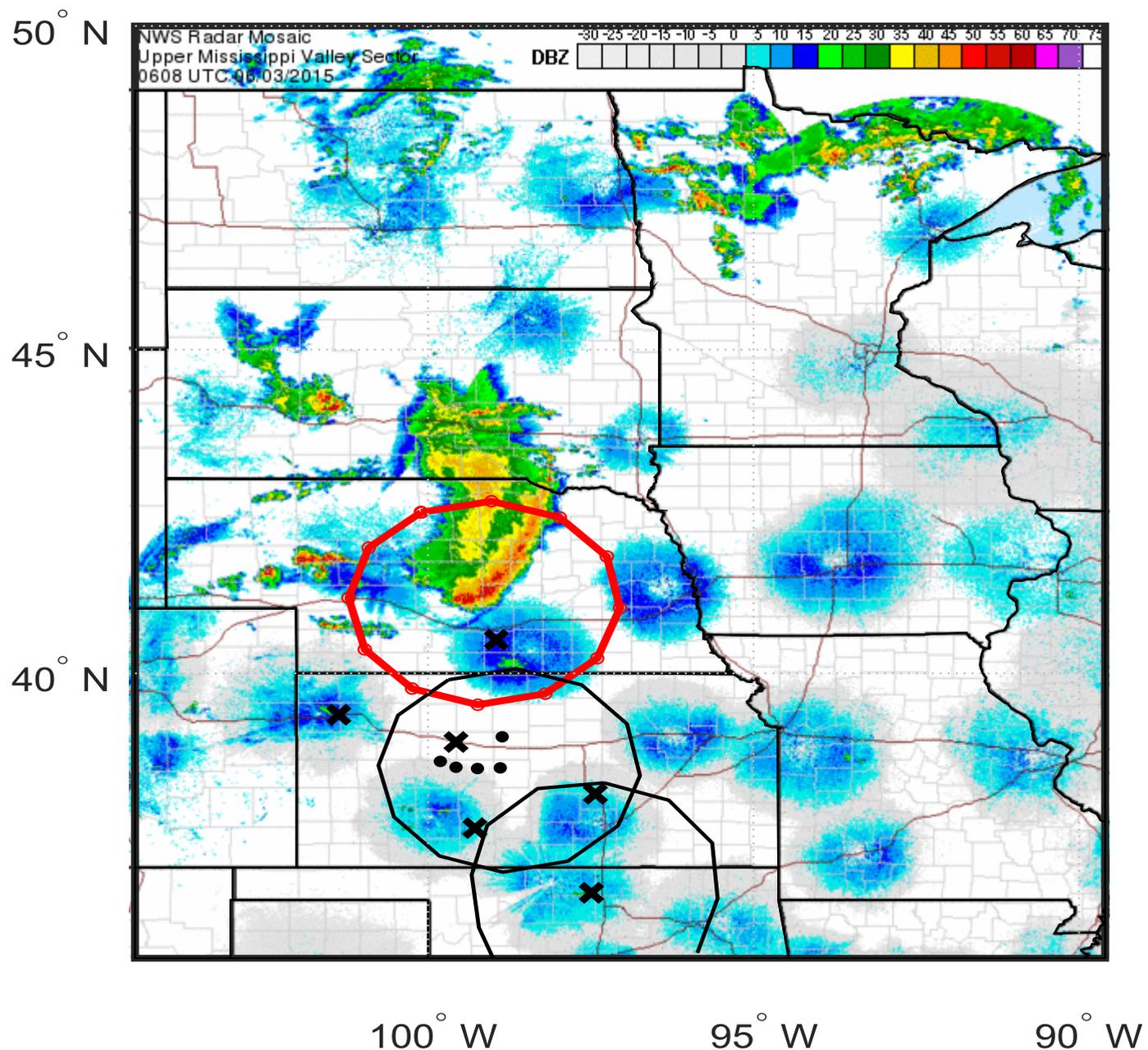
VARANAL period: 6/2 18:00 – 6/3 18:00 UTC

Mobile PISAs balloons: 0000, 0130, 0300, 0430

Fixed PISAs balloons: 0000, 0130, 0300, 0430,
0600, 0730

LLJ track between 100.03W and 98.89W
following 38.7N

The jet started to develop around 1UTC and was
well organized by 3UTC. It continued to
strengthen until 6UTC (when observations
of MPs ended). The jet speed was about 25 m/s
and located at about 400 m AGL.



IOP2

MCS

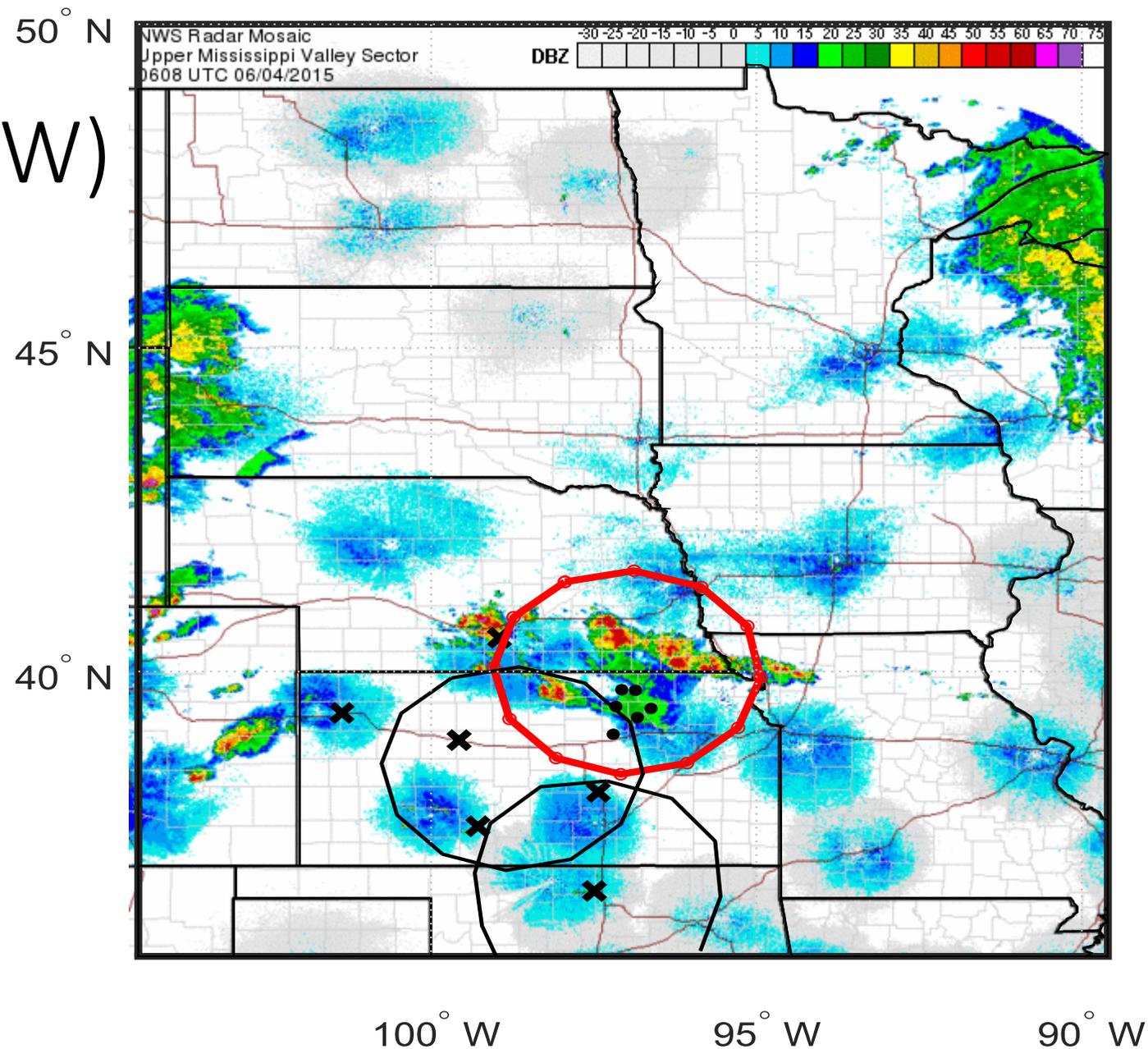
IOP3 (39.99N, 96.99W)

6/4/2015 0000-0630UTC

VARANAL period: 6/3 18:00 – 6/4 18:00 UTC

An unsuccessful MCS-A mission with the IP being Salina and deployment around Clay Center, Kansas. The forecast suggested that cold pool development would force a MCS to propagate towards the east-southeast out of the south central parts of NE, where it would form, into north central to northeastern KS.

Apparently, these cells were supported by 850-700 mb moisture convergence.



IOP3

Bore

IOP4(39.42N, 98.62W)

6/5/2015 0000-????UTC

VARANAL period: 6/4 18:00 – 6/5 18:00 UTC

Several bores generated overnight

50° N

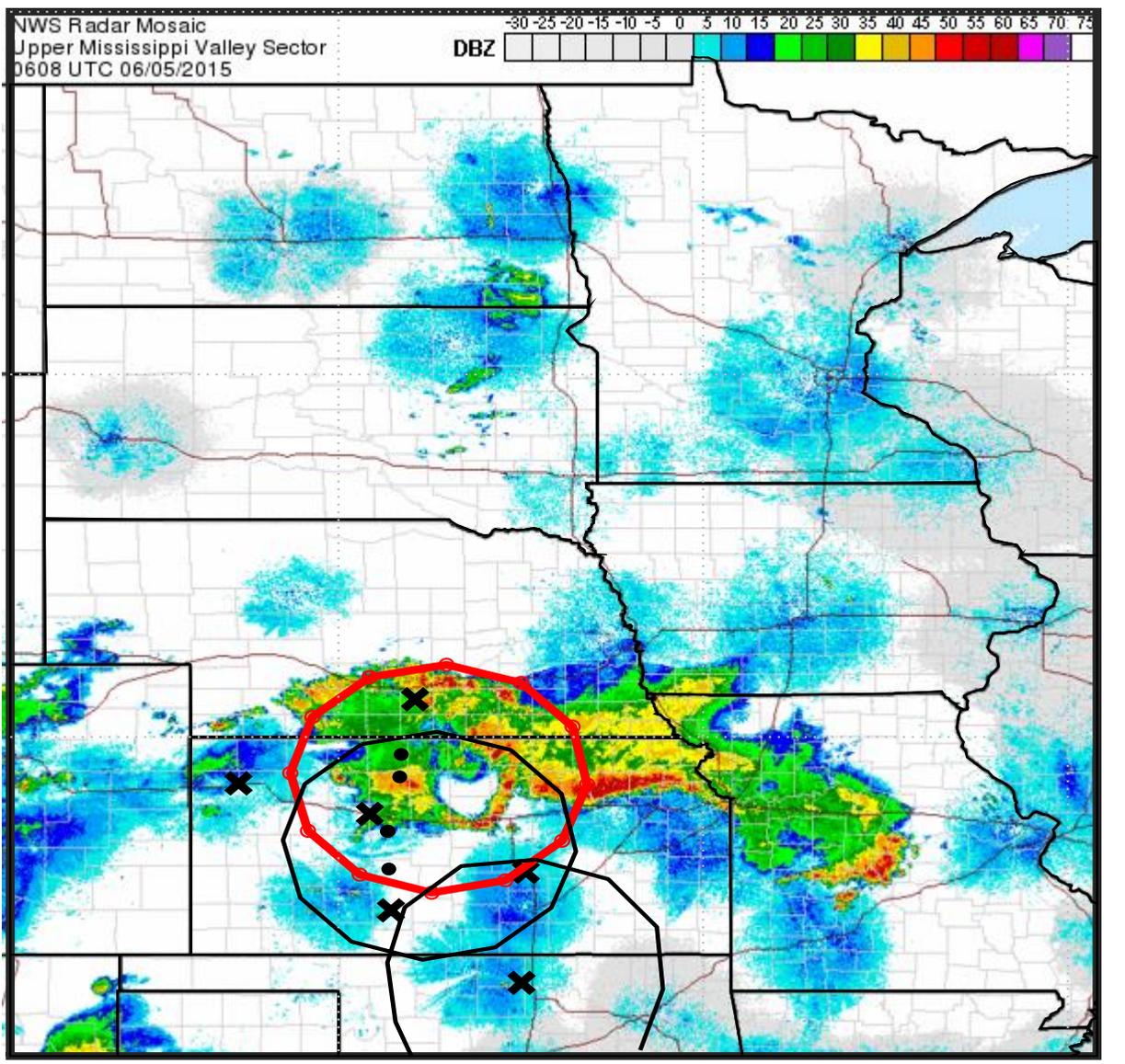
45° N

40° N

100° W

95° W

90° W



IOP4

Bore

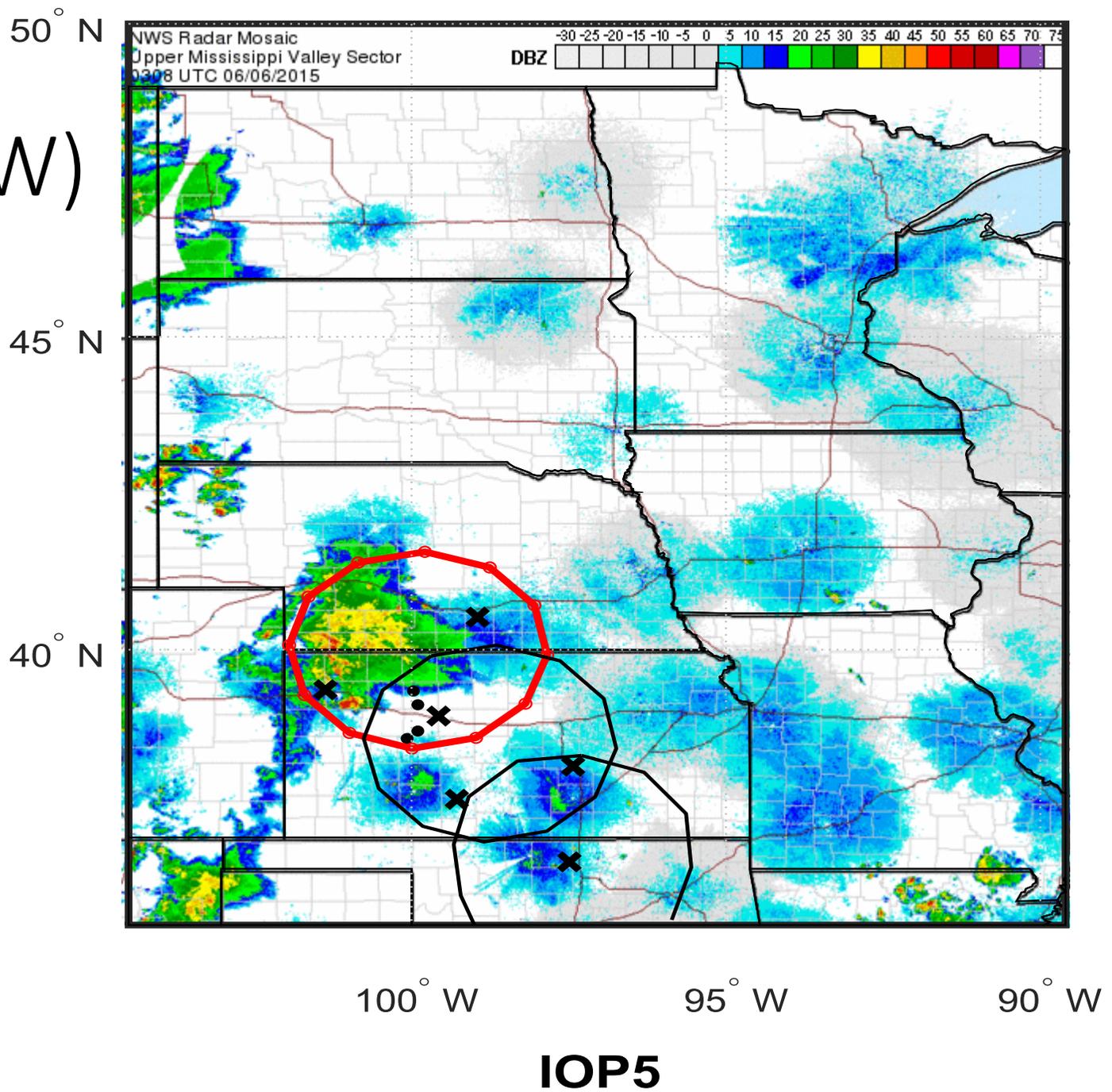
IOP5(39.99N, 99.89W)

