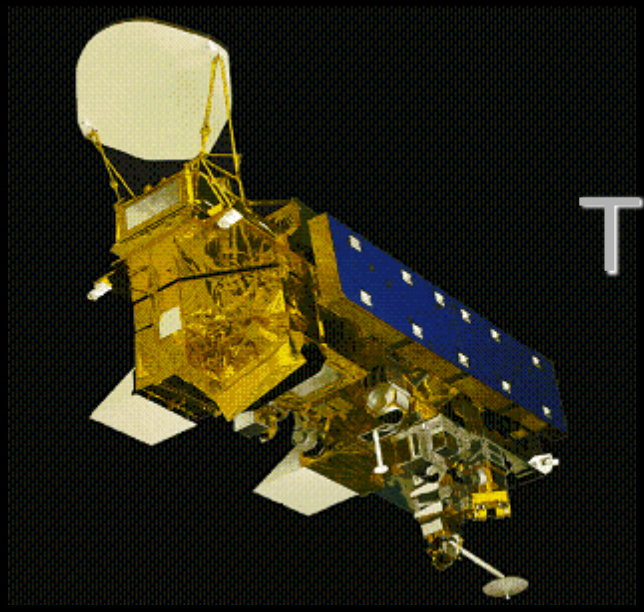


An Evaluation of Transitioning New Satellite Products to Operations, and Future Directions

Jordan Joel Gerth
Undergraduate Student and Project Support Scientist
Cooperative Institute for Meteorological Satellite Studies
Space Science and Engineering Center
University of Wisconsin – Madison, WI

NWA Session 5B
October 14, 2008

CIMSS

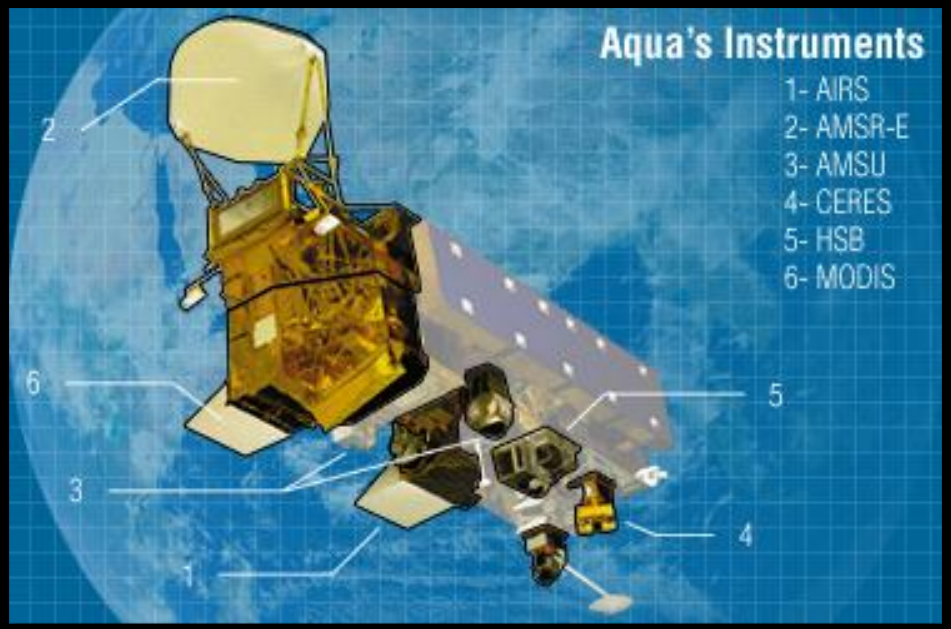
The CIMSS Team

- **Robert Aune (NESDIS)** – Numerical Weather Prediction
- **Scott Bachmeier** – CIMSS Satellite Blog and VISIT
- **Kaba Bah** – GOES-R Proving Ground and Weather Event Simulator
- **Kris Bedka** – Aviation Applications and Convective Initiation
- **Russ Dengel** – Product Creation and Processing
- **Wayne Feltz** – GOES-R Proving Ground and Aviation Applications
- **Scott Lindstrom** – VISIT
- **Jerry Robaidek** – Product Distribution
- **Tim Schmit (NESDIS)** – GOES-R Proving Ground and Weather Event Simulator
- **Kathy Strabala** – MODIS
- **Gary Wade (NESDIS)** – GOES Sounder Evaluation

MODIS

MODerate resolution Imaging Spectroradiometer

- Terra/Aqua satellites
- 36 spectral bands
- Visible and InfraRed
- 250 / 500 / 1000 m spatial resolution

