



UPS Airlines Operators/Dispatch Mission and Weather Needs

Randy Baker

4/14/2009



Imagine a Passenger Airline that...

- Picks up the passengers at their houses or work place.
- Transports passengers to a hub for a connecting flight to their destination. Hub only has one bank of flights per day.
- Drops passengers off at their final destination (business, hotel, resort, etc.)
- If late, they get a refund.



SDF Next Day Air Operations

- **03-06z: 100 arrivals**
- **06-09z: 100 departures**



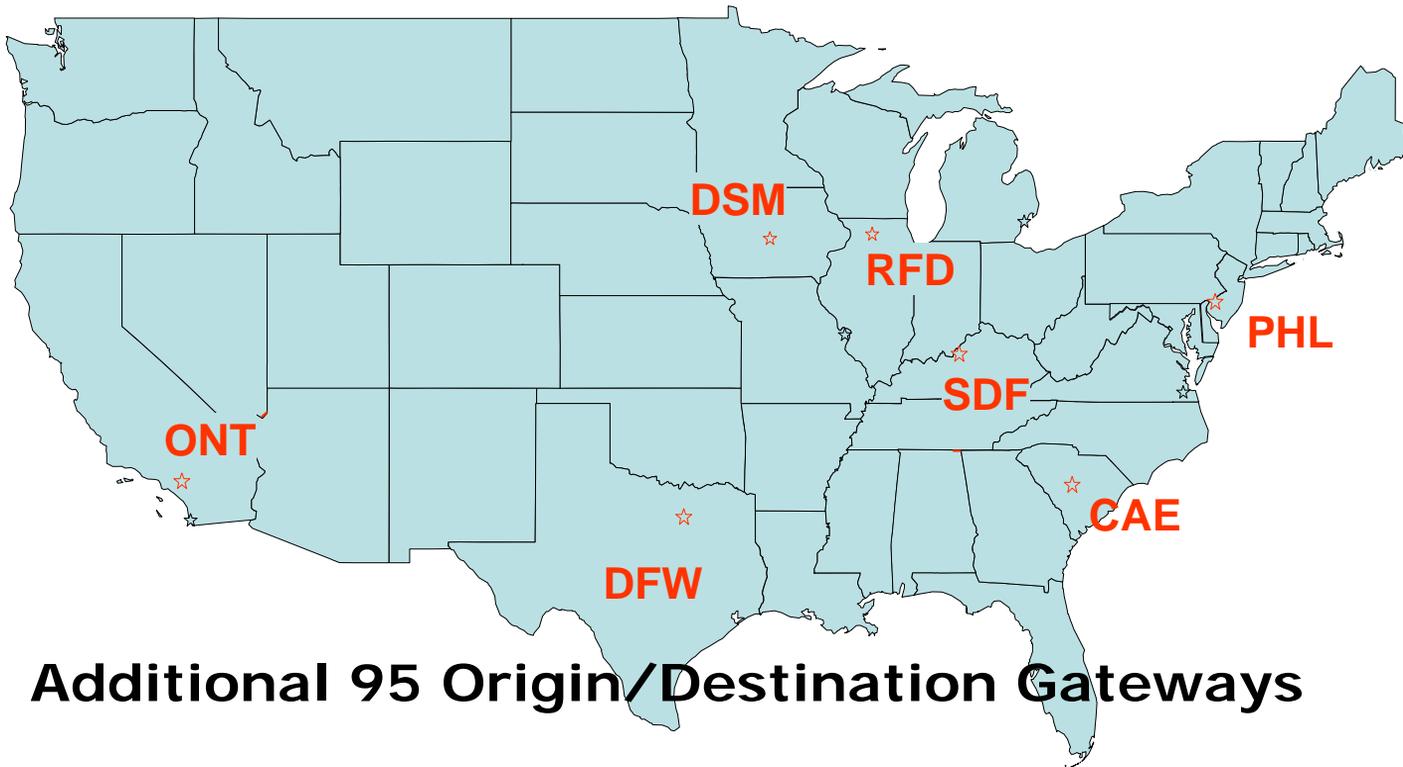
On Time Performance is Critical

Bureau of Transport Stats for August 2007

All Airlines	71.7%
Southwest	77.7%
UPS Next Day Air	88.2%
UPS 2DA	85.3%



Domestic Hub Operations



Additional 95 Origin/Destination Gateways



International Operations



74 International Origin/Destination Airports



Alternate Operations

Develop and maintain alternate air operating plans in the event of a major air sort disruption - whether due to adverse weather conditions or any crisis that the Airline may encounter. We strive to maintain service levels within the operation by reducing the impact the event has on our air sorts.





24:00

Major Weather Impacts

- Fog
- T-storms
- Deice events
 - Winter Precipitation (Snow, Ice Pellets, Freezing Rain, Freezing Drizzle)
 - Frost
- Hurricanes/Typhoons
- Volcanic Ash



Major Weather Impacts- Fog

- Average 4 US/Canadian airports every night with $\frac{1}{4}$ sm and/or ceiling 100 feet during morning arrival time.
- Night-time hubs average 1-2 fog threats each year.
- Developed our UPS Fog Forecasting Method
 - Focuses on lowest 1000 feet temperature, wind, moisture profile
 - Prompted us to implement ARINC 620 Specification for AMDAR (MDCRS) Reports, and WVSS Sensor for moisture



Boundary Layer Observations

- UPS ARINC Spec 620

- Ascent: 6 second interval for 90 seconds, then 20 second intervals until 510 seconds have elapsed.
- Descent: Beginning from 20,000 feet, 30 second interval until landing.

– Provides ~300 foot interval lowest several thousand feet.

– Need Water Vapor in addition to Temp/Winds.

- Hydrolapse lowest 1000 feet most important to fog forecasting.

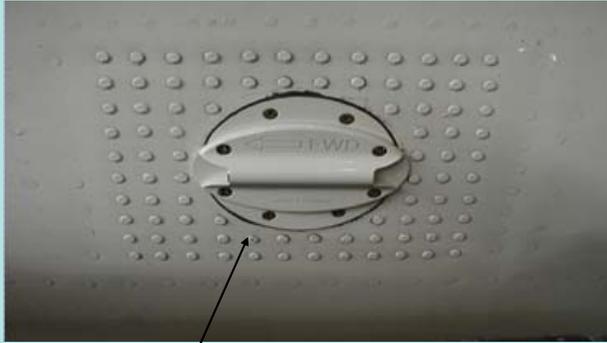


Enroute Aircraft Observations

- UPS ARINC 620 Spec – 3 minute intervals
 - 3 minute Intervals (8-13 km/minute)
 - Winds are currently instantaneous winds...need to be 10-second average winds.



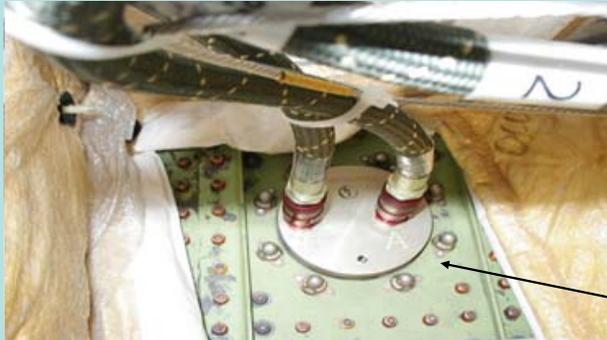
Aircraft N411UP WVSS-II installation pictures at Goodrich during "C" check in May 2004.



Air Sampler (View looking inboard)



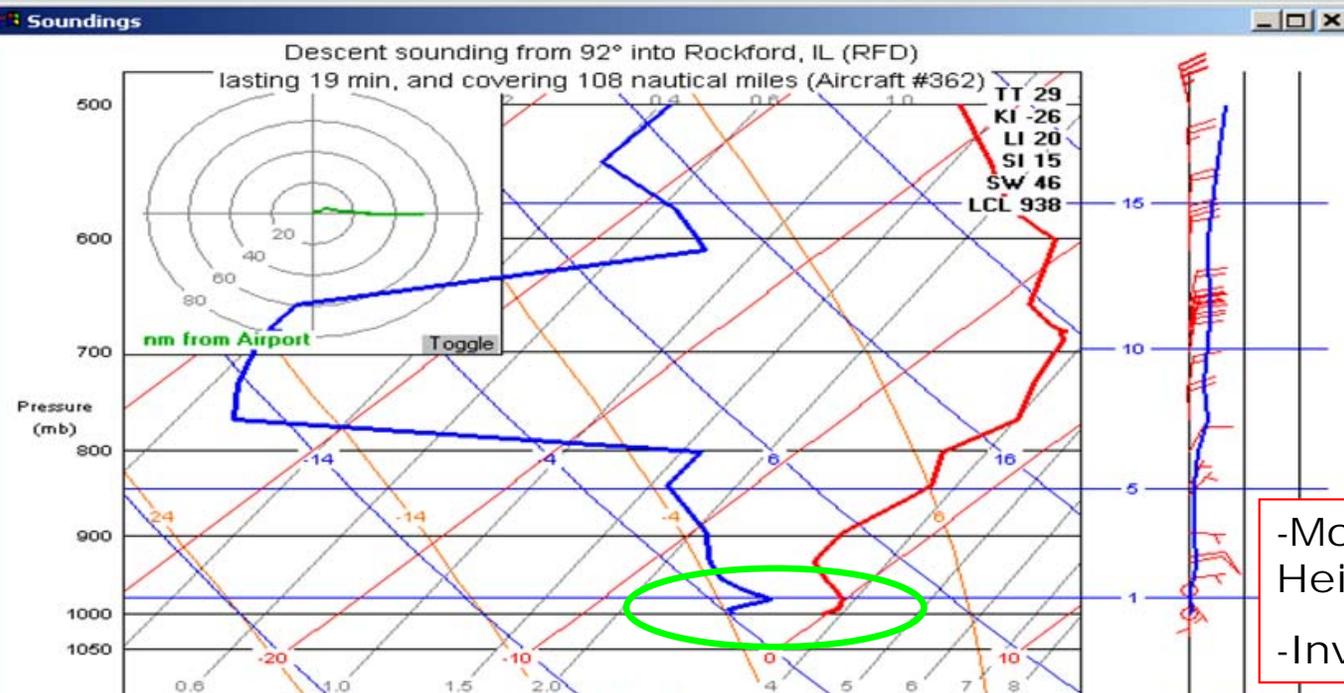
System Electronics Box (SEB) (View looking outboard)



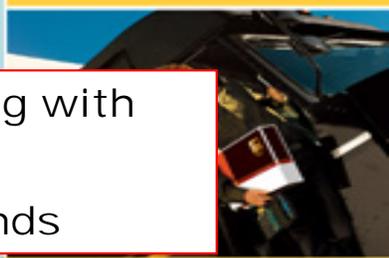
Air Sampler (View looking outboard)



Fog Forecasting



- Moisture Increasing with Height
- Inversion/Light Winds



RFD(Dn) 0443 07/03/06 (#362)

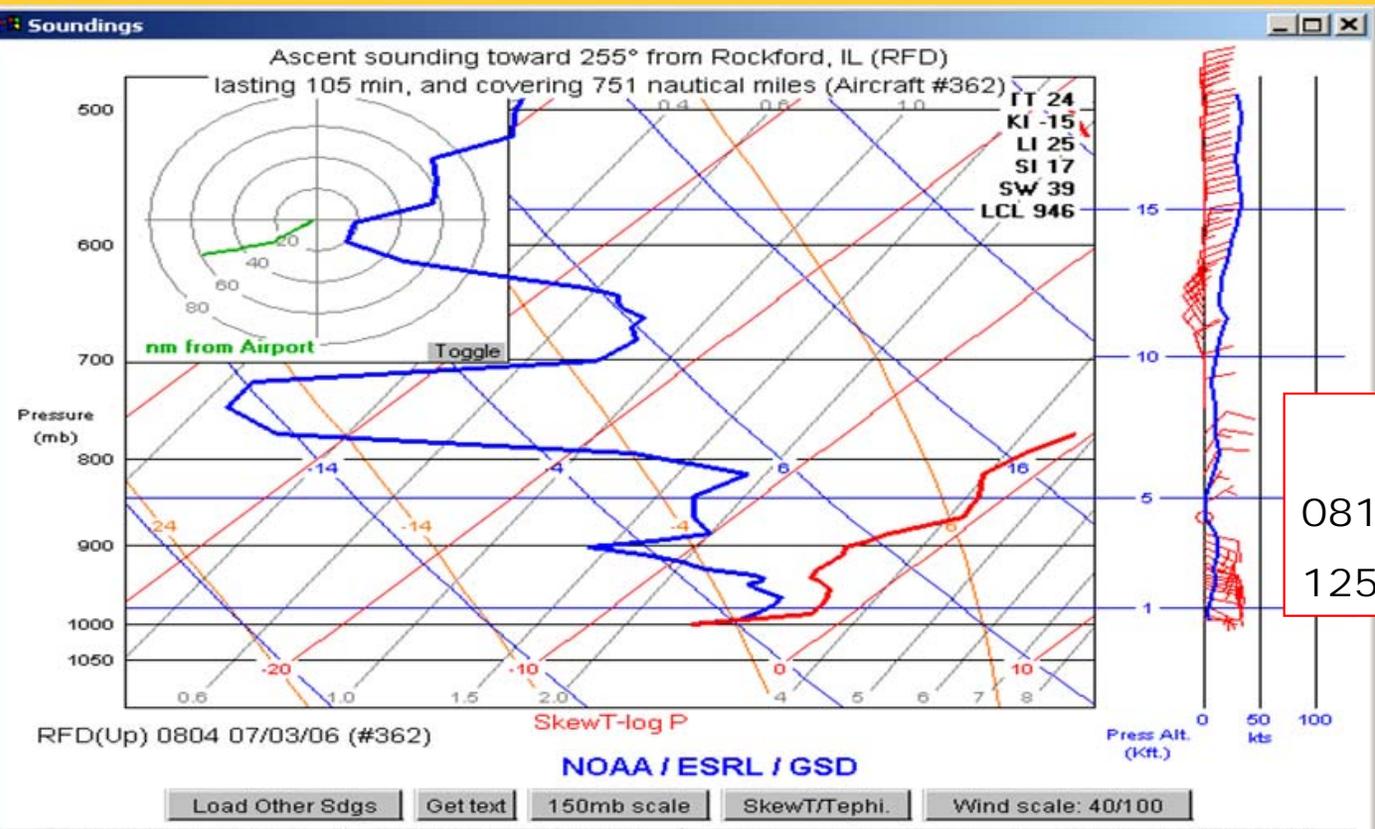
NOAA / ESRL / GSD

Load Other Sdgs | Get text | 150mb scale | SkewT/Tephi. | Wind scale: 40/100

RFD(Dn) 1126 07/03/06	RFD(Up) 0936 07/03/06	RFD(Up) 0804 07/03/06	RFD(Dn) 0702 07/03/06
RFD(Dn) 0443 07/03/06	RFD(Dn) 0437 07/03/06	ORD(Up) 1819 08/03/06	



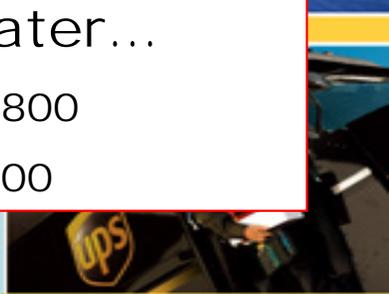
Fog Forecasting



3 hours later...

0812z RVR 1000-2800

1254z RVR 600-1000



RFD(Dn) 1126 07/03/06	RFD(Up) 0936 07/03/06	RFD(Up) 0804 07/03/06	RFD(Dn) 0702 07/03/06
RFD(Dn) 0443 07/03/06	RFD(Dn) 0437 07/03/06	ORD(Up) 1819 08/03/06	

Fog Forecasting - SDF 29 Mar 05

- Earlier in the day rain had occurred (0.34"), followed by clearing late in the day.
- Using the UPS Fog Forecasting method, the Crossover temperature was 8.3C, and with expected clear skies, calm winds, and a forecast low temperature of 4C, fog was of some concern.
- Soil temperatures were on the warm side (9C), and BUFKIT ETA output showed good dry advection just off the surface until about 04z, followed by decoupling and possible fog conditions by around 07z.
- Based on the model forecast of moisture decreasing with height, UPS meteorologists forecast ground fog with no operational impact at SDF where, due to runway construction, visibility below 3 miles would have caused significant delays to our Next Day Air inbounds.



Fog Forecasting - SDF 29 Mar 05

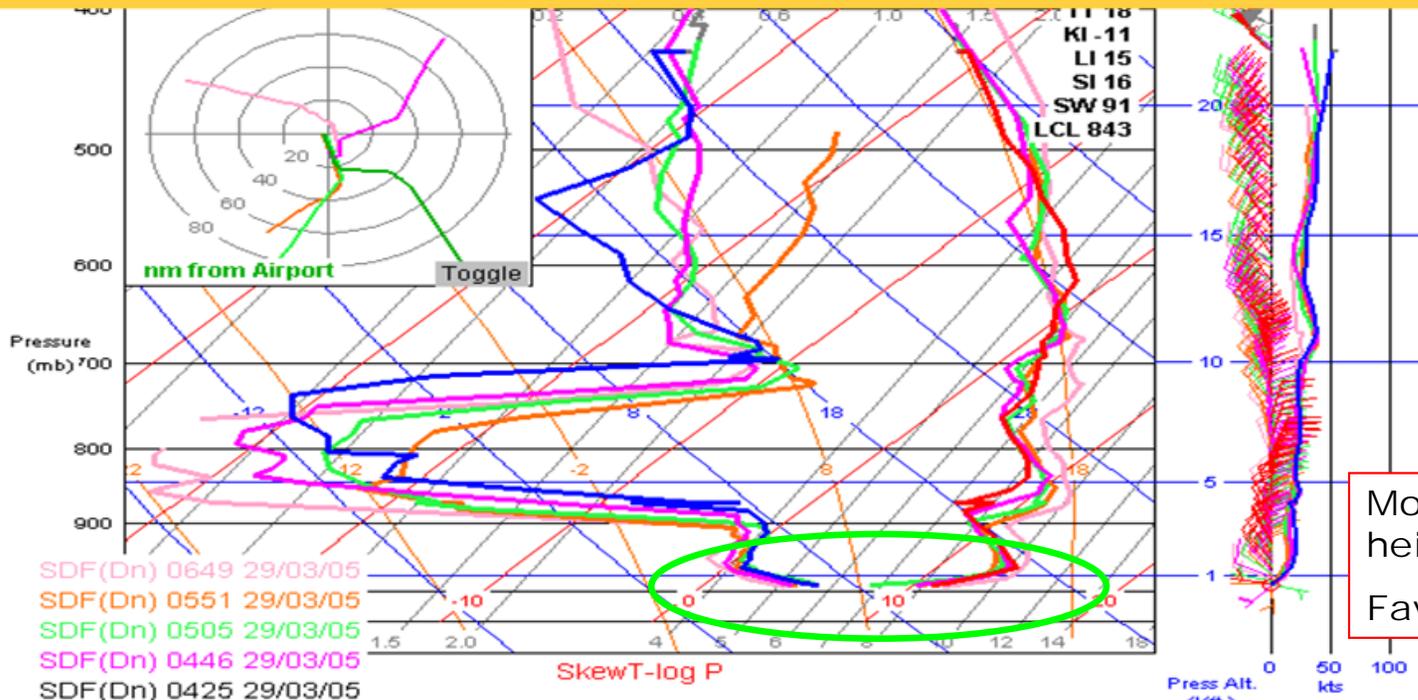
AC#362 TYS->SDF starting at 29-Mar-2005 03:47:00 with 85 obs
descent sounding ending at 29-Mar-2005 04:25:00

S	F	HHMM	lat/lon	Alt	wd/ws	t / td	(RH)	code
0	0	0421	38.0370/-85.7060	3300	338°/020	9.0/-1.10	(48.9%)	3930
2	0	0421	38.0150/-85.7030	3400	338°/020	8.6		
0	0	0422	38.0600/-85.7150	2840	340°/022	10.3/-0.20	(47.9%)	4130
0	0	0422	38.0820/-85.7220	2400	339°/022	11.5/0.000	(45.0%)	4130
2	0	0423	38.1000/-85.7270	2040	331°/022	12.2/0.200	(43.5%)	4130
0	0	0424	38.1150/-85.7340	1710	324°/020	13.0/0.700	(42.8%)	4230
0	0	0424	38.1320/-85.7370	1360	328°/018	13.8/0.800	(41.1%)	4230
2	0	0425	38.1640/-85.7490	700	279°/003	11.5/4.700	(62.9%)	5430
0	0	0425	38.1720/-85.7510	580	130°/002	11.0/5.500	(68.9%)	5730

The First Descent report at 0425z confirmed the model forecasts of a sharp decrease in moisture with height. Furthermore, there was a 3C inversion with 18 knots of wind, indicating still mixy conditions, helping to mix the drier air down to the surface.



Fog Forecasting – SDF 29 Mar 05



NOAA - Forecast Systems Laboratory

Load Other Sdgs

Get text

150mb scale

SkewT/Tephi.

Wind scale: 40/100

SDF(Up) 1000 29/03/05

SDF(Dn) 0649 29/03/05

SDF(Dn) 0446 29/03/05

SDF(Dn) 0425 29/03/05

SDF(Up) 0954 29/03/05

SDF(Dn) 0649 29/03/05

SDF(Up) 0734 29/03/05

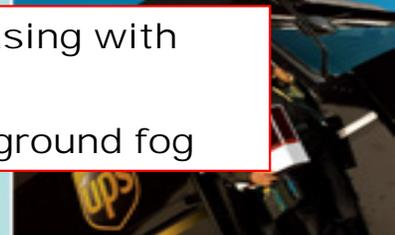
SDF(Up) 1005 29/03/05

SDF(Up) 1000 29/03/05

SDF(Dn) 0551 29/03/05

SDF(Dn) 0505 29/03/05

SDF(Dn) 0425 29/03/05



Moisture decreasing with height
Favours shallow ground fog



Fog Forecasting – SDF 29 Mar 05

LOU (Louisville Bowman Field) did report ¼ mile in ground fog, which was patchy across the city, especially in low-lying locations.

SDF never dropped below a sector visibility of 2 ½ miles.

SDF 0356 00000KT 7SM MIFG CLR 08/07 A2978 REMRK A02VIS W 2 1/2 SLP084 T00780072

SDF 0456 00000KT 6SM MIFG CLR 07/07 A2979 REMRK AO2 SLP087 T00720067 401170067

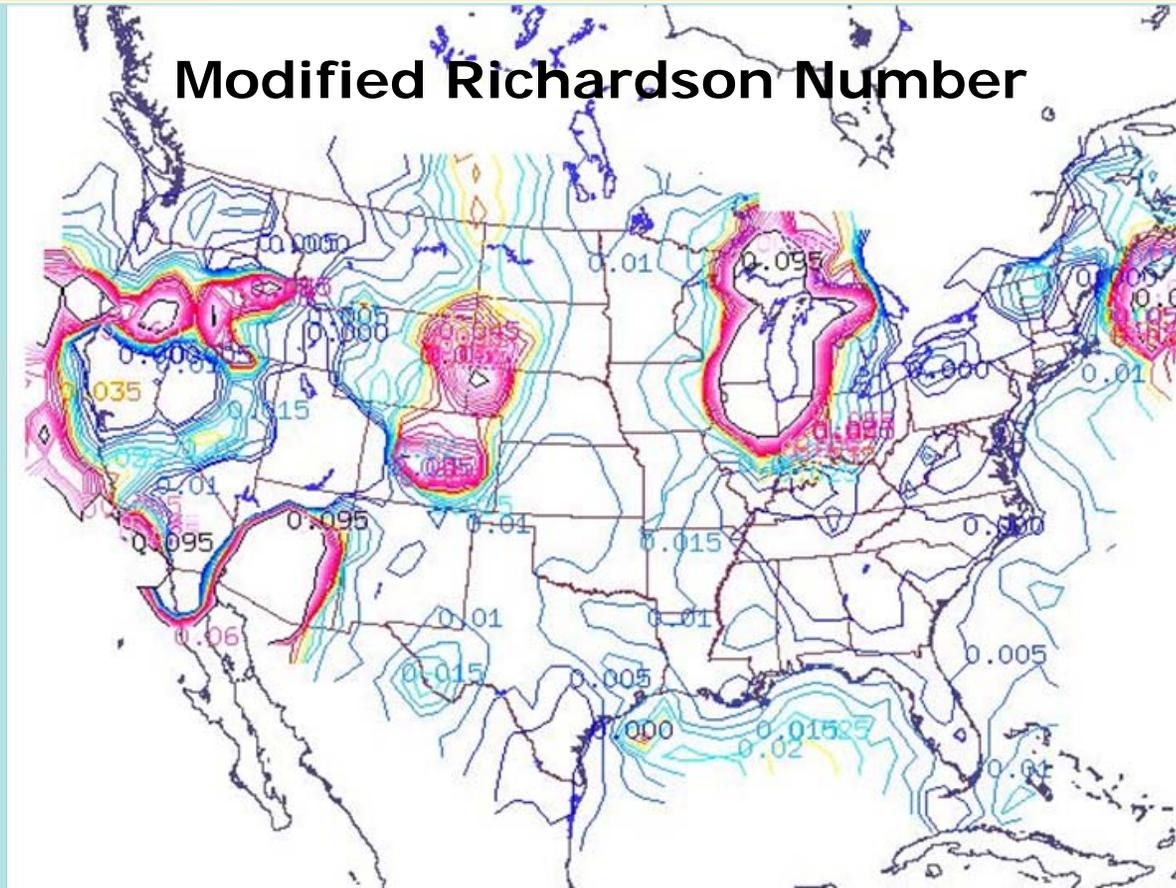
SDF 0556 10003KT 4SM BR CLR 05/04 A2979 REMRK AO2 SLP090 T00500044 10106 20050
51012

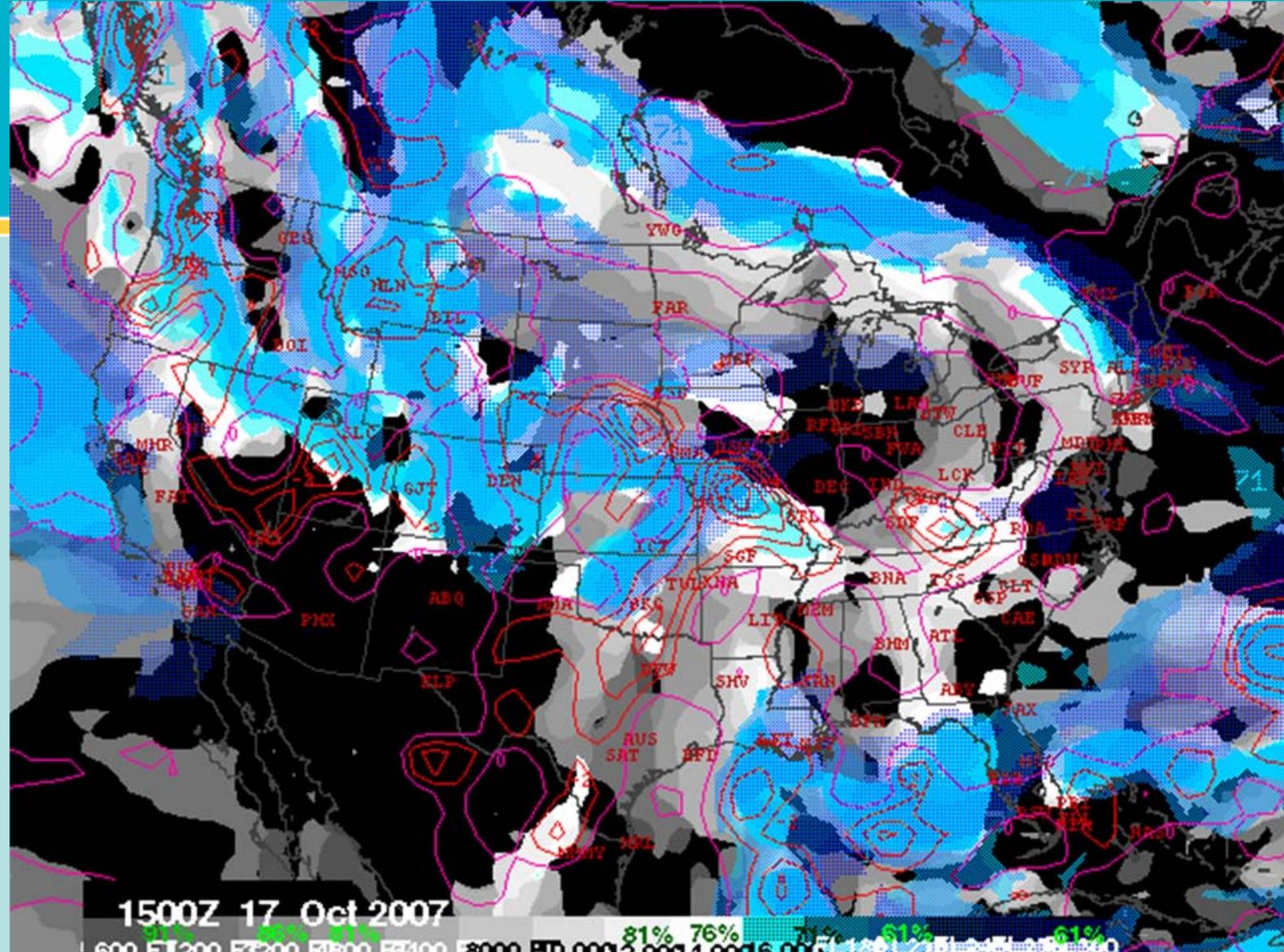
SDF 0656 00000KT 5SM BR CLR 06/06 A2981 REMRK AO2 SLP096 T00560056