6/6/2015 0000-????UTC

VARANAL period: 6/5 18:00 – 6/6 18:00 UTC

Bore mission was conducted after LLJ mission was scrubbed at 5:00 pm due to reconsideration of LLJ location being undesirable.

weak, shallow bore generated at about midnight in area south of Colby KS and west of Ness City, unfortunately just 30 miles west of the western edge of the observing network
This bore did not generate new convection



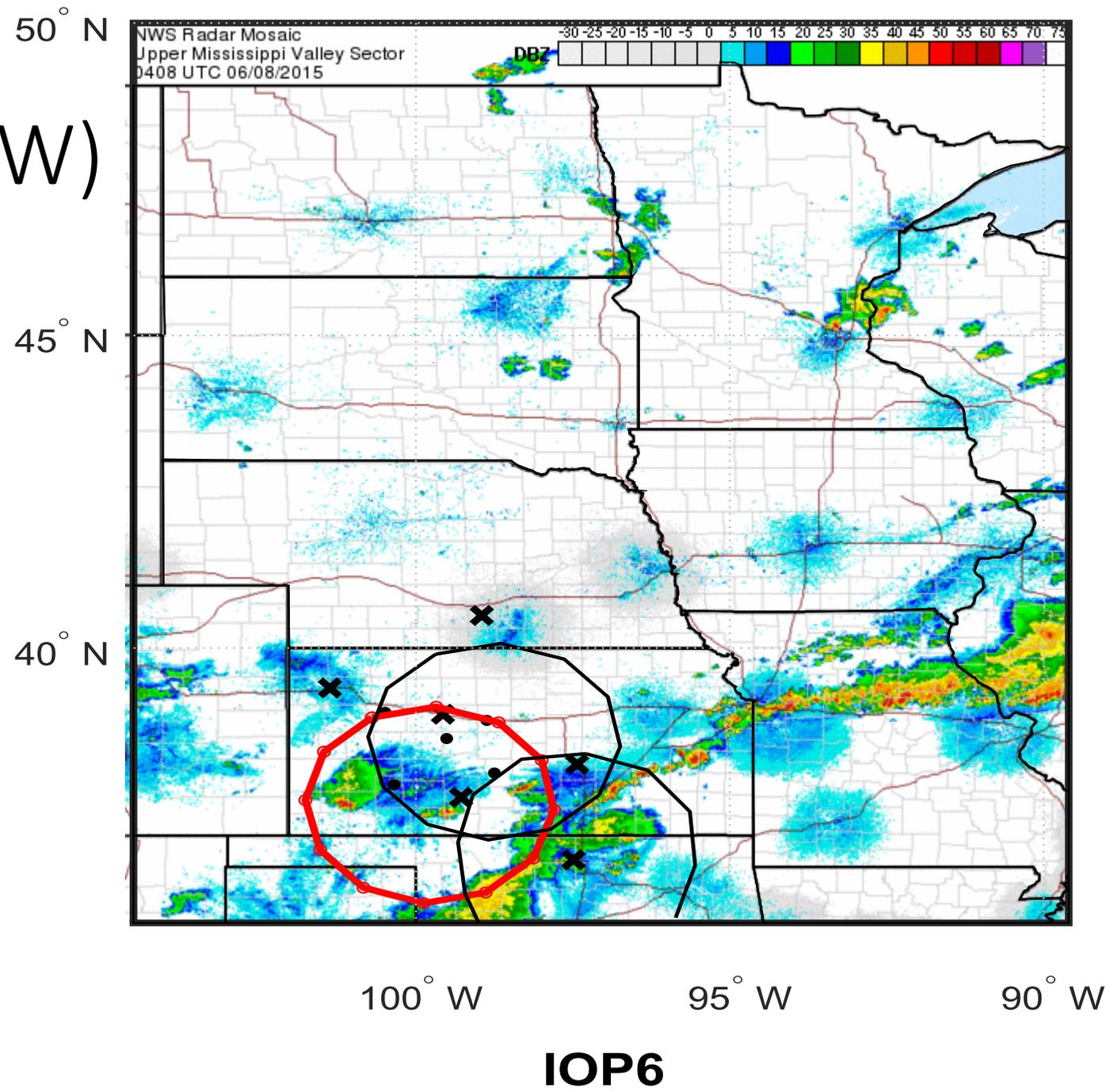
CI

IOP6 (37.49N, 99.78W)

6/8/2015 0200-0630UTC

VARANAL period: 6/7 18:00 – 6/8 18:00 UTC

A **bore initiated new convection** at 0340 UTC ~100km south of S-Pol. The bore passed over MP3 at Cimarron. MM observed 8mb pressure rise across bore and then CI formed over that location.



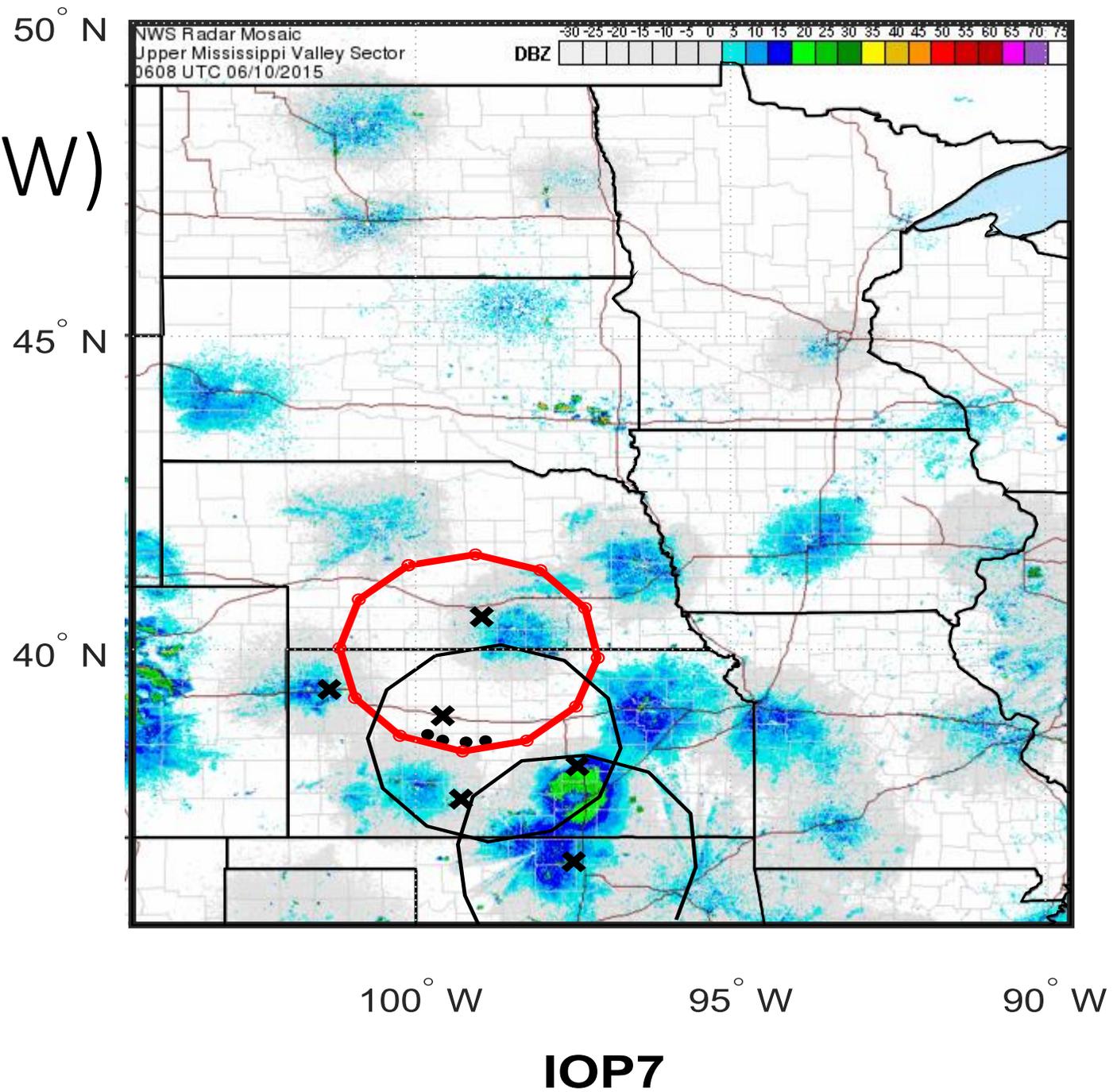
LLJ

IOP7 (39.94N, 99.16W)

6/10/2015 0000-0930UTC

VARANAL period: 6/9 18:00 – 6/10 18:00 UTC

A nice data set of remarkably pure
baroclinically-generated LLJ over a shallow
slope.



MCS

50° N

IOP8 (40.07N, 97.75W)

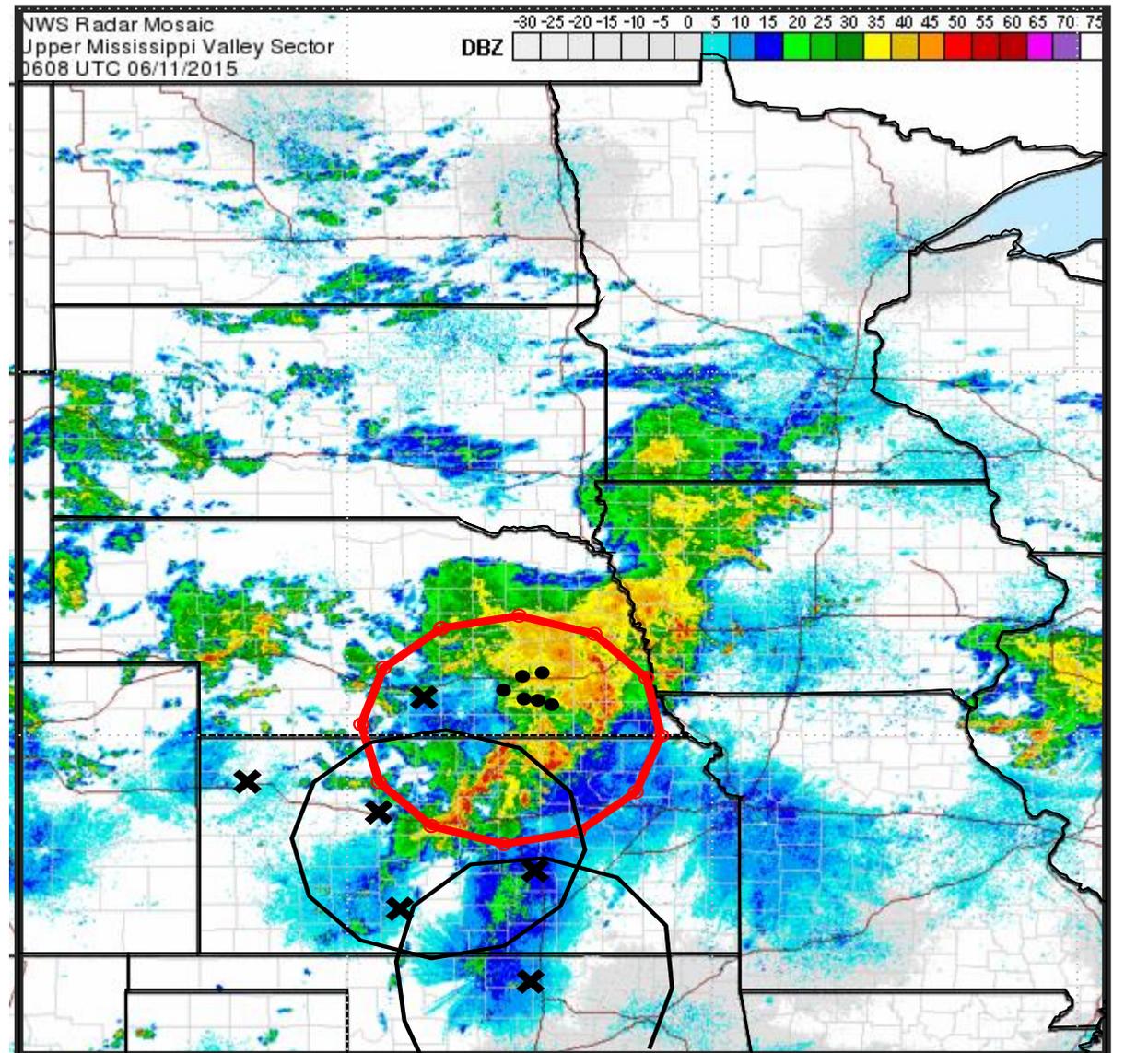
6/11/2015 0000-0630UTC

VARANAL period: 6/10 18:00 – 6/11 18:00 UTC

Several convective "fingers" developed in the inflow region and merged with convection that developed along the surging outflow from the main MCS. A good case for examining several wake-like bands of elevated convection.