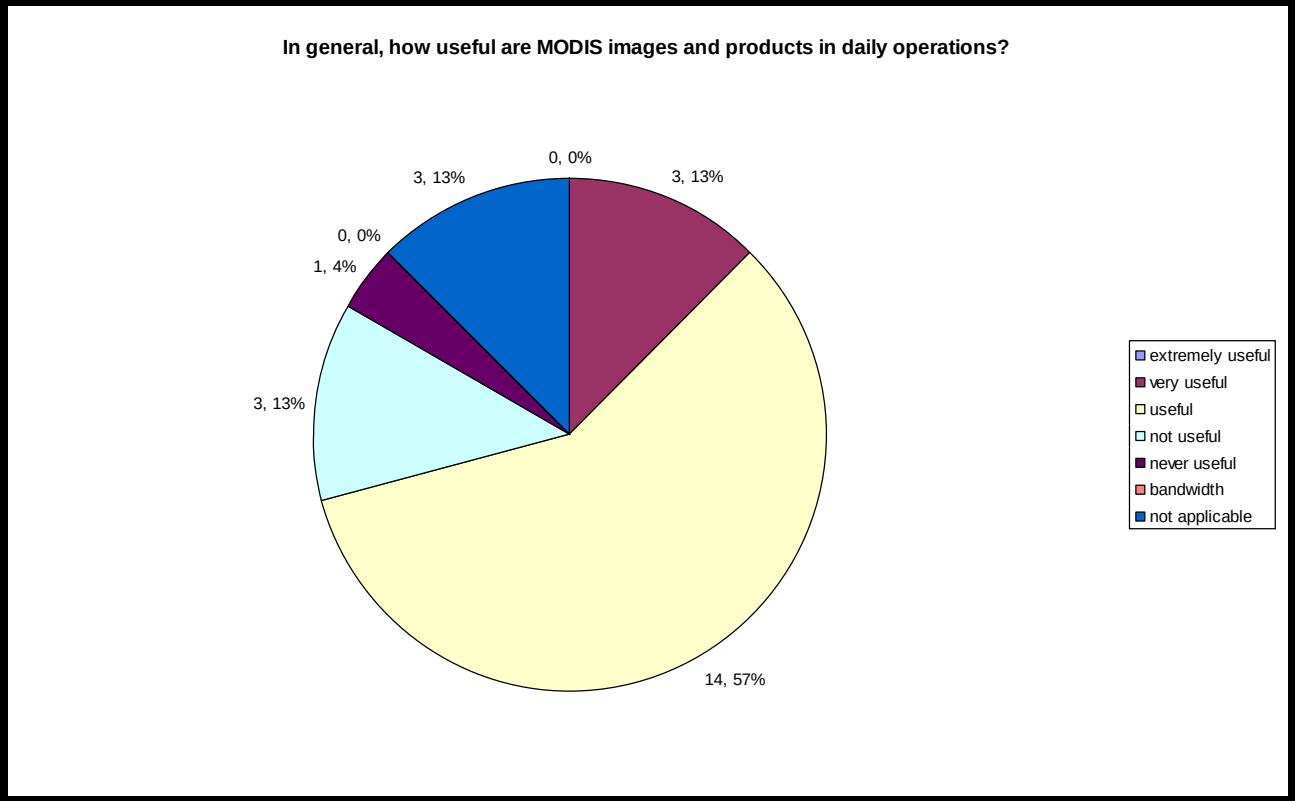


MODIS

MODerate resolution Imaging Spectroradiometer

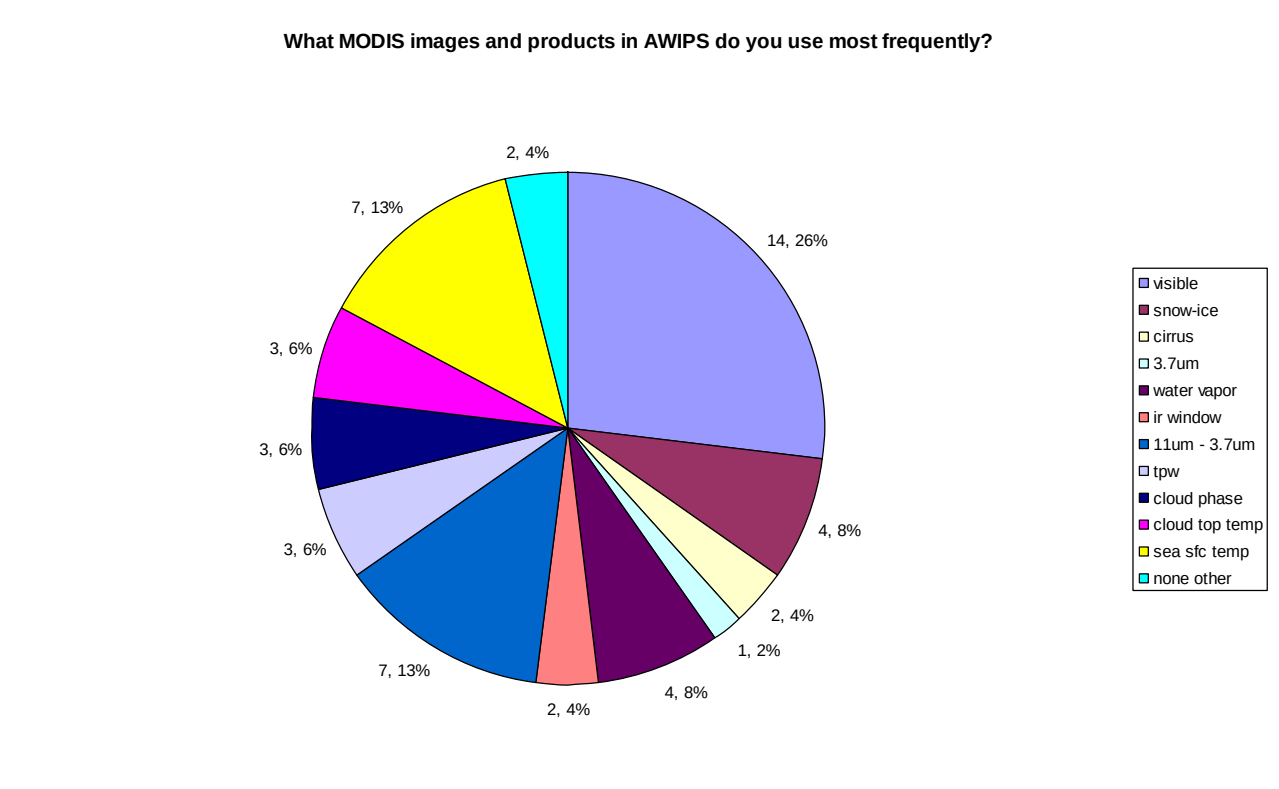
Primary Use	Band	Bandwidth[1]
Land/Cloud/Aerosols Boundaries	1	620 - 670
	2	841 - 876
Land/Cloud/Aerosols Properties	3	459 - 479
	4	545 - 565
	5	1230 - 1250
	6	1628 - 1652
	7	2105 - 2155
Ocean Color/ Phytoplankton/ Biogeochemistry	8	405 - 420
	9	438 - 448
	10	483 - 493
	11	526 - 536
	12	546 - 556
	13	662 - 672
	14	673 - 683
	15	743 - 753
	16	862 - 877
Atmospheric Water Vapor	17	890 - 920
	18	931 - 941
	19	915 - 965

Primary Use	Band	Bandwidth[1]
Surface/Cloud Temperature	20	3.660 - 3.840
	21	3.929 - 3.989
	22	3.929 - 3.989
	23	4.020 - 4.080
Atmospheric Temperature	24	4.433 - 4.498
	25	4.482 - 4.549
Cirrus Clouds Water Vapor	26	1.360 - 1.390
	27	6.535 - 6.895
	28	7.175 - 7.475
Cloud Properties	29	8.400 - 8.700
Ozone	30	9.580 - 9.880
Surface/Cloud Temperature	31	10.780 - 11.280
	32	11.770 - 12.270
Cloud Top Altitude	33	13.185 - 13.485
	34	13.485 - 13.785
	35	13.785 - 14.085
	36	14.085 - 14.385