SDF 0756 00000KT 6SM BR CLR 05/04 A2982 REMRK AO2 SLP100 T00500044

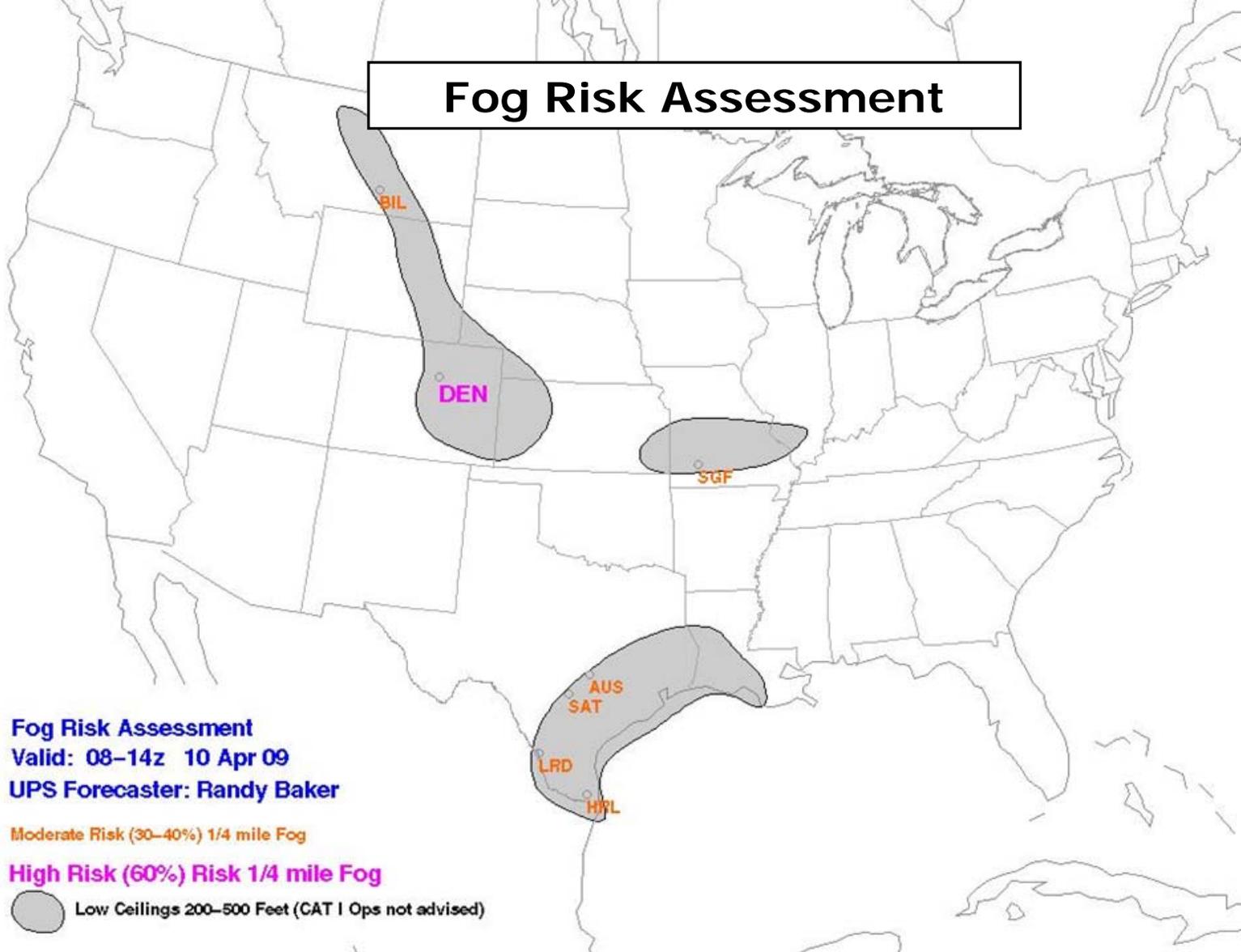


Fog Risk Assessment





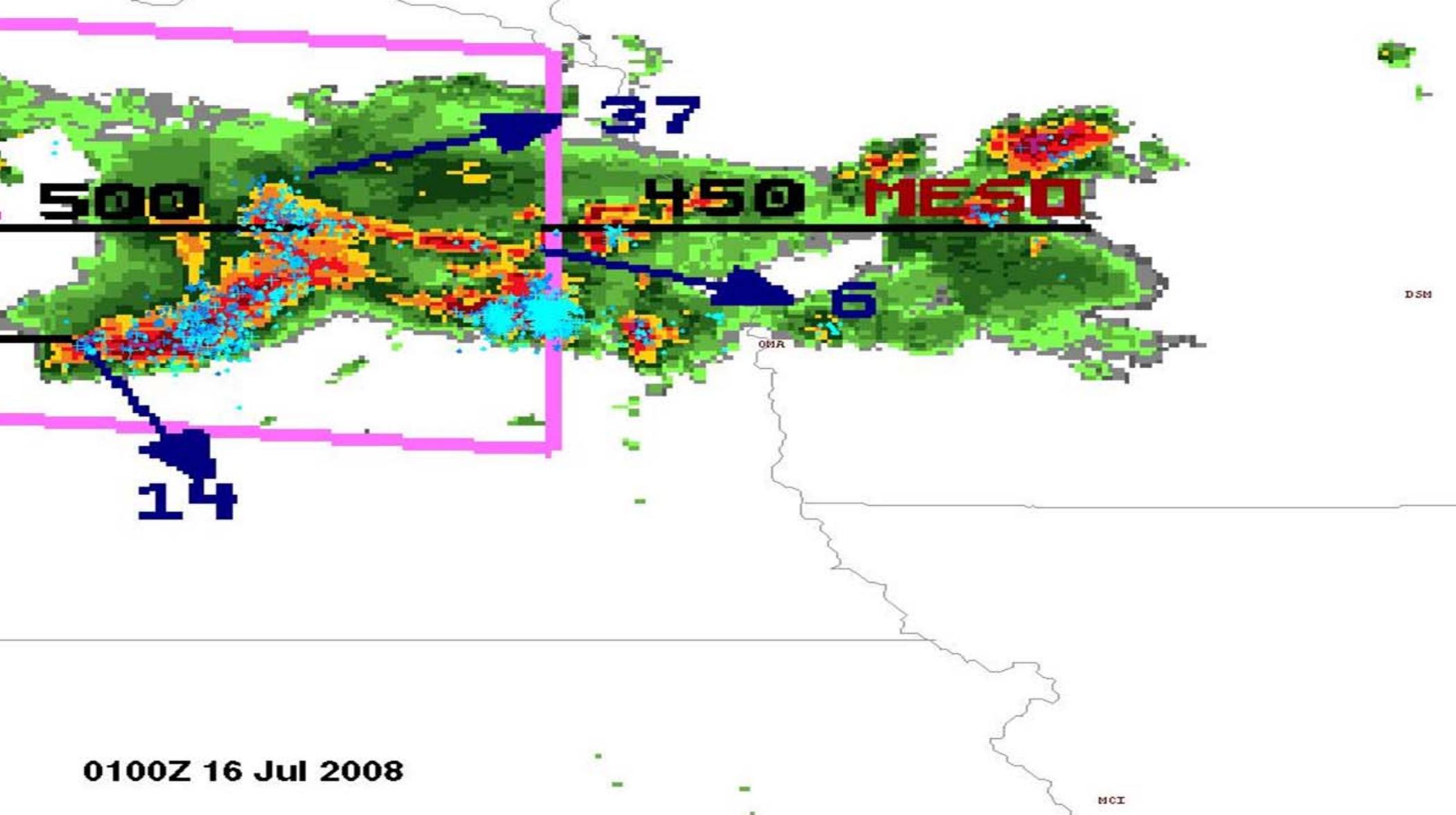
Fog Risk Assessment



Major Weather Impacts- T-storms

- Organized and long-lived convection at the airport are the worst
- Here's an example at OMA (departure at 03z).