45° N

40° N



100° W

95° W

90° W

IOP8

MCS

50° N

IOP9 (37.51N, 100.71W)

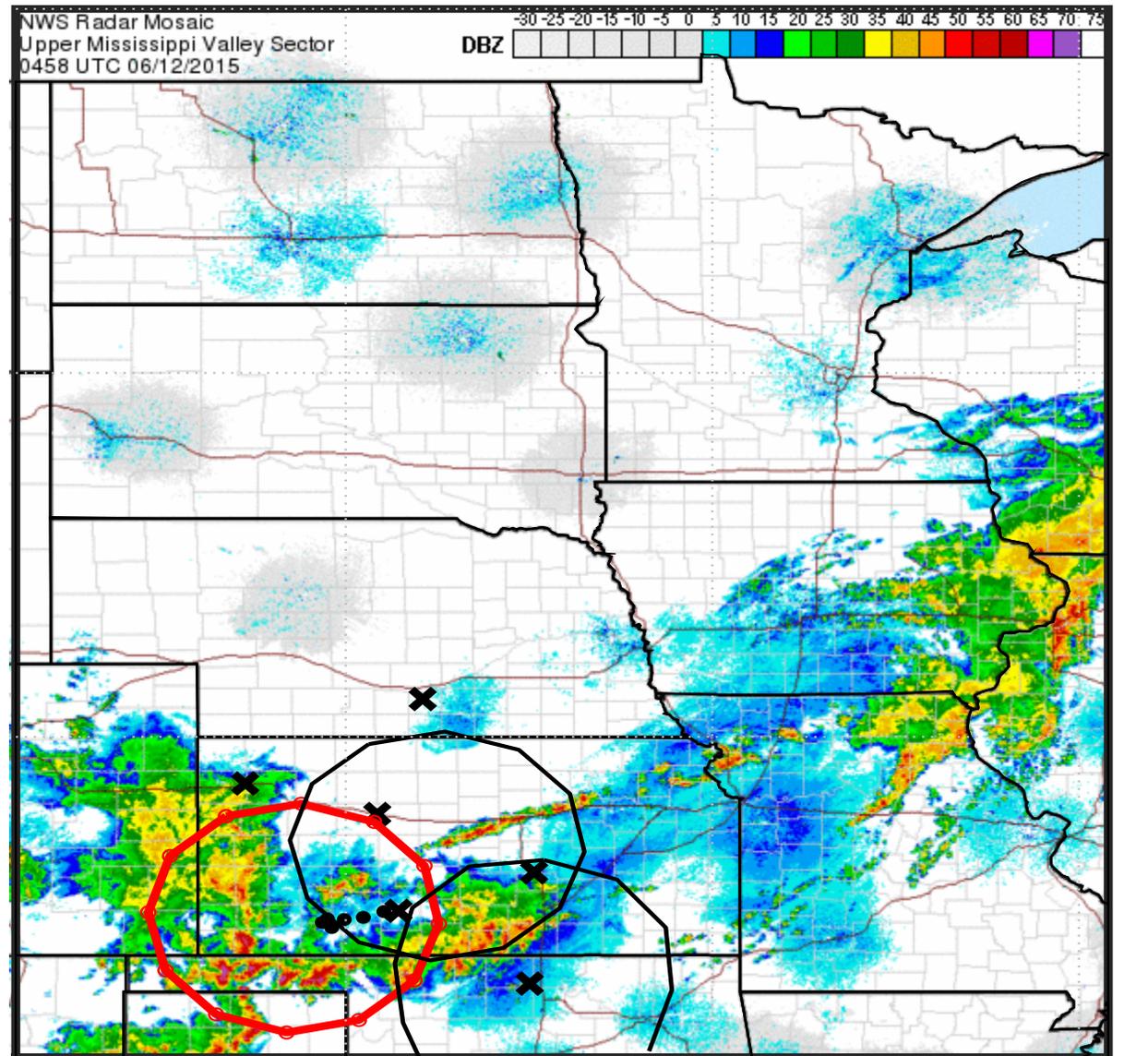
6/12/2015 0000-0800UTC

VARANAL period: 6/11 18:00 – 6/12 18:00 UTC

MPs collected data of a northward-moving outflow early on and then in a precipitation-free region for "ambient" observations.

45° N

40° N



100° W

95° W

90° W

IOP9

MCS

IOP10 (37.17N, 99.26W)

6/15/2015 0000-0430UTC

VARANAL period: 6/14 18:00 – 6/15 18:00 UTC

An MCS mission located near Sawyer, Kansas.
good data was collected on back-building
convection above a weak cold pool as well as a CI
event along colliding boundaries

50° N

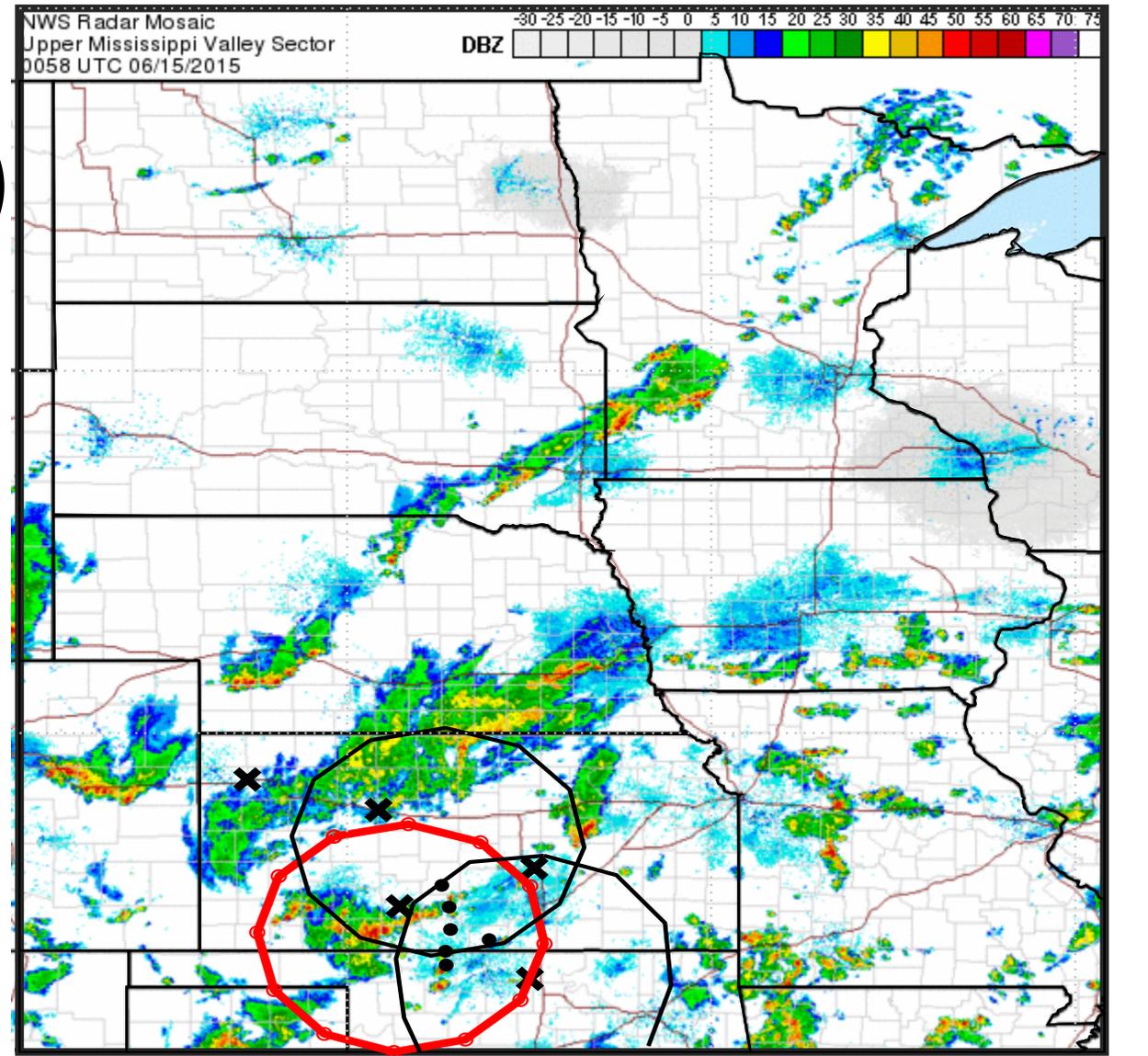
45° N

40° N

100° W

95° W

90° W



IOP10

MCS

50° N

IOP11 (40.16N, 99.86W)

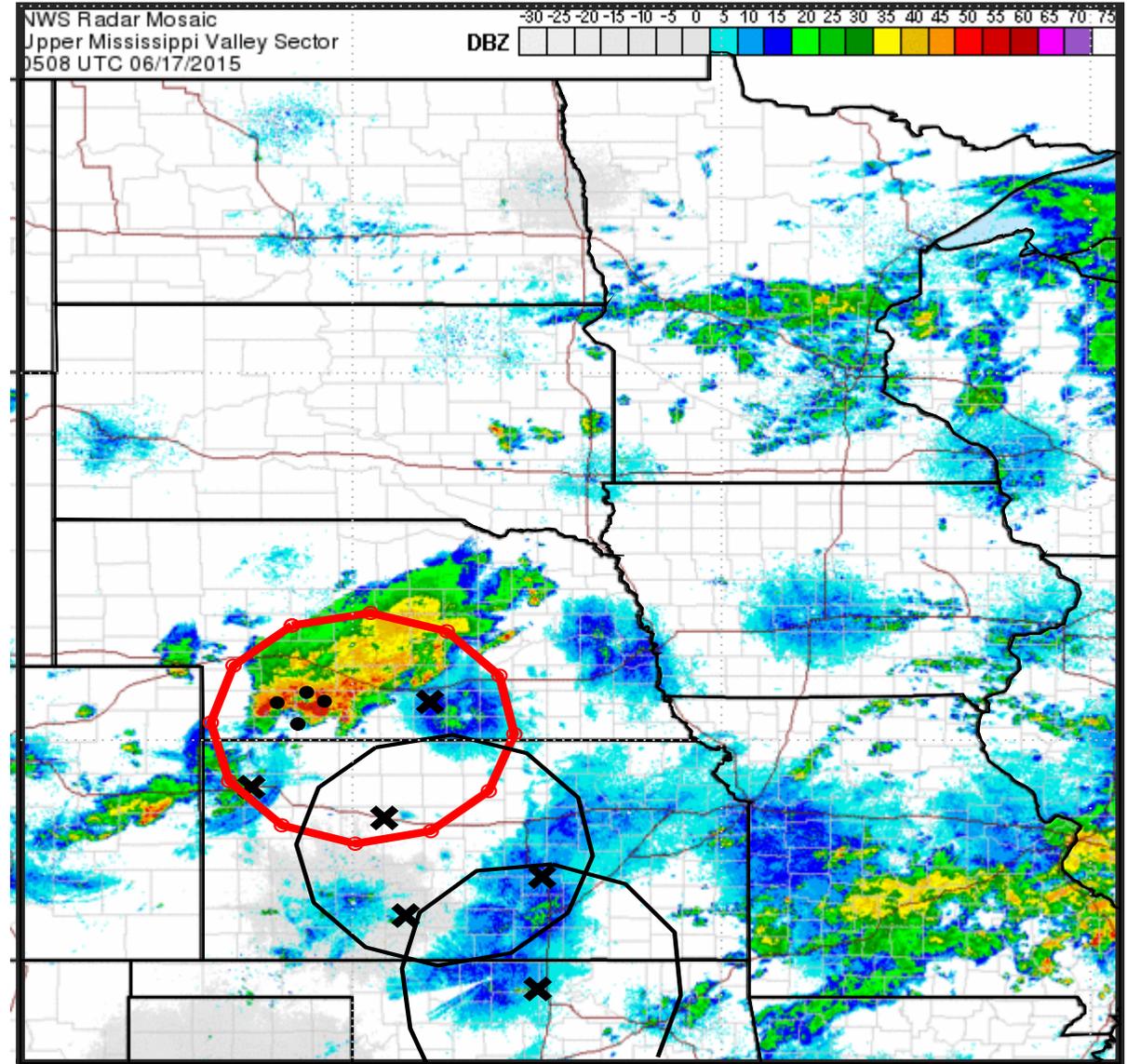
6/17/2015 0000-0800UTC

VARANAL period: 6/16 18:00 – 6/17 18:00 UTC

A successful long-duration data collection on upscale growth and MCS genesis and early evolution near McCook, Nebraska.

45° N

40° N



100° W

95° W

90° W

IOP11

LLJ

50° N

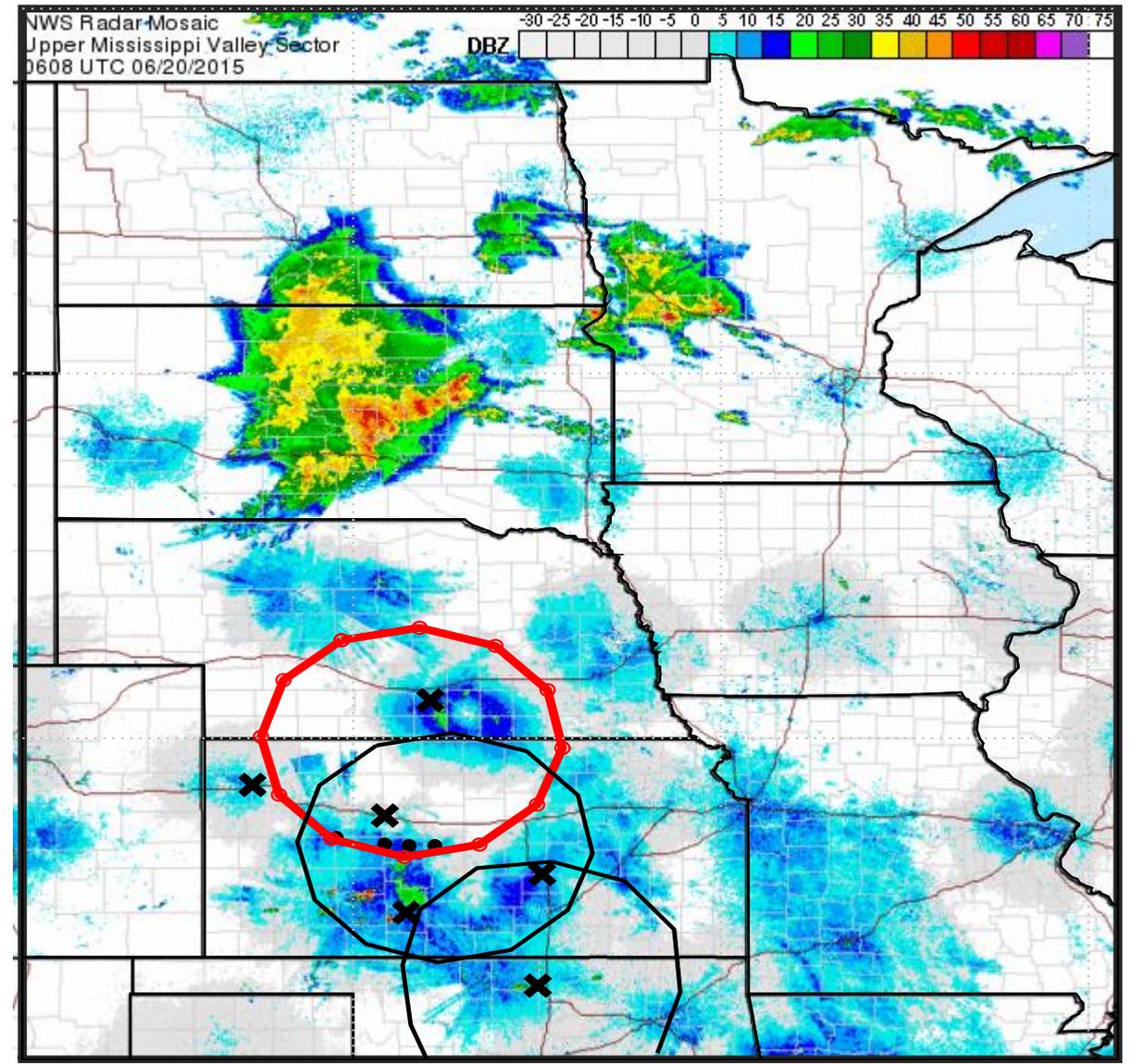
IOP12 (39.94N, 99.20W)