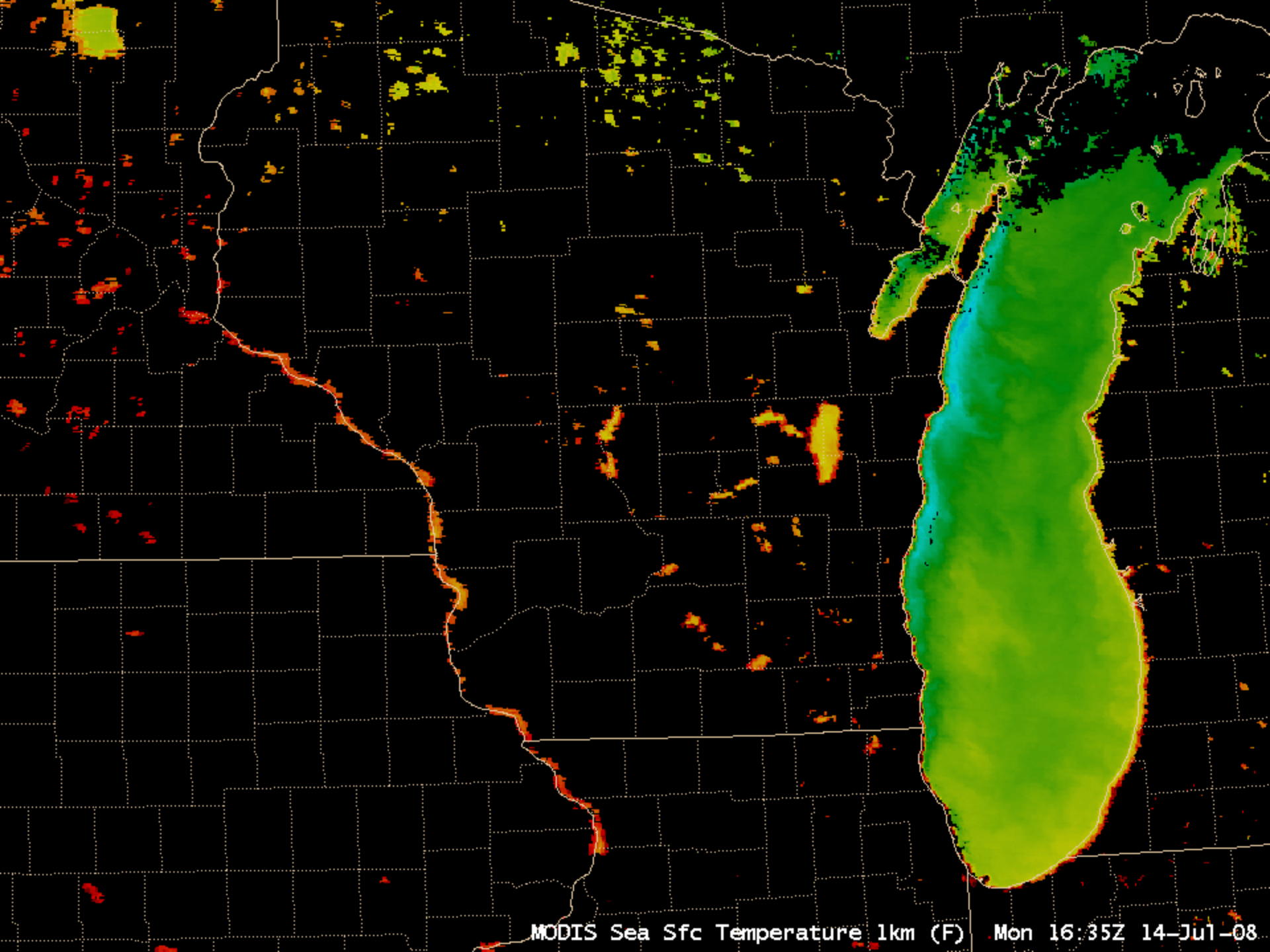
"I love the MODIS product but I only get one picture PER SHIFT which really doesn't make it totally useful. I wish we could get MODIS pictures at least every 30 minutes, but every 15 would be excellent."

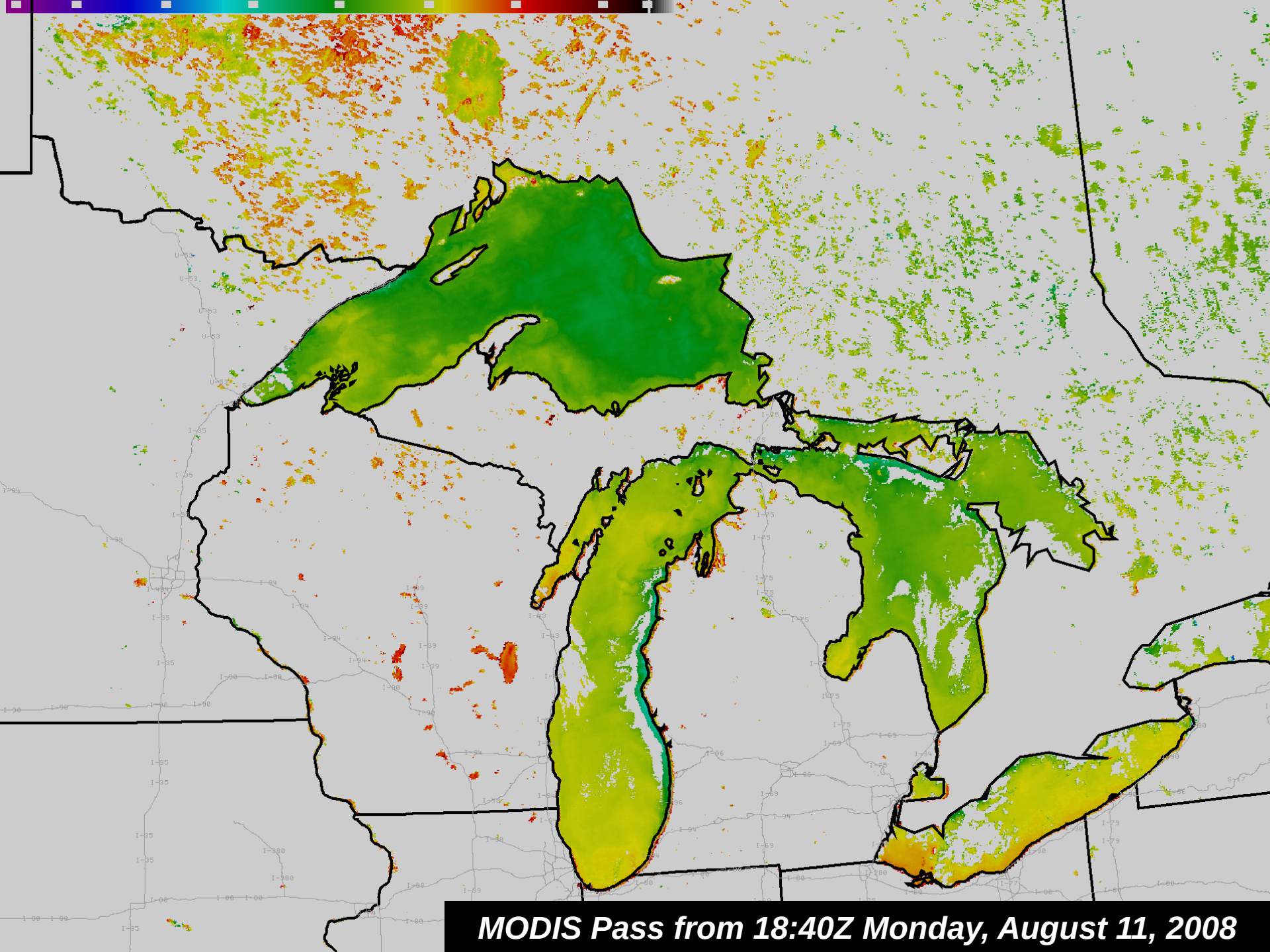
From National Weather Service Forecast Office in Indianapolis, Indiana