500

37

450

MESO

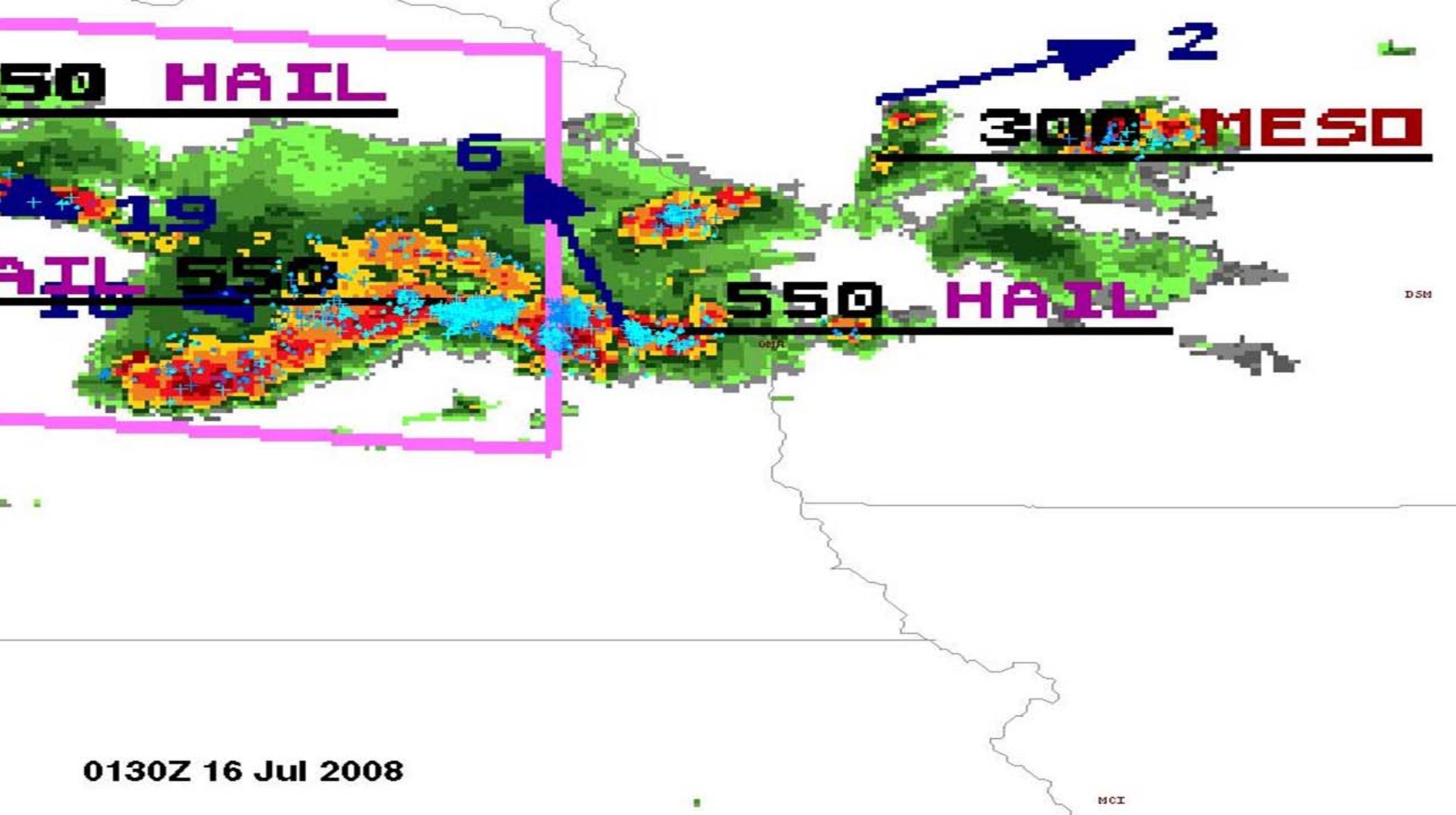
6

14

0100Z 16 Jul 2008

DSM

MCI



50 HAIL

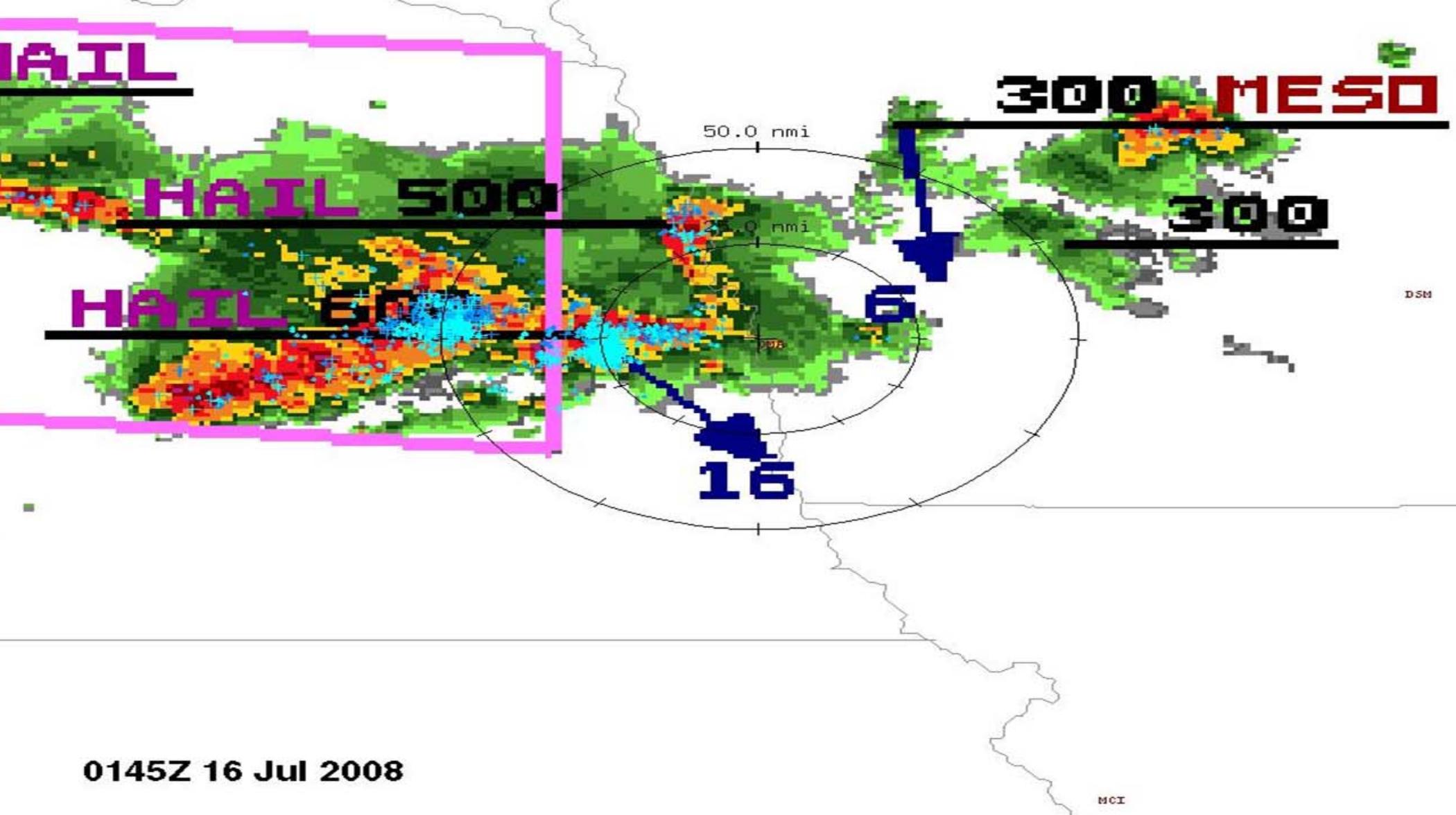
300 MESO

HAIL 550

550 HAIL

0130Z 16 Jul 2008

MCI



HAIL

300 MESO

HAIL 500

300

HAIL 600

6

16

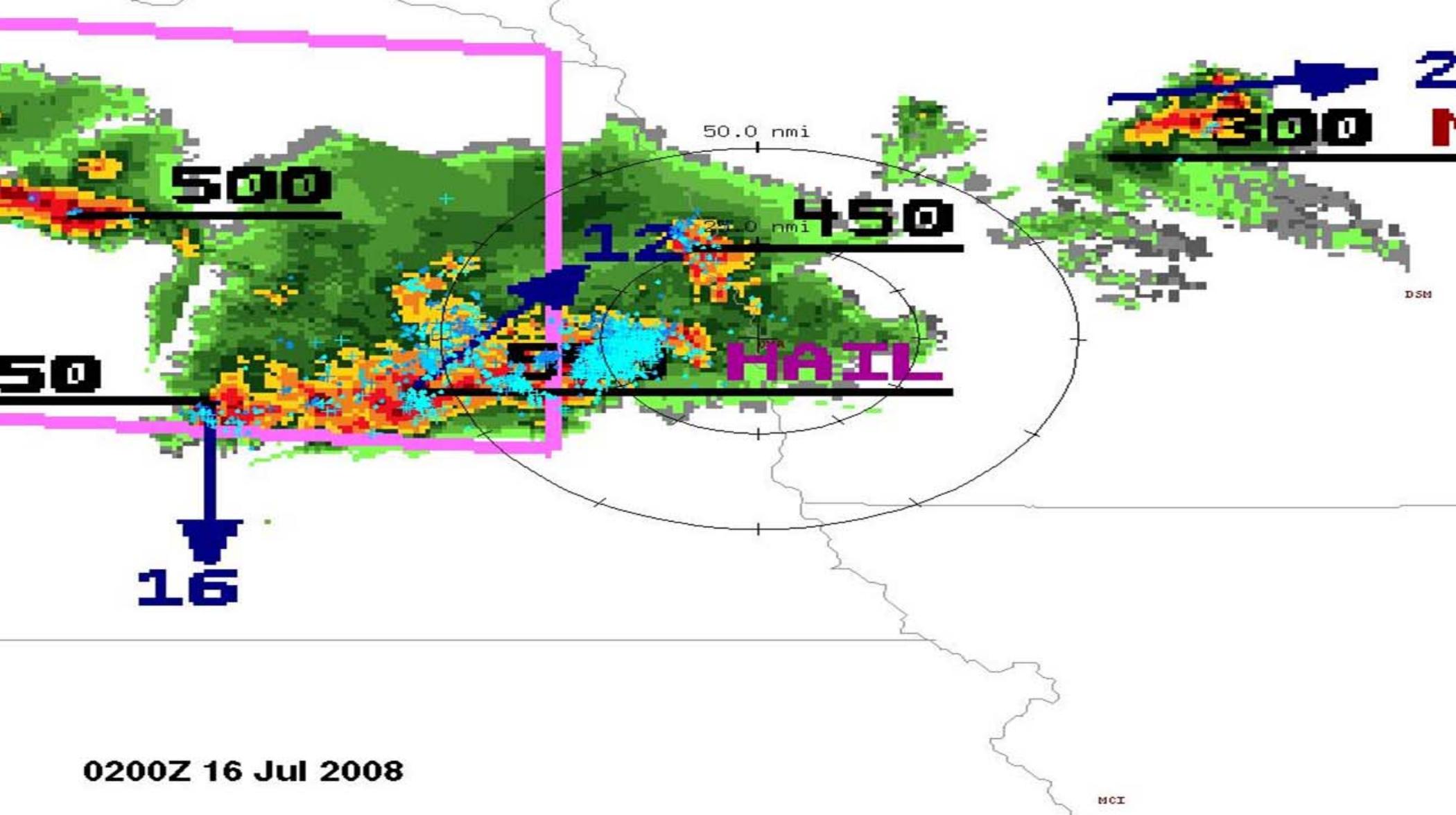
50.0 nmi

100.0 nmi

DSM

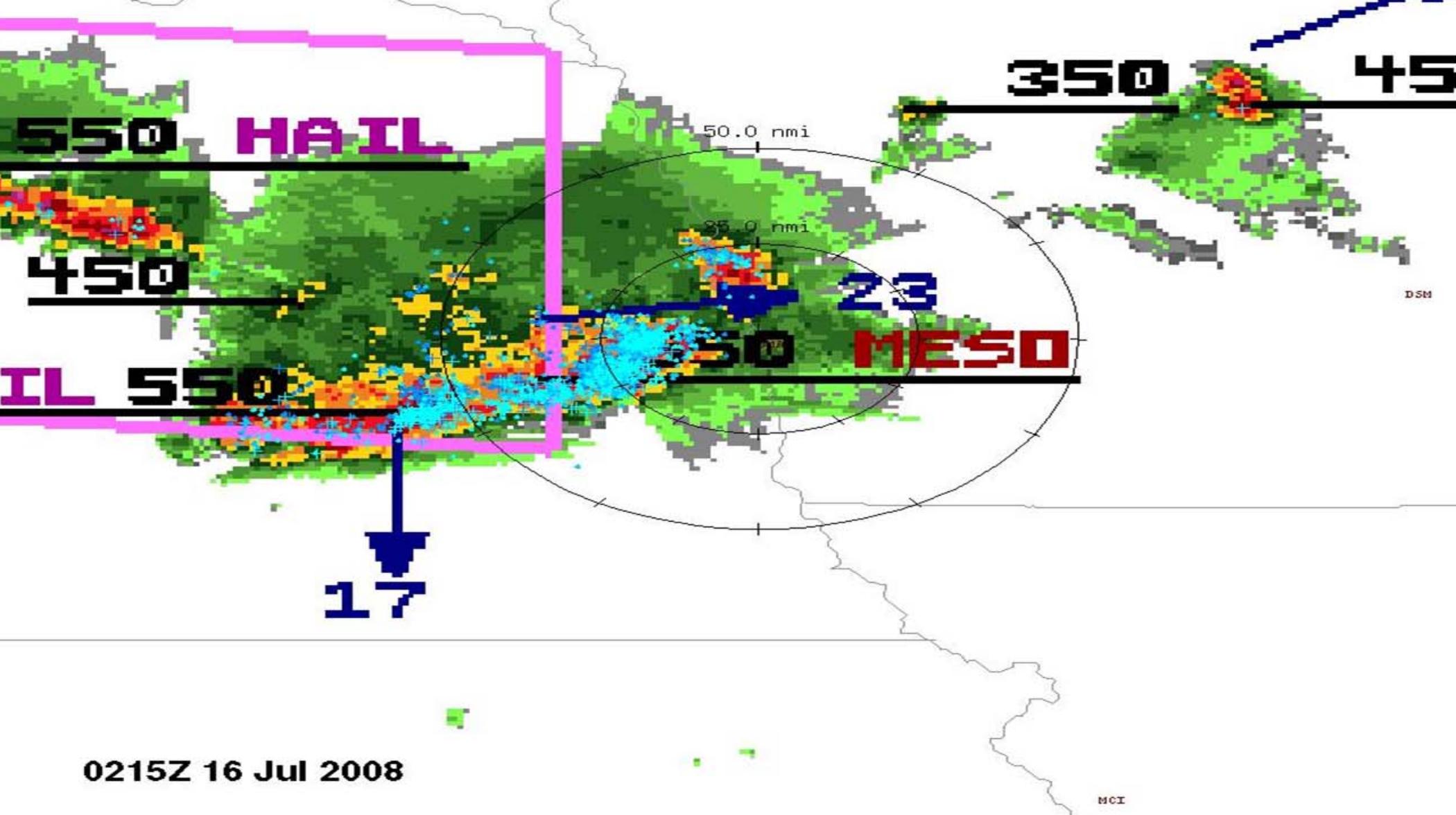
MCI

0145Z 16 Jul 2008

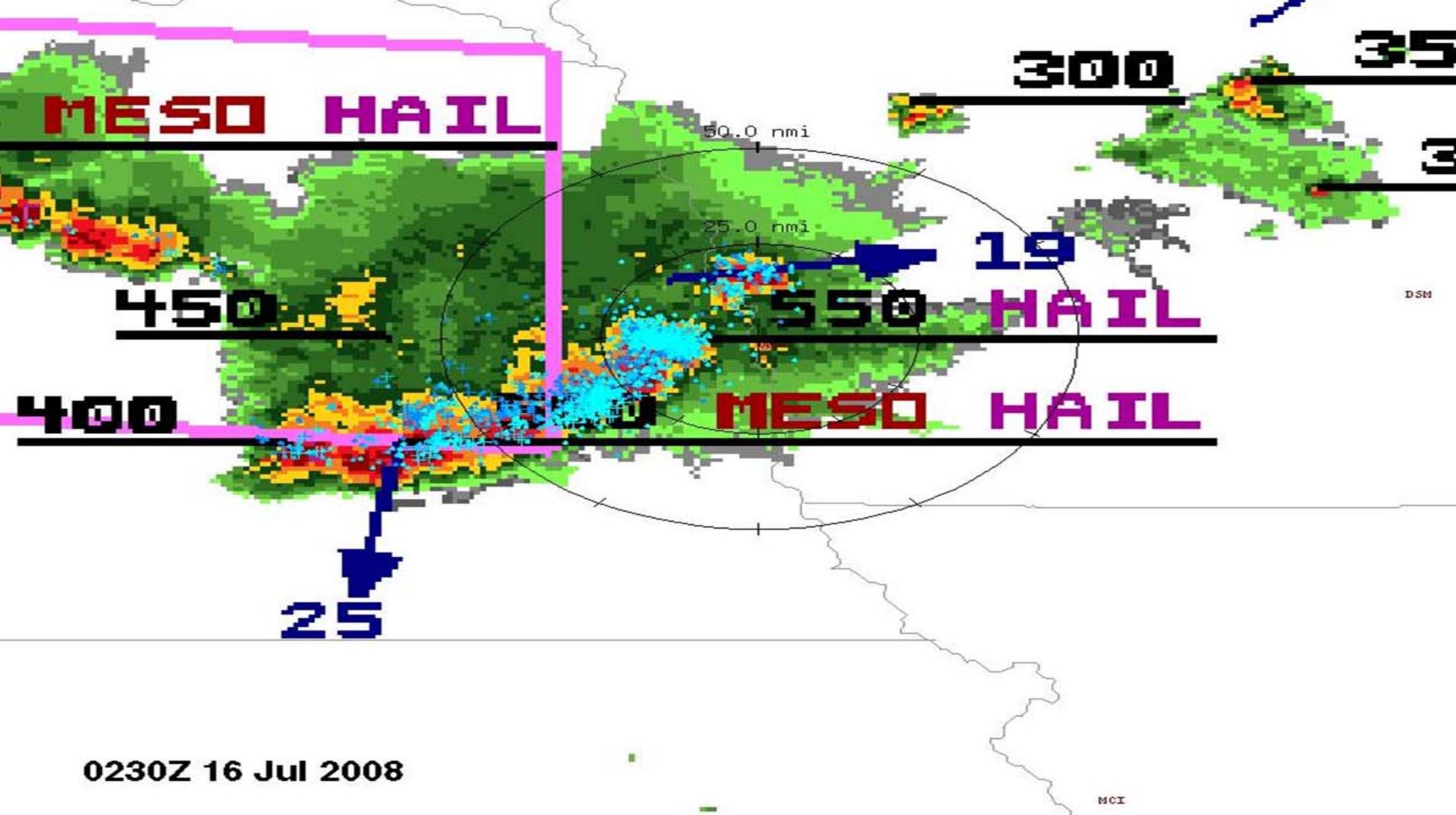


0200Z 16 Jul 2008

MCI

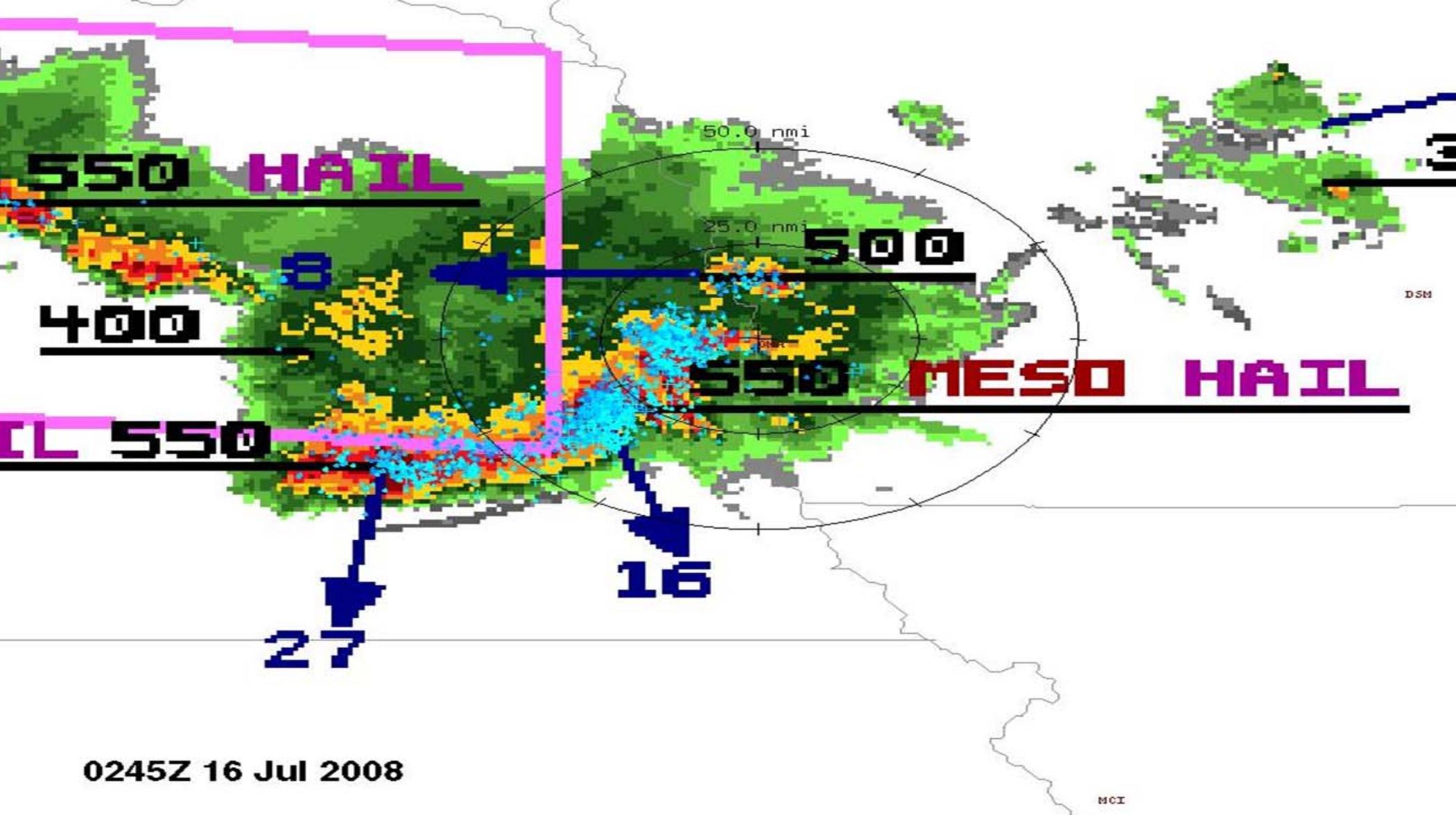


0215Z 16 Jul 2008



0230Z 16 Jul 2008

MCI



550 HAIL

400

8

IL 550

27

16

50.0 nmi

25.0 nmi

500

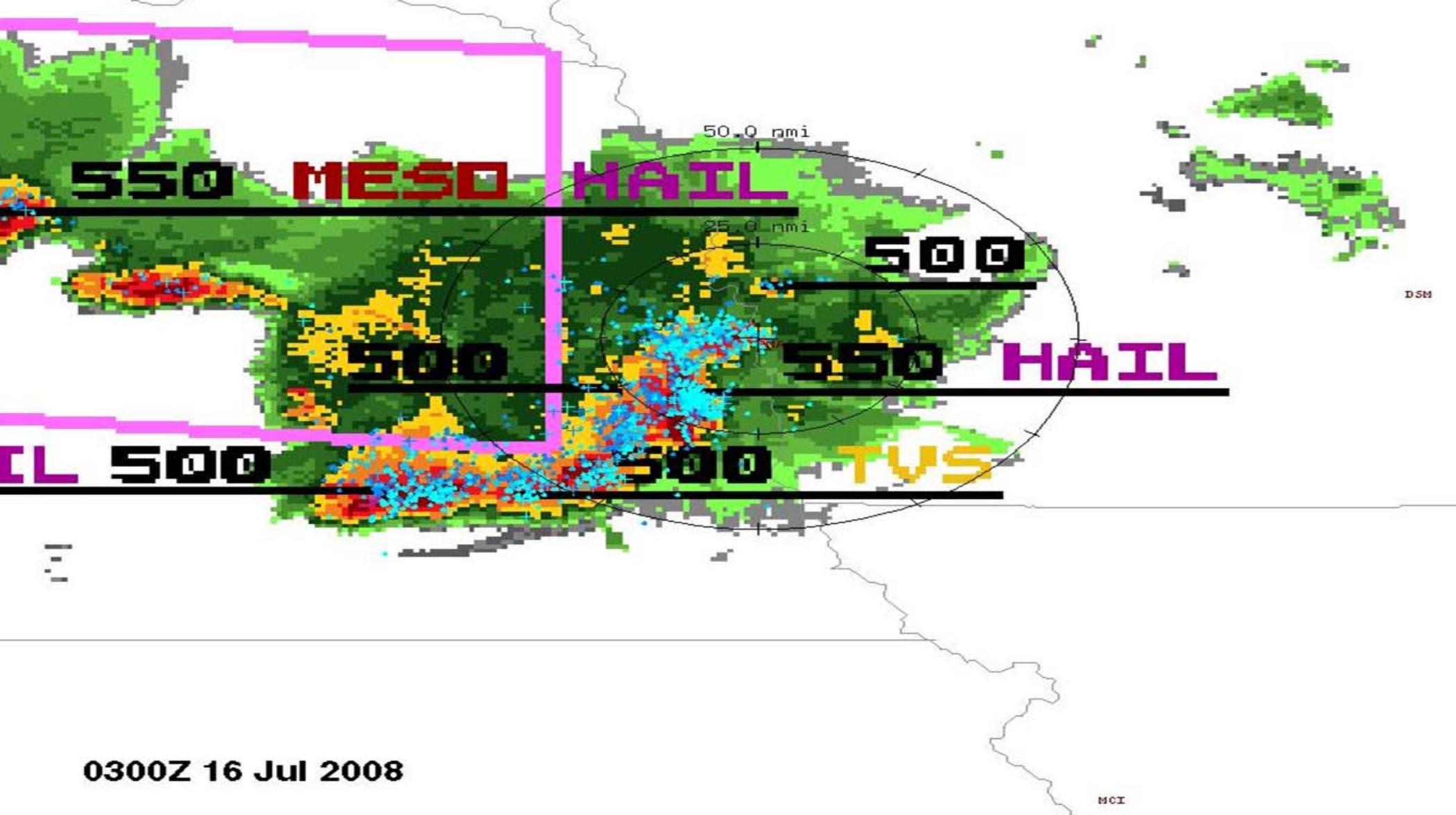
550

MESO HAIL

0245Z 16 Jul 2008

DSM

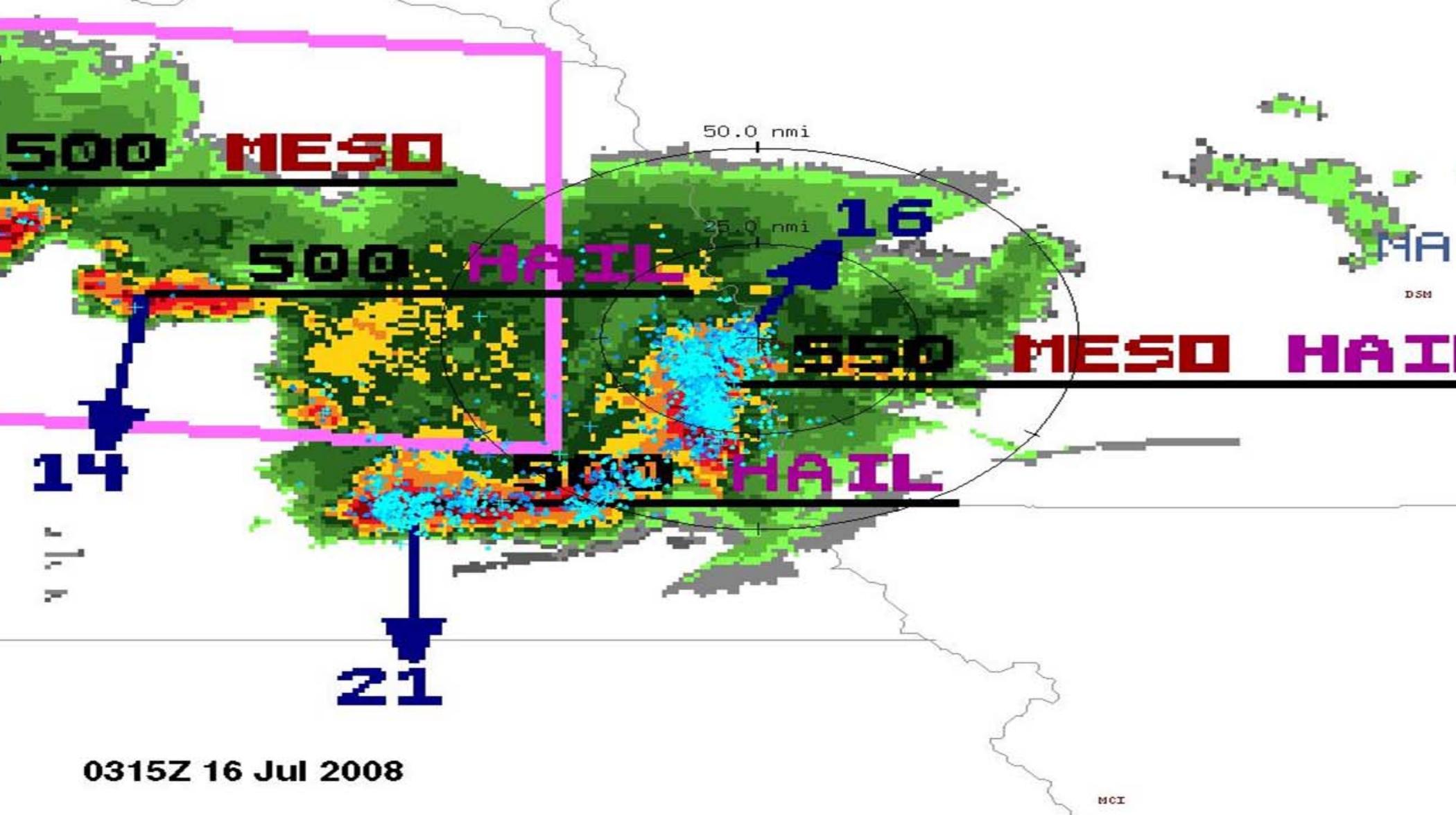
MCI

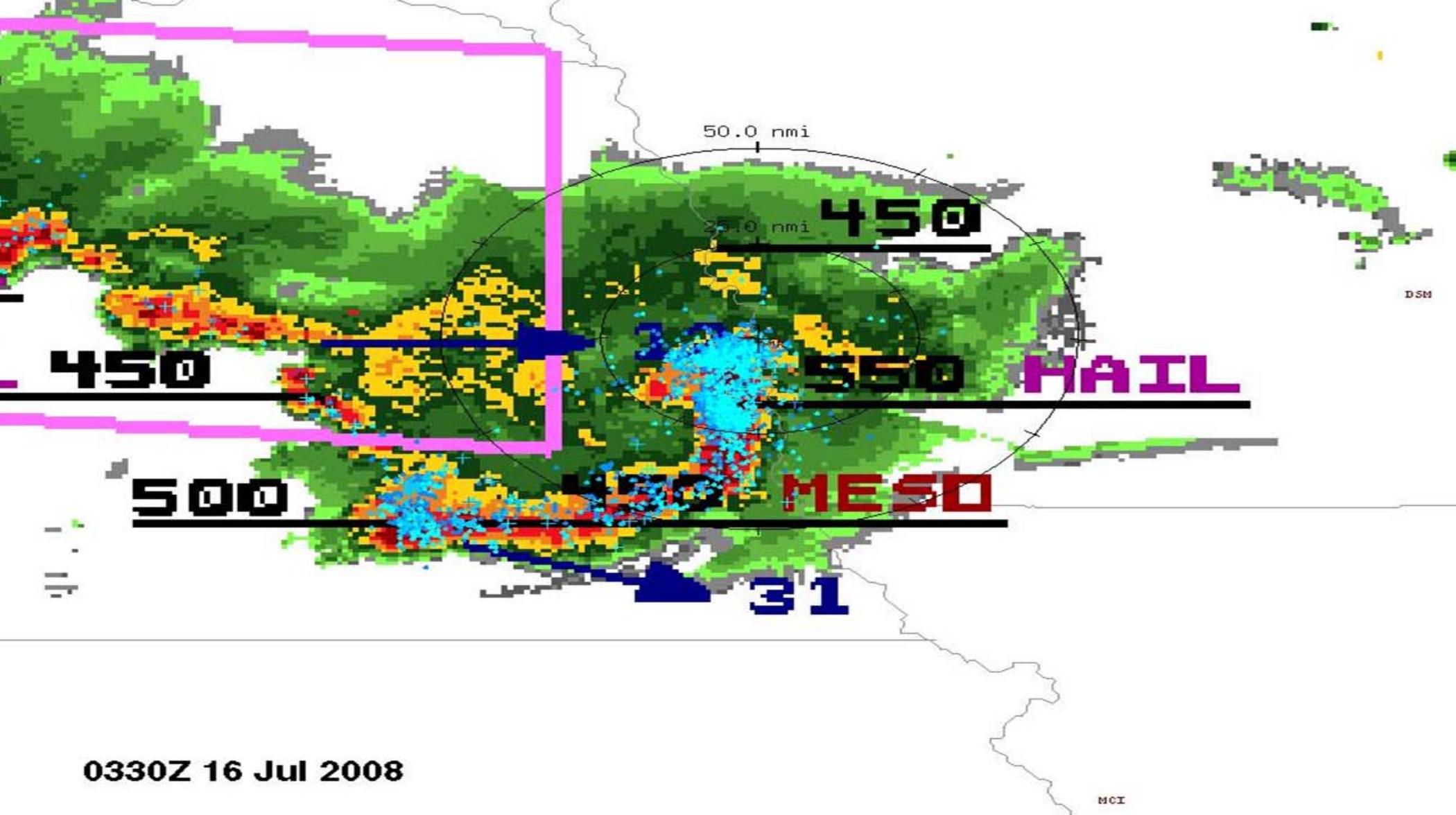


0300Z 16 Jul 2008

DSM

MCI





450

450

550

HAIL

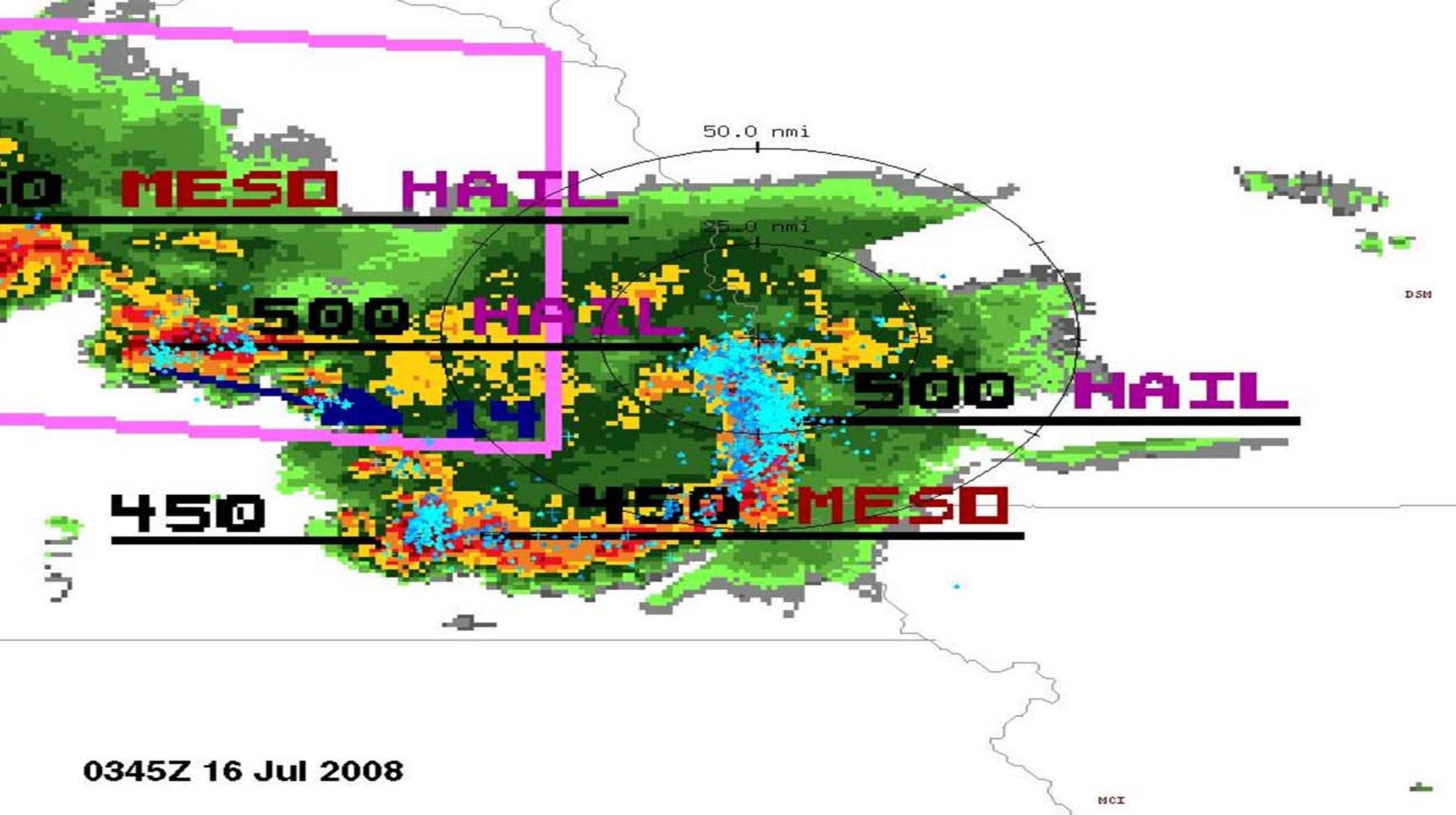
500

MESO

31

0330Z 16 Jul 2008

MCI



MESO HAIL

500 HAIL

500 HAIL

450

MESO MESO

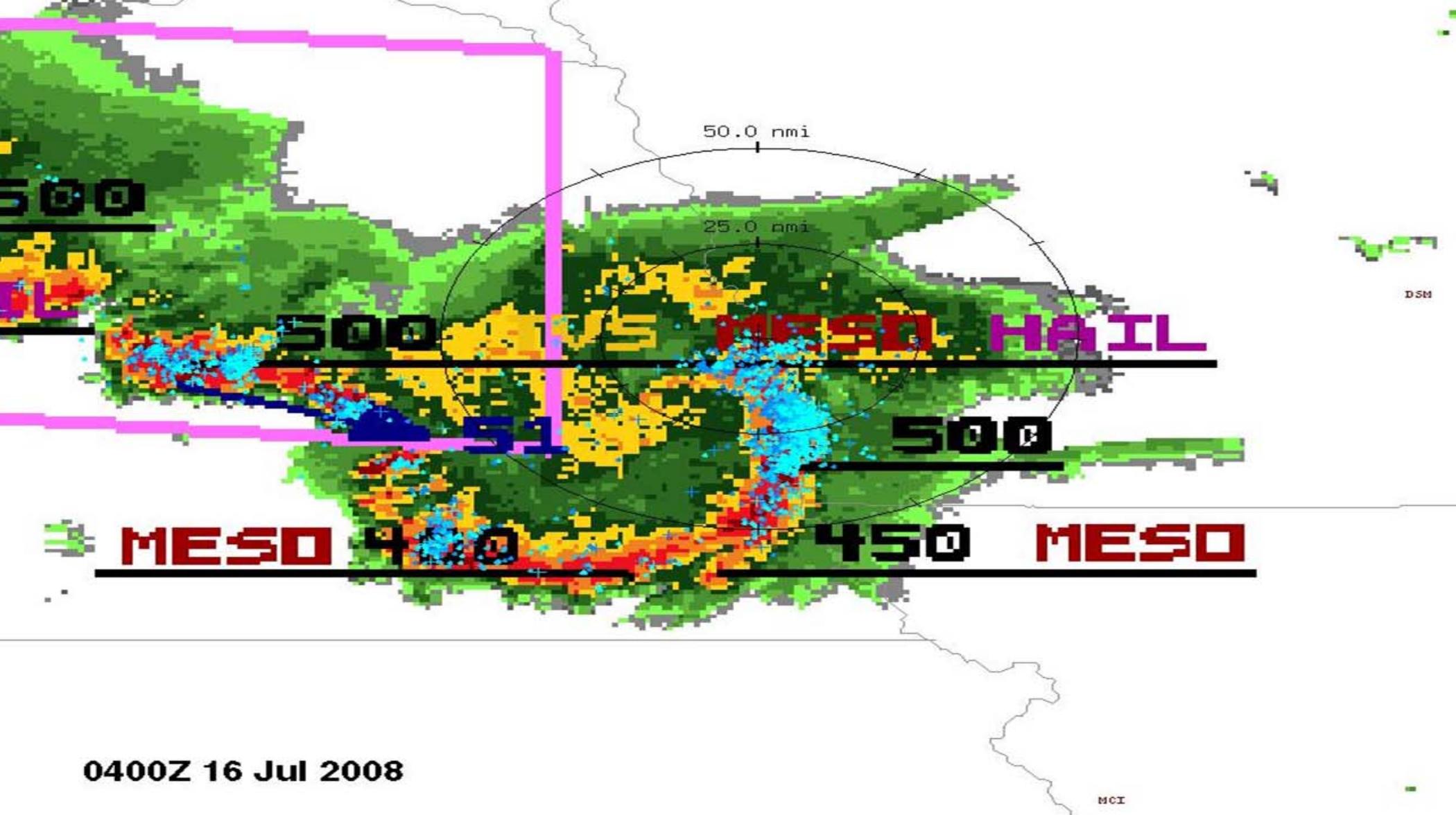
50.0 nmi

25.0 nmi

0345Z 16 Jul 2008

DSM

MCI



50.0 nmi

25.0 nmi

DSM

500

500

MESO

HAIL

500

MESO

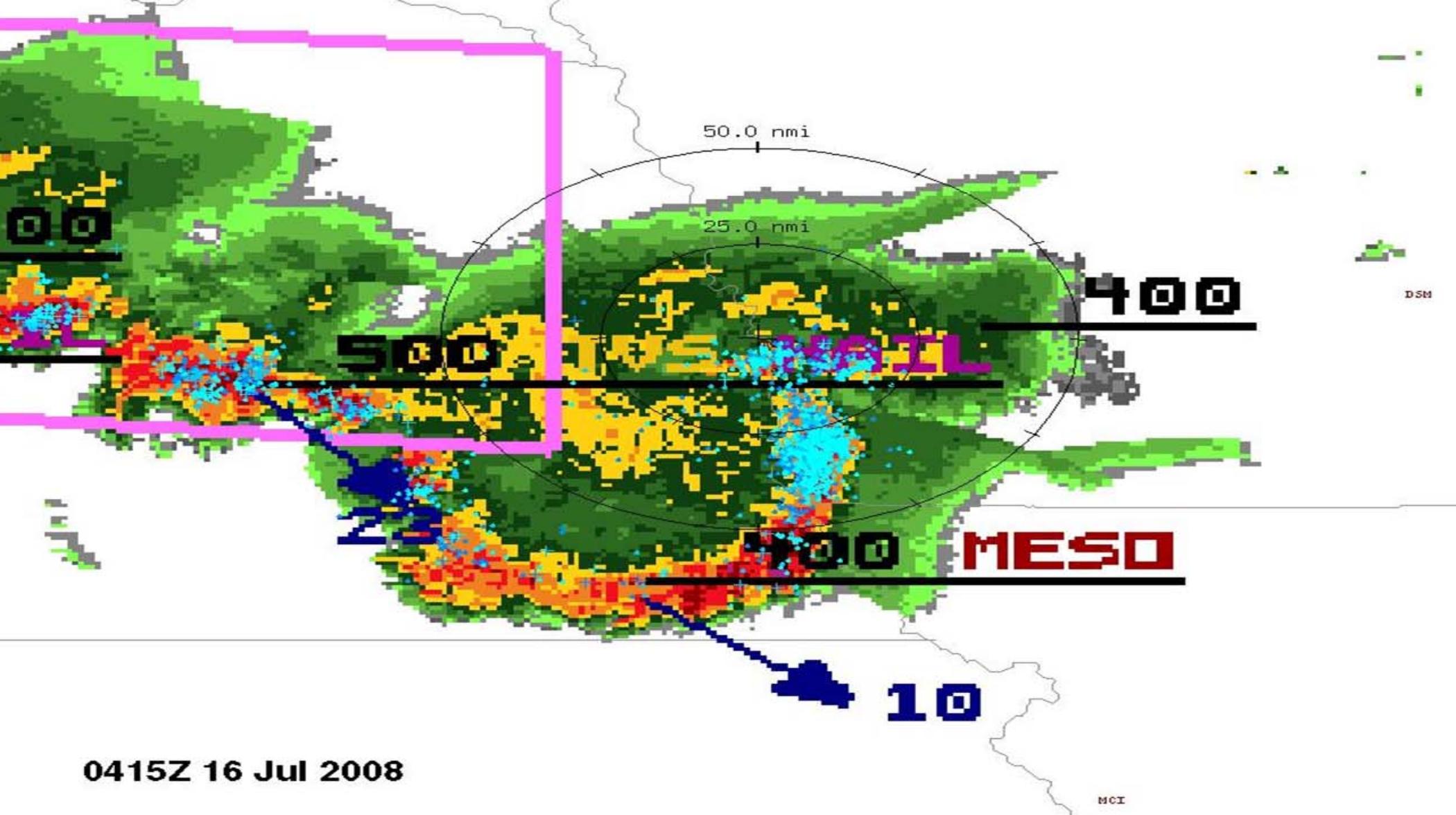
400

450

MESO

0400Z 16 Jul 2008

MCI