6/20/2015 0000-0930UTC

VARANAL period: 6/19 18:00 – 6/20 18:00 UTC

45° N

40° N



100° W

95° W

90° W

IOP12

LLJ

50° N

IOP13 (39.92N, 99.20W)

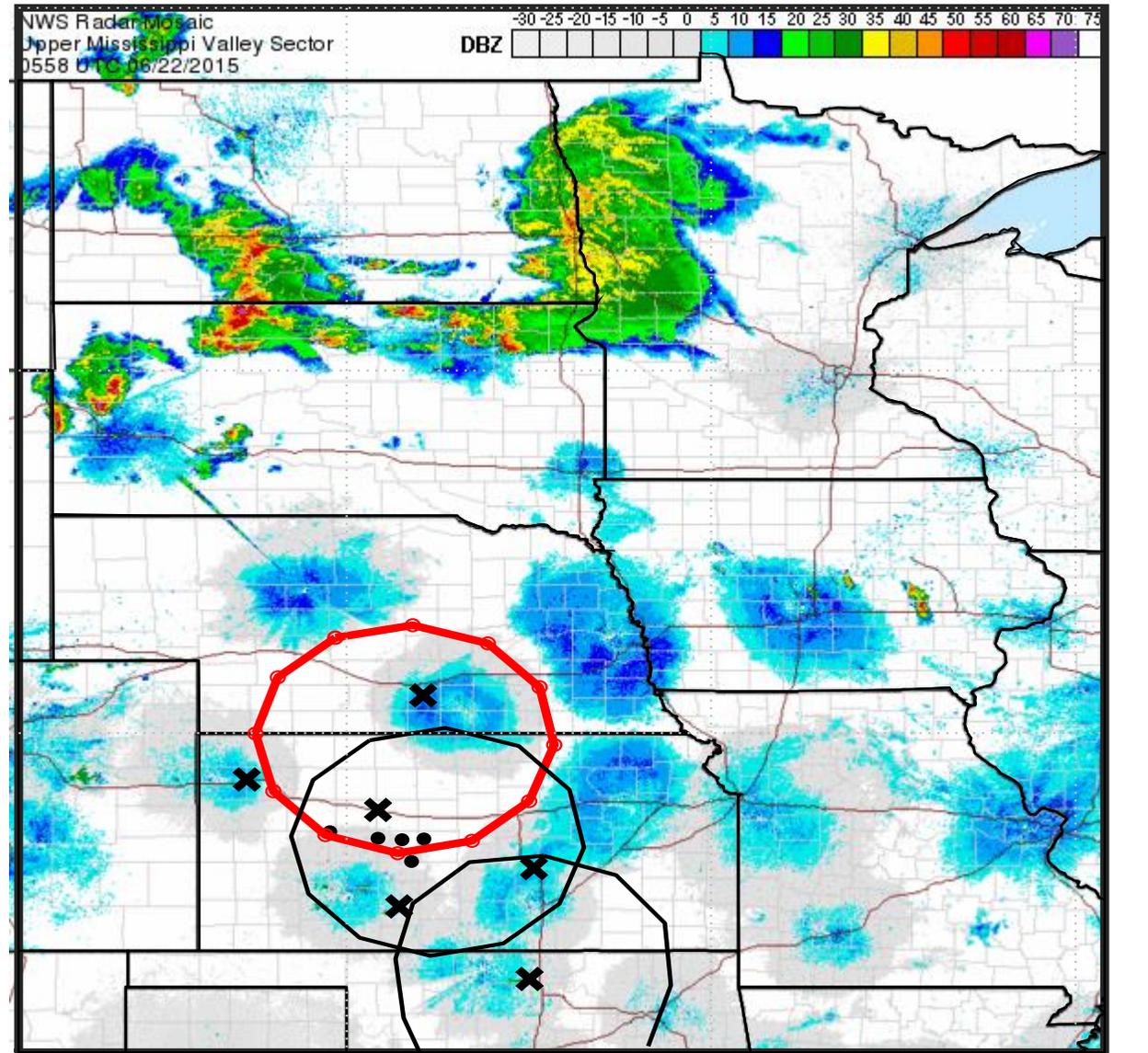
6/21/2015 2300 - 6/22/2015 0930UTC

VARANAL period: 6/21 18:00 – 6/22 18:00 UTC

Peak winds of about 30 m/s were observed with the core of the jet occurring within the IOP domain.

45° N

40° N



100° W

95° W

90° W

IOP13

CI-LLJ

50° N

IOP14 (39.86N, 97.56W)

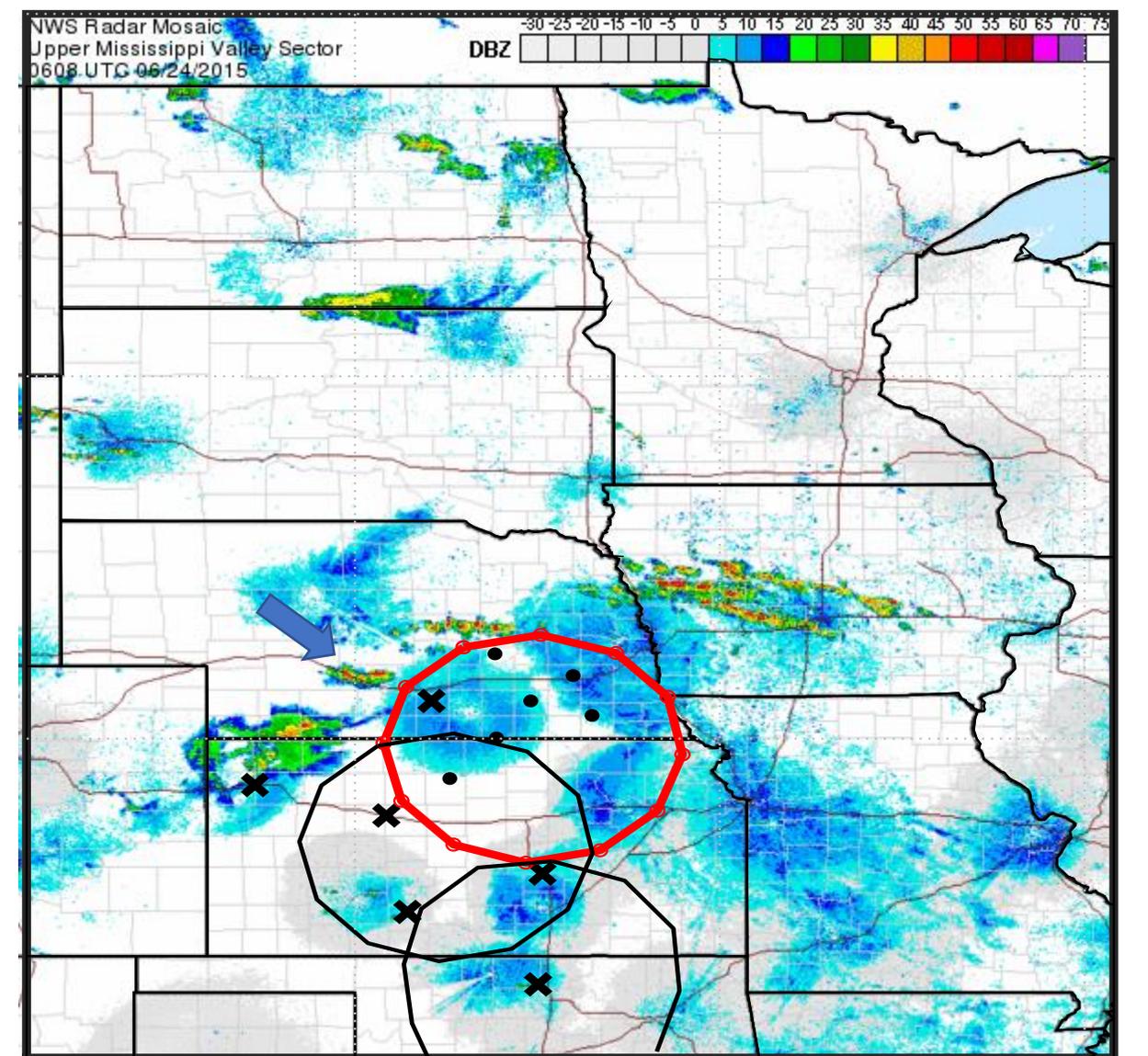
6/24/2015 0000-0930UTC

VARANAL period: 6/23 18:00 – 6/24 18:00 UTC

Joint CI-LLJ mission in SE Nebraska. Several interesting structures in the elevated convection and wave features in the boundary layer and evolution of the LLJ were observed within the PECAN domain

45° N

40° N



100° W

95° W

90° W

IOP14

MCS

50° N

IOP15 (41.19N, 93.96W)

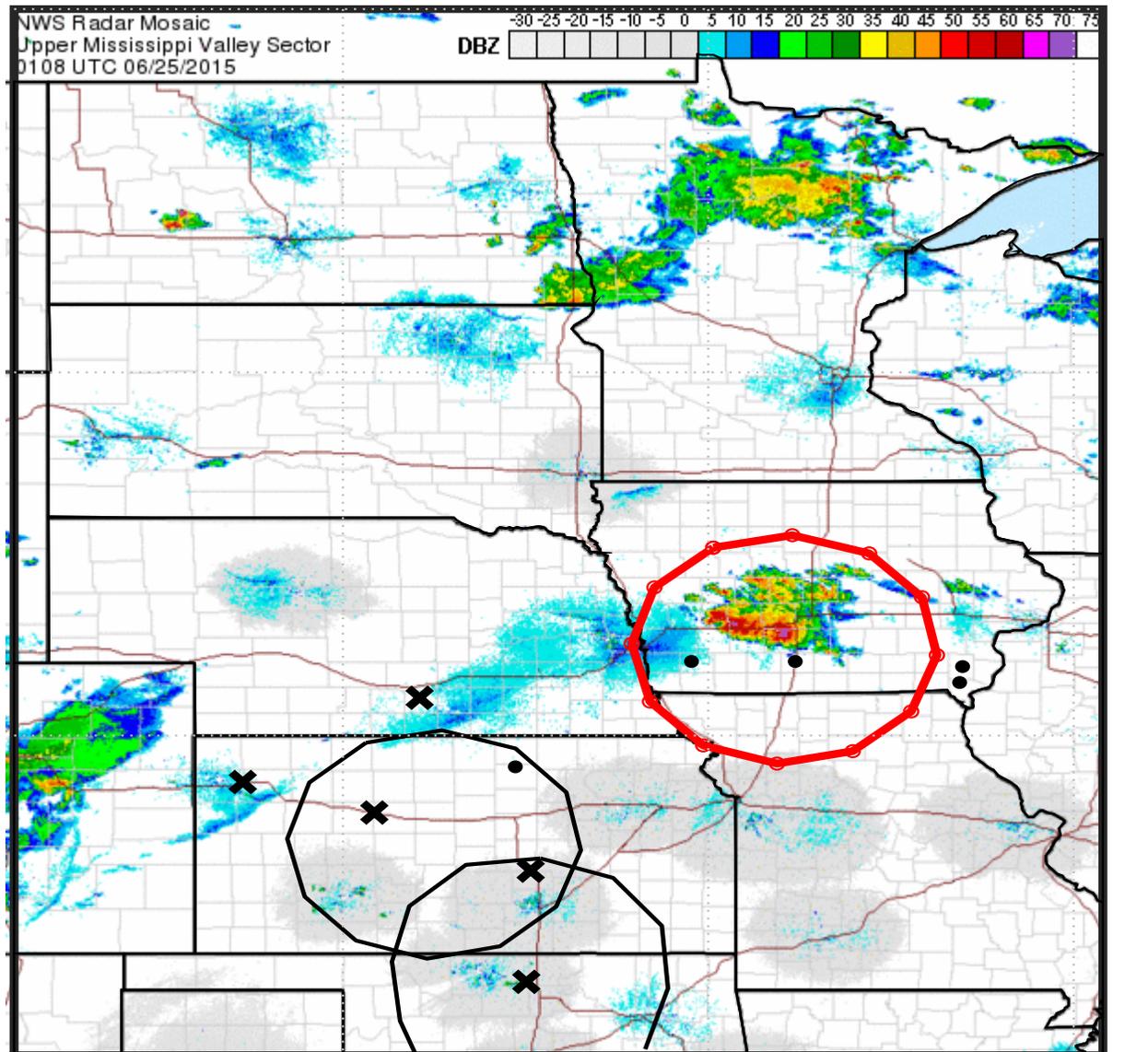
6/24/2015 2300 - 6/25/2015 0700UTC

VARANAL period: 6/24 18:00 – 6/25 18:00 UTC

MCS mission over Eastern Iowa and Western Illinois

45° N

40° N



100° W

95° W

90° W

IOP15

Bore

IOP16 (39.58N, 96.07W)

6/26/2015 0000-0700UTC

VARANAL period: 6/25 18:00 – 6/26 18:00 UTC

over 7 different bores present.