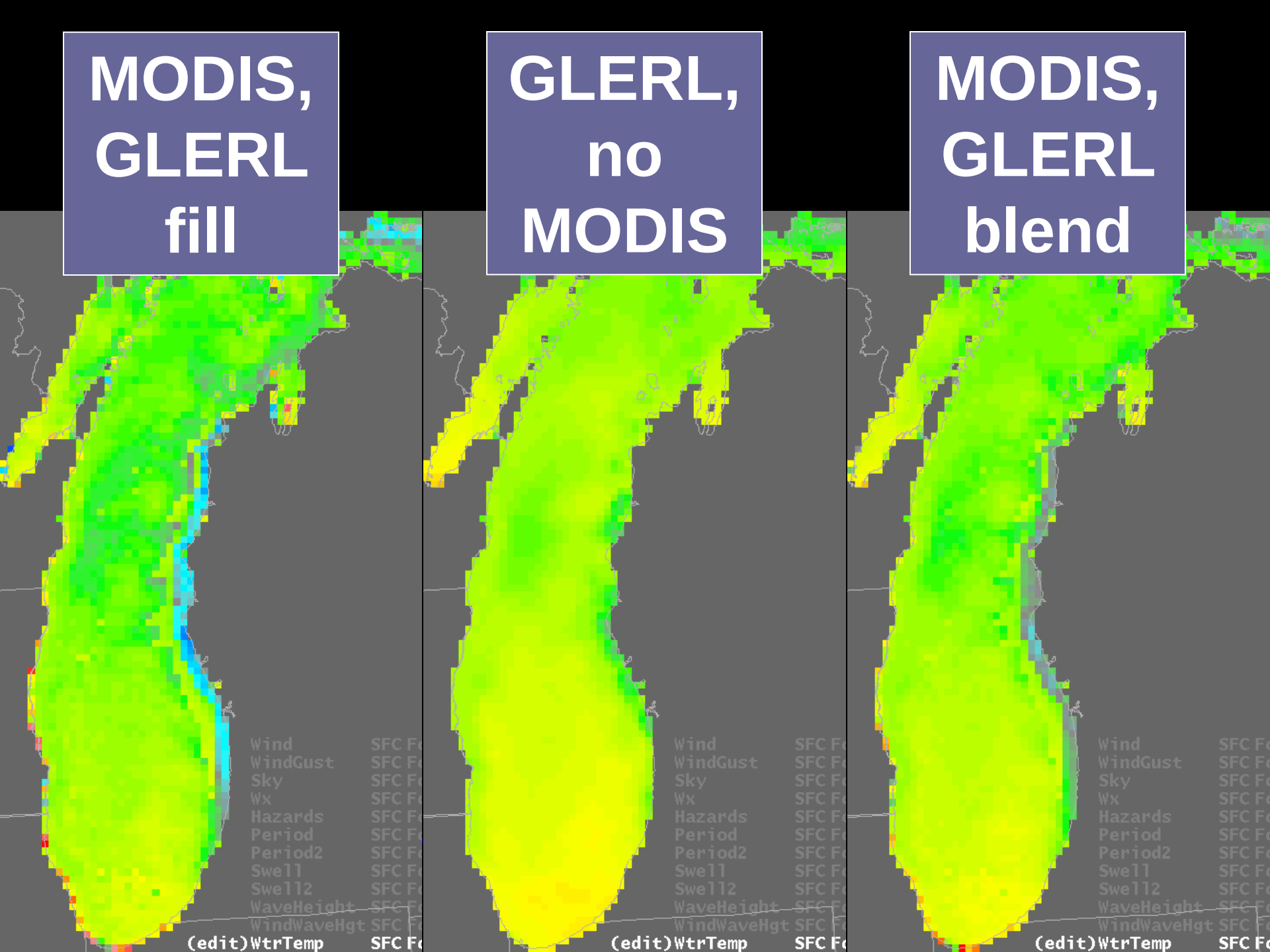


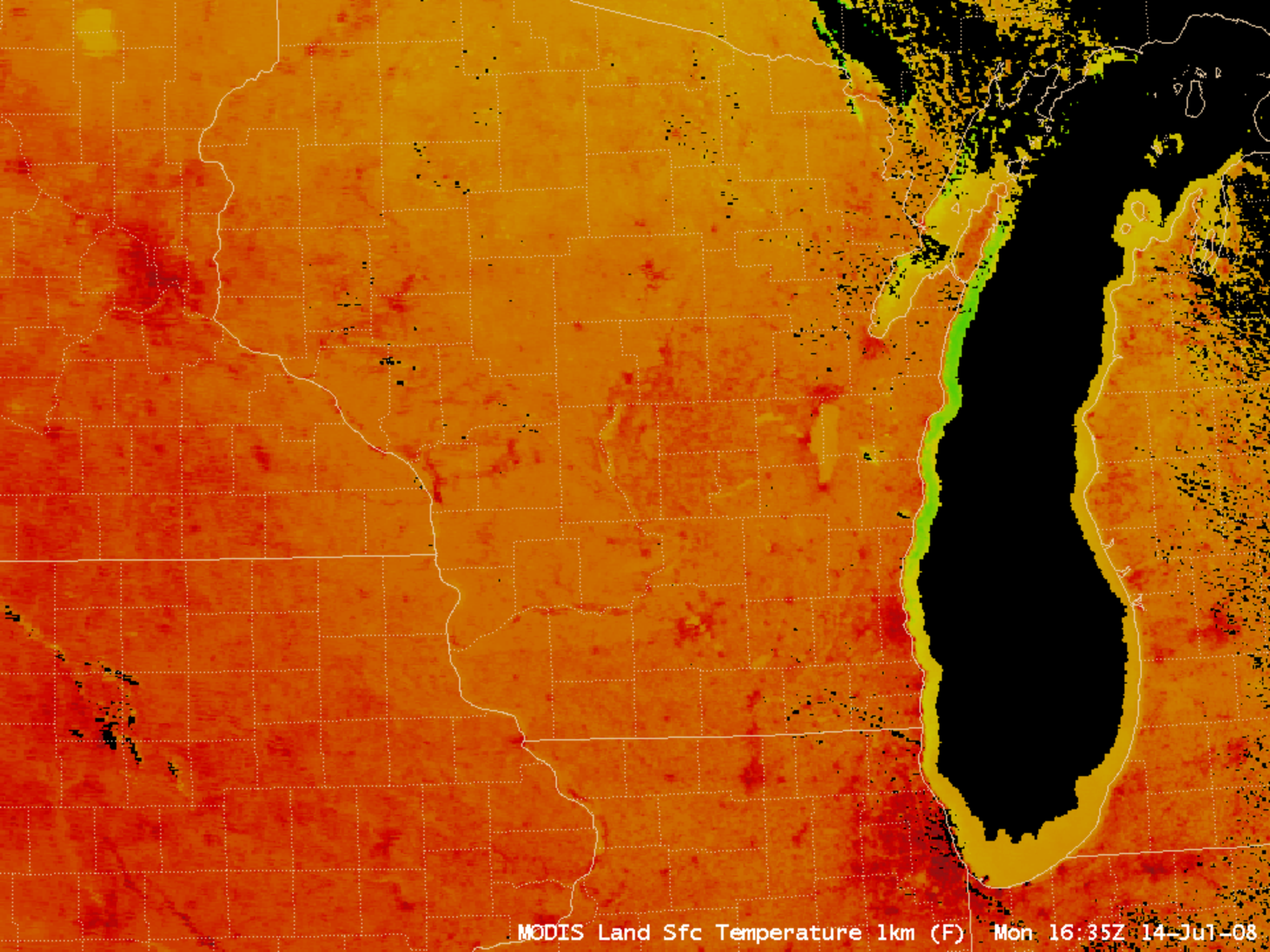
"This is a great dataset for WFO Operations. We would love to continue to see more and more data get into AWIPS. The Fog product I have found to be especially useful, as well as the Snow/Ice Band 7. Great stuff!"