50.0 nmi

25.0 nmi

400

500

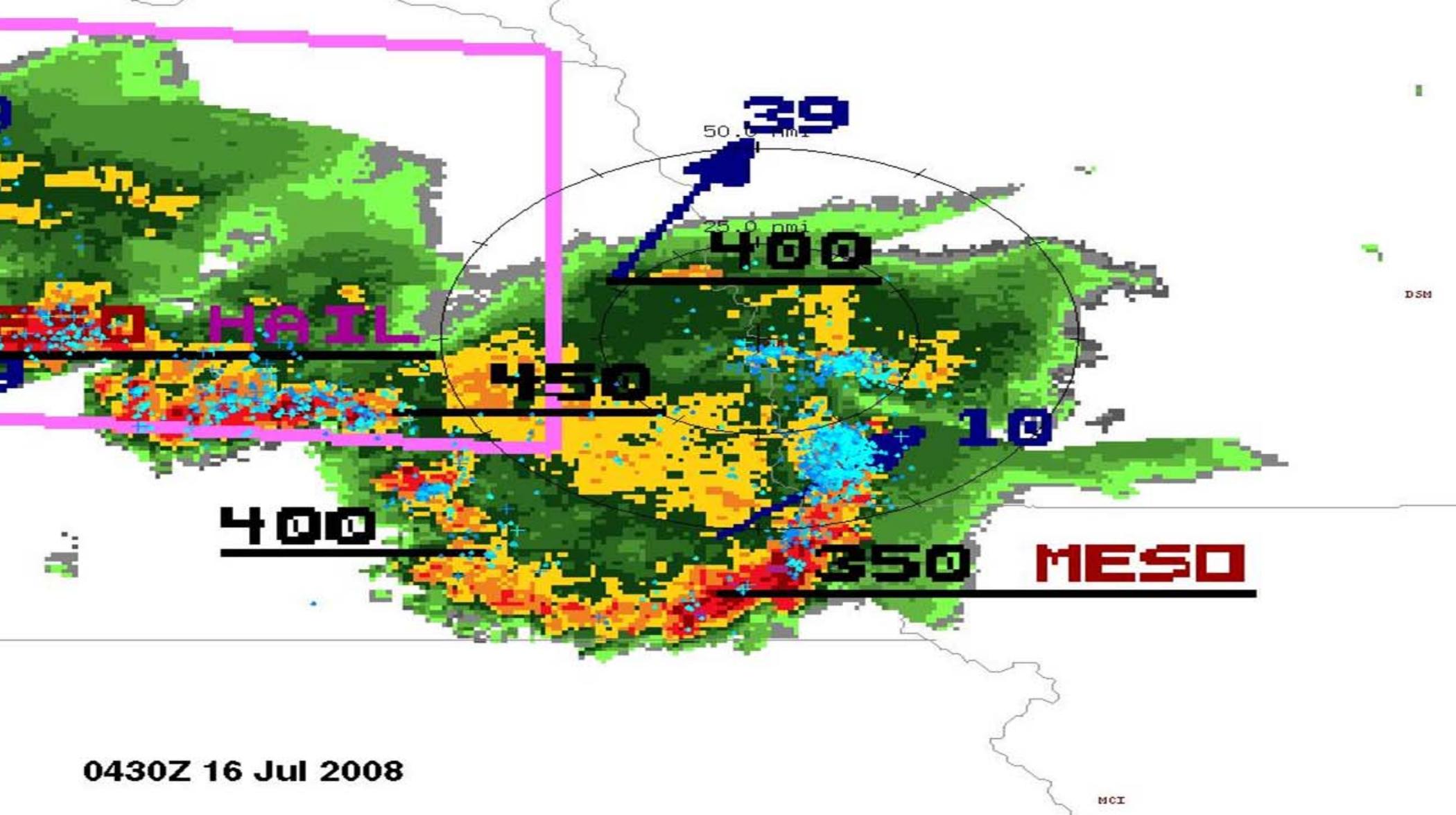
400

MESO

10

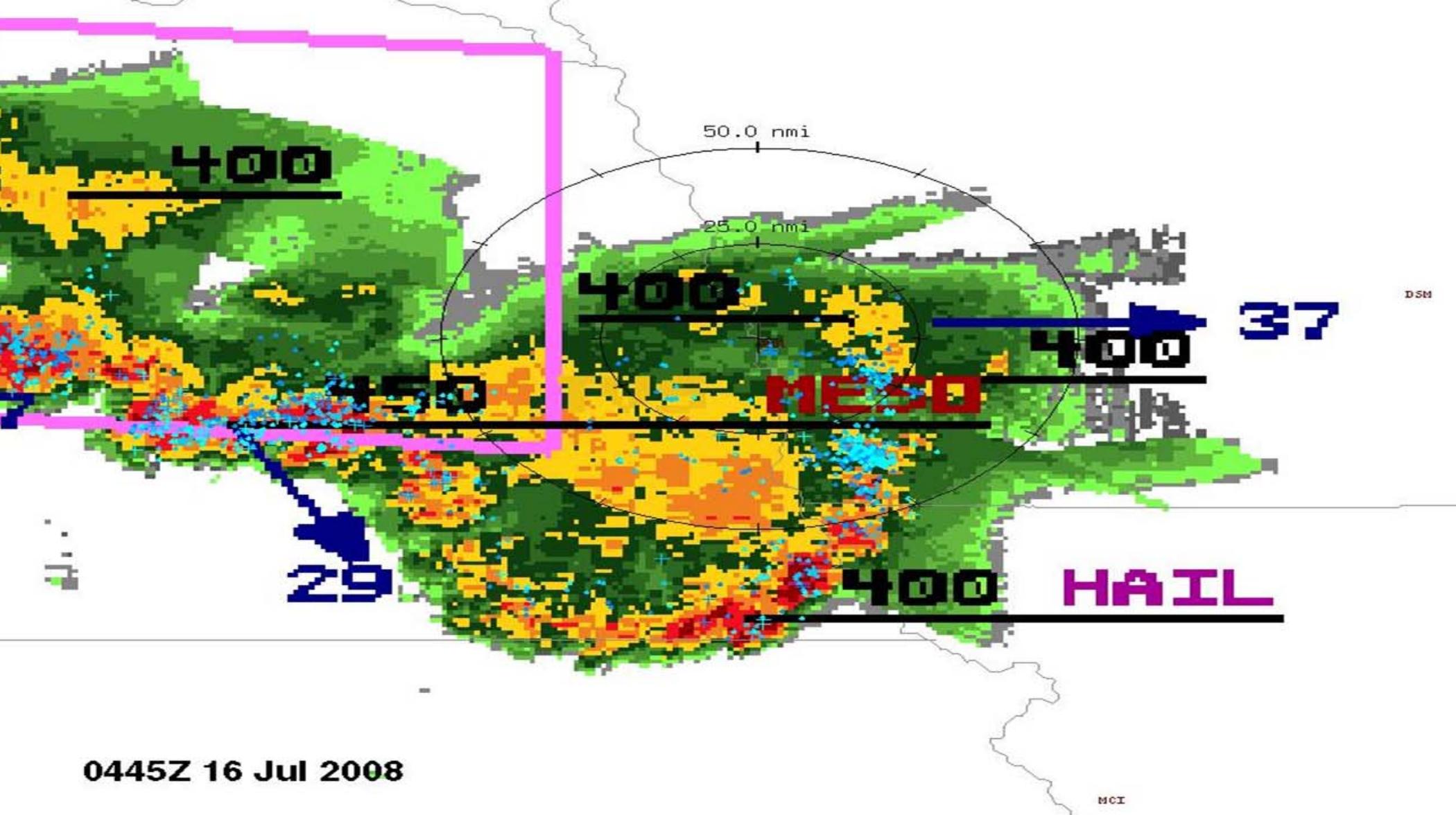
0415Z 16 Jul 2008

MCI



0430Z 16 Jul 2008

MCI



400

50.0 nmi

25.0 nmi

400

MESO

400

37

DSM

400

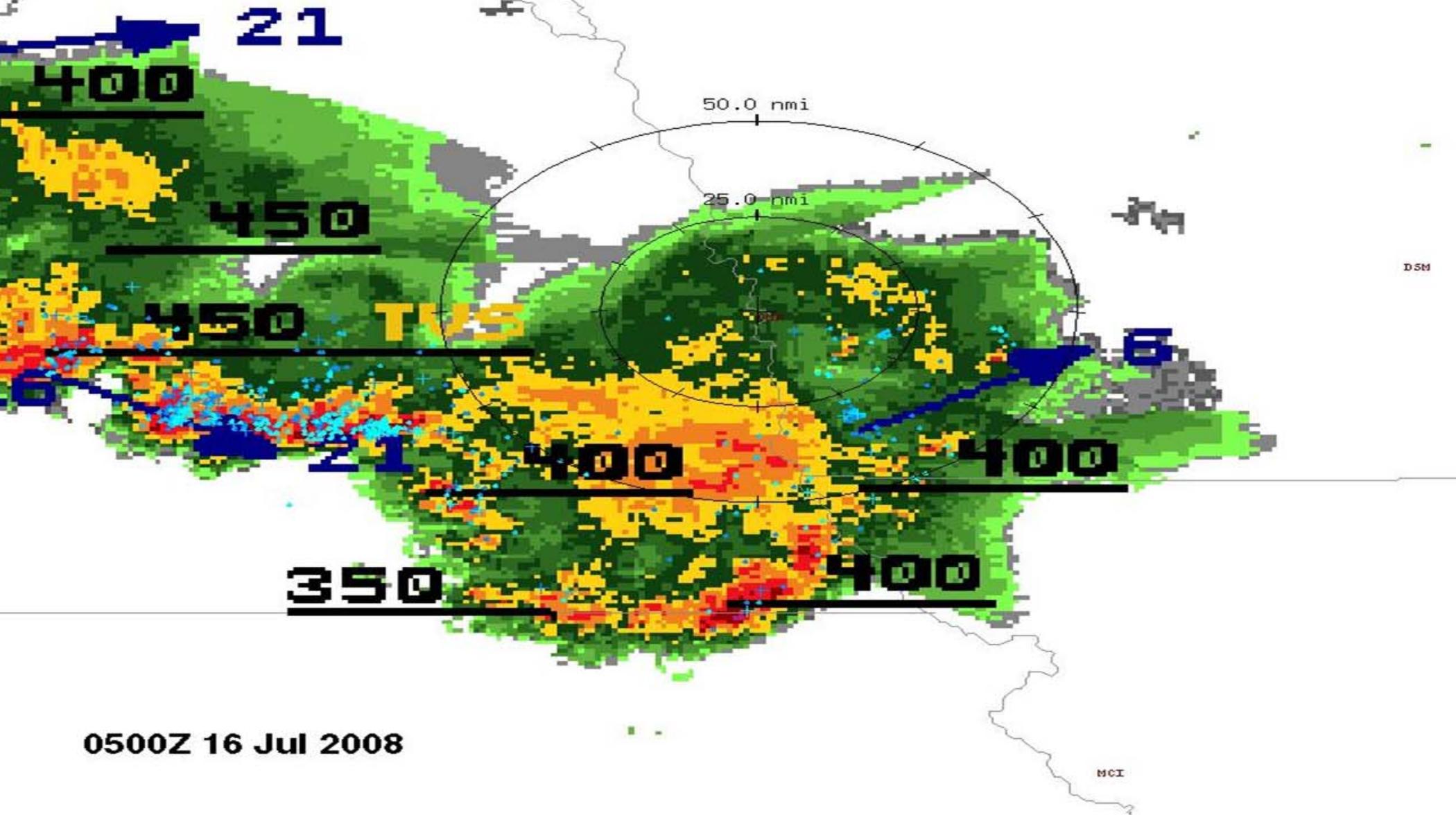
29

400

HAIL

0445Z 16 Jul 2008

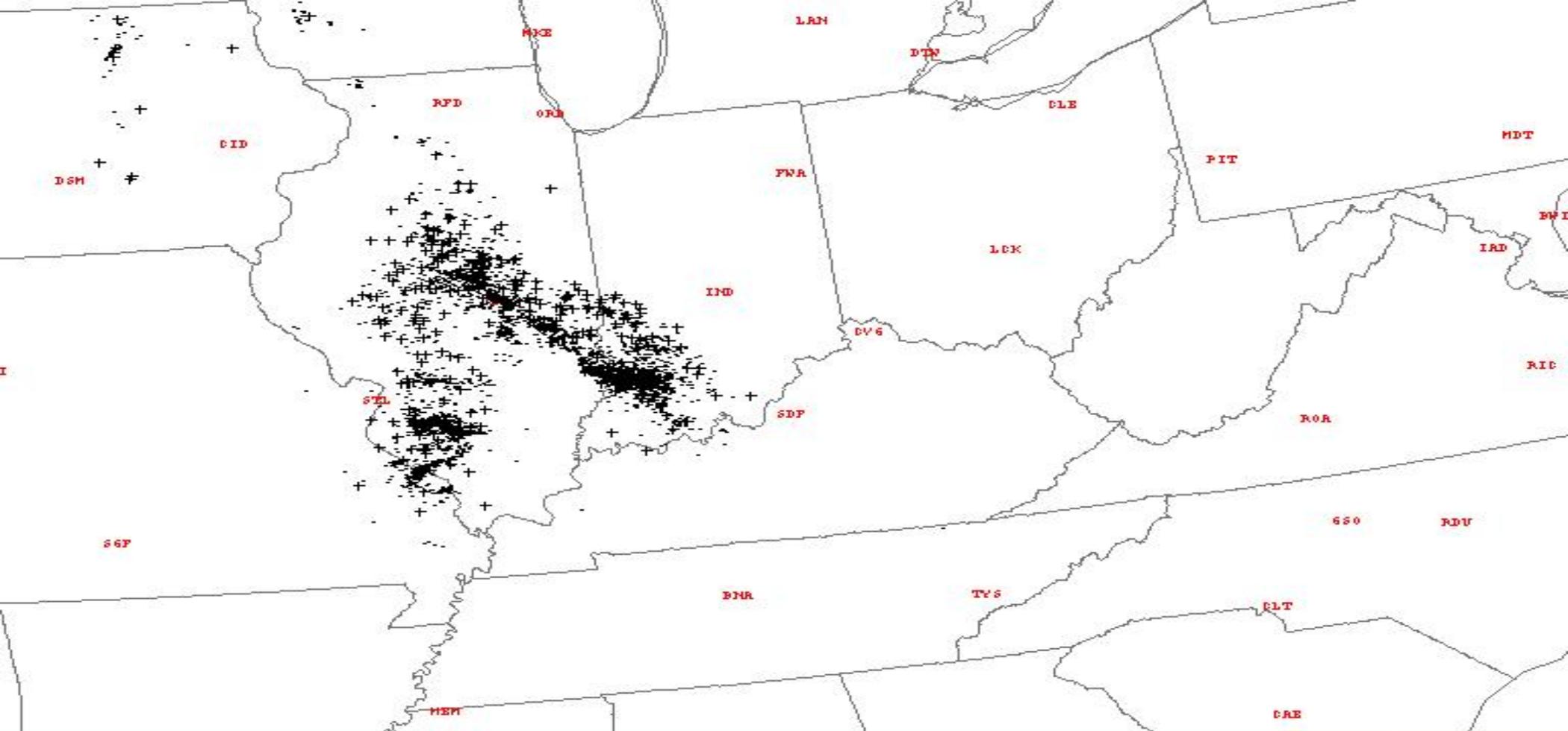
MCI



0500Z 16 Jul 2008

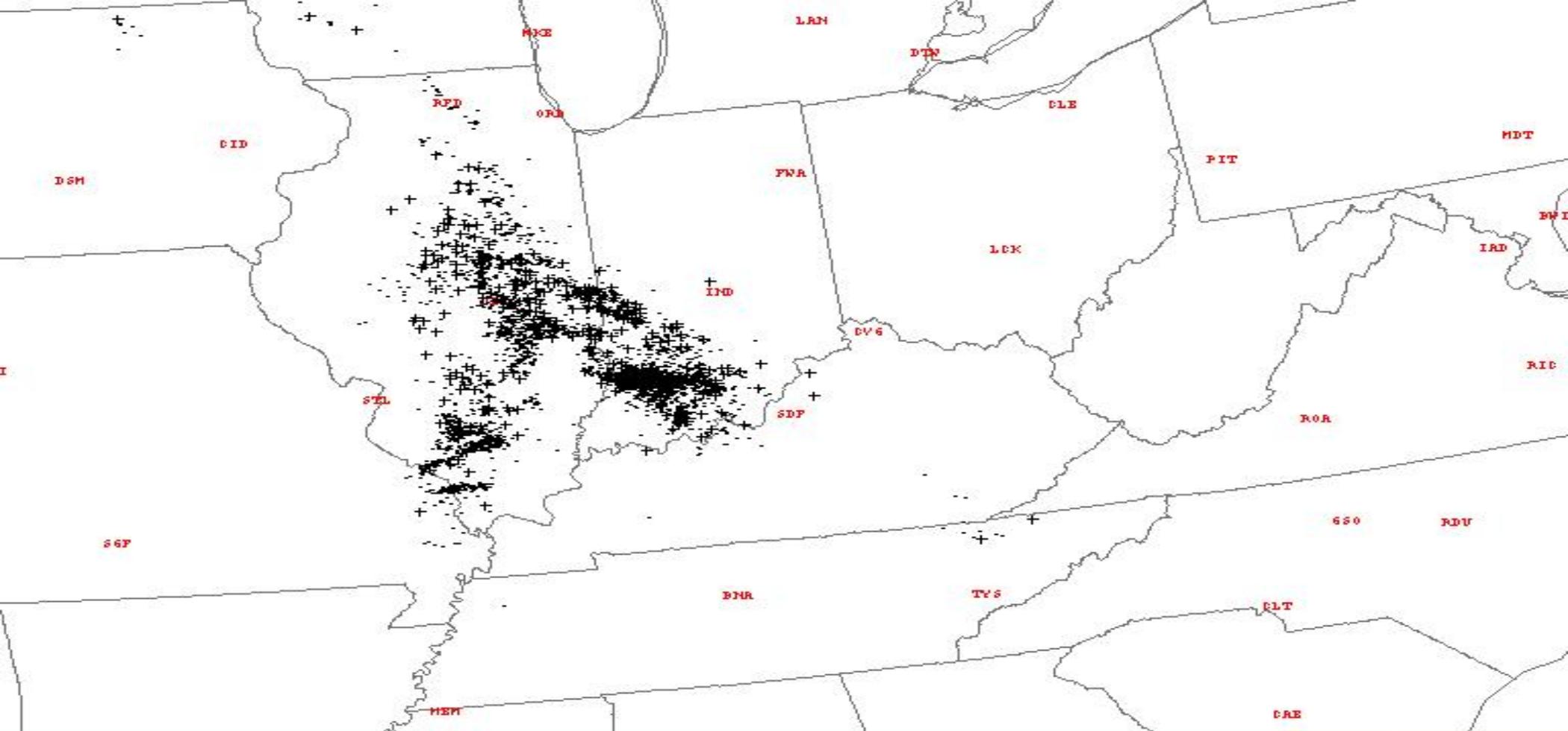
T-Storms at Hub





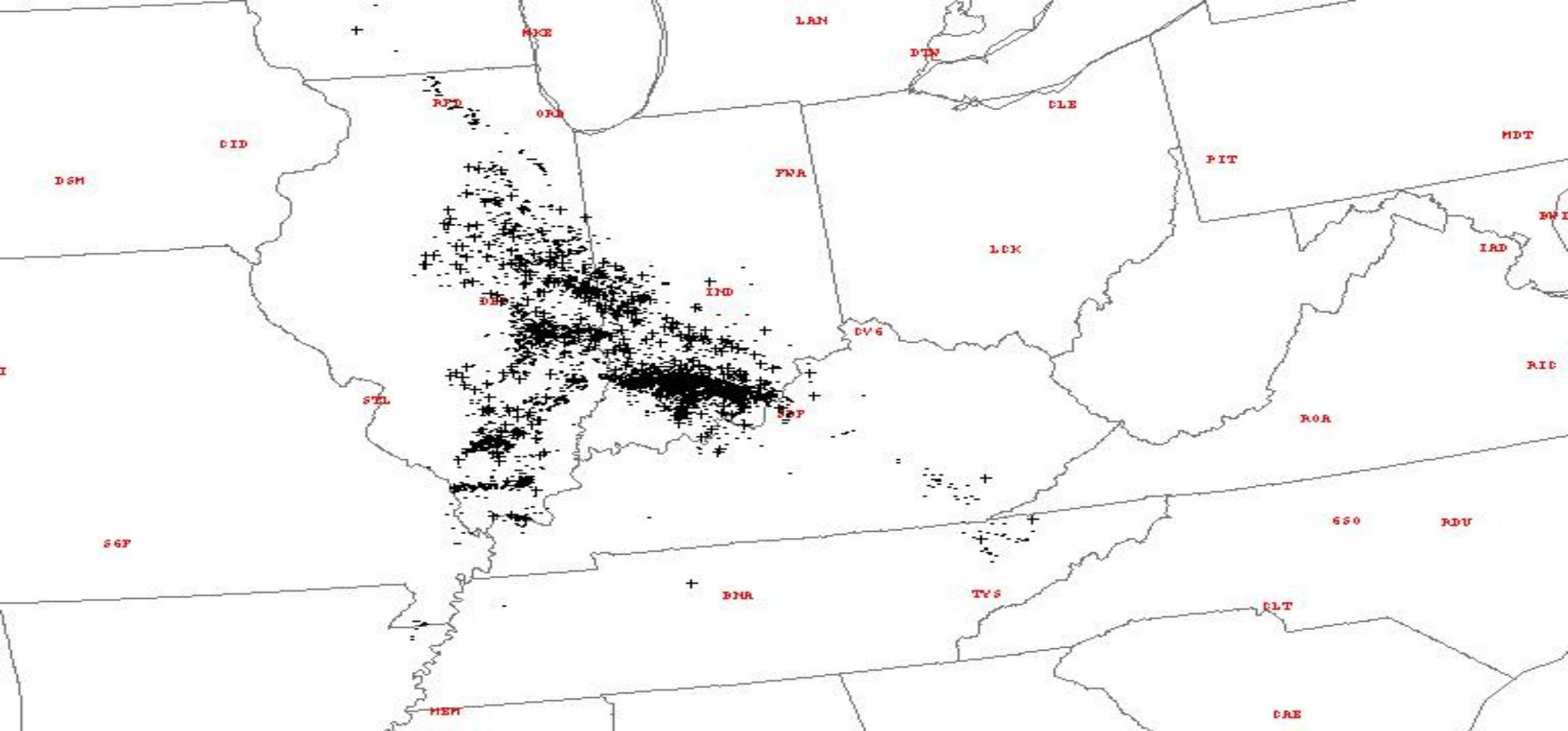
0600-0630z





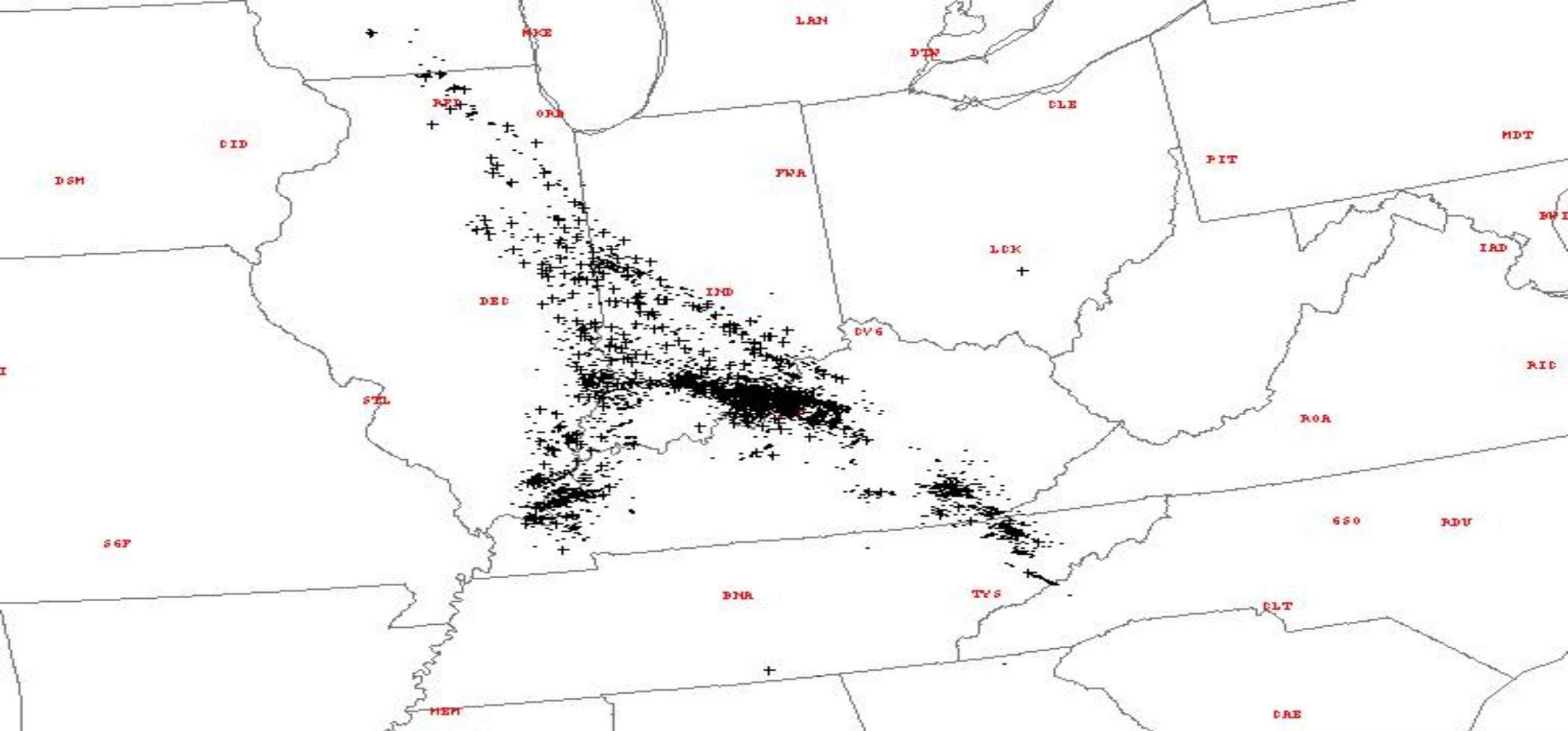
0630-0700z





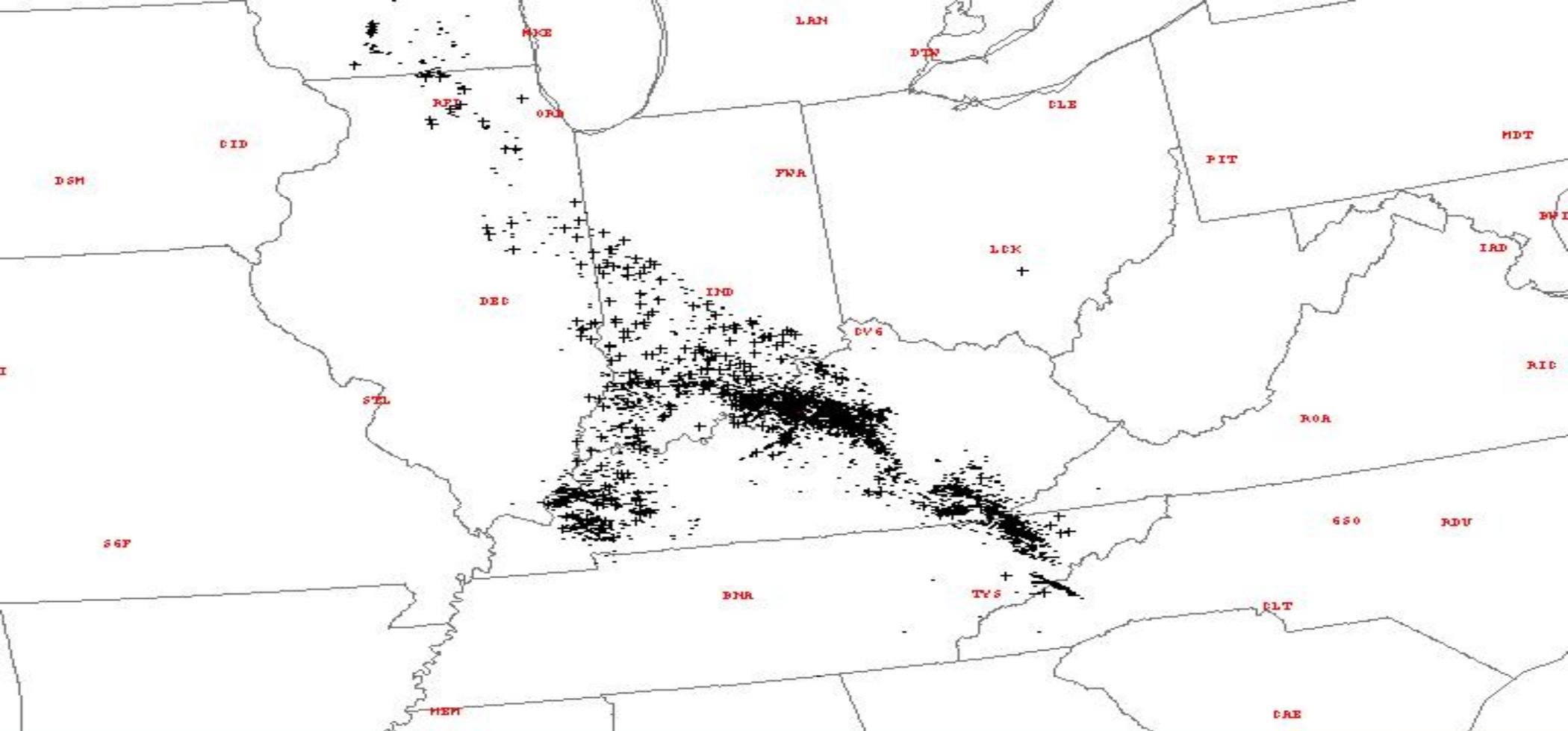
0730-0800z





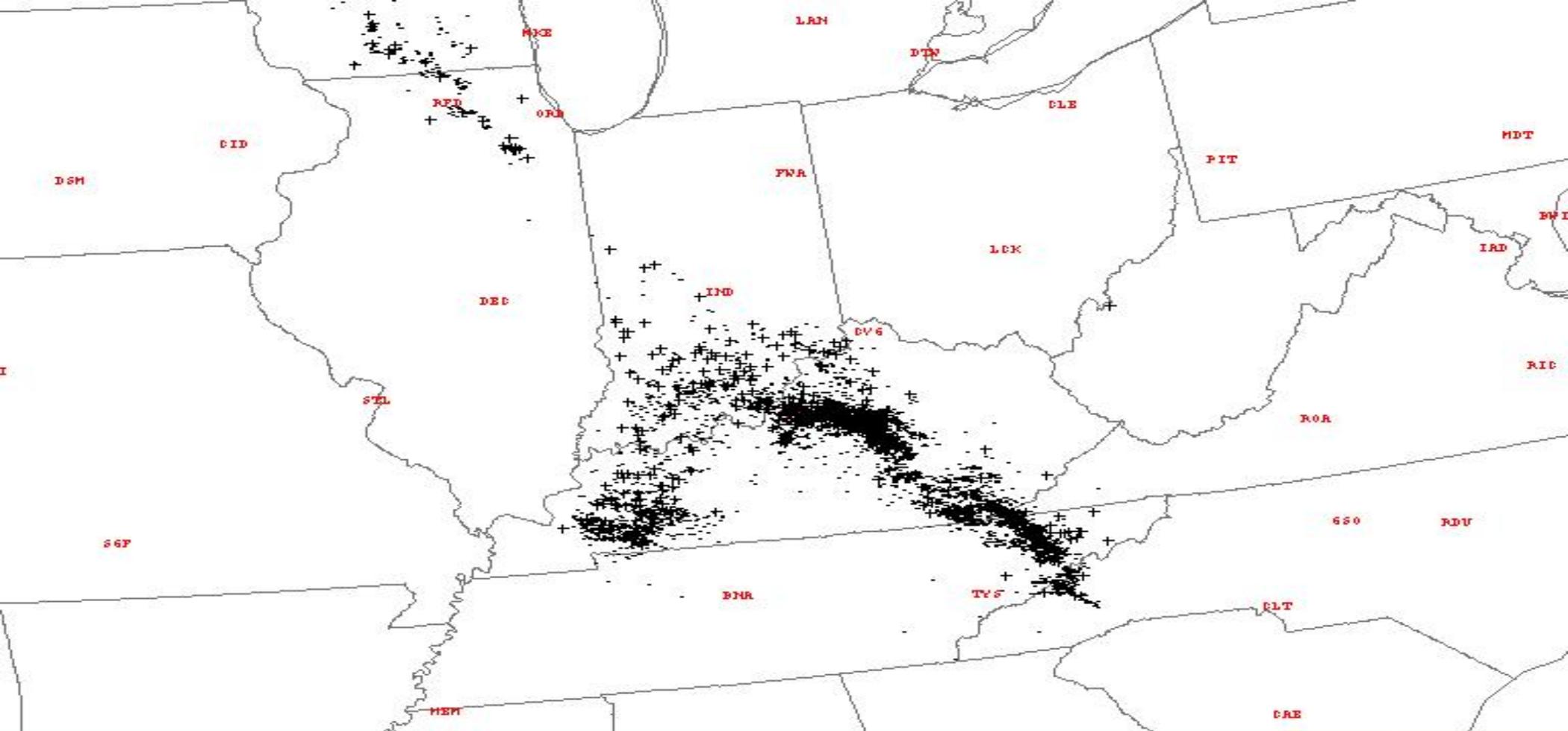
0800-0830z





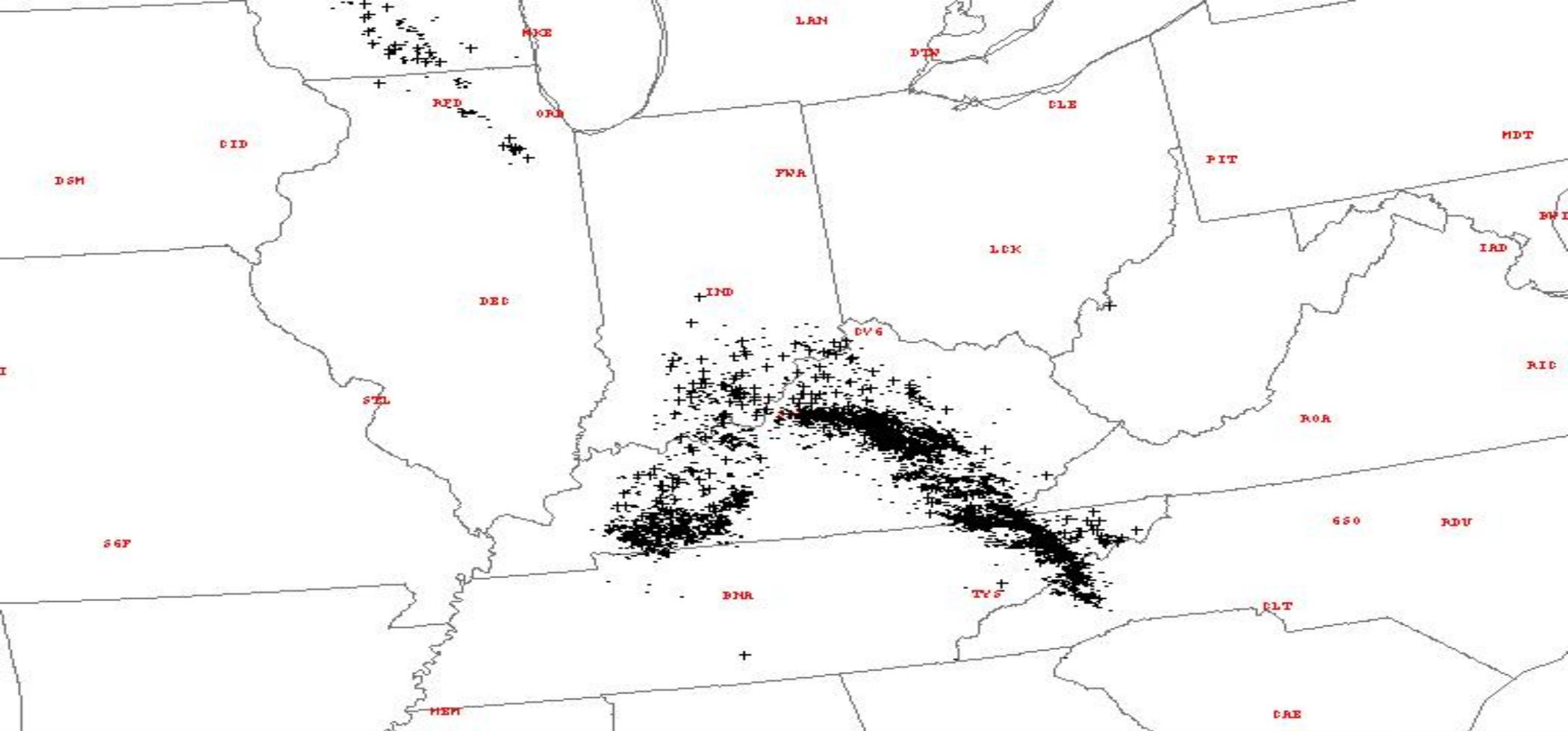
0830-0900z





0930-1000z





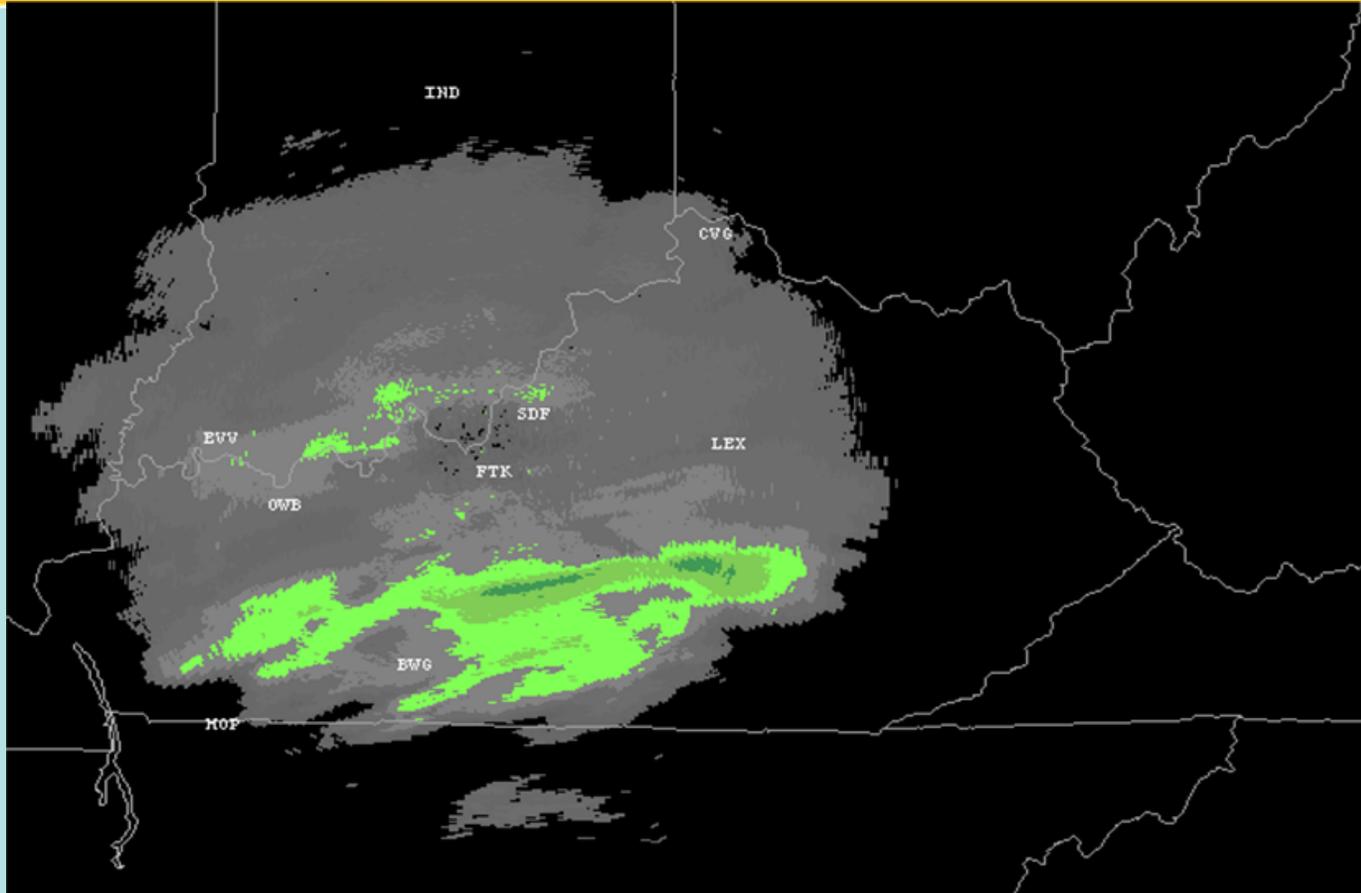
1000-1030z



Major Weather Impacts – Deice Events



22 January 2003 Localized Snow Event



Requirements For Frost

- Generally Clear skies or absence of low clouds.
- Dew Point 32°F or lower.
- Temperature-Dew Point Spread 12°F degrees or less.
- Winds generally 5-10 knots or less.



Heavy Frost Conditions

- Clear Skies and Dew Point 32°F or less.
- Temperature-Dew Point Spread 5°F or less.
- Light winds.