MCS from elevated CI. Gravity wave clouds are seen before CI

50° N

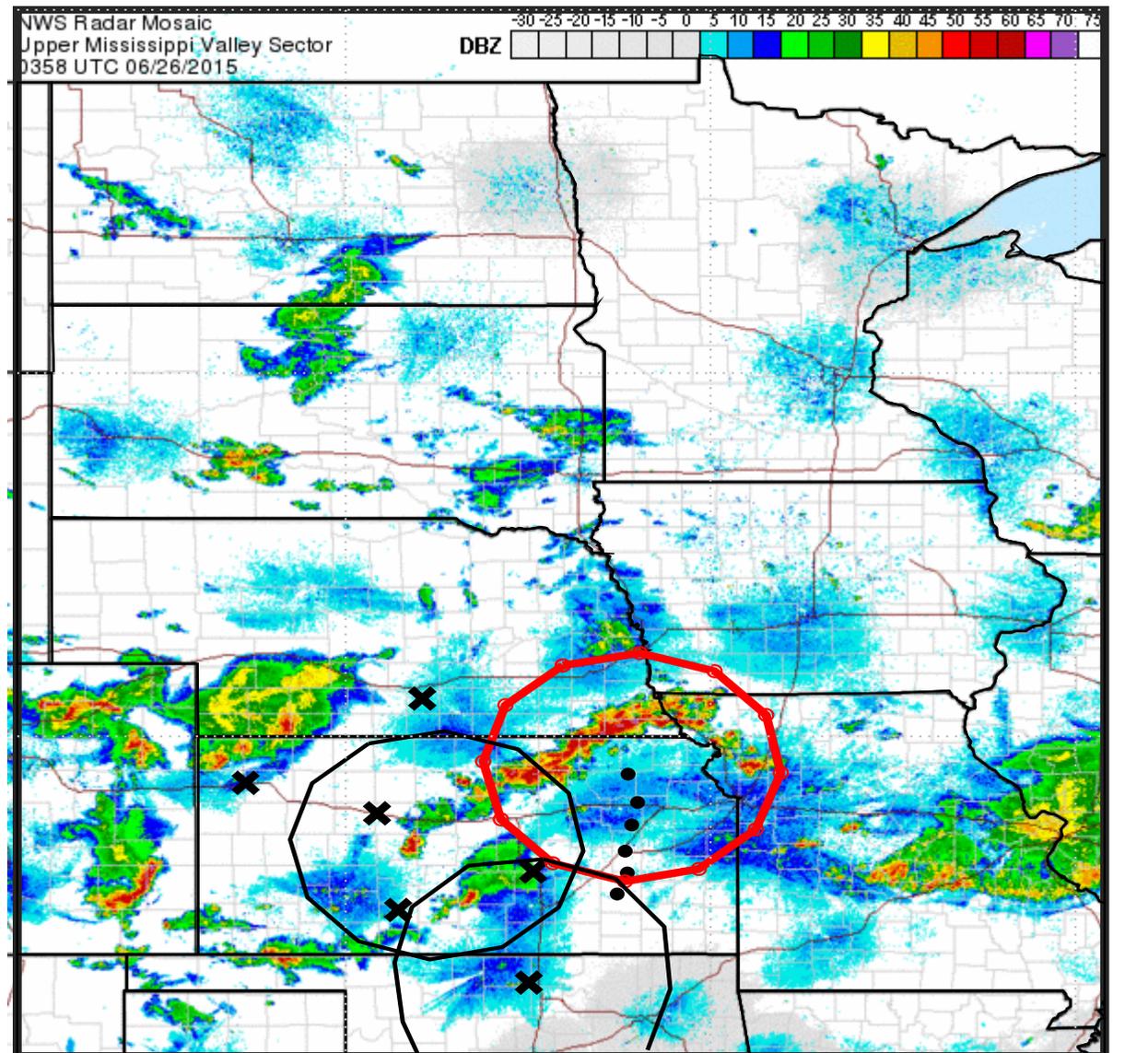
45° N

40° N

100° W

95° W

90° W



IOP16

MCS

50° N

IOP17 (39.76N, 95.19W)

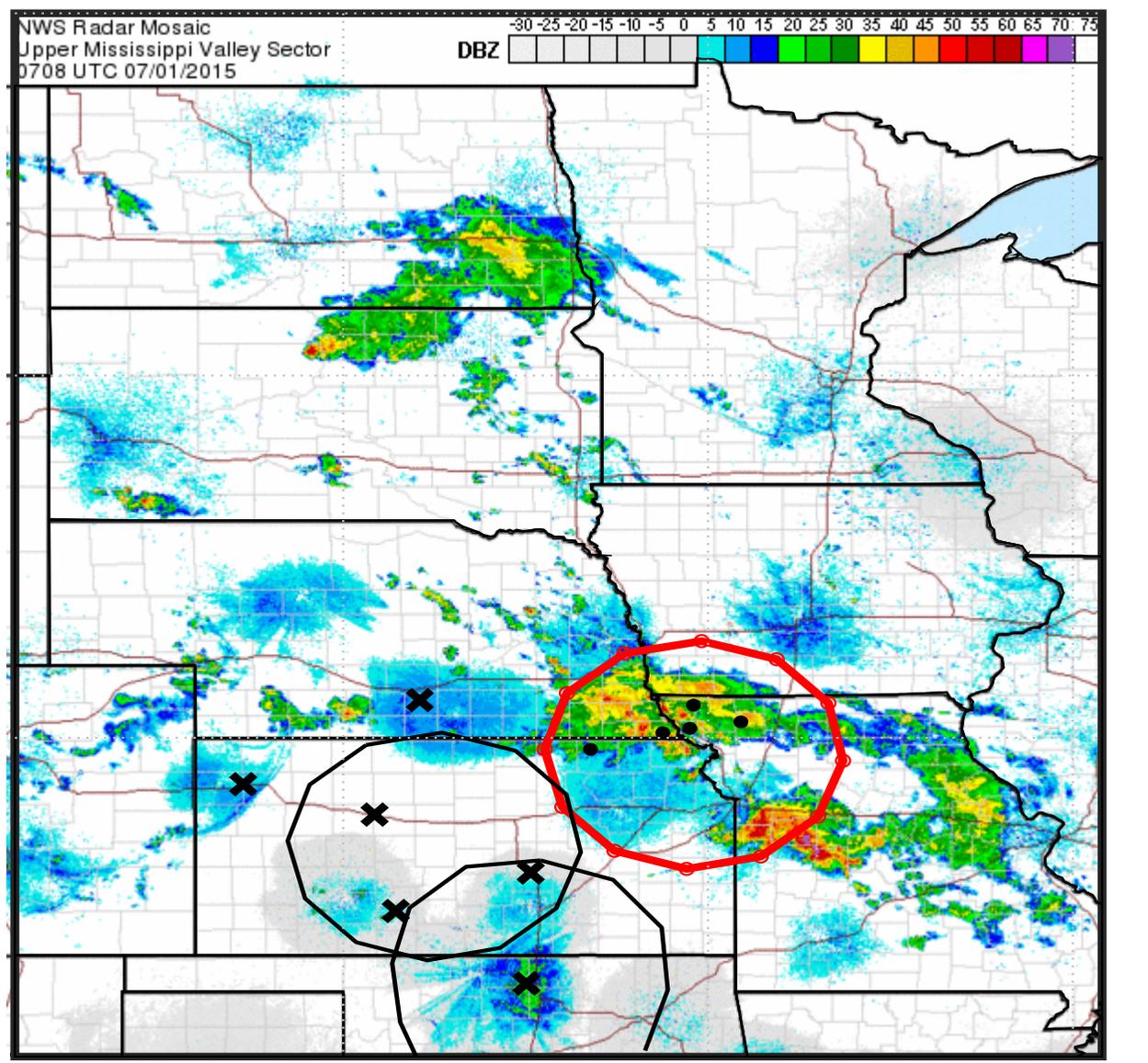
7/1/2015 0200-1200UTC

VARANAL period: 6/30 18:00 – 7/1 18:00 UTC

MCS mission over Northwestern Missouri and Southeastern Nebraska.

45° N

40° N



100° W

95° W

90° W

IOP17

CI

IOP18 (38.61N, 100.14W)

7/4/2015 0200-0730UTC

VARANAL period: 7/3 18:00 – 7/4 18:00 UTC

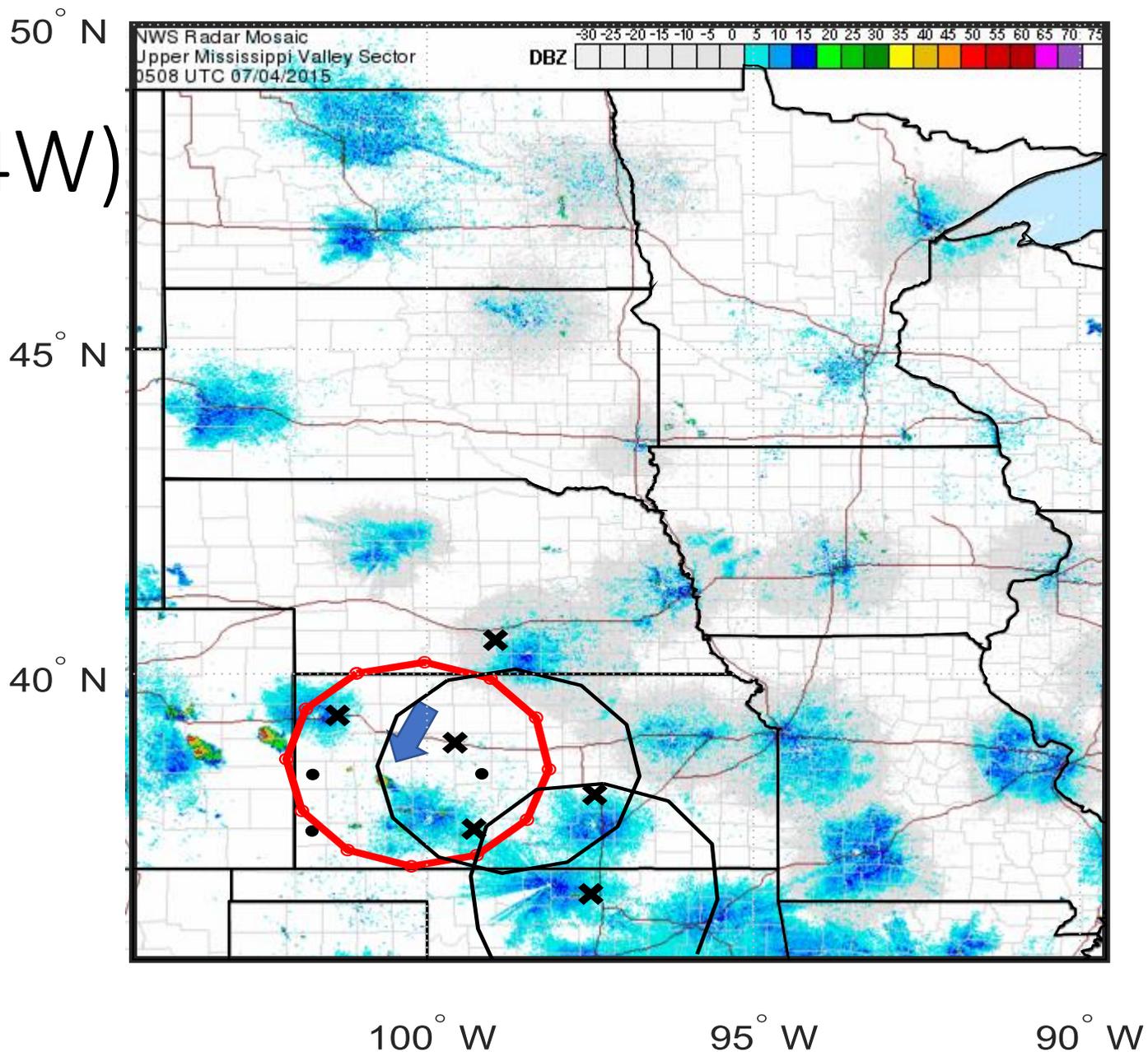
(Wilson et al., 2018):

Small-scale hailstorm, “pristine CI” since it was far from other storms and un-associated with any near-surface convergence lines.

On 7/3 afternoon, PECAN forecasters mentioned the following phenomena could contribute to the favorable conditions for CI: warm advection, short-wave trough, isentropic ascent, elevated CAPE and the veering of LLJ. Of these factors mentioned by the forecasters, warm-air advection and elevated CAPE clearly played a role.

the western edge of the PECAN domain exhibit a deep elevated moist layer that facilitates nocturnal CI.

Weak lifting motion increases humidity and decreases CIN, which, combined with weak gravity wave updrafts, enable large-scale updrafts roots near 1.5km AGL. The updrafts roots extended downward and ingest larger CAPE air which maintain the updrafts.



IOP18

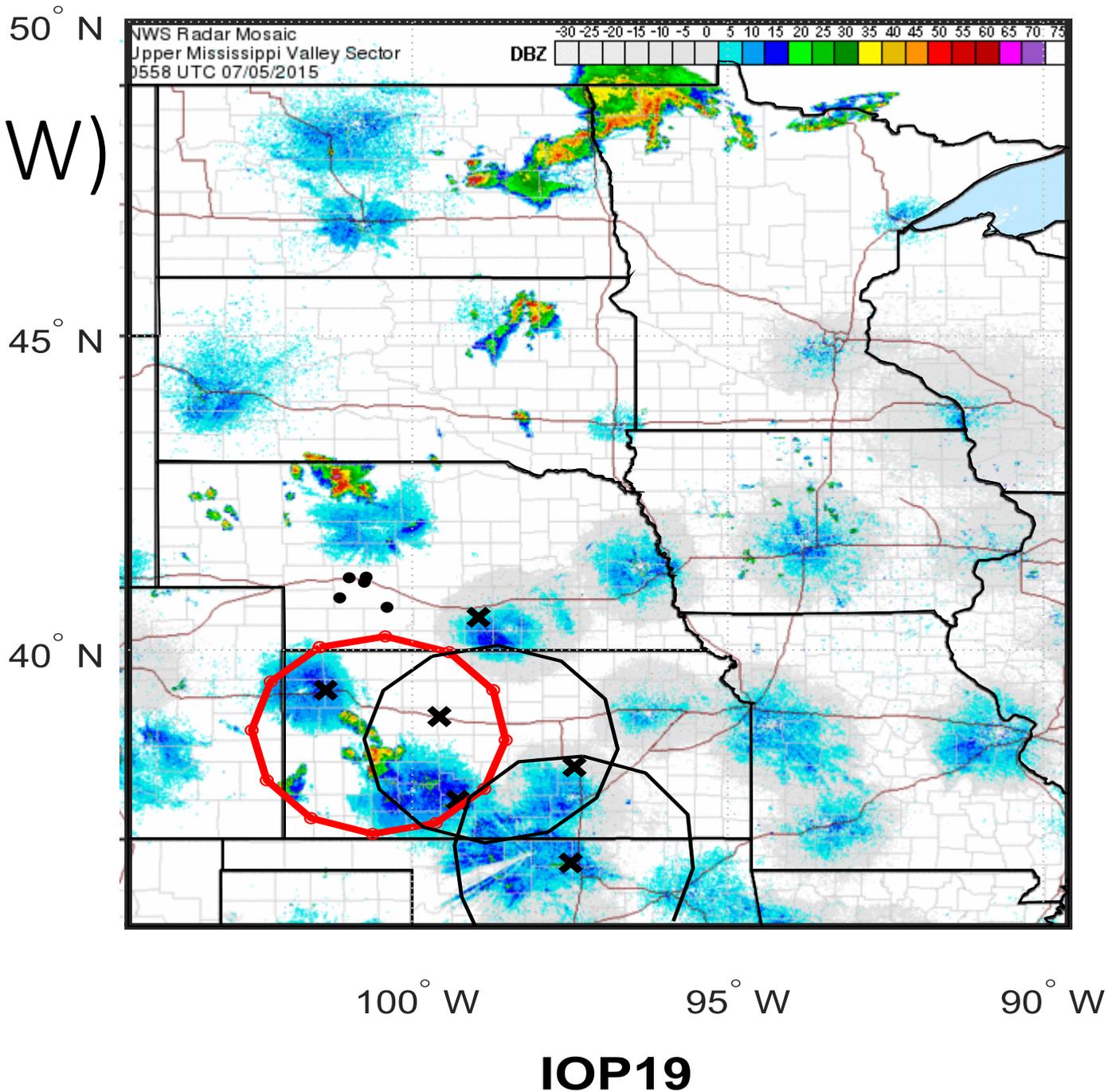
Bore

IOP19 (38.64N, 100.53W)

7/4/2015 2000 – 7/5/2015 0600UTC

VARANAL period: 7/4 18:00 – 7/5 18:00 UTC

The MCS that was hoped to develop with a subsequent bore never grew upscale in the time allotted. No data was obtained on an MCS or a bore. There was **some CI** around SPol.