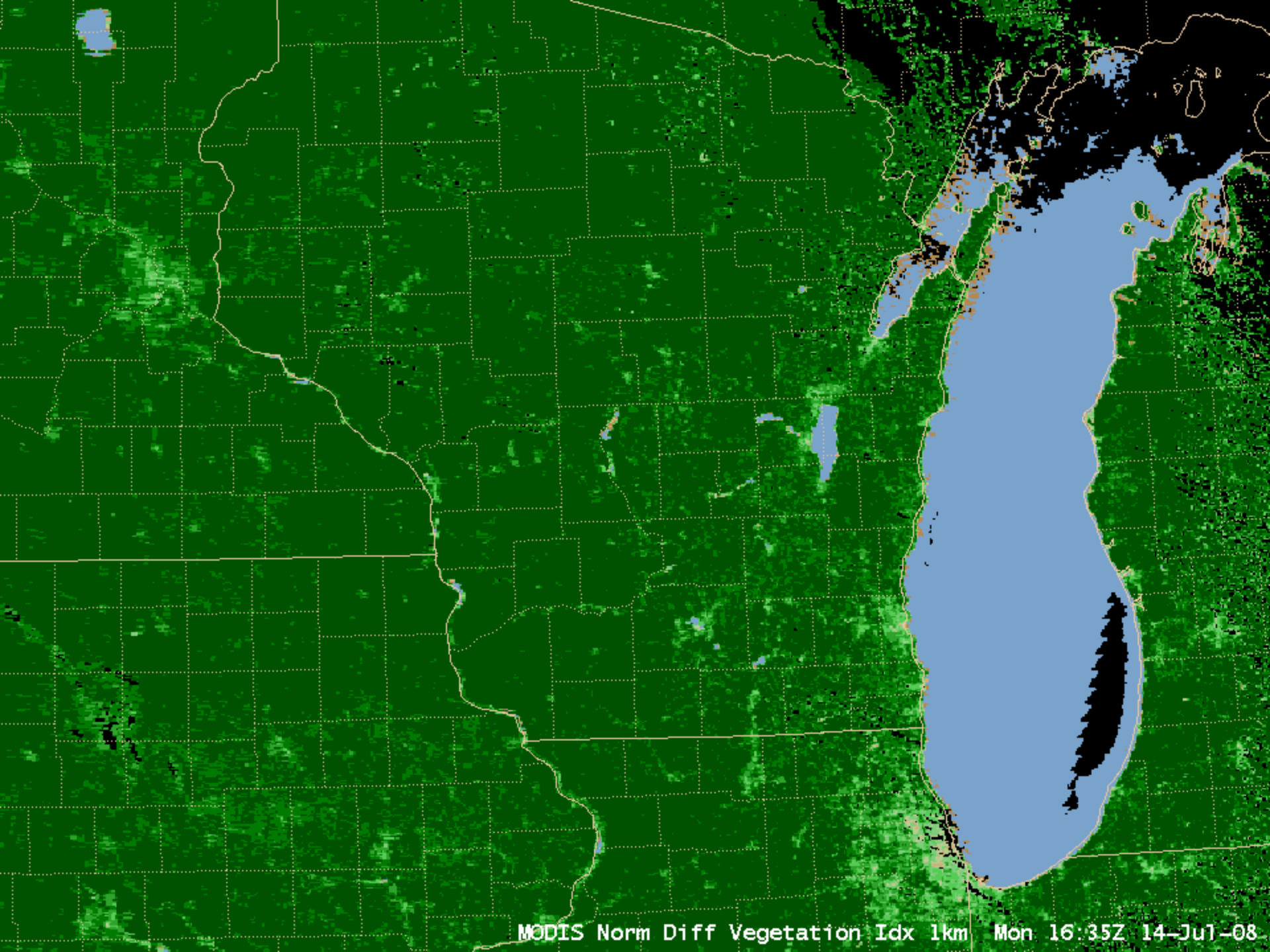
From National Weather Service Forecast Office in La Crosse, Wisconsin