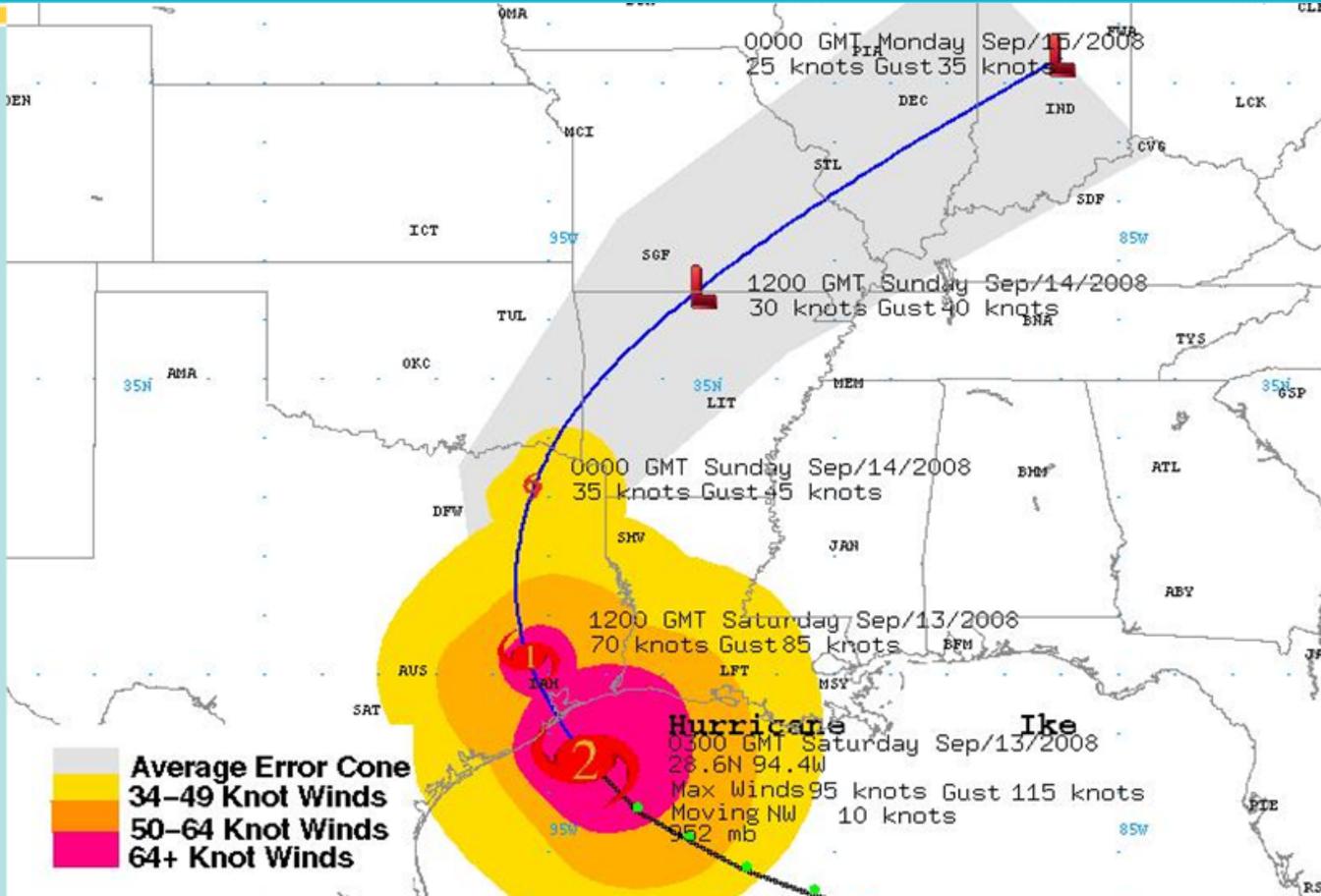


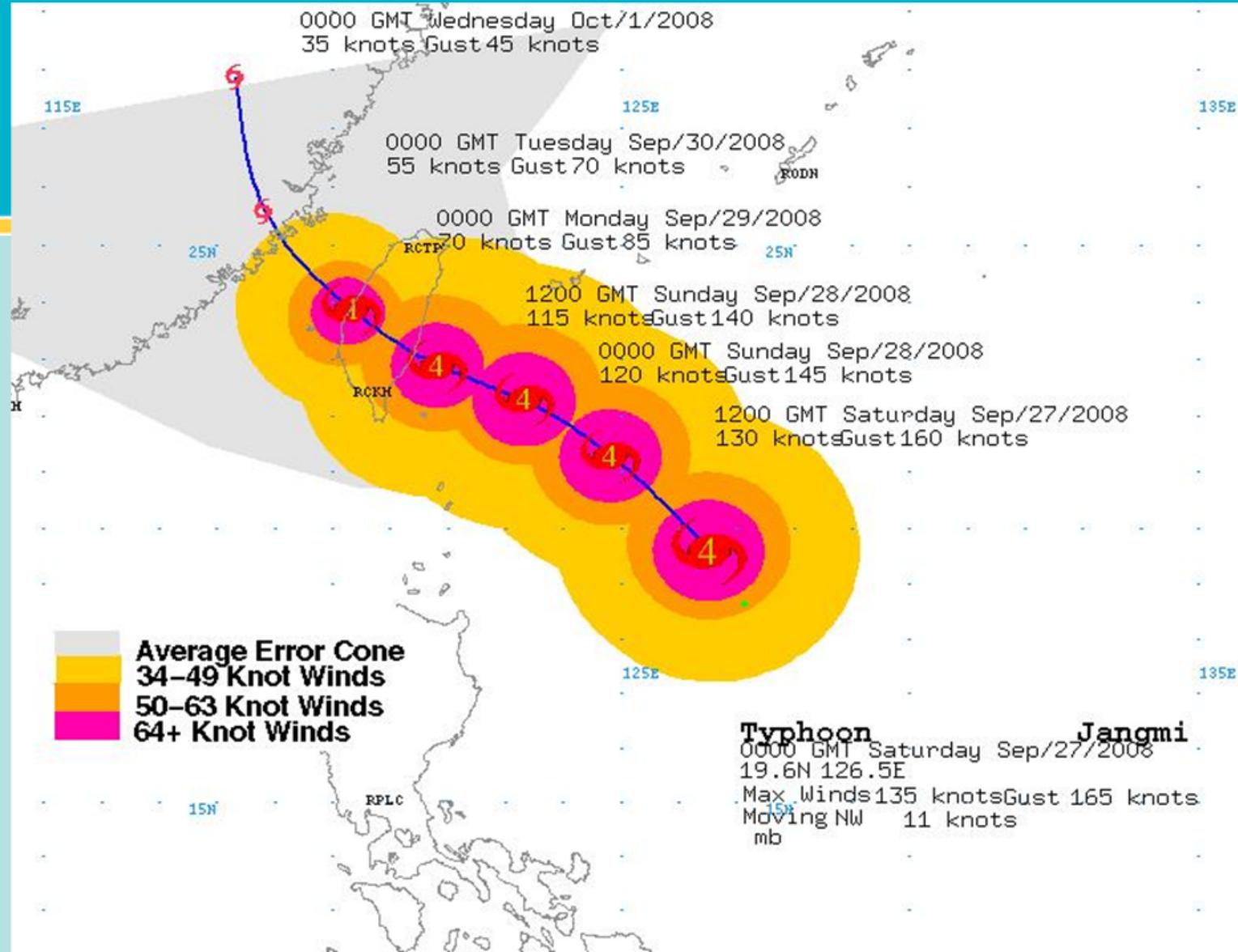
Frozen Dew Conditions

- Dew Point 33-36°F.
- Clear skies, light winds.
- Temperature 38°F or less.



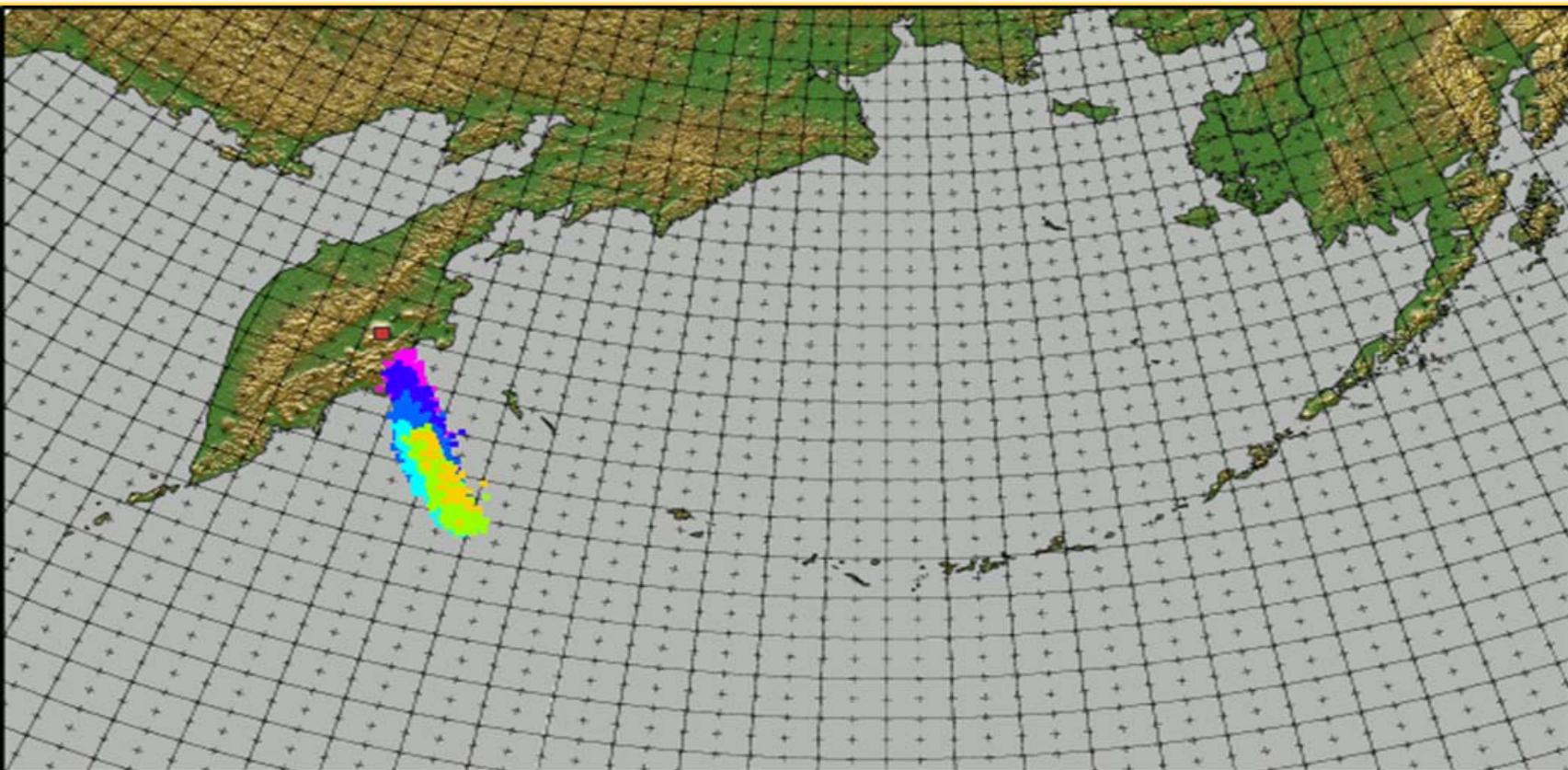
Major Weather Impacts – Hurricanes/Typhoons





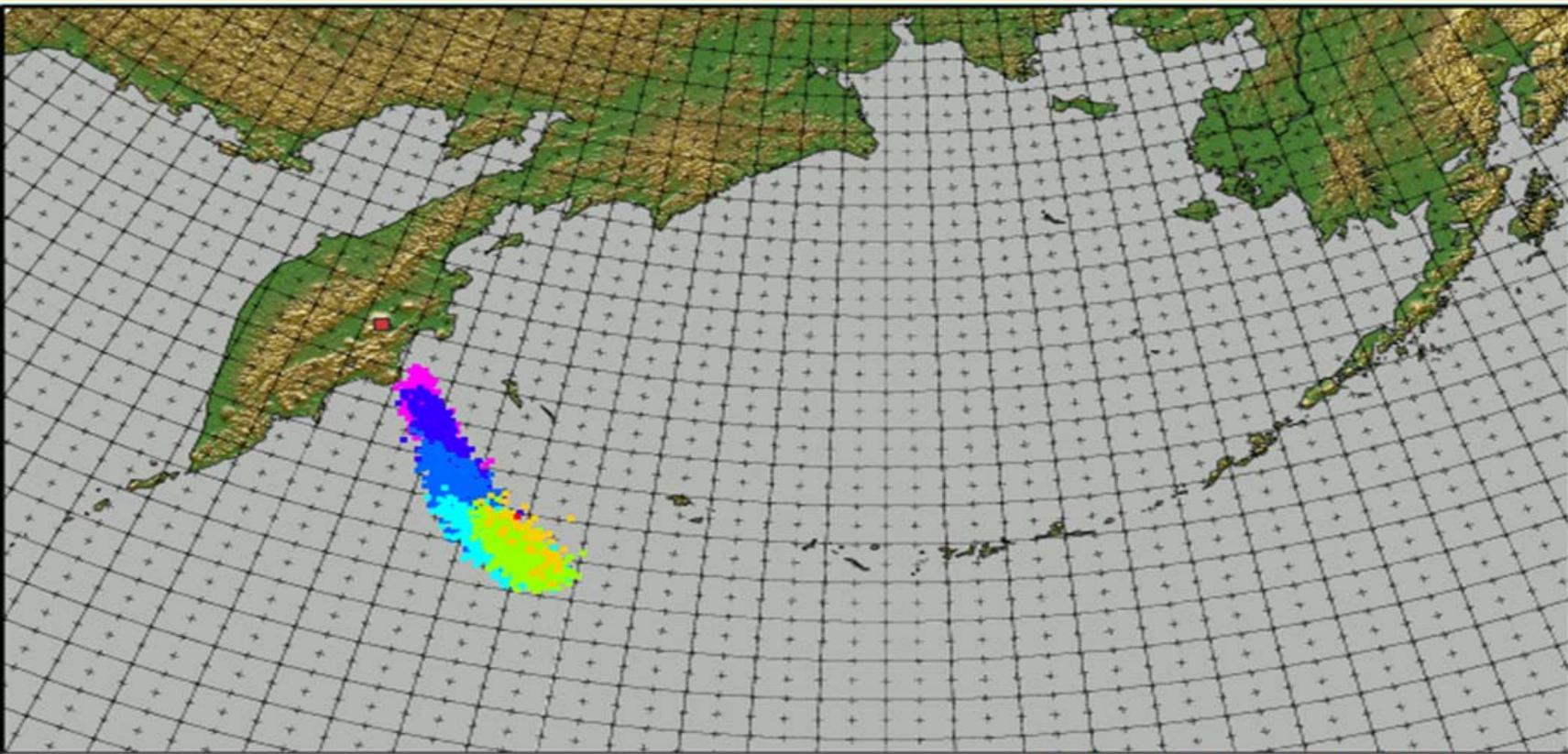
Major Weather Impacts – Volcanic Ash





Bezyznianny 2007 10 16 09:00 UTC
 Valid: 2007 10 16 15:00 UTC [+6:00]

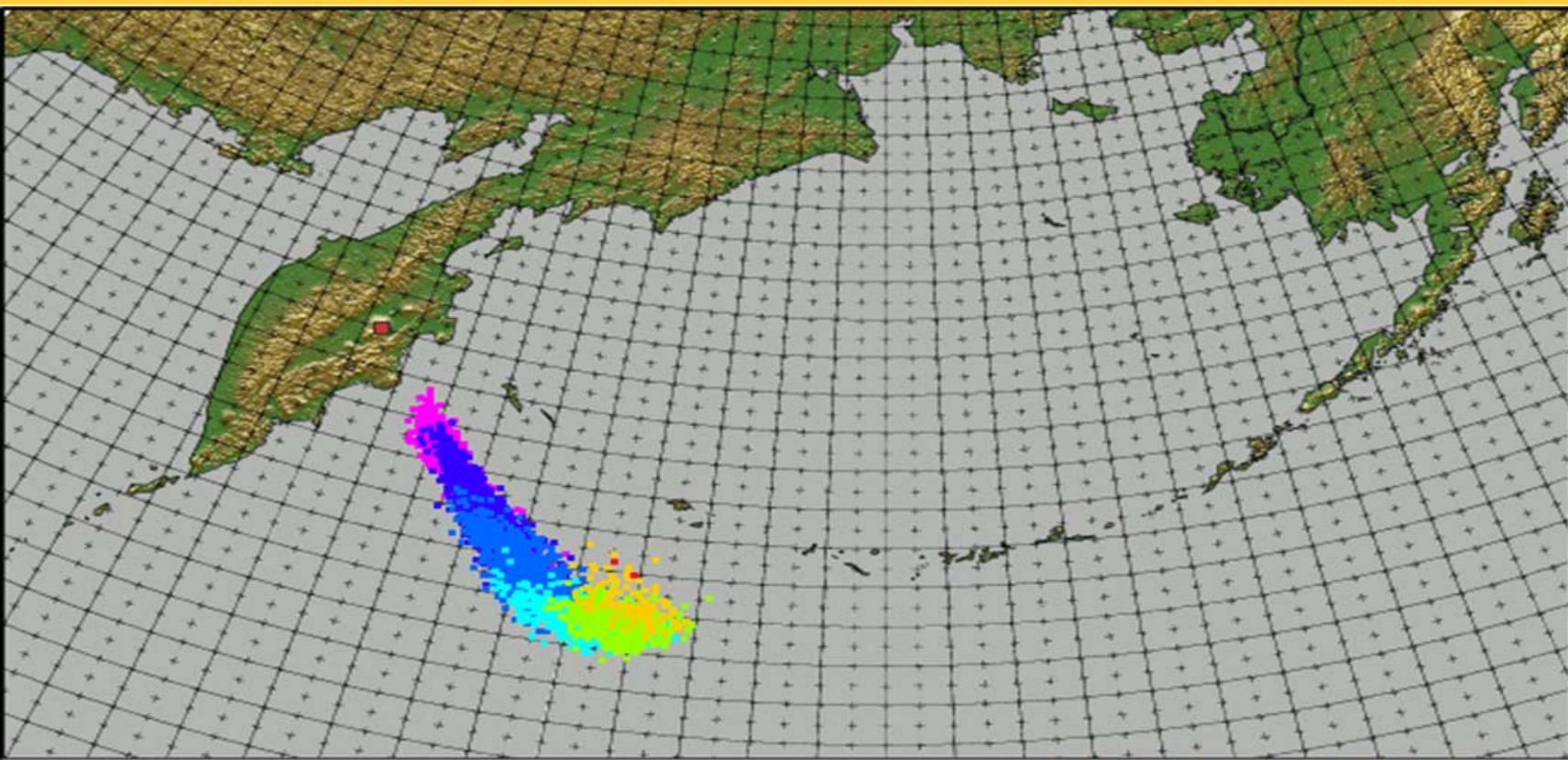




Bezyanianny 2007 10 16 09:00 UTC
 Valid: 2007 10 16 18:00 UTC [+9:00]

6 12 18 24 30 36 42 kft

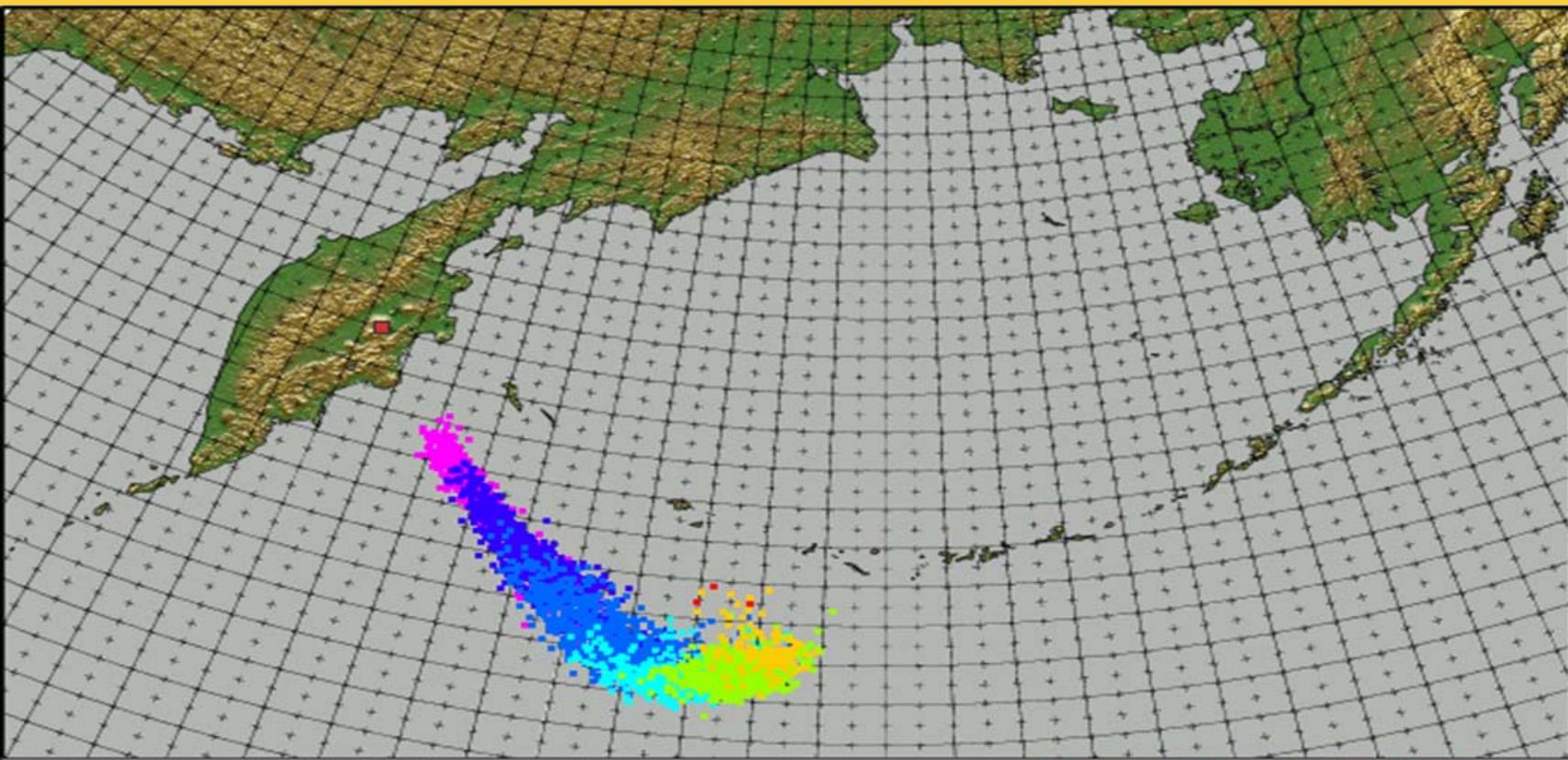




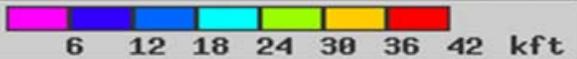
Bezyianny 2007 10 16 09:00 UTC
 Valid: 2007 10 16 21:00 UTC [+12:00]

6 12 18 24 30 36 42 kft





Bezyznianny 2007 10 16 09:00 UTC
 Valid: 2007 10 17 00:00 UTC [+15:00]



Dispatcher Weather Needs

- **Jointly responsible with the Captain for safe and legal planning of the flight. (Domestic/Flag FARs)**
- **Use LIDO Flight Planning System (UKMET Winds/NCEP Winds backup)**
- **Most Planning starts 3-6 hours before the flight departs. Domestic flight times 1-4 hours. International flight times 1-12 hours.**



Dispatcher Weather Needs

- **Use Standard Weather Products**
 - METARs
 - TAFs
 - SIGMETs
 - Significant Weather Progs
 - AIRMETs (sometimes)
 - FIP (Forecast Icing Potential)
 - CCFP



METAR Deficiencies

- **Winter Weather Precipitation Types**
 - **Snow Intensity: Needs to switch to Liquid Water Equivalent basis rather than visibility. This is for deicing purposes (Safety & Economics)**
 - **FZDZ and PL not automatically detected, require Augmenter. Updates often not timely.**
- **1-minute ASOS access**
- **RVR**



Live RVR Monitoring Tool

RVR Status Monitor

05:58:23 UTC 04-13-2009

RVR Airports						
ANC 6500	ATL 4500	BFI 6500	BNA 6500	BOS 6000	BUF 6500	BUR 6500
BWI 5500	CLE 6500	CLT 6000	CVG 5500	DAL 6500	DCA 6000	DEA 2000
DEB 3500	DFA 6500	DFB 6500	DPA 6500	DTW 5500	EUG 6500	EWR 6000
GEG 6500	GJT 00	HOU 6500	HPN 6500	IAD 6500	IAH 5500	ILG 00
IND 6500	ISP 6500	JFK 6500	LAX 6500	LGA 6500	LGB 6500	LMT 6500
MCI 6500	MCO 6000	MDW 6500	MEM 6500	MFR 00	MIA 6500	MRJ 6500
MSP 6000	MWH 00	OAK 6500	ONT 6500	ORN 6500	ORS 6500	PAE 6500
PDX 6500	PHL 6000	PHX 6500	PIT 6500	PSC 6500	RDU 5500	SAN 6500
SDF 6500	SEA 6500	SFO 5500	SJC 6500	SLC 6500	SMF 6000	SNA 6500
STL	TPA					

Need more airports added!

KEY:

Values = lowest visibility (in feet) over last 10 minutes.

6100+	2500-6000	1300-2400	800-1200	0-700	No Data
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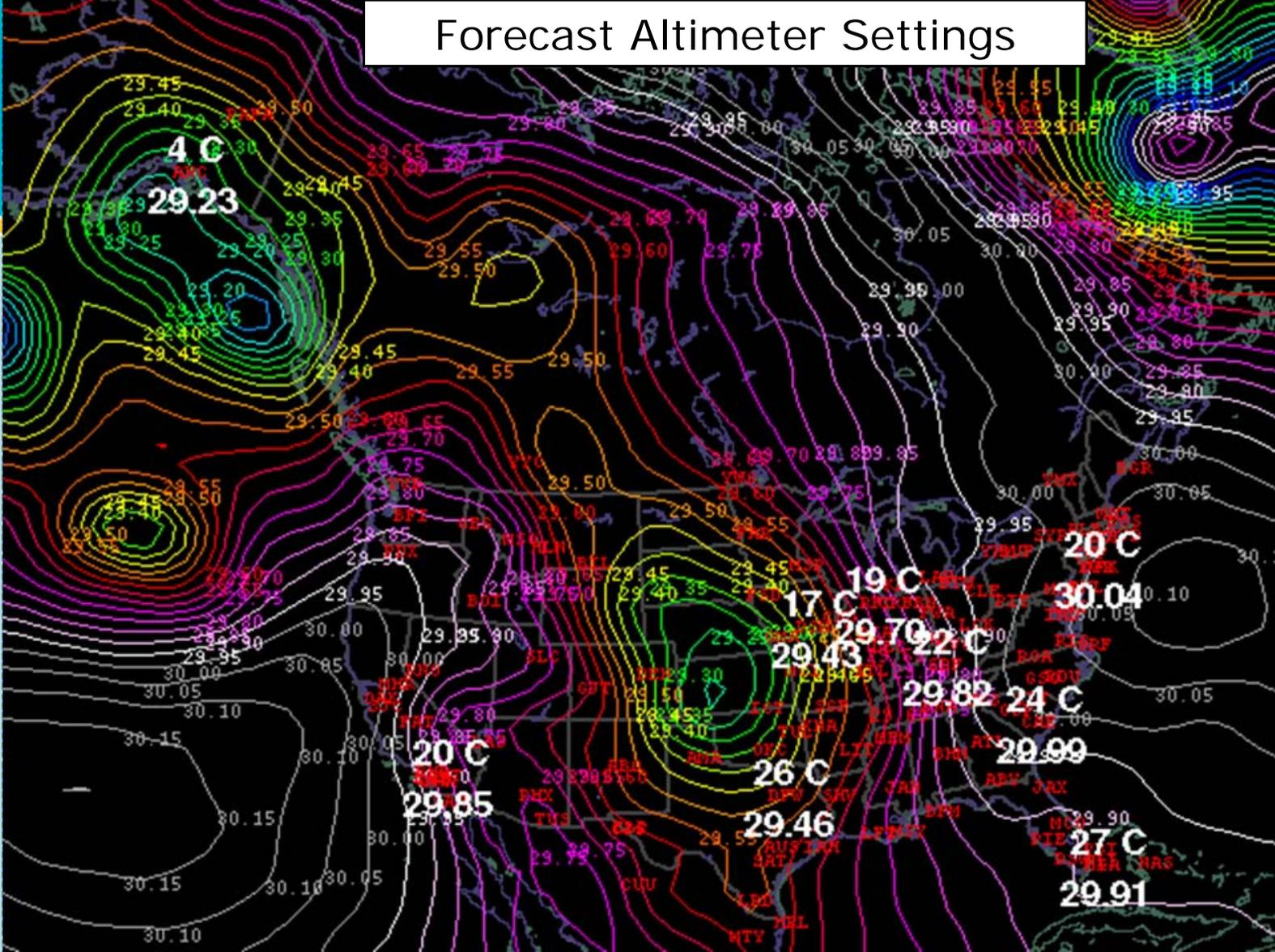


TAF Deficiencies

- Major changes often wait until 00, 06, 12, and 18z Update times
- Major airports need hour by hour wind/ceiling/precipitation information for airline and ATC planning.
- Major airports also need to know about T-storms impacting arrival and departure corridors.
- Forecast Altimeter Settings



Forecast Altimeter Settings



SIGMETs

- Convection
- Severe Turbulence
- Severe Icing
- Volcanic Ash



Bezymianny Volcano

- WVAK03 PAWU 160259 RRA
WSVAK3
ANCK WS 160300 RRA
PAZA SIGMET KILO 1 VALID 160040/160640 PANC-
ANCHORAGE FIR.

SATELLITE/PILOT REPORTS INDICATE THAT ASH FROM BEZYMIANNY VOLCANO WITHIN THE KAMCHATKAN PENINSULA CONTINUES TO MOVE INTO THE ANCHORAGE

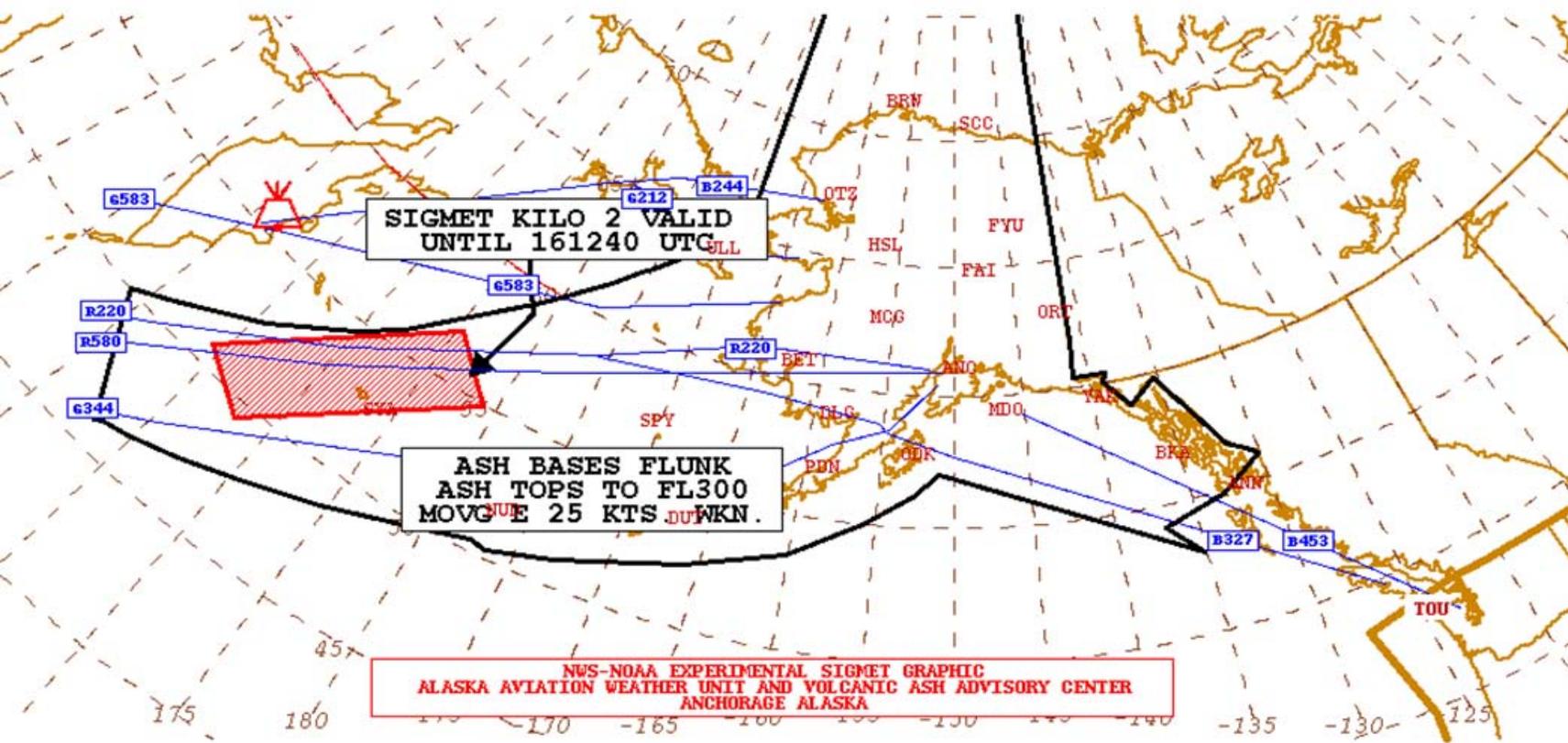
FIR. ASH CLOUD INFORMATION...ASH BASES FLUNKN. ASH TOPS FL300.

THE AREA AFFECTED THROUGH 160640 UTC IS BOUNDED BY...SFC/FL300 N5653 W17934 - N5511 W17935 - N5536 E17109 - N5646 E17049 - N5653 W17934.