MCS

50° N

IOP20 (41.73N, 98.91W)

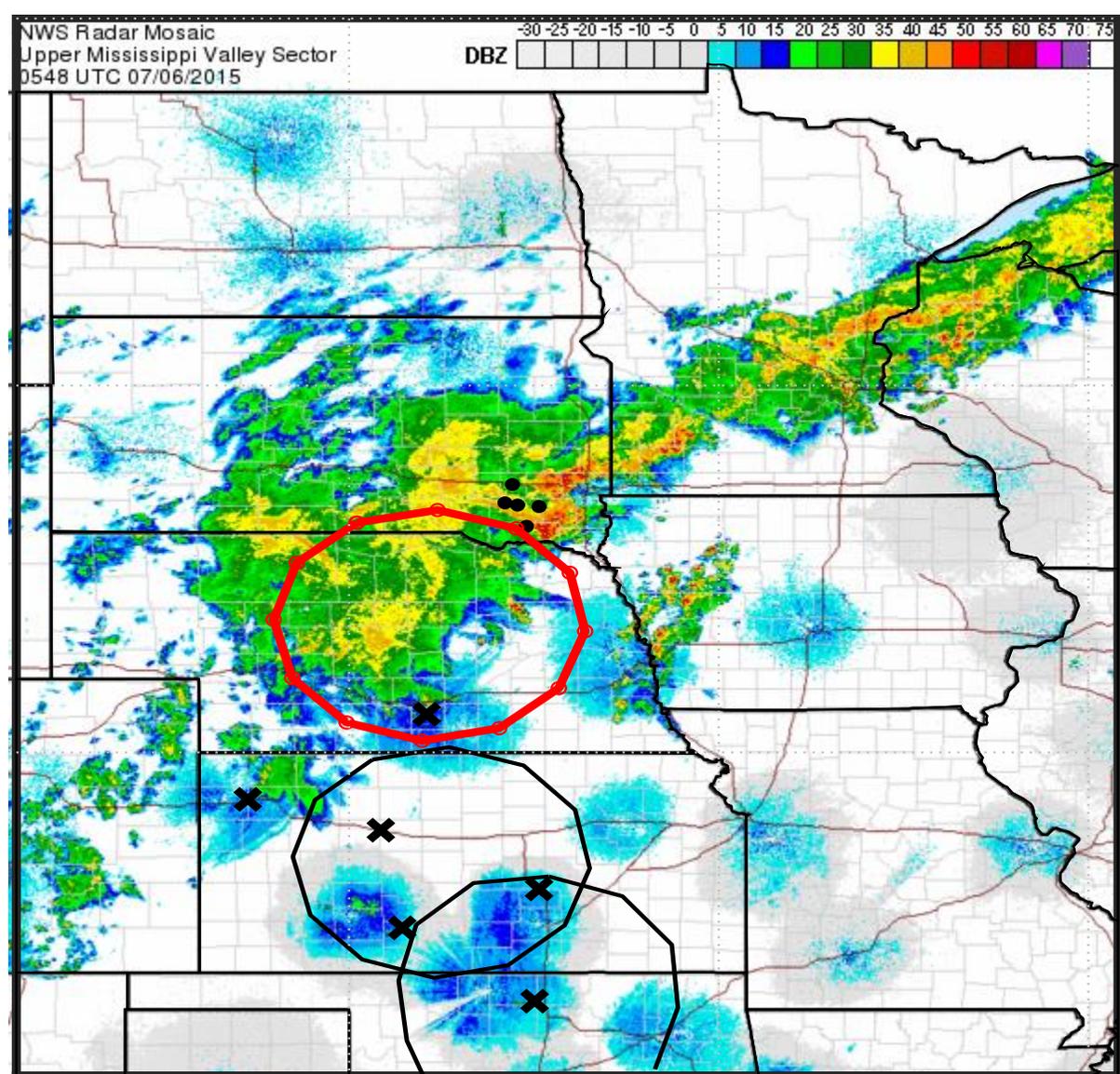
7/6/2015 0000-0900UTC

VARANAL period: 7/5 18:00 – 7/6 18:00 UTC

An MCS mission in SE South Dakota and NE Nebraska highlighted by three bow echoes and bores on its south side. The ground assets were north of Yankton, South Dakota. The King Air flew further south, intercepting a bore several times. CI occurred along this bore.

45° N

40° N



IOP20

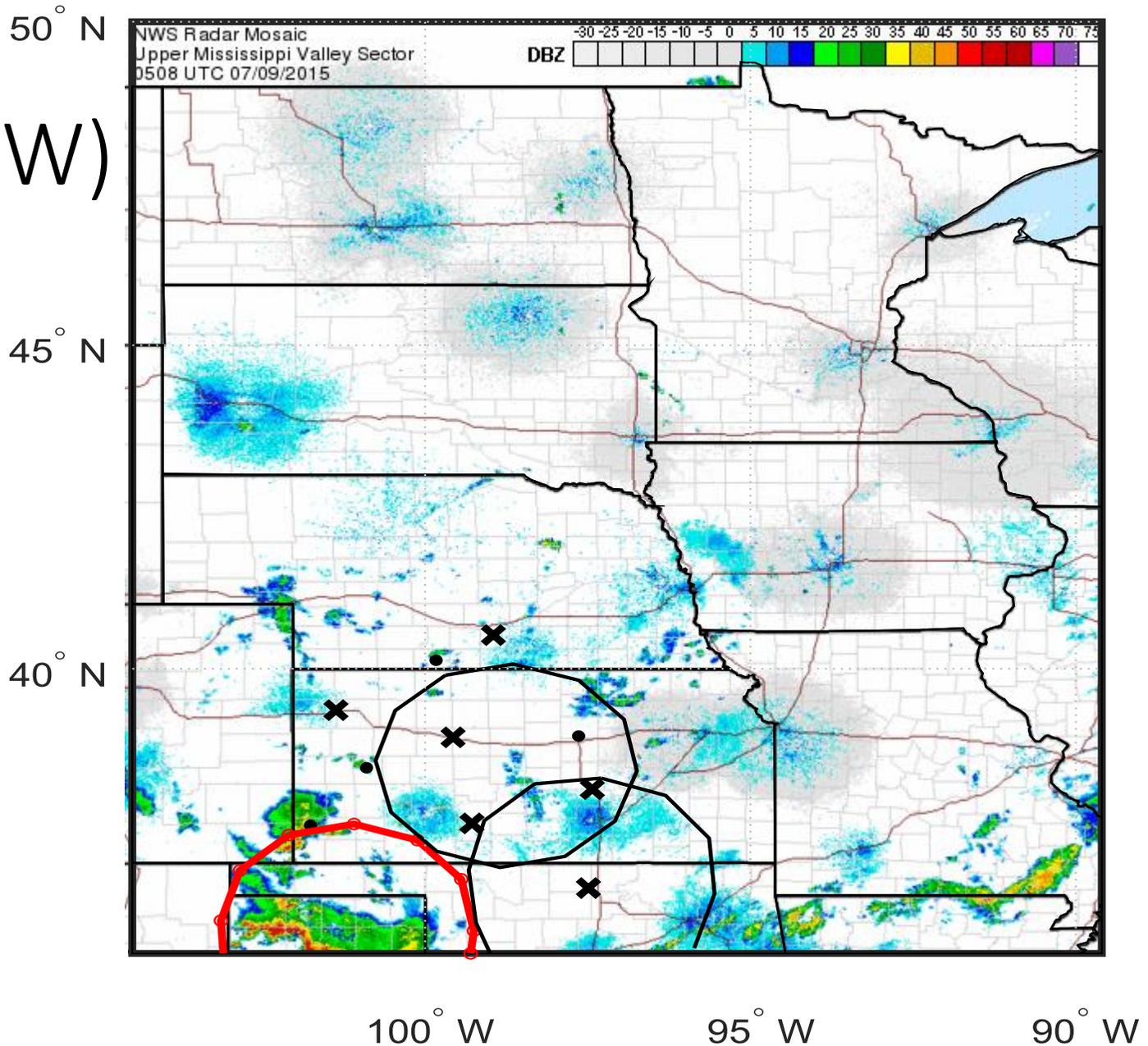
MCS

IOP21 (36.03N, 101.19W)

7/9/2015 0000-0900UTC

VARANAL period: 7/8 18:00 – 7/9 18:00 UTC

An MCS mission in the **Texas panhandle** with ground crews east of Amarillo. An MCS developed in the Texas panhandle, starting as a convective line and expanding to several complex lines and a very large stratiform region.



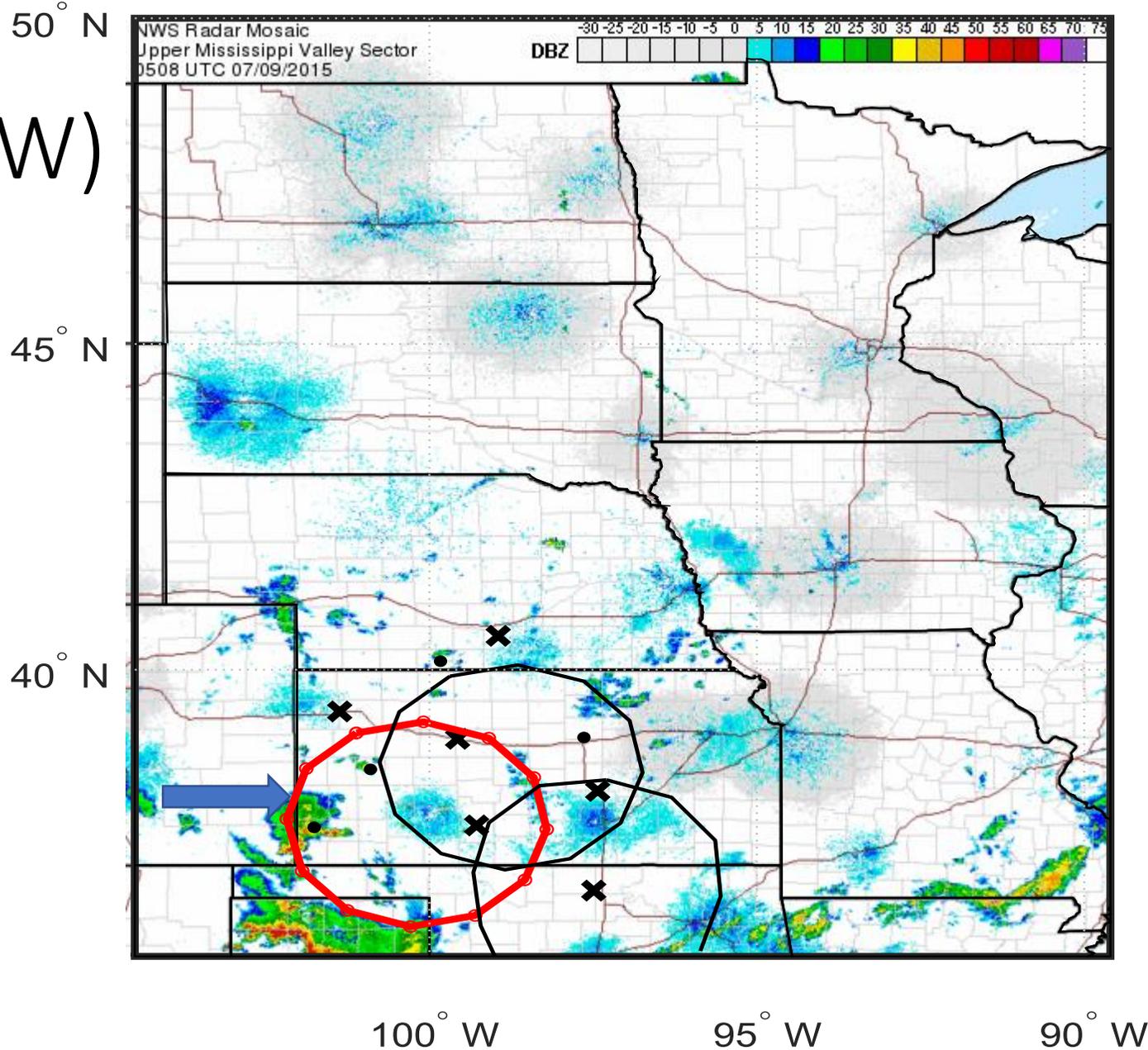
IOP21

CI

IOP22 (37.63N, 100.19W)

7/9/2015 0000-0900UTC (same as IOP21)
VARANAL period: 7/8 18:00 – 7/9 18:00 UTC

A CI mission with ground assets around S-Pol



IOP22

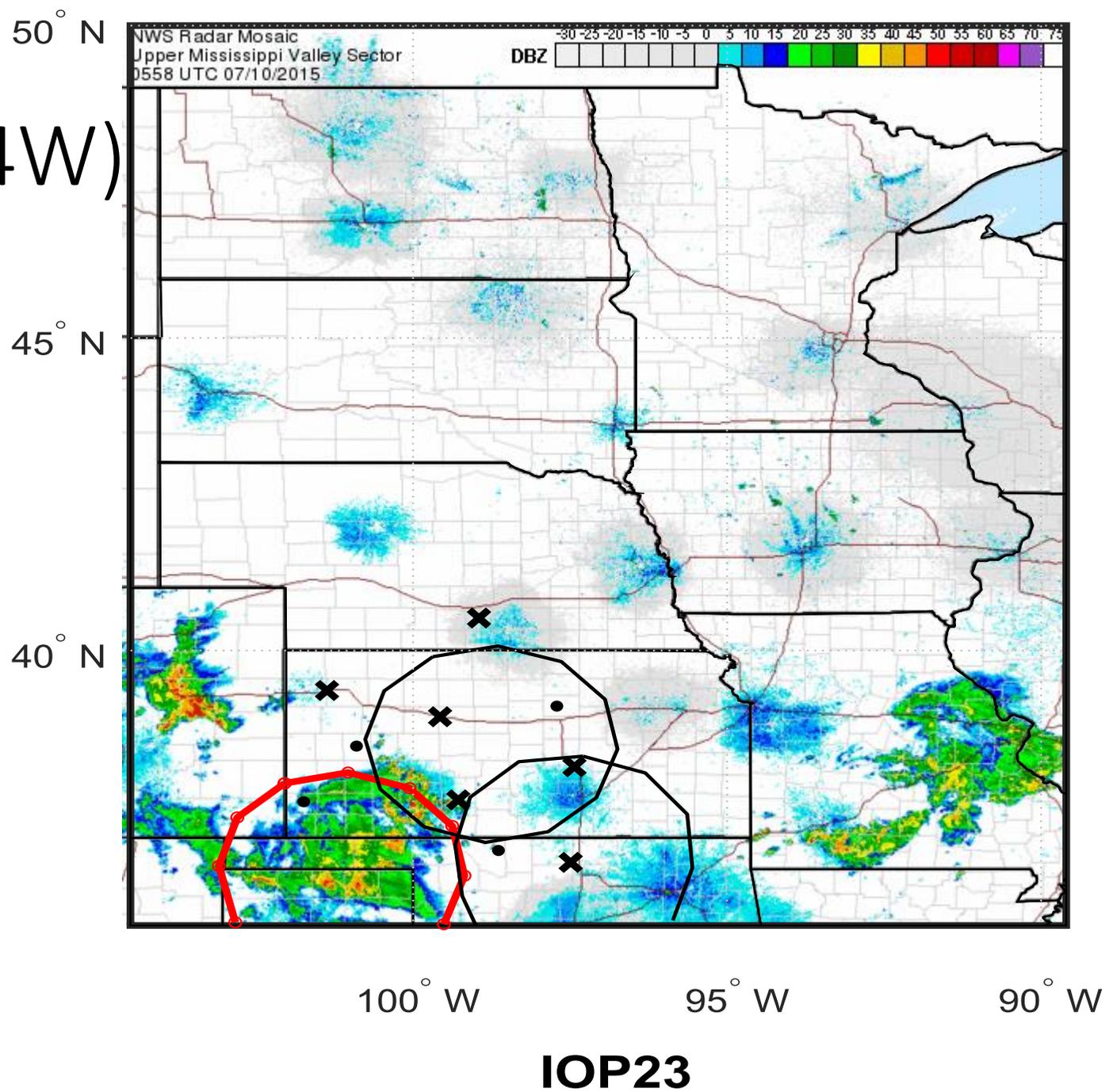
MCS

IOP23 (36.48N, 101.14W)