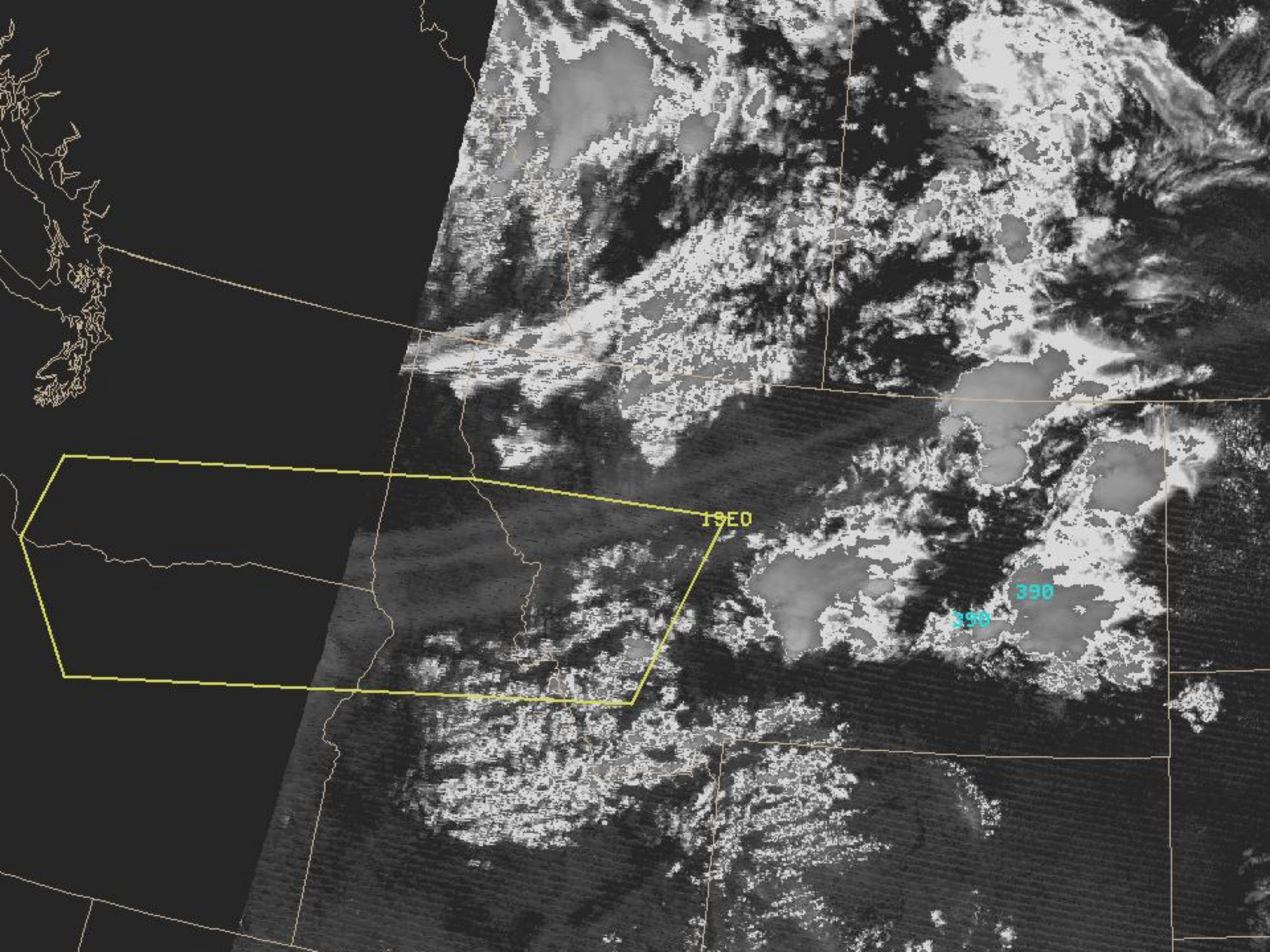

MODIS Sea Sfc Temperature 1km (F) Mon 16:35Z 14-Jul-08


MODIS Pass from 18:40Z Monday, August 11, 2008

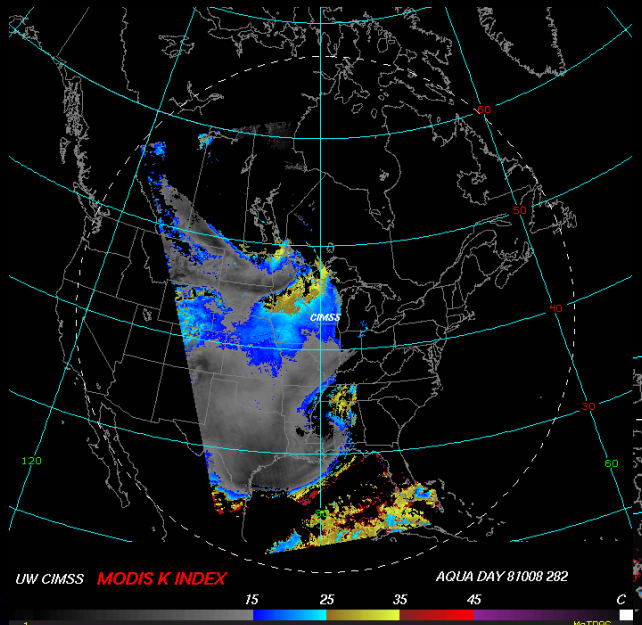

MODIS, GLERL fill
GLERL, no MODIS
MODIS, GLERL blend
Wind
WindGust
Sky
Wx
Hazards
Period
Period2
Swell
Swell2
WaveHeight
WindWaveHgt
(edit)WtrTemp