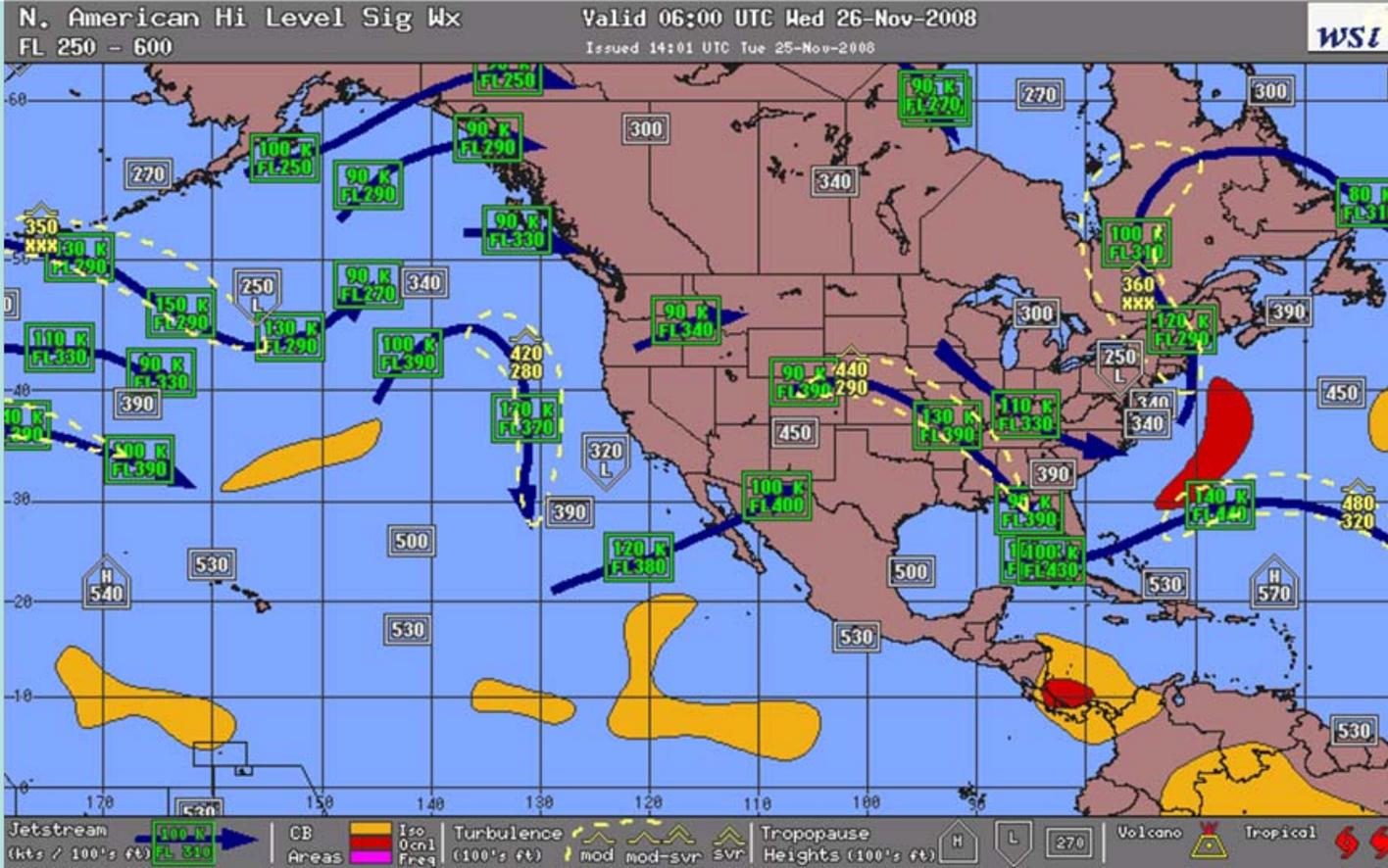
ASH MOV E 80 KTS.

OTLK...FORECAST VOLCANIC ASH AREA AT 161829 UTC NIL





Significant Weather Progs

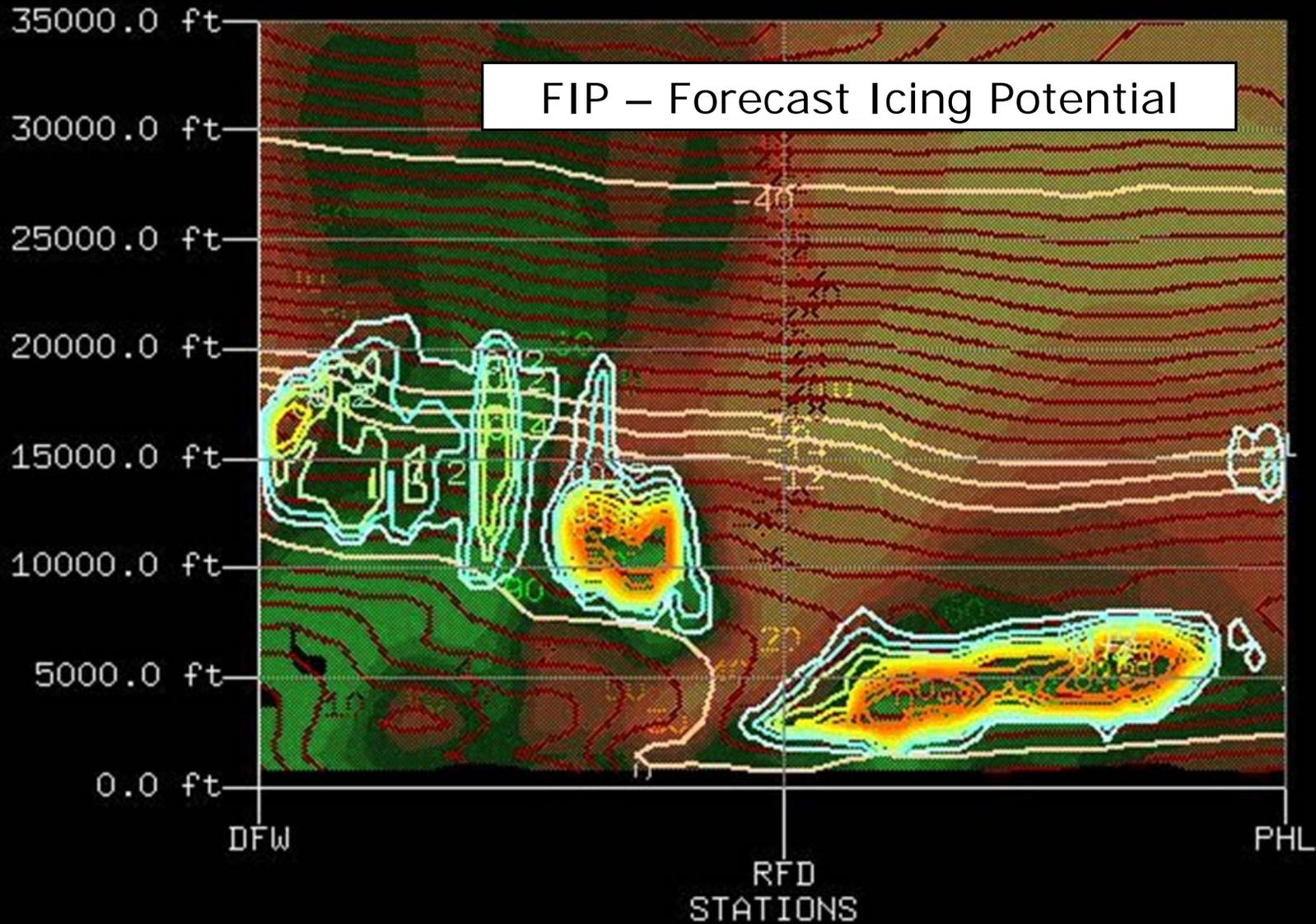


AIRMETs

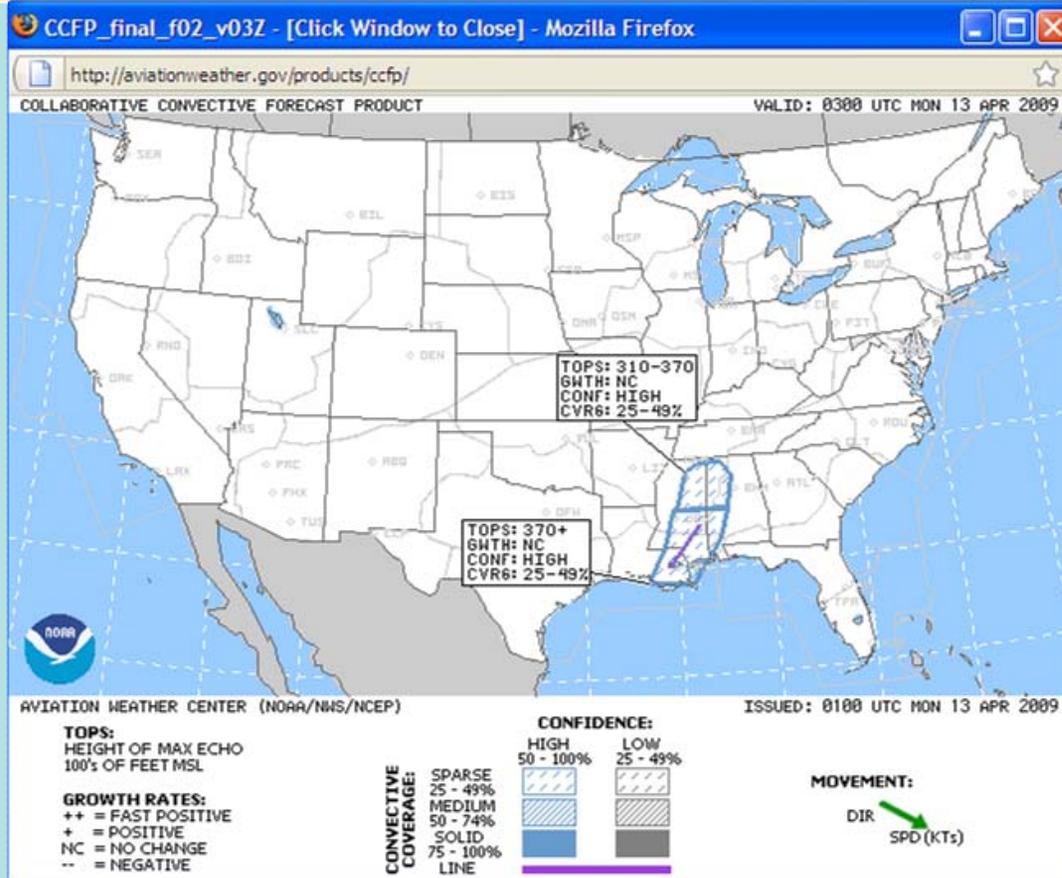
- Rare to make operational changes due to AIRMETs
 - Moderate Icing
 - Moderate Turbulence



FIP – Forecast Icing Potential



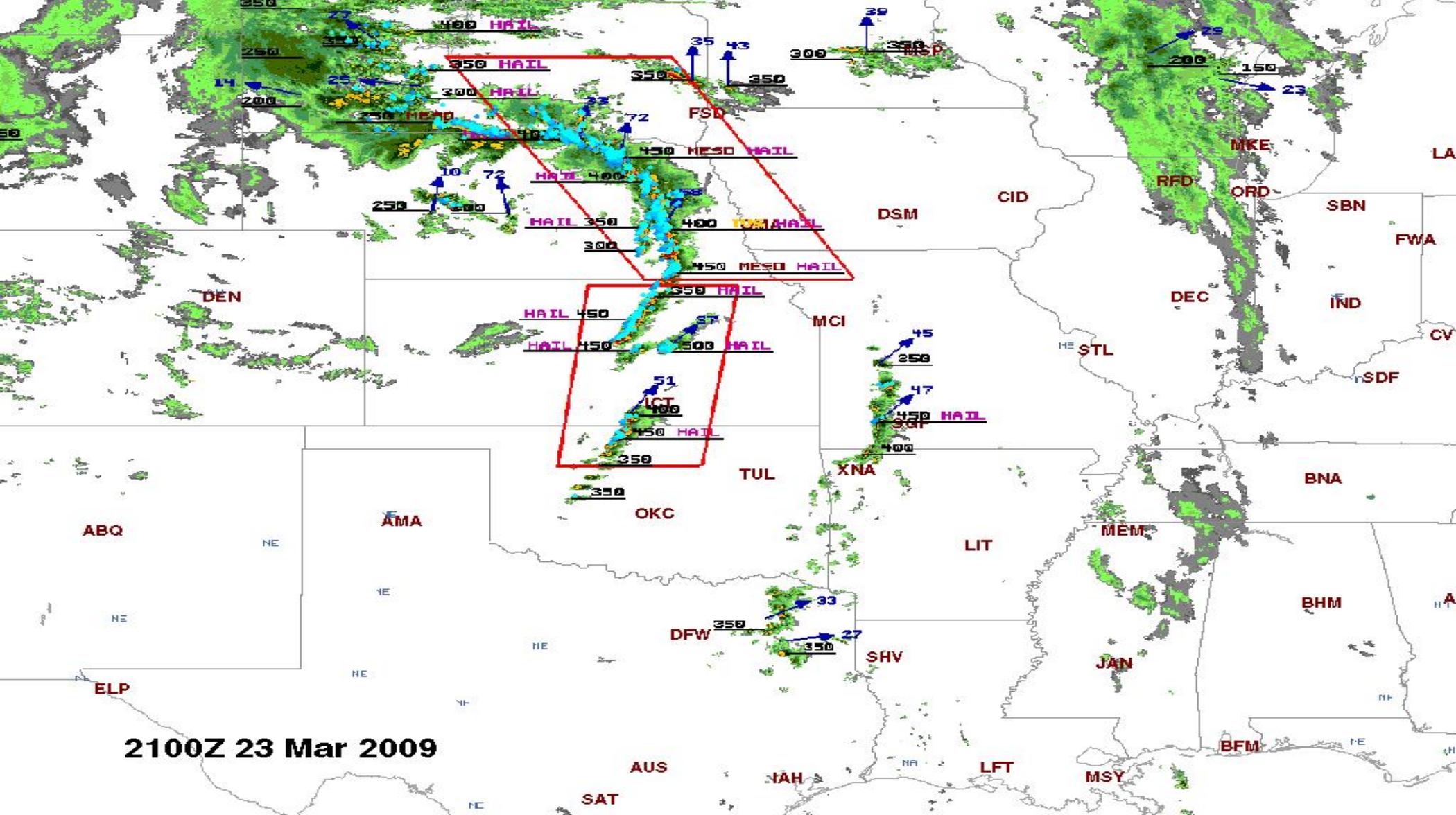
CCFP



CCFP Deficiencies

- Only goes out 6 hours, in 2 hour time steps
- Probabilistic vs. Deterministic? Most users request a forecast radar.

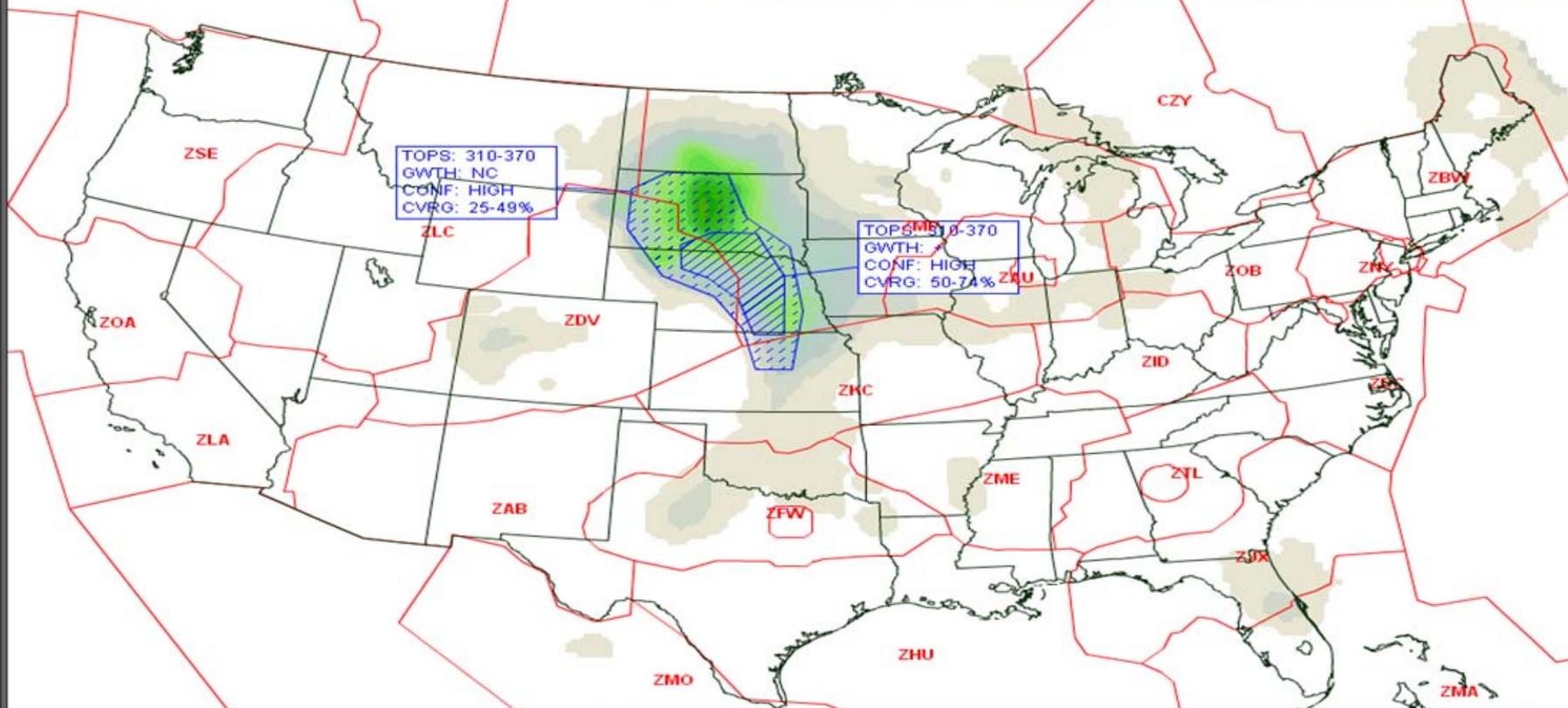




2100Z 23 Mar 2009

LAMP-CCFP Hybrid

No Canadian or Gulf LAMP data 50 miles outside of the US Border.

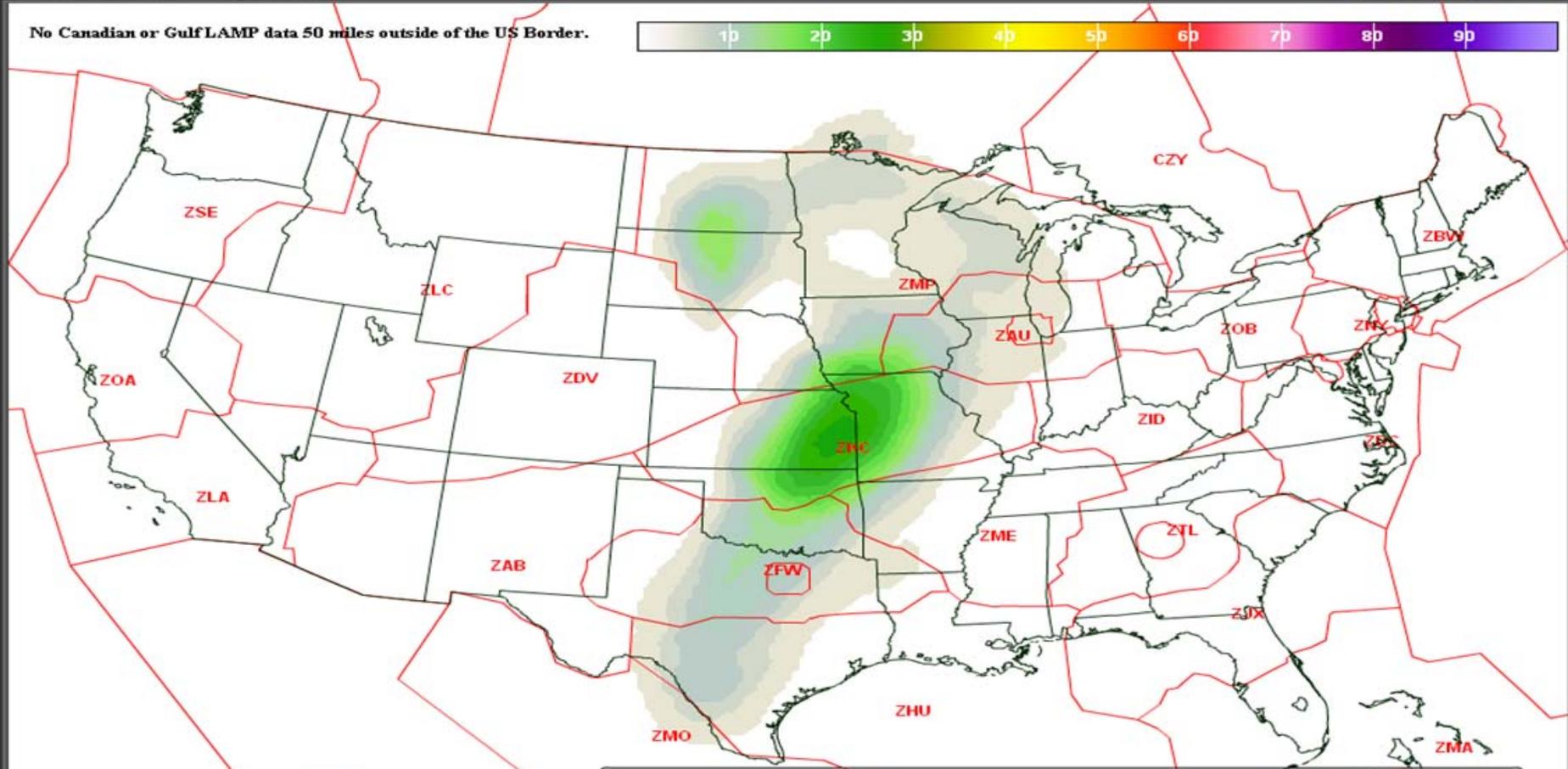


Navigation controls: Left arrow, Right arrow, Double left arrow, Double right arrow, Refresh, Stop. A row of 16 small colored squares (green, blue, red) below the arrows.

Forecast	Hours +	Issued	Valid	Current Time:
LAMP	+4 - +6	1700	2100 - 2300	2041
CCFP	+4	1700	2100	Version: 1.02

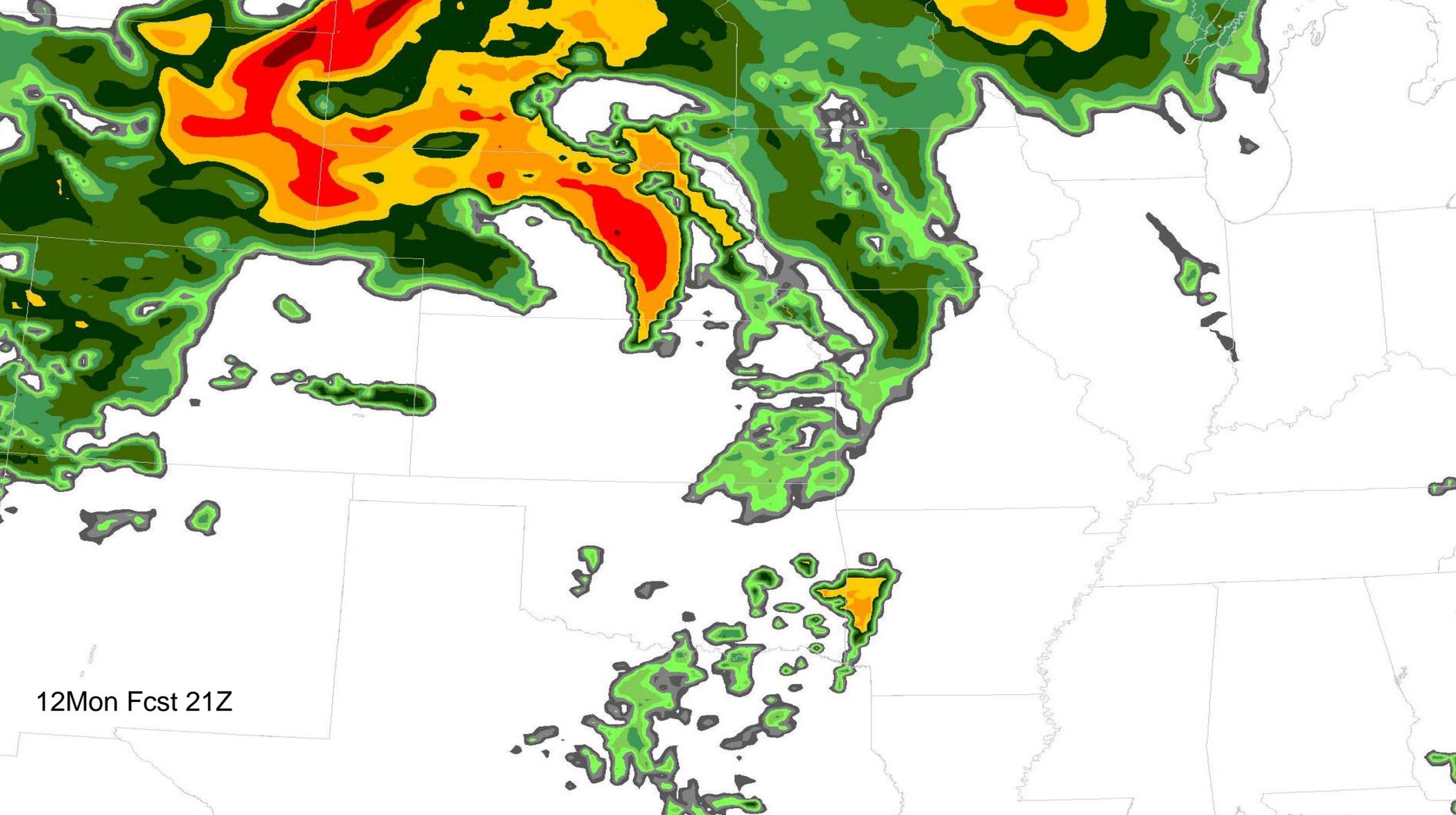
LAMP-CCFP Hybrid

No Canadian or Gulf LAMP data 50 miles outside of the US Border.

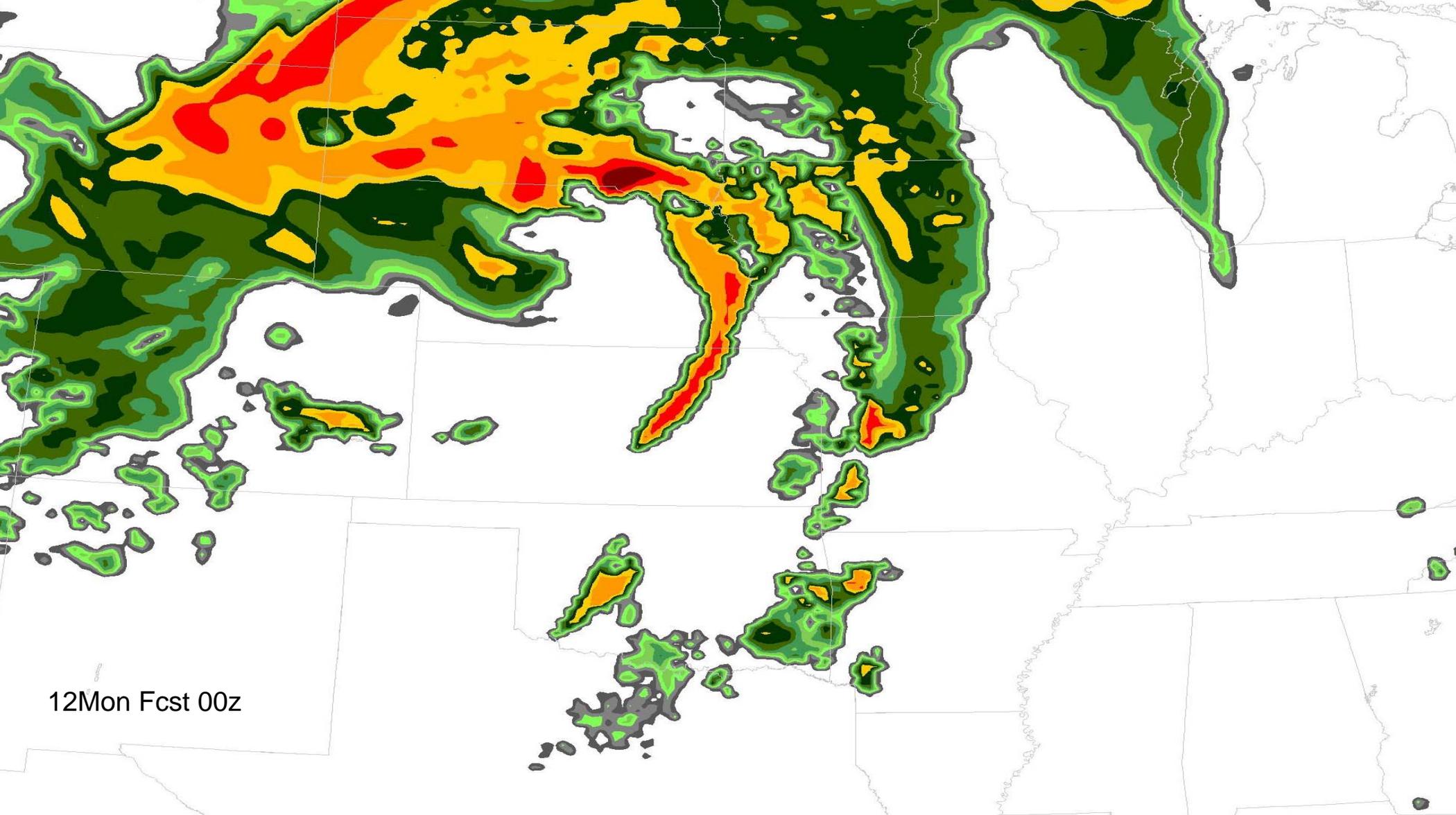


Navigation controls: Left arrow, Right arrow, Play/Pause, Stop, Refresh, Home, and a row of status indicators (green and blue squares).