7/10/2015 0000-0600UTC

VARANAL period: 7/9 18:00 – 7/10 18:00 UTC

An MCS mission in the Texas panhandle
with ground crews east of Amarillo



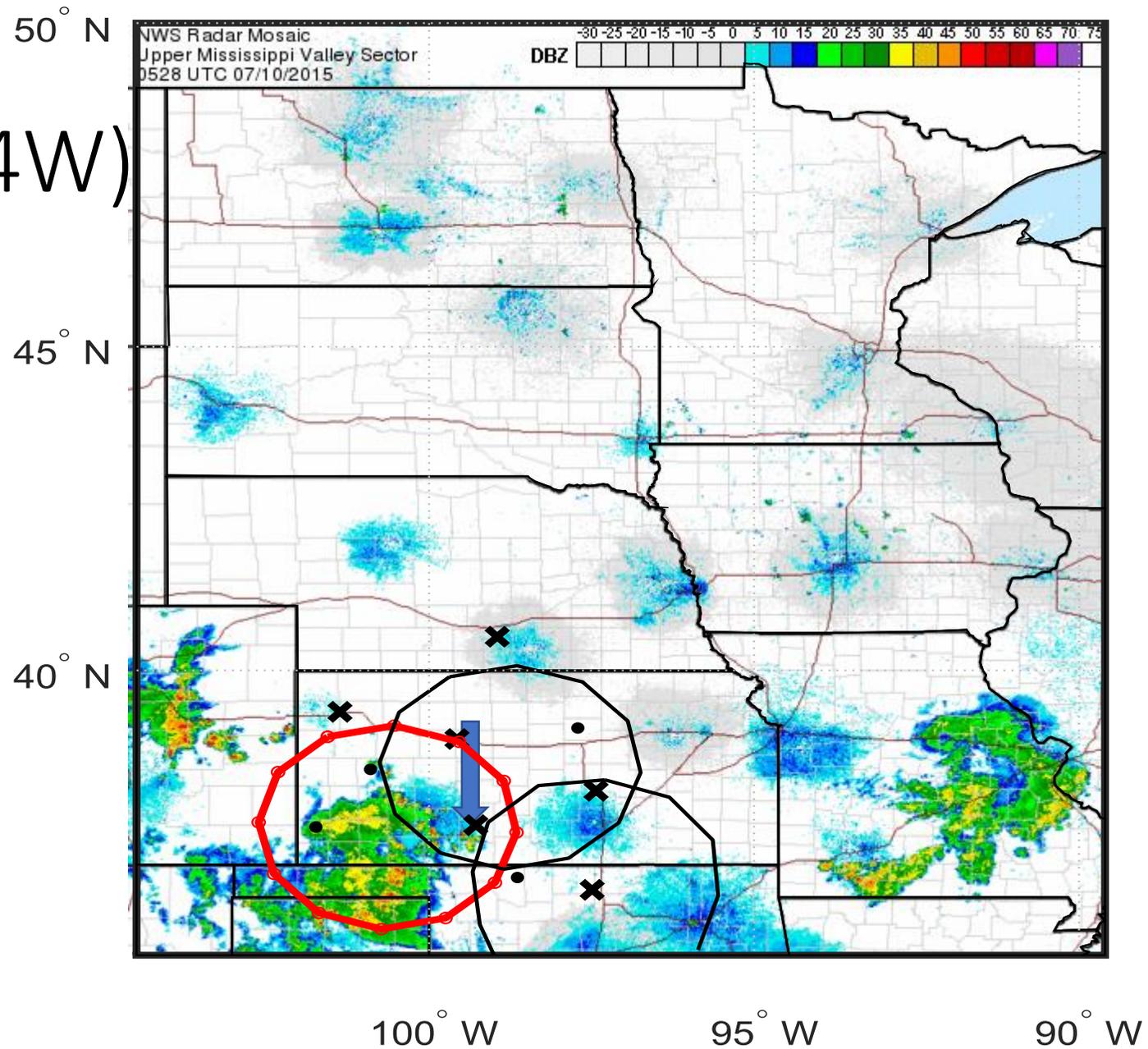
CI-LLJ

IOP24 (37.58N, 100.64W)

7/10/2015 0000-0730UTC (same as IOP23)

VARANAL period: 7/9 18:00 – 7/10 18:00 UTC

A CI-LLJ mission with ground assets around S-Pol



IOP24

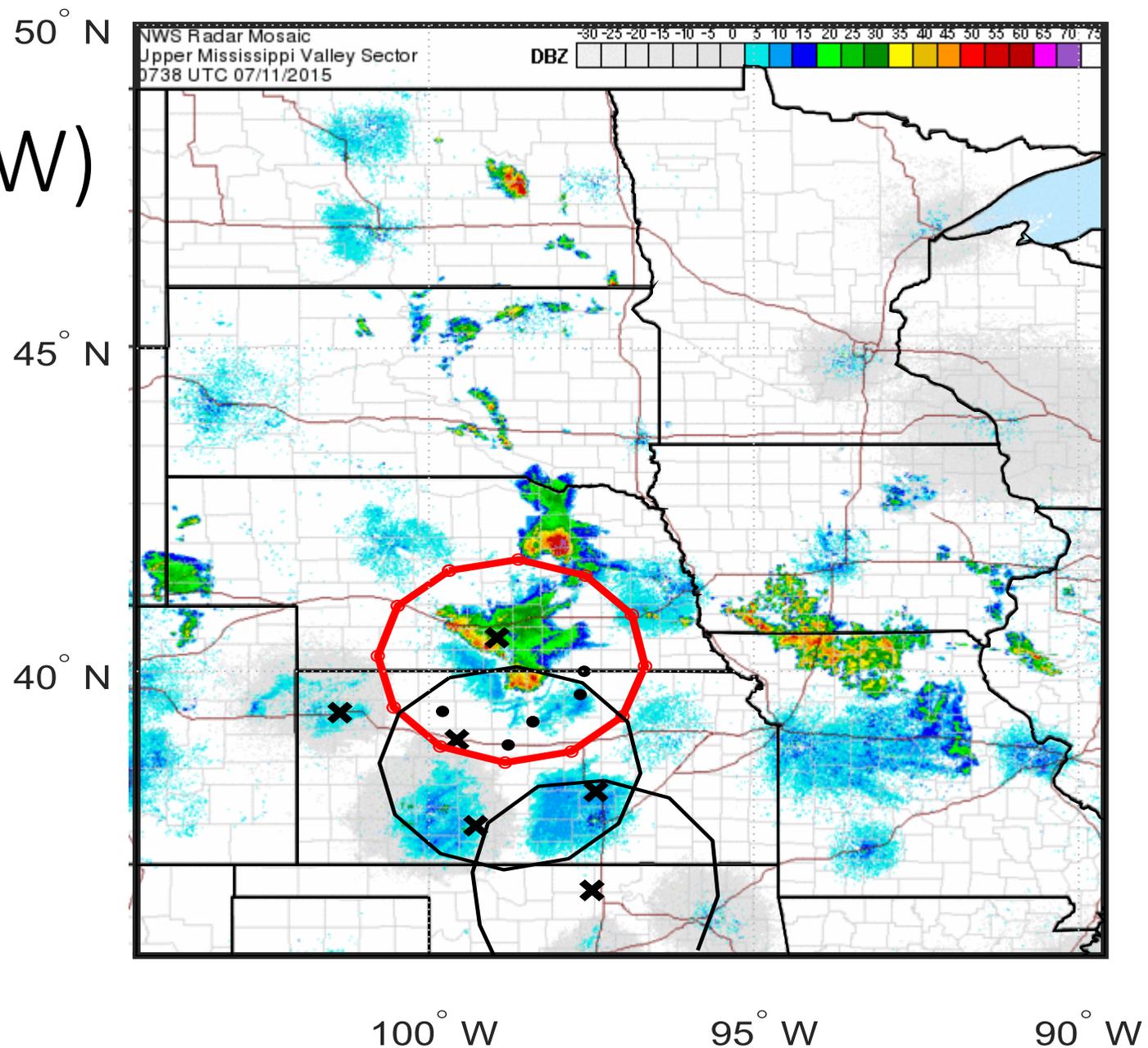
Bore

IOP25 (40.16N, 98.73W)

7/11/2015 0000-0930UTC

VARANAL period: 7/10 18:00 – 7/11 18:00 UTC

A bore mission in SC Nebraska and NC Kansas



IOP25

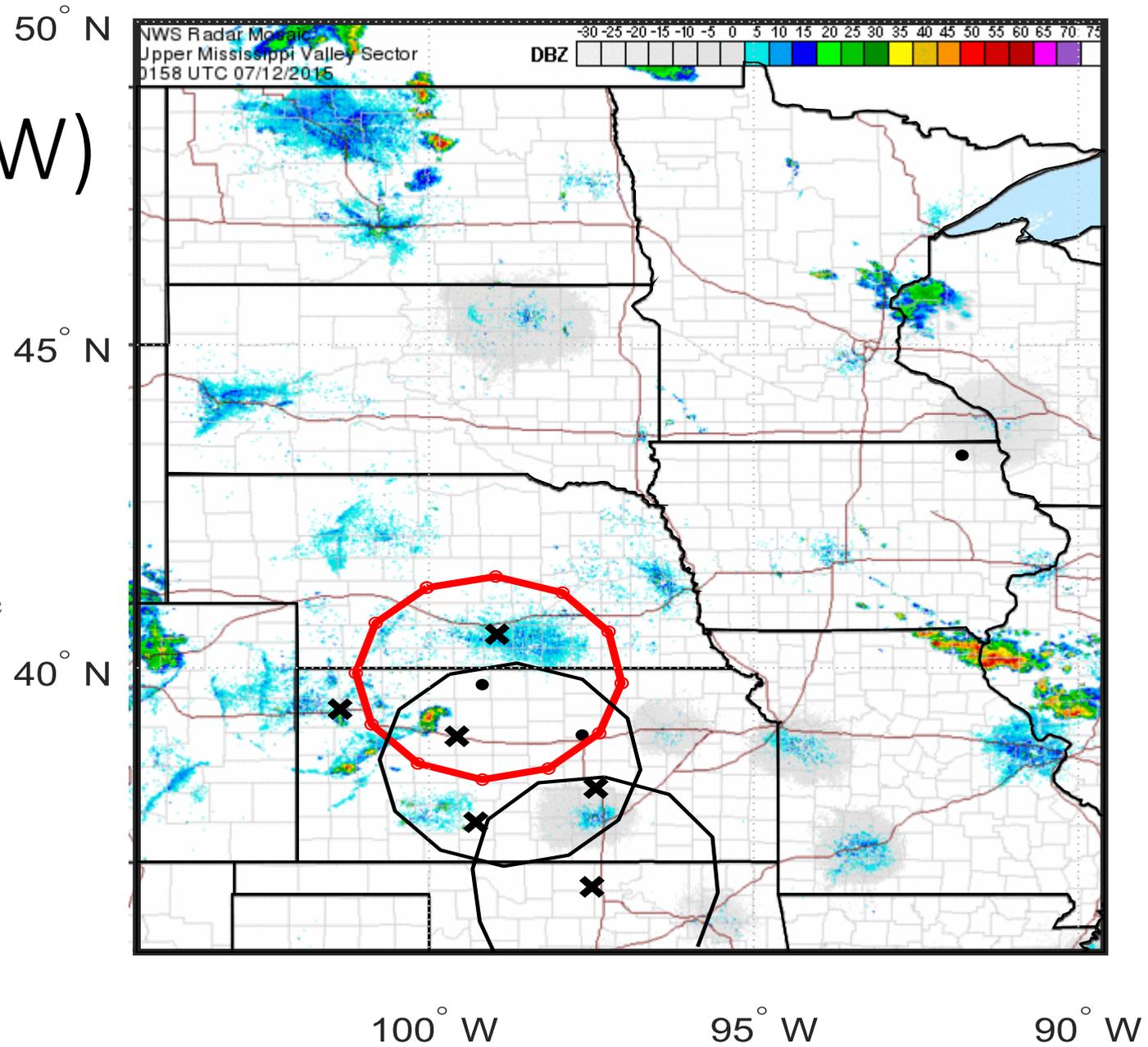
CI-LLJ

IOP26 (39.84N, 99.08W)

7/11/2015 2200 – 7/12/2015 0600UTC

VARANAL period: 7/11 18:00 – 7/12 18:00 UTC

A CI-LLJ mission around central/western Kansas. Objectives were to sample the early evolution of the LLJ, the forecasted strong gradient of wind speed along its western edge, the convergence near the northern terminus of the LLJ, and any CI within the IOP area.