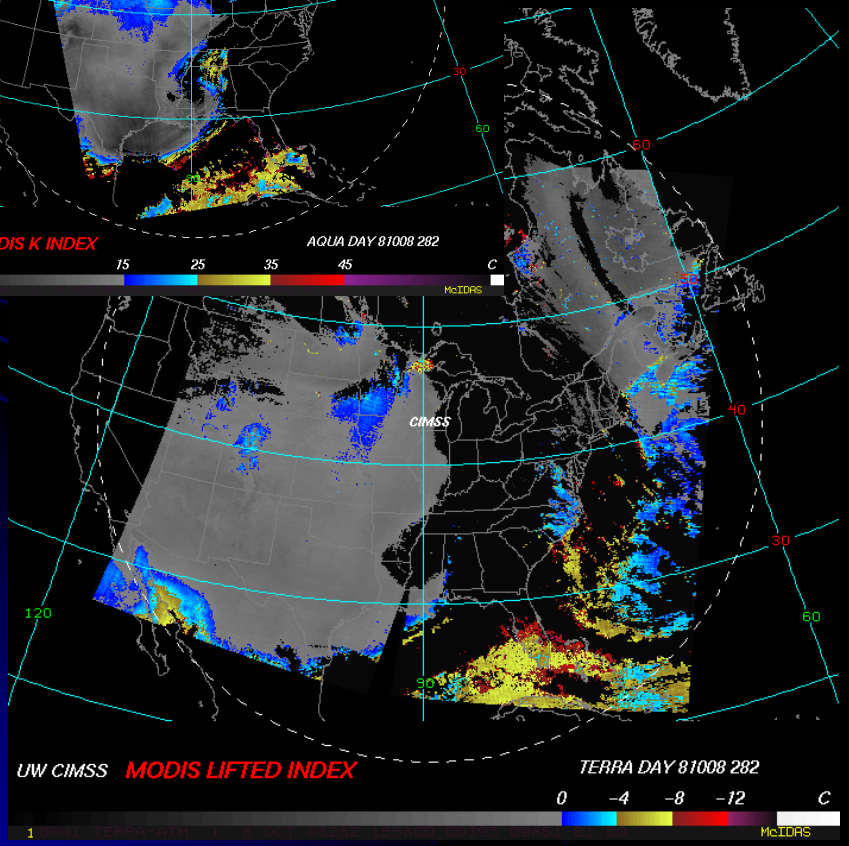

MODIS Land Sfc Temperature 1km (F) Mon 16:35Z 14-Jul-08

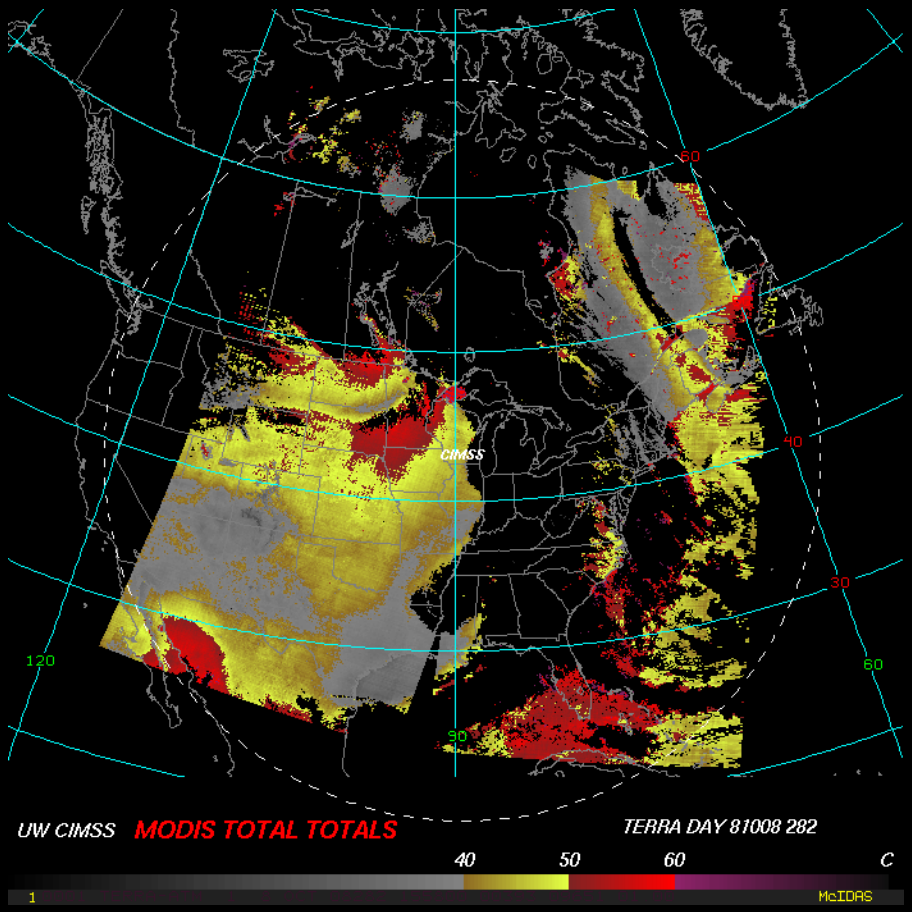

MODIS Norm Diff Vegetation Idx 1km Mon 16:35Z 14-Jul-08


19E0
390
390

Proposed and in Development







Involved Weather Forecast Offices

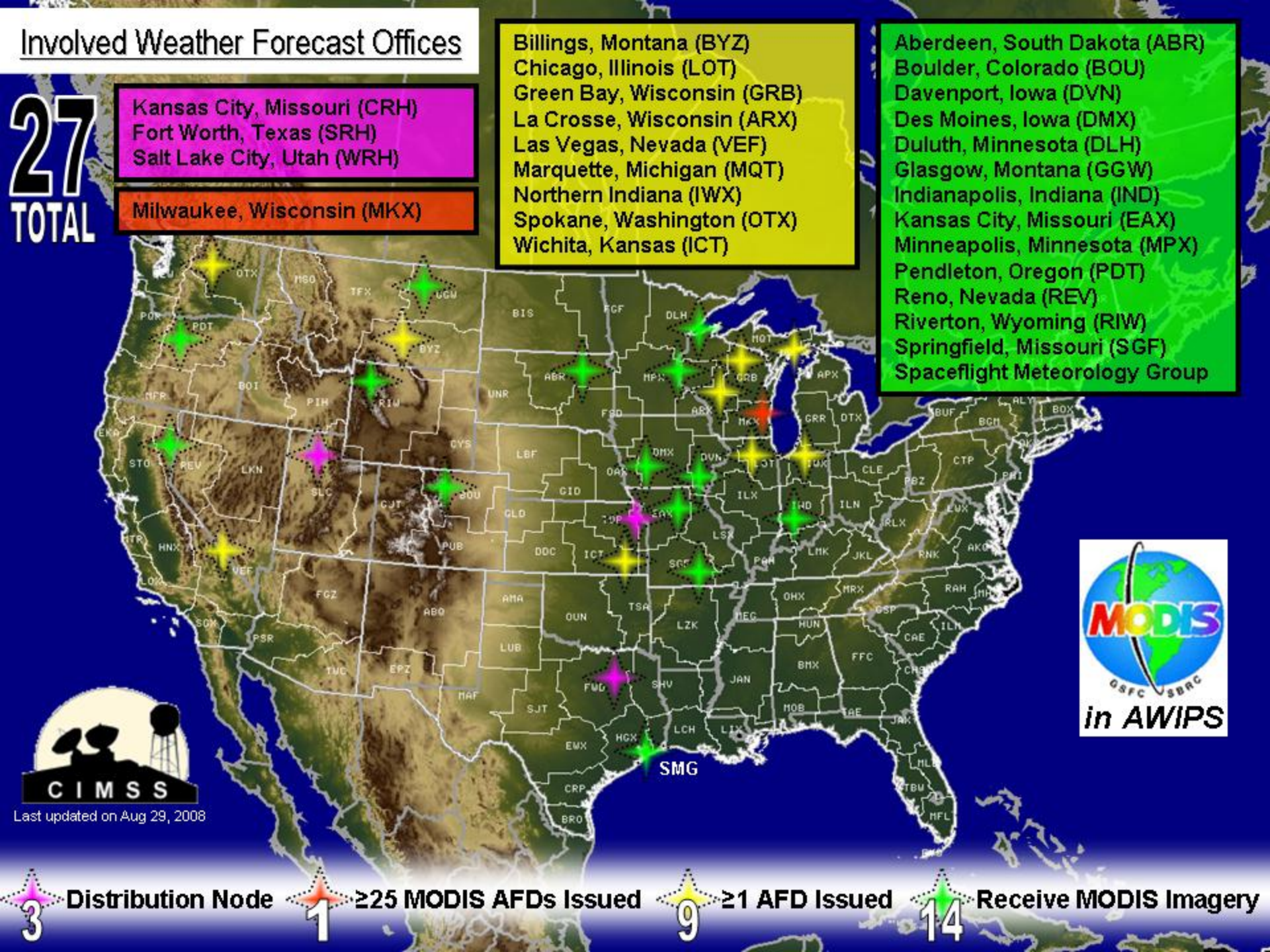
27 TOTAL

Kansas City, Missouri (CRH)
Fort Worth, Texas (SRH)
Salt Lake City, Utah (WRH)

Milwaukee, Wisconsin (MKX)

Billings, Montana (BYZ)
Chicago, Illinois (LOT)
Green Bay, Wisconsin (GRB)
La Crosse, Wisconsin (ARX)
Las Vegas, Nevada (VEF)
Marquette, Michigan (MQT)
Northern Indiana (IWX)
Spokane, Washington (OTX)
Wichita, Kansas (ICT)

Aberdeen, South Dakota (ABR)
Boulder, Colorado (BOU)
Davenport, Iowa (DVN)
Des Moines, Iowa (DMX)
Duluth, Minnesota (DLH)
Glasgow, Montana (GGW)
Indianapolis, Indiana (IND)
Kansas City, Missouri (EAX)
Minneapolis, Minnesota (MPX)
Pendleton, Oregon (PDT)
Reno, Nevada (REV)
Riverton, Wyoming (RIW)
Springfield, Missouri (SGF)
Spaceflight Meteorology Group