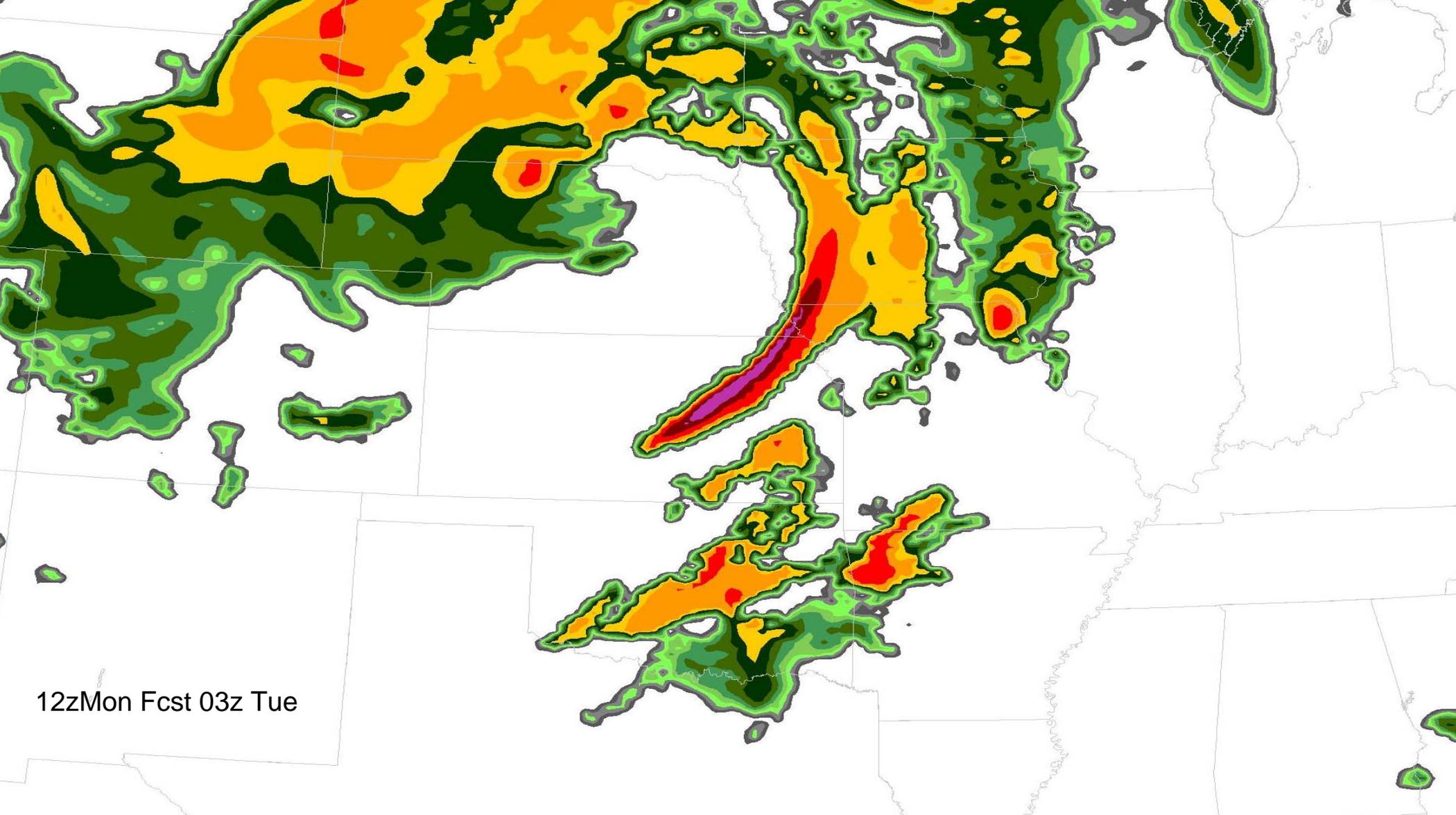
Forecast	Hours +	Issued	Valid	Current Time:
LAMP	+13 - +15	1700	0600 - 0800	2048
CCFP	NA	NA	NA	Version: 1.02



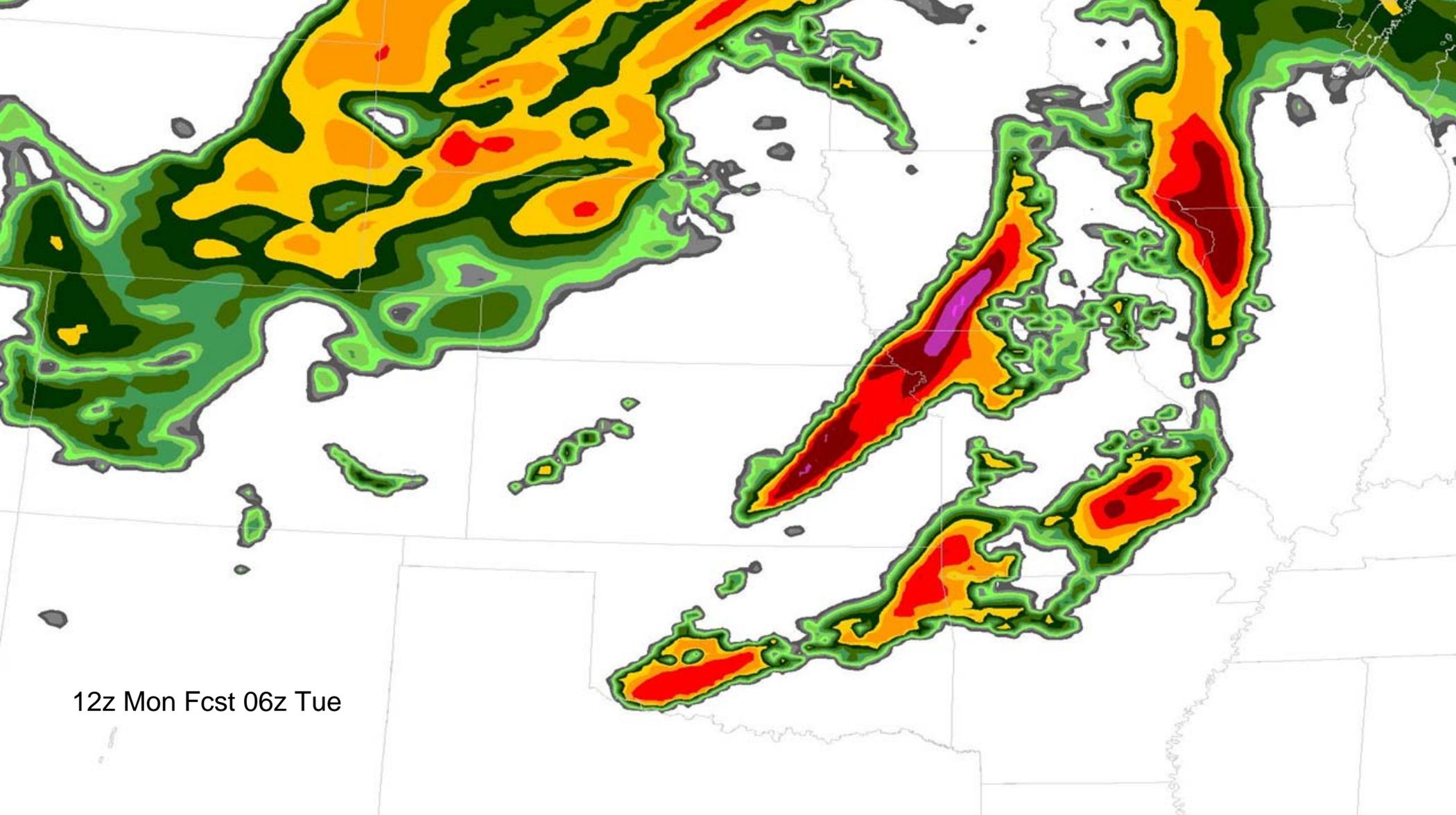
12Mon Fcst 21Z



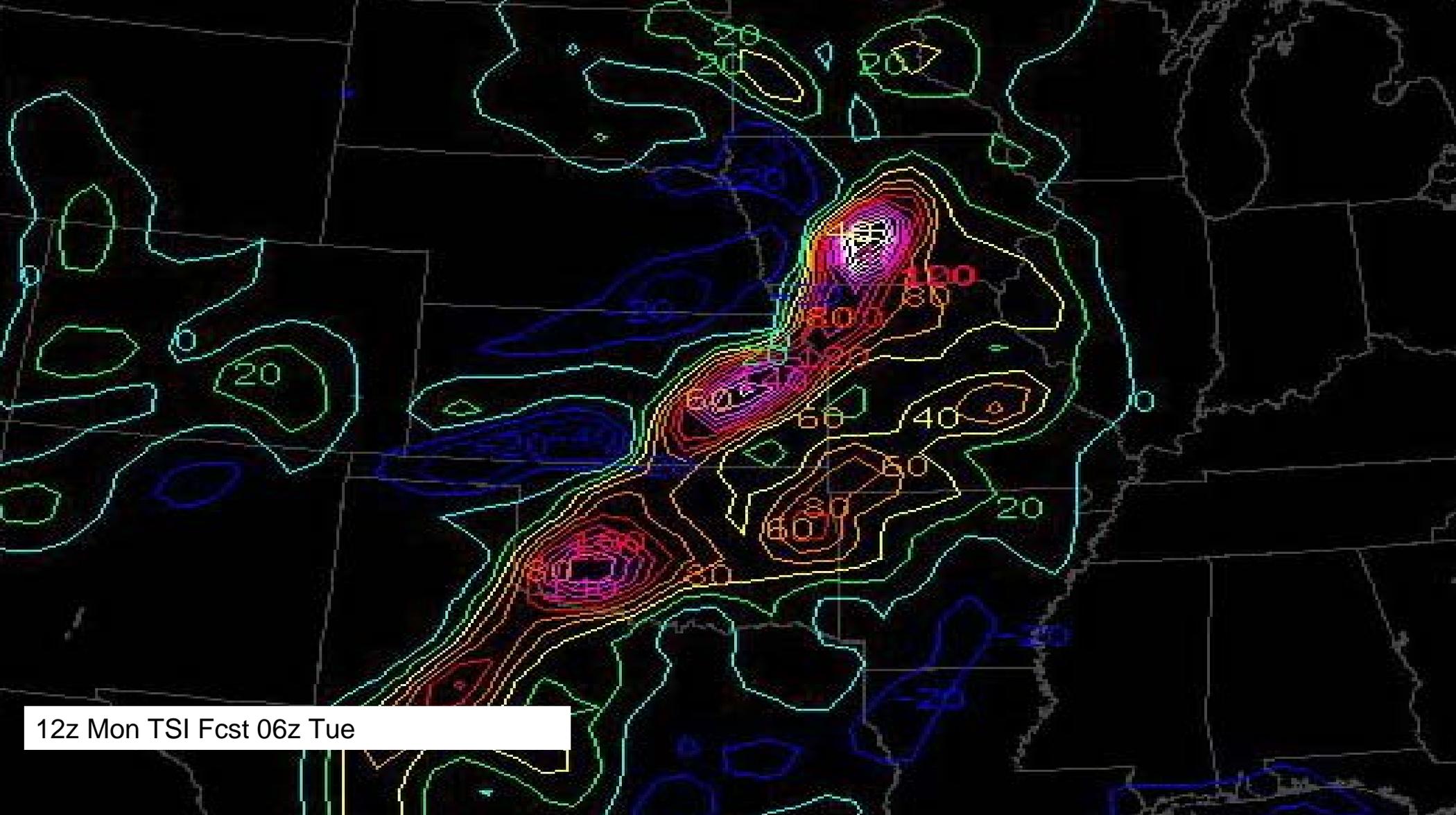
12Mon Fcst 00z



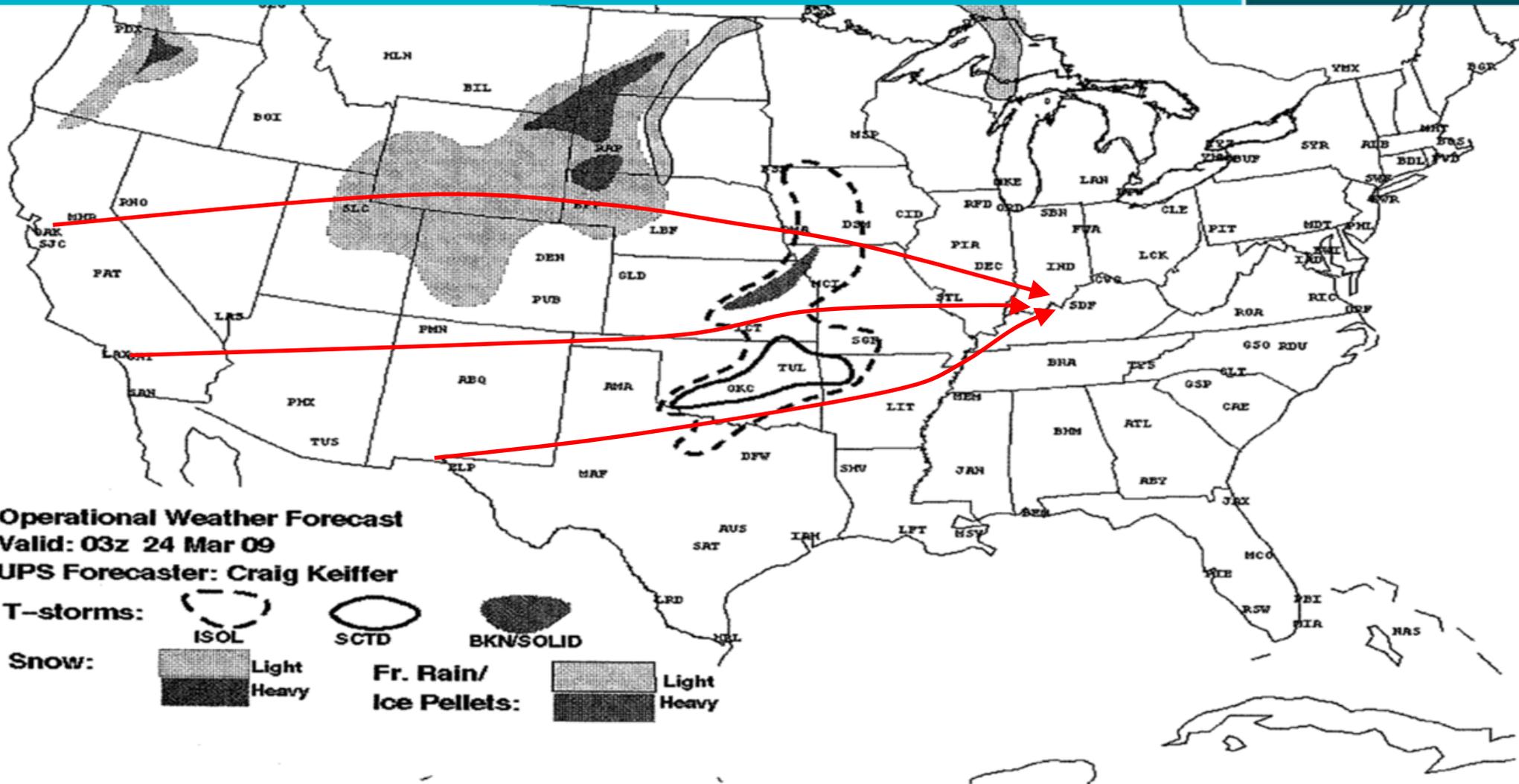
12z Mon Fcst 03z Tue

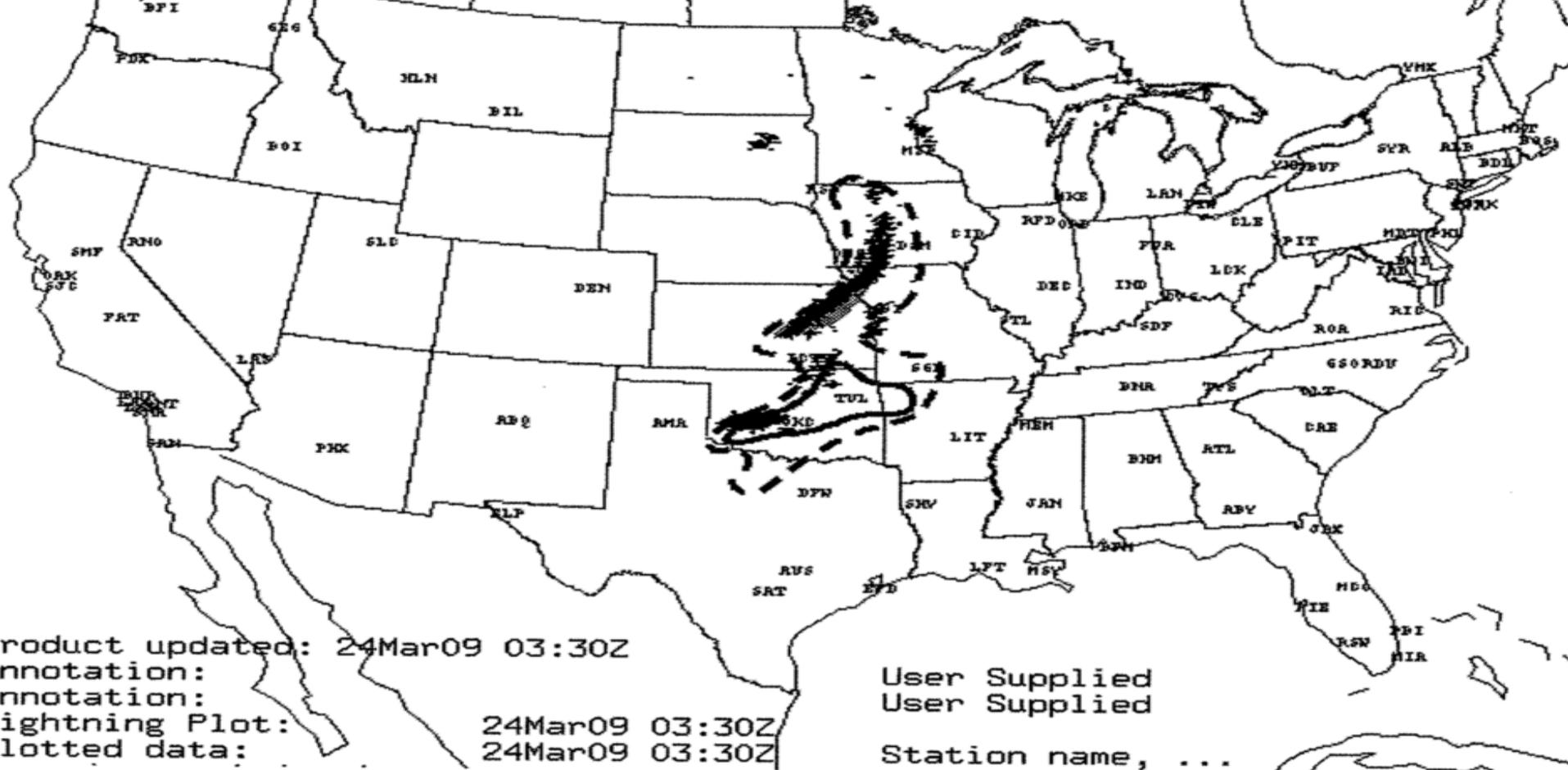


12z Mon Fcst 06z Tue



12z Mon TSI Fcst 06z Tue





Product updated: 24Mar09 03:30Z

Annotation:

Annotation:

Lightning Plot:

Plotted data:

24Mar09 03:30Z

24Mar09 03:30Z

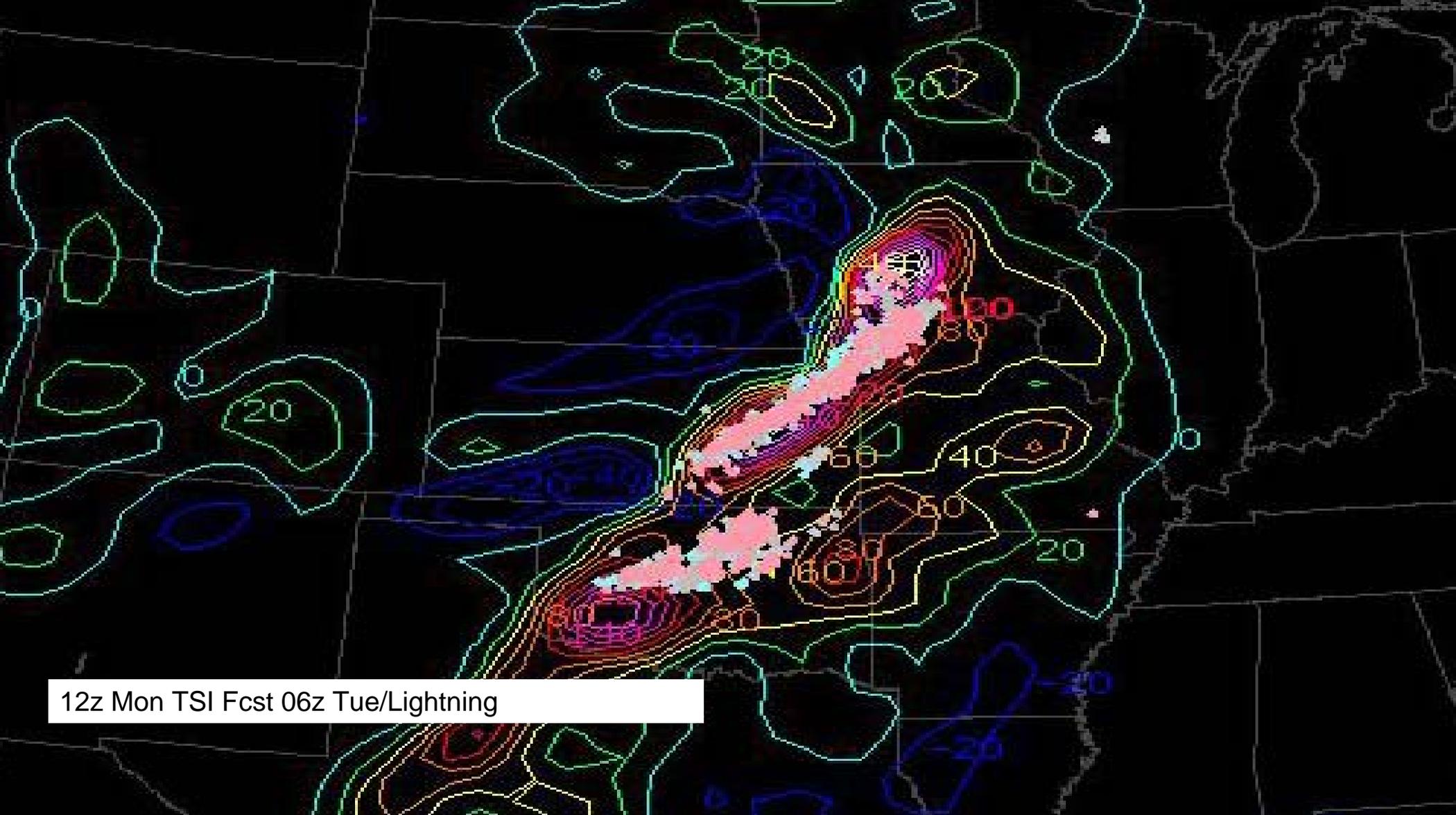
User Supplied

User Supplied

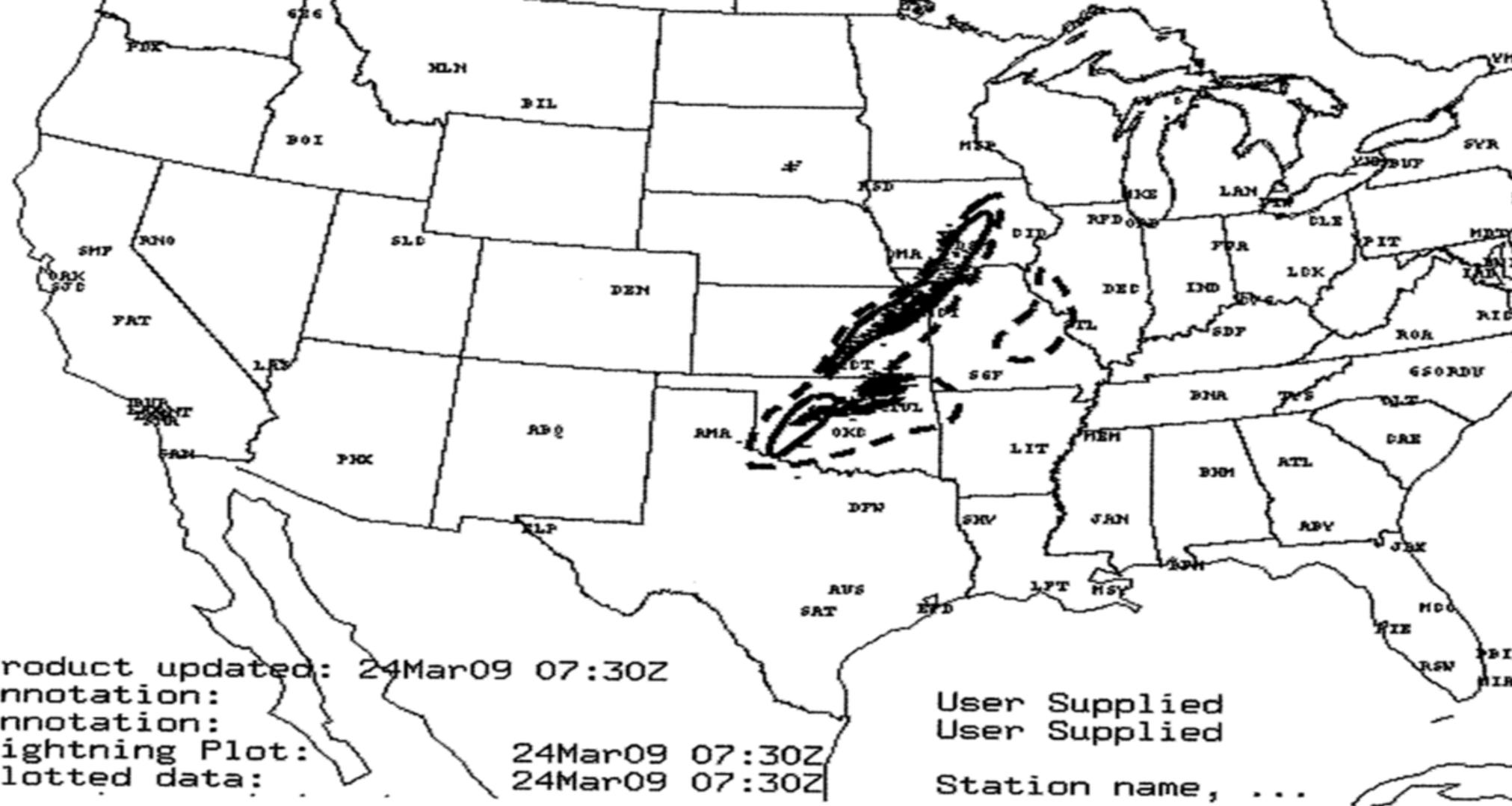
Station name, ...

03:30 24-Mar-09





12z Mon TSI Fcst 06z Tue/Lightning



Convective Forecast Product Final

Valid Time:
Mar 24, 2009 05Z

Issuance Time:
Mar 23, 2009 23Z

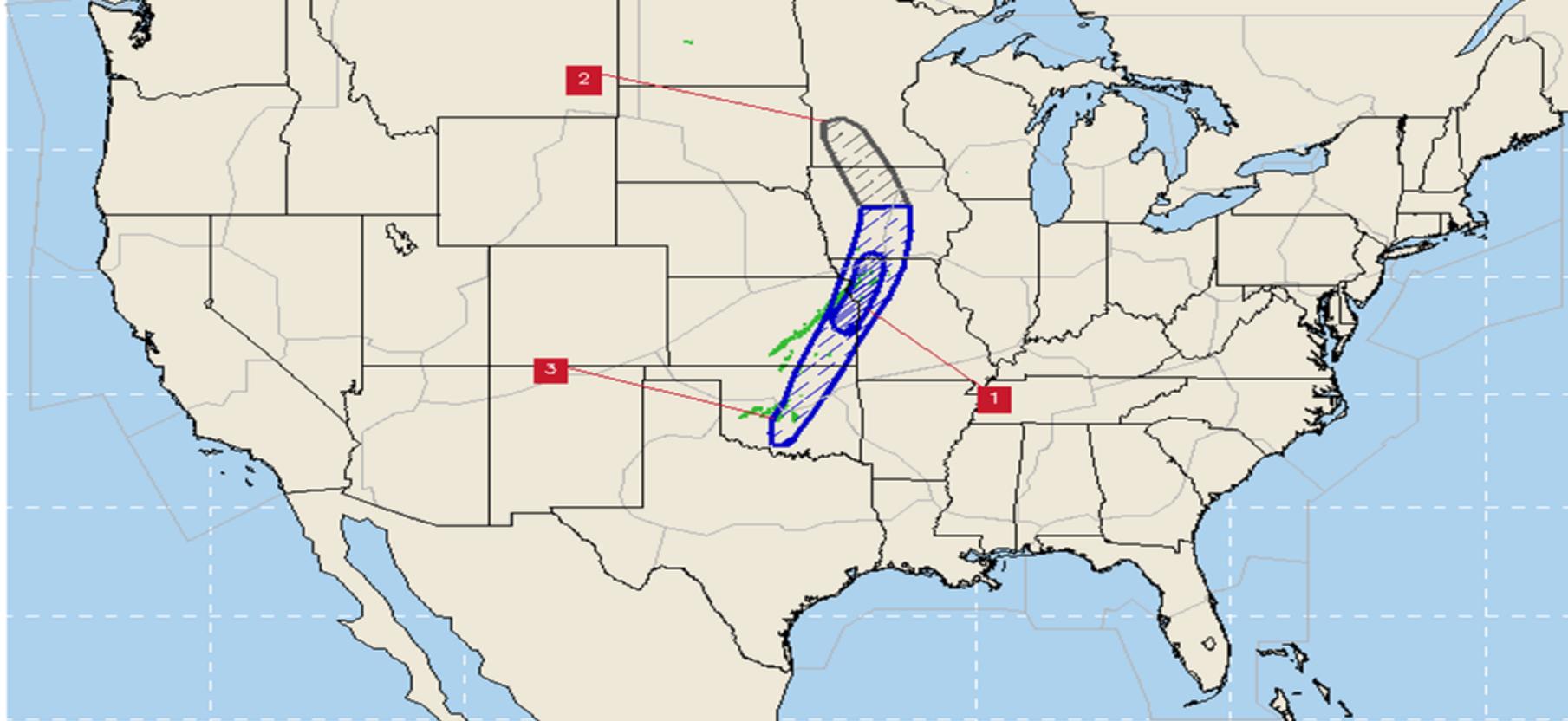
Forecast Length:
6 hours

Forecast Coverage
High = 75-100%
Medium = 50-74%
Low = 25-49%

Forecast Confidence
High
Low
No W/D

RTVS Verification

PODy: 0.40
Bias: 10.27
CSI: 0.04
HSS: 0.07
% Area: 1.96
Consistency: N/A



Real-Time Verification System

NOAA Research/ES

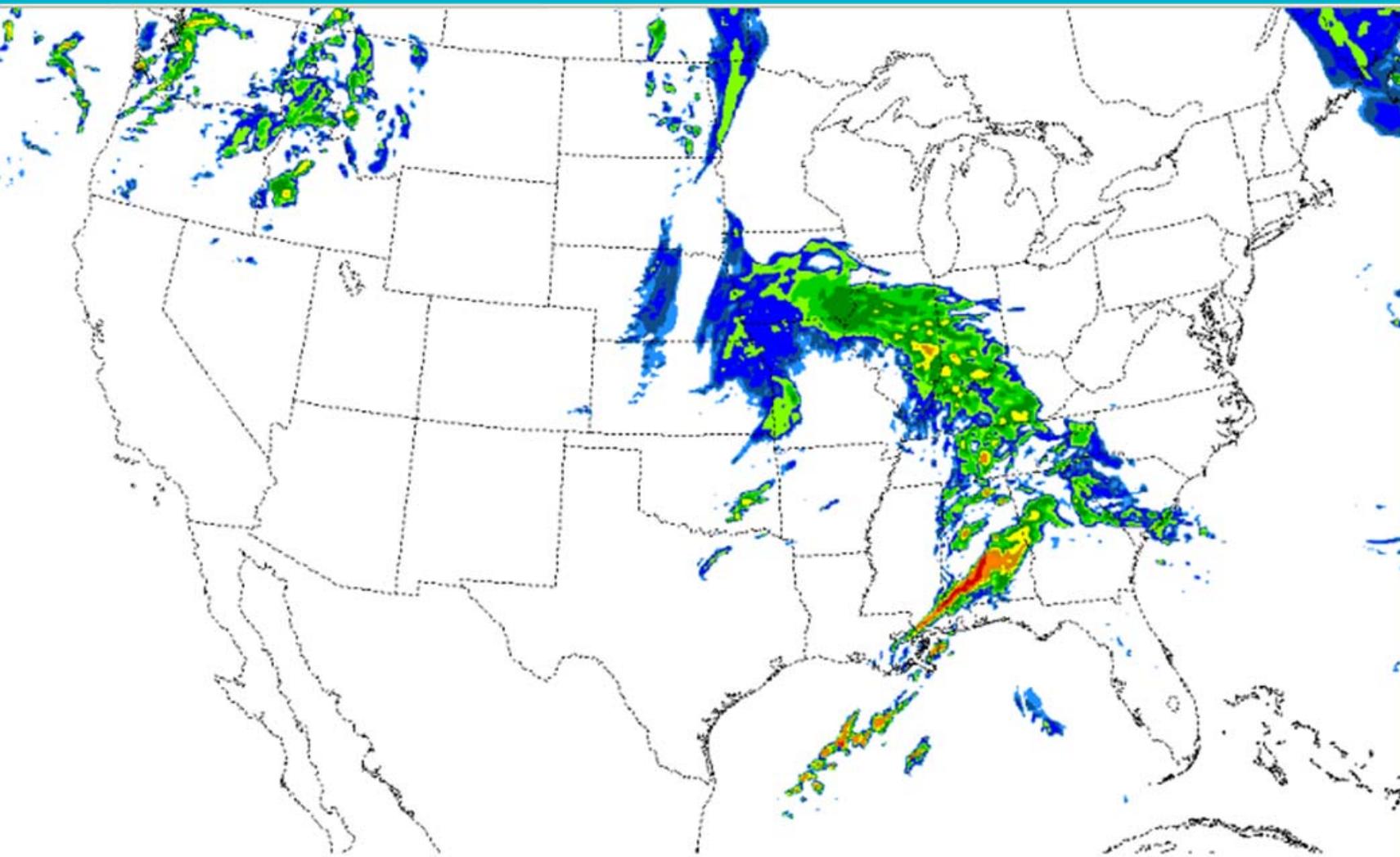
Polygon Information

Polygon	Conf	FCov	OCov	FTops	OTops	Gwth
1	High	50-74%	8.3%	310-370	250-310	-
2	Low	25-49%	0.0%	250-310	<250	-
3	High	25-49%	5.6%	310-370	250-310	NC

Deterministic Forecast Radar

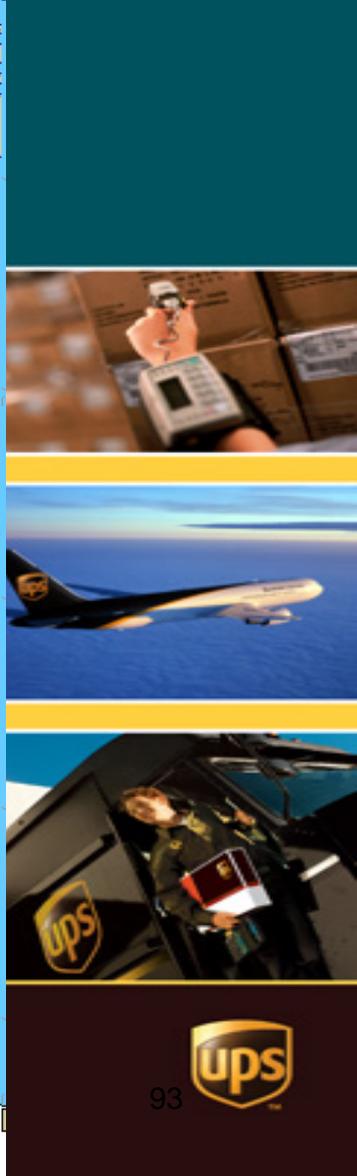
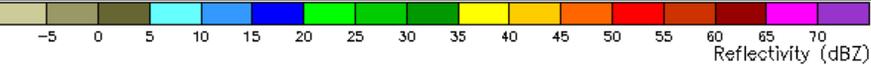
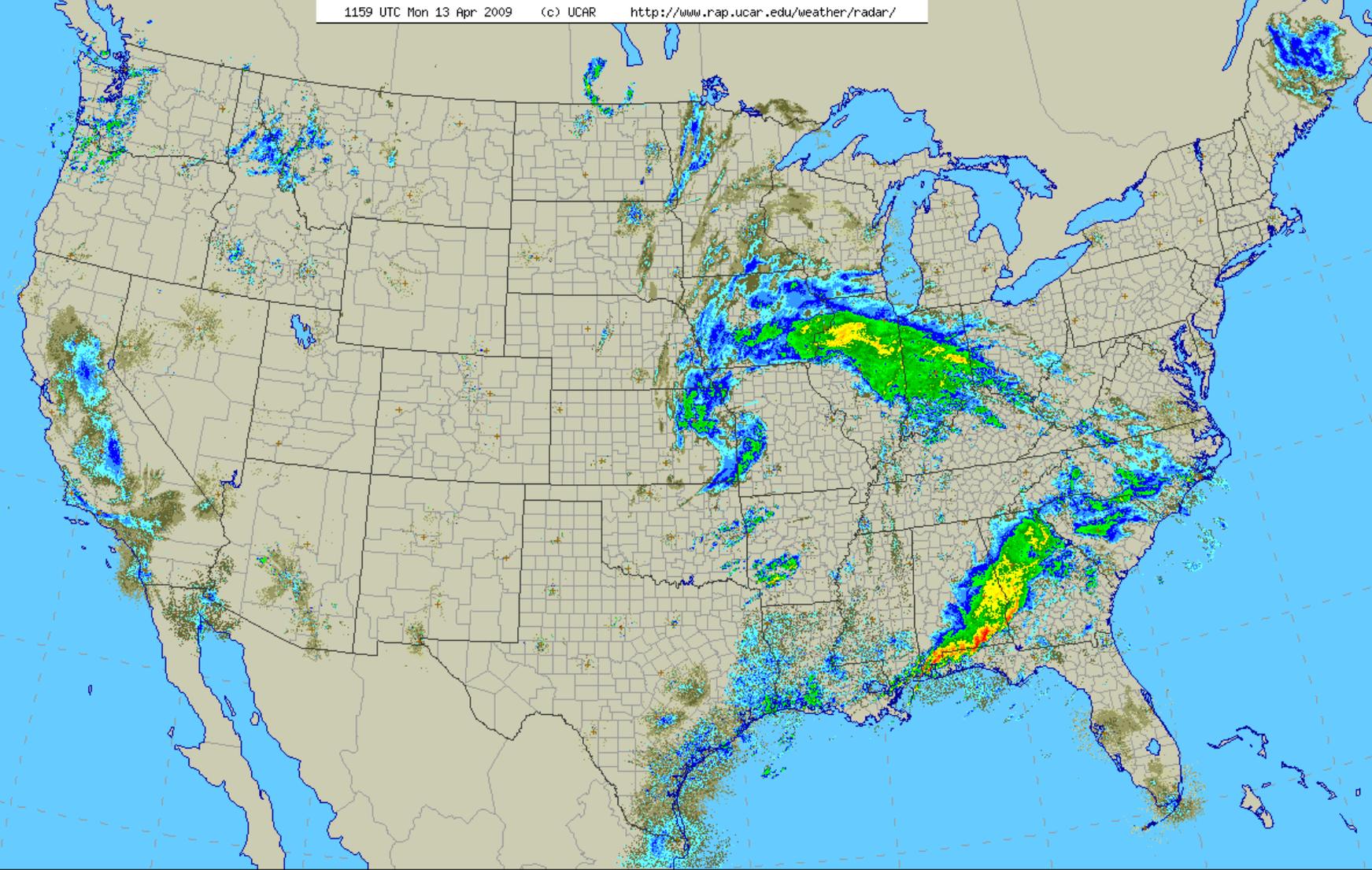
- 12km NAM shows significant skill at times
- 4km WRF NMM even better at showing convective mode (isolated vs. multicell, supercell, or MCS)
- Both Probabilistic and Deterministic T-storm forecasts have their place.