IOP26

MCS

50° N

IOP27 (42.13N, 93.11W)

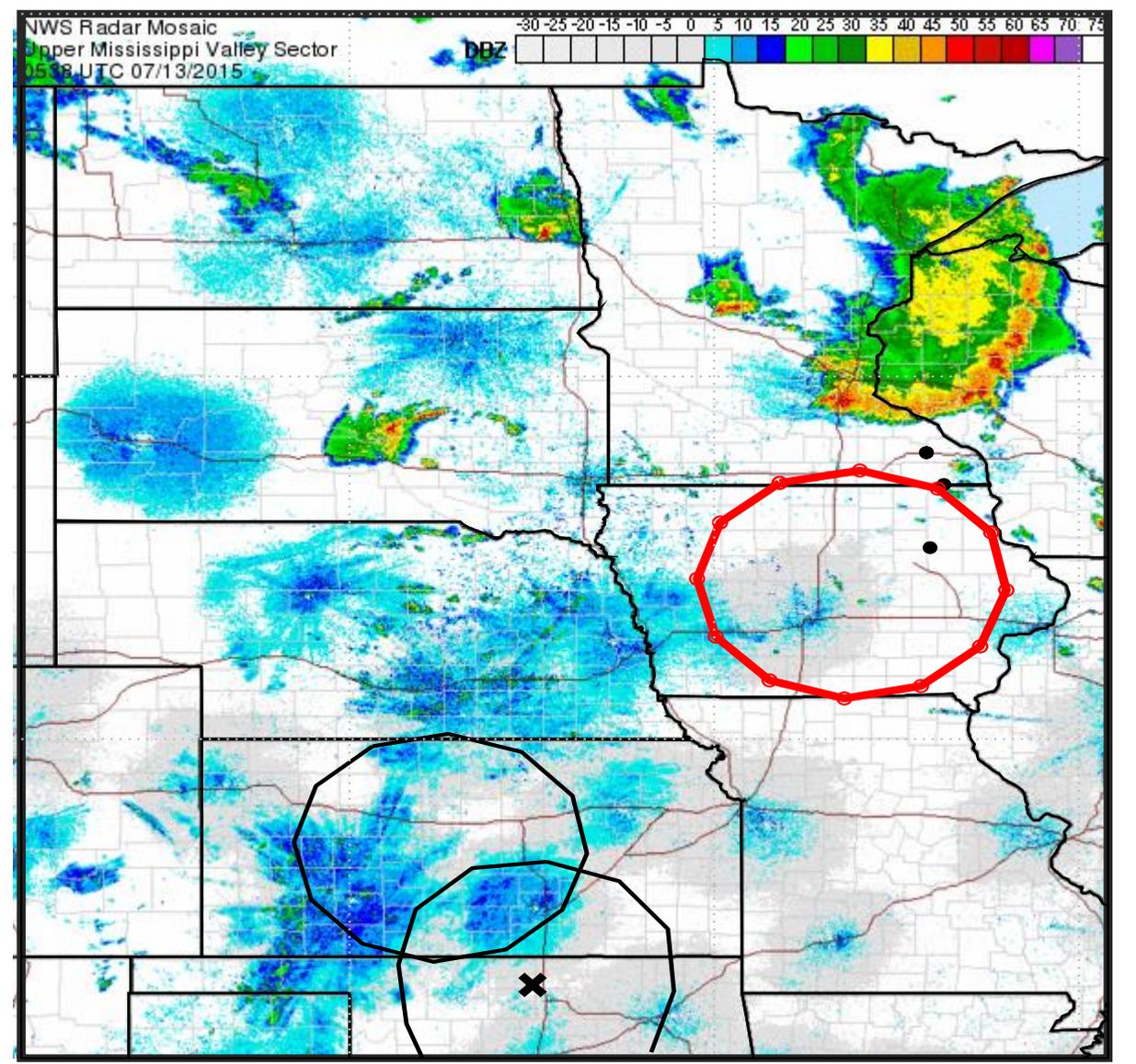
7/13/2015 0000-0900UTC

VARANAL period: 7/12 18:00 – 7/13 18:00 UTC

A beautiful squall line formed and moved through southern Minnesota,

45° N

40° N



IOP27

MCS

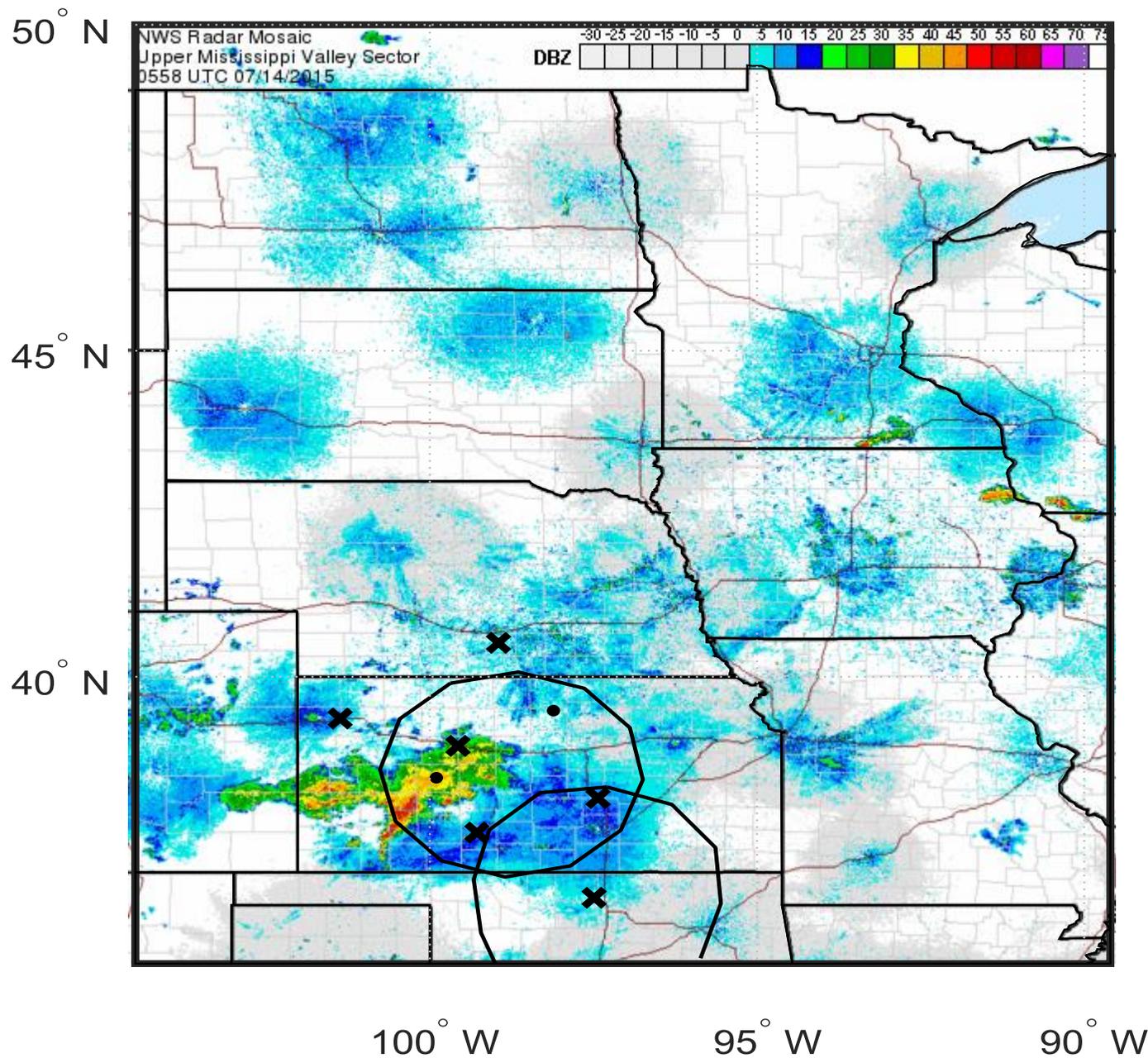
IOP28

Too far away

7/14/2015 0000-0630UTC

VARANAL period: skipped

An MCS mission conducted by ground crews in **western Indiana**. It was not a high-end MCS, but vigorous CI was sampled with upscale growth right in the radar array. CLAMPS provided BL profiles including a period in which the BL was lifted with CI shortly after.



IOP28

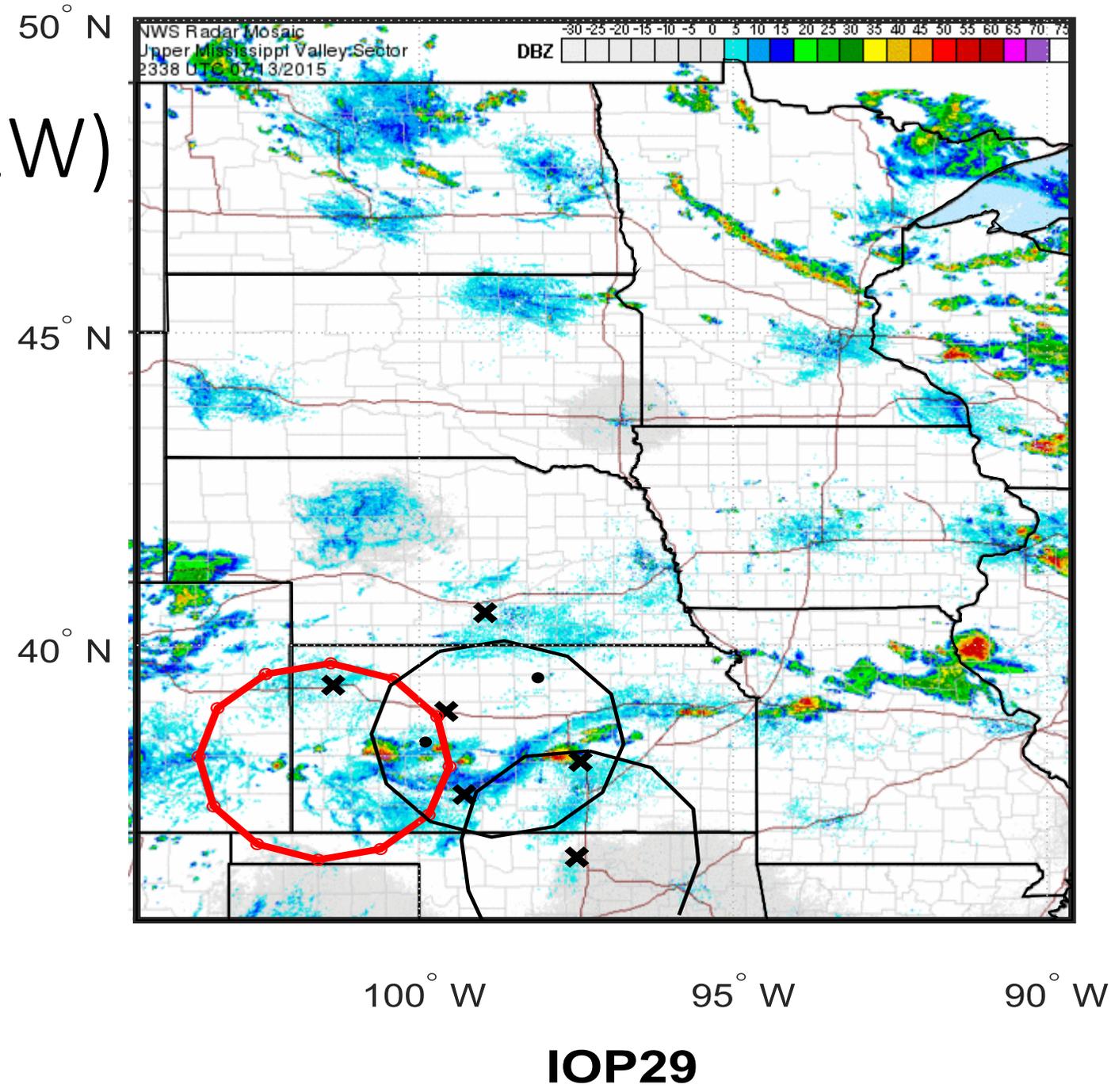
CI

IOP29 (38.14N, 101.51W)

7/14/2015 0000-0730UTC (same as IOP28)

VARANAL period: 7/13 18:00 – 7/14 18:00 UTC

A CI mission in western Kansas. A cluster of storms formed in SW Kansas and grew into an MCS during the night. There was a mixture of surface-based and elevated CI, along with at least two bores.



CI

IOP30 (38.85N, 100.38W)

7/15/2015 0000-0700UTC

VARANAL period: 7/14 18:00 – 7/15 18:00 UTC

A CI mission in western Kansas. Most of the initiation was surface based, but an excellent data set was collected on a large MCS with multiple bow echoes and heavy rains.

50° N

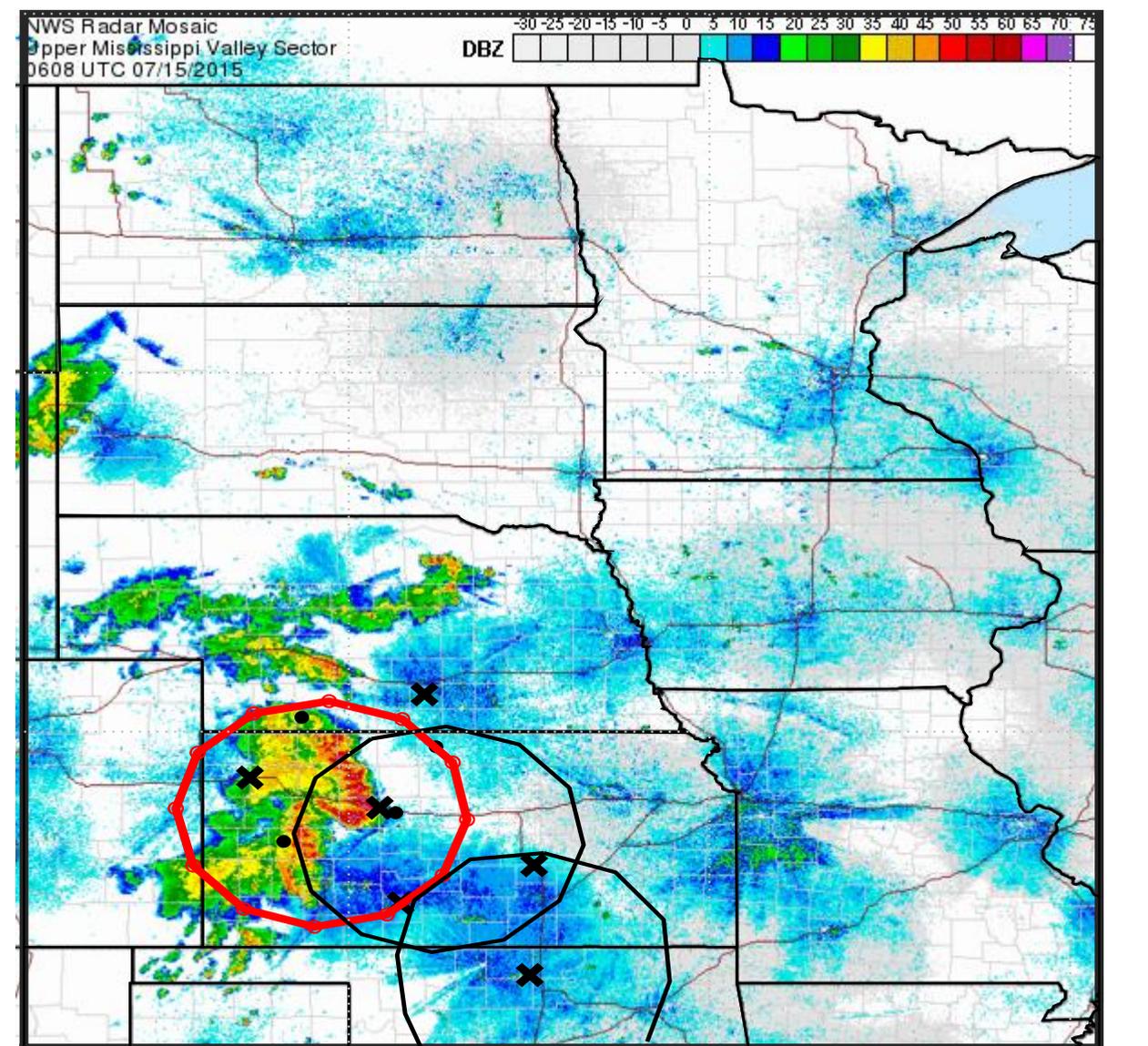
45° N

40° N

100° W

95° W

90° W



IOP30