090413/1200V012 1000 M REFD





Other Dispatcher Operational Needs

- **Braking Action/Runway Condition Reports**
- **Wind Shear Alerts (increase from 45 to 70 airports)**



Meteorology Department

- **5 Experienced Meteorologists**
- **Staffed 10z Monday to 10z Saturday**



UPS Meteorology Mission Statement:

- The Meteorology Department will provide high-quality weather forecasts for UPS major airline hubs and U.S. feeder routes to key UPS decisionmakers who will use these forecasts to proactively avoid or minimize potential service failures.



UPS Meteorology Mission Statement:

- **Additionally, as staffing, resources, and time permits, the Meteorology Department will provide a limited, floating weather watch on the worldwide airline operation to help anticipate weather conditions that could have a safety, service, or economic impact on the UPS airline.**



Weather Alerts/Forecasts

Contingency - Microsoft Internet Explorer provided by United Parcel Service Inc.

File Edit View Favorites Tools Help

Back Forward Stop Search Favorites Media Print Address <http://gocontingency.air.ups.com/apps/meteorology/> Go

Links BuKa Model Output Tropics - Volcano International Google Meteorology NCEP 12 km NAM NAM SVR WX Graphics GFS 00z - NCEP AWC - CCFP Storm Prediction Center

Air Group Home | Inside.ups.com | Site Guide | Site Search | UPSers.com | Web Content | Library | E-Mail



Airline Contingency

Worldwide Services
Synchronizing the world of commerce

Home Meteorology Hot Spares Reports Met Contacts Related Links

Meteorology

Current Zulu time: 21-Sep-2006 13:06
Click on the gateway ID to see weather forecast details.
BLUE indicates a hub with no weather alert.
RED indicates a weather alert.
Weather data is updated every 5 minutes.
Last update: 21-SEP-2006 13:05 Z [Zulu time conversion sheet](#)



Take our Customer Service Survey

This data is based on the FCMET transaction; use FCMET if the map is unavailable or unresponsive.

[See all current forecasts in easy-to-copy format](#) [Administration](#)

The following weather maps may be viewed online or printed. The .jpg maps should be printed in landscape format.

- [15x Thu T-storms.jpeg](#) (103 kb) 9-21-2006
- [21x Thu T-storms.jpeg](#) (105 kb) 9-21-2006
- [3x Fri T-storms.jpeg](#) (105 kb) 9-21-2006
- [Daily Ops Briefing.doc](#) (MS Word, 78 kb) 9-21-2006

[Operational Weather Chart Terms](#)

Done Local intranet



Additional Maps



[Take our Customer Service Survey](#)

This data is based on the FCMET transaction; use FCMET if the map is unavailable or unresponsive.

[See all current forecasts in easy-to-copy format](#)

[Administration](#)

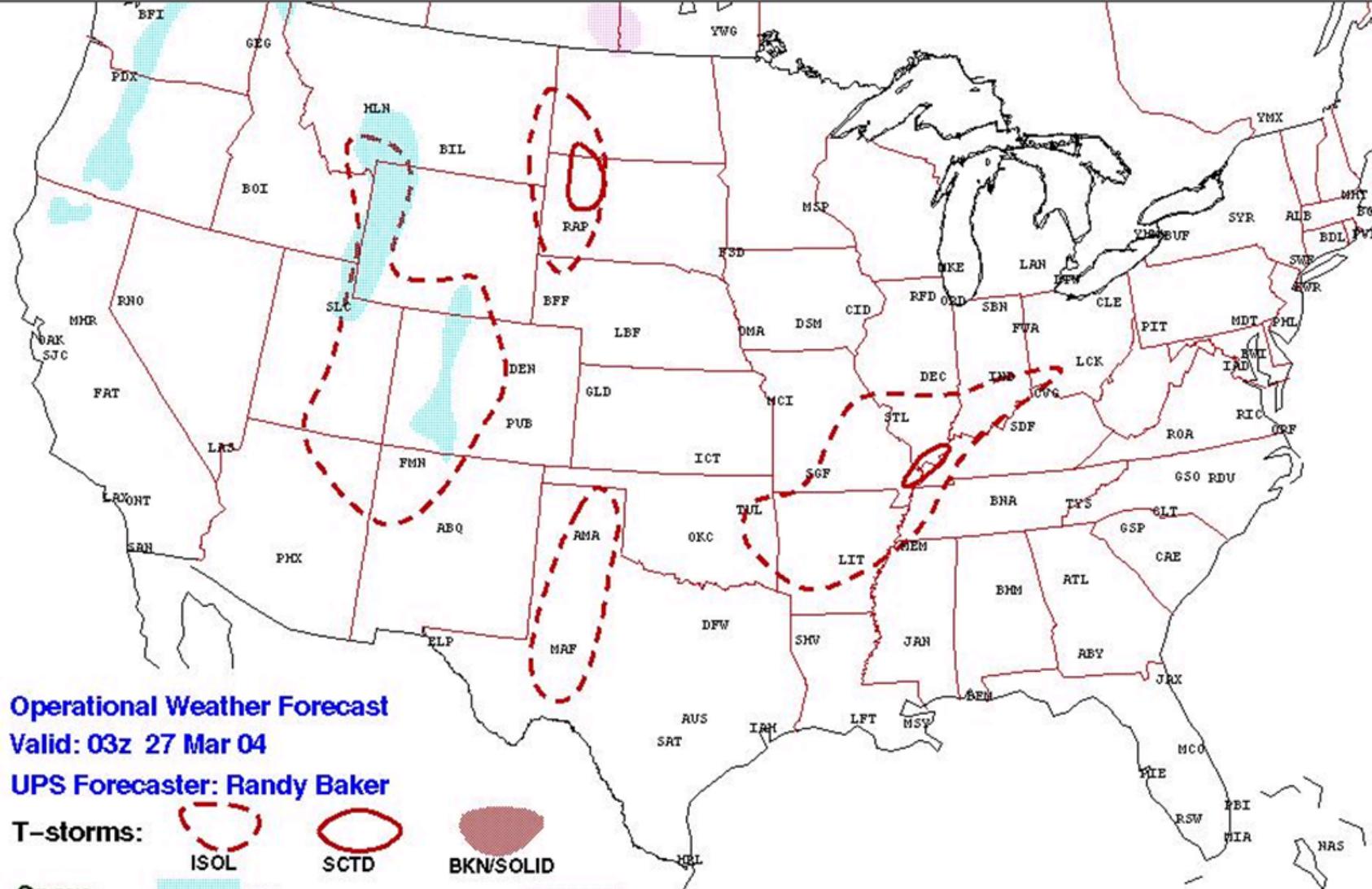
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- [Daily Ops Briefing.doc](#) (MS Word, 78 kb) 9-21-2006

[Operational Weather Chart Terms](#)

Related weather sites





Operational Weather Forecast

Valid: 03z 27 Mar 04

UPS Forecaster: Randy Baker

T-storms:



ISOL



SCTD



BKNS/SOLID

Snow:



Light

Heavy

**Fr. Rain/
Ice Pellets:**



Light

Heavy



FCMET Example (HUB)

FCMETU CLOUMXF5 AUTOMATED FLIGHT CONTROL 05MAR02 20:04:46 UTC
AIRPORT: KPHL METEOROLOGY DEPARTMENT FORECAST FORECASTER: DAG

X WEATHER ALERTS: ** PHILADELPHIA ** (FROST RISK UPDATE)
50% RISK FOR FROST 03-07Z WED.

X FORECAST: ** PHILADELPHIA **
TUE : HI 36 . MOSTLY CLEAR. BREEZY.
TUE NITE: LO 30. CLEAR W/RISK FOR FROST EARLY; HIGH CLOUDS OVERNIGHT.
WED : HI 58 LO 41. SOME HIGH CLOUDS, BREEZY.
THU : HI 58 LO 40. HIGH CLOUDS DAY; MOSTLY CLOUDY OVERNIGHT.
FRI : HI 57 LO 46. MOSTLY CLOUDY.
SAT : HI 65 LO 37. PARTLY CLOUDY, WINDY. SHOWERS OVERNIGHT.

PF3=END PF8=NEXT <CLEAR>=EXIT
CMD: _____

PAGE 1 OF 2



FCMET Example (Gateway)

FCMETU CLOUMXF5 AUTOMATED FLIGHT CONTROL 05MAR02 19:44:25 UTC
AIRPORT: CYYC METEOROLOGY DEPARTMENT FORECAST FORECASTER: DAG

X WEATHER ALERTS: ** CALGARY ** (SNOW UPDATE)
AT 17Z TUES, YYC REPORTED VIS 1/2 MI IN SNOW. 5" OF NEW SNOW ON THE GROUND.
EXPECT VIS 1/2 TO 1.5 MI IN SNOW NOW-22Z. AN ADDITIONAL 1-2" ACCUM.

_ FORECAST: _____

PF3=END PF8=NEXT <CLEAR>=EXIT
CMD: _____



Hub Alerts Issued For:

- Any snow, freezing precipitation.
- Lightning.
- Wind gusts over 30 knots.
- Frost, frozen dew.
- Reduced visibility less than 3 miles, including dense fog.
- Risk of severe T-storms (hail, tornado, wind)

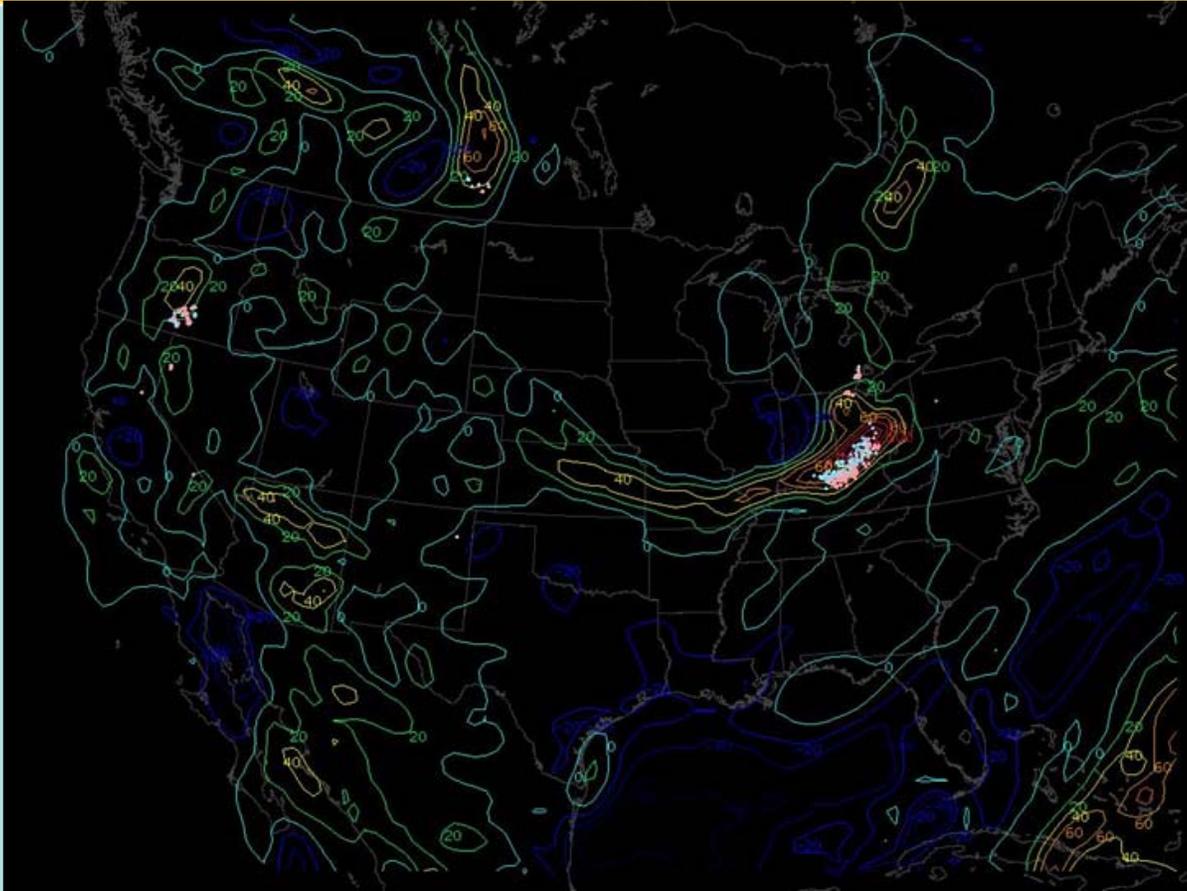


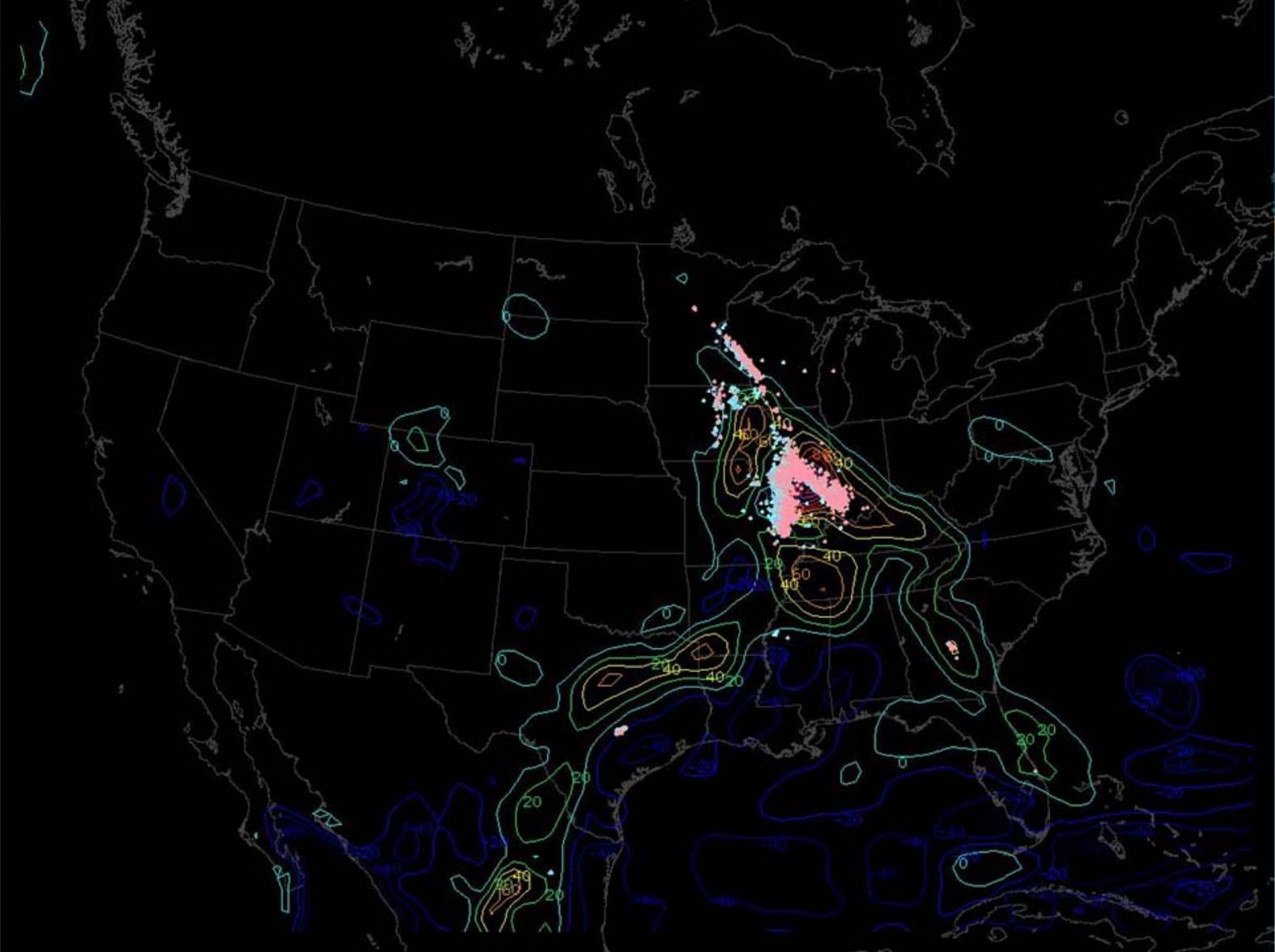
Gateway Alerts Issued For:

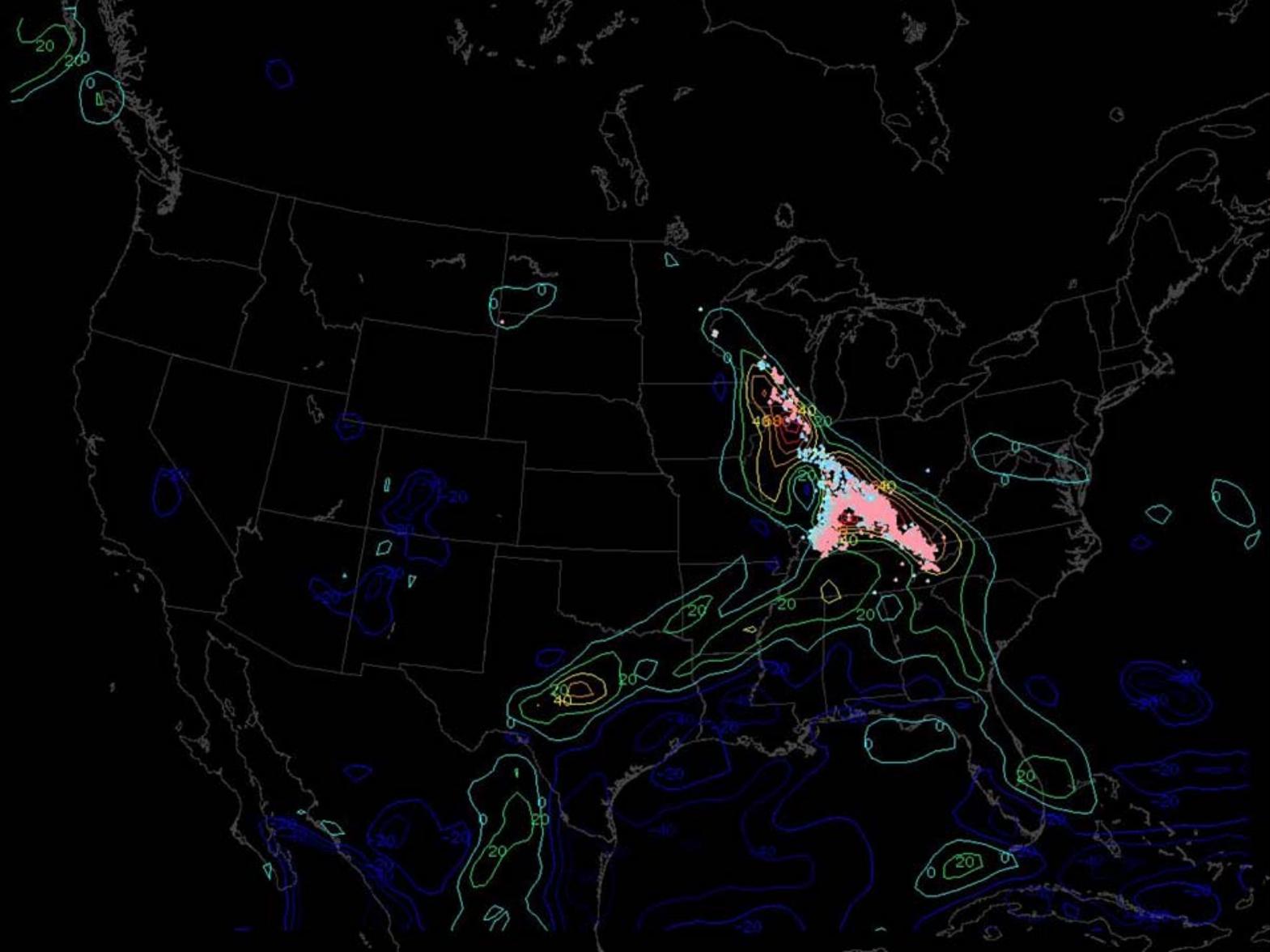
- Any Freezing Precipitation (Freezing Rain, Freezing Drizzle, Ice Pellets) - US/Canada only.
- Expected Snow Accumulation of 4” or more. US/Canada only.
- Tropical Storm/Hurricane/Typhoon - Worldwide.
- Visibility below landing minimums - US/Canada only

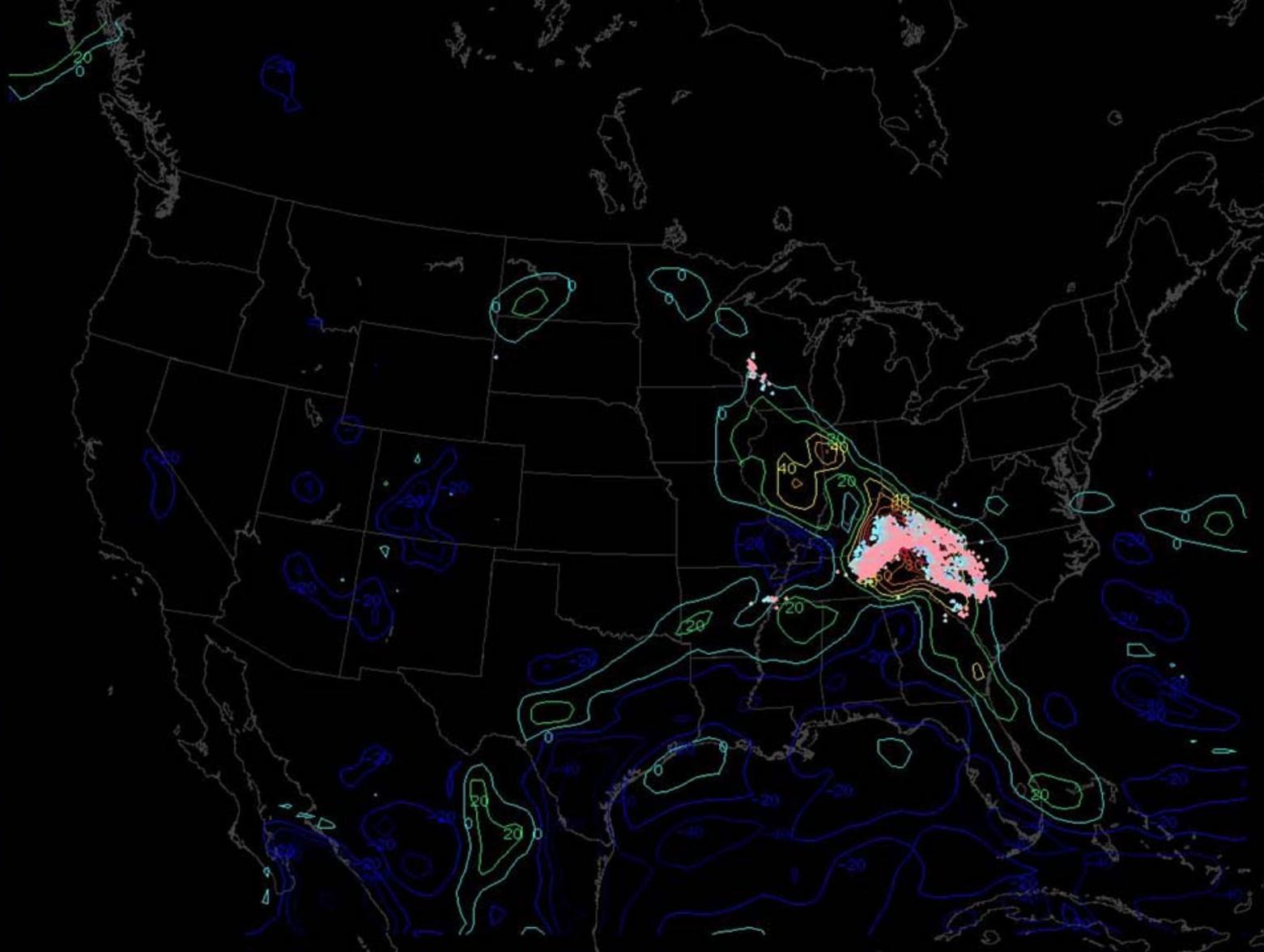


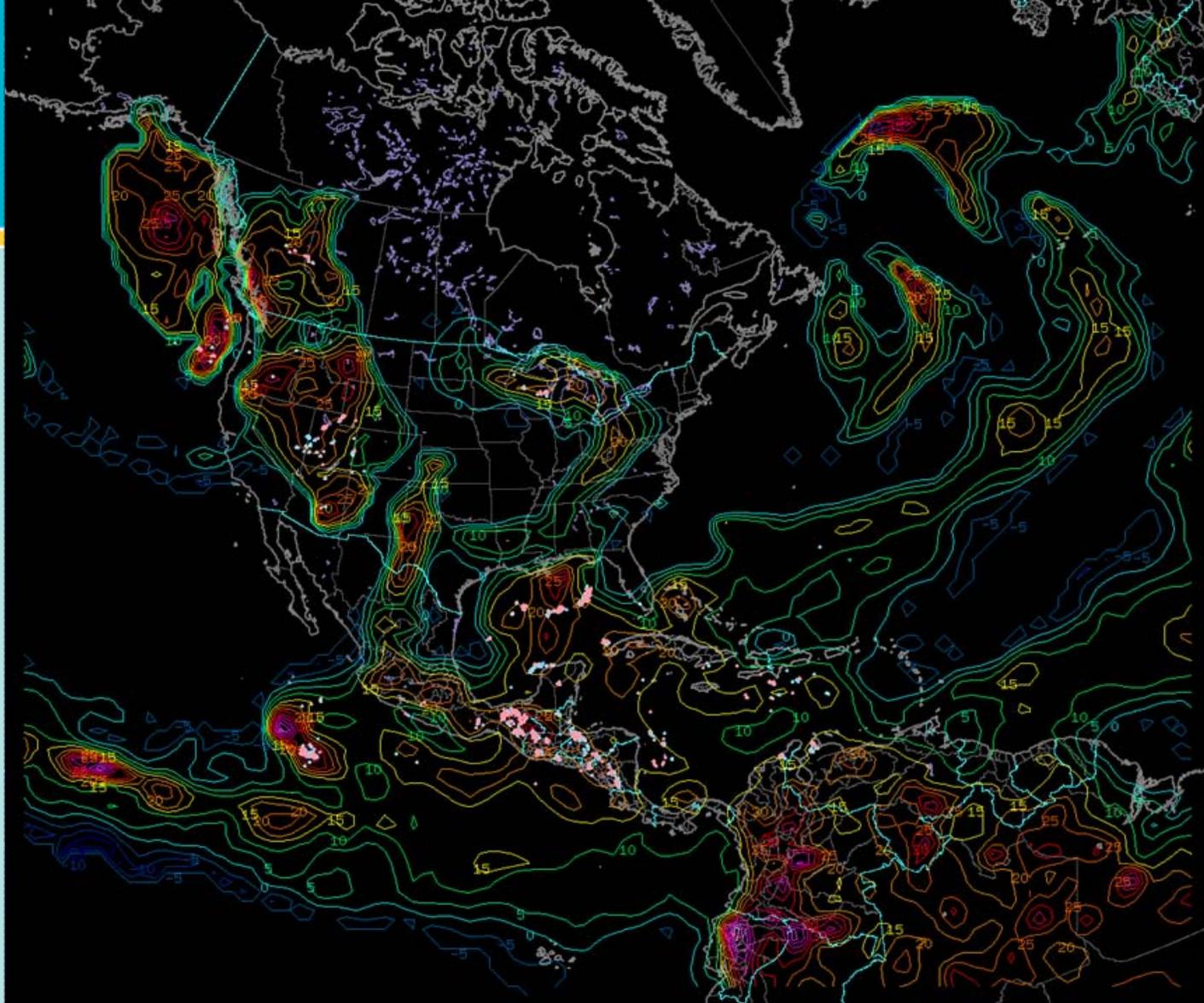
T-storm Index















Questions