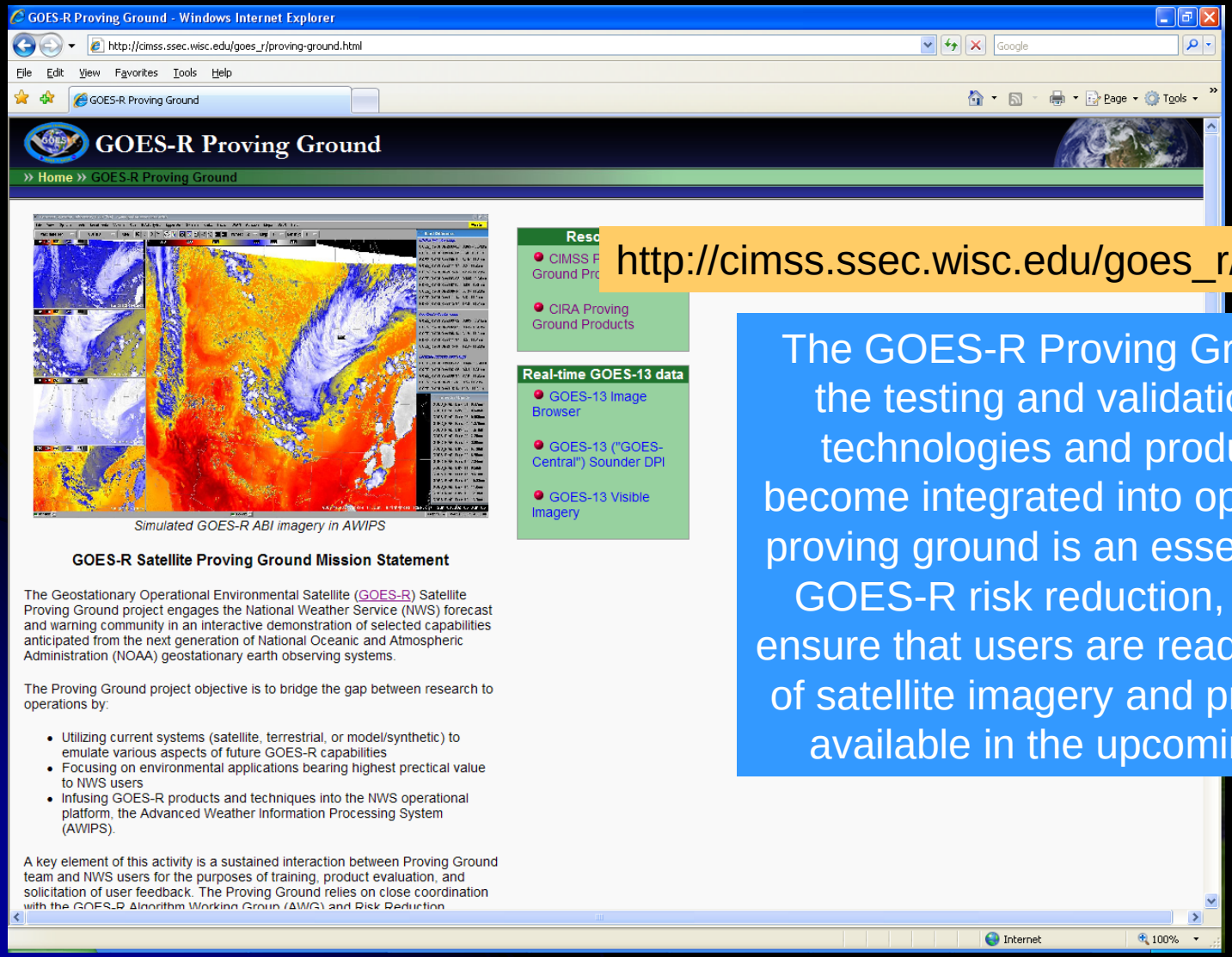
CIMSS

Last updated on Aug 29, 2008

MODIS GSFC SBRC in AWIPS

3 Distribution Node
1 ≥25 MODIS AFDs Issued
9 ≥1 AFD Issued
14 Receive MODIS Imagery

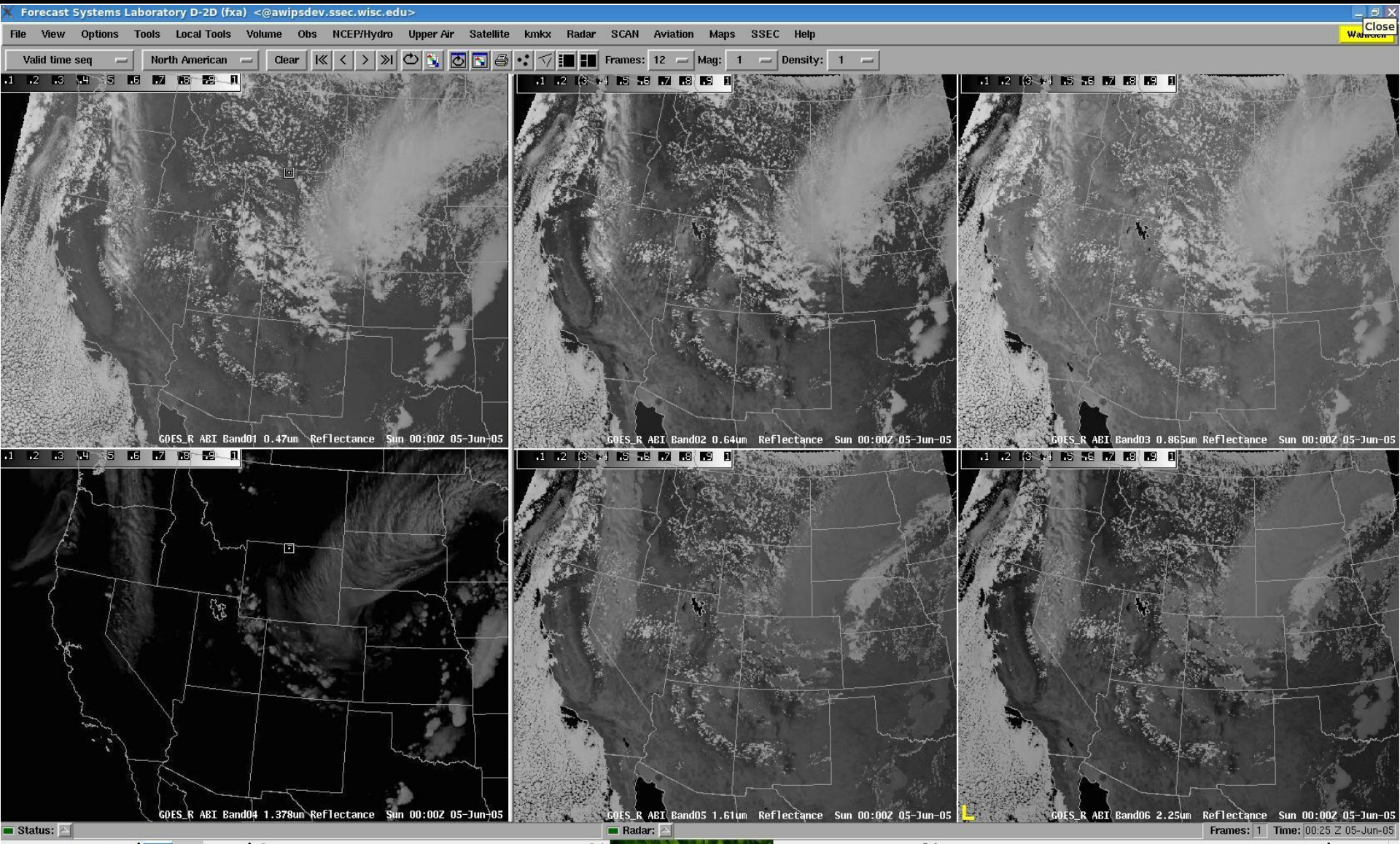
GOES-R Proving Ground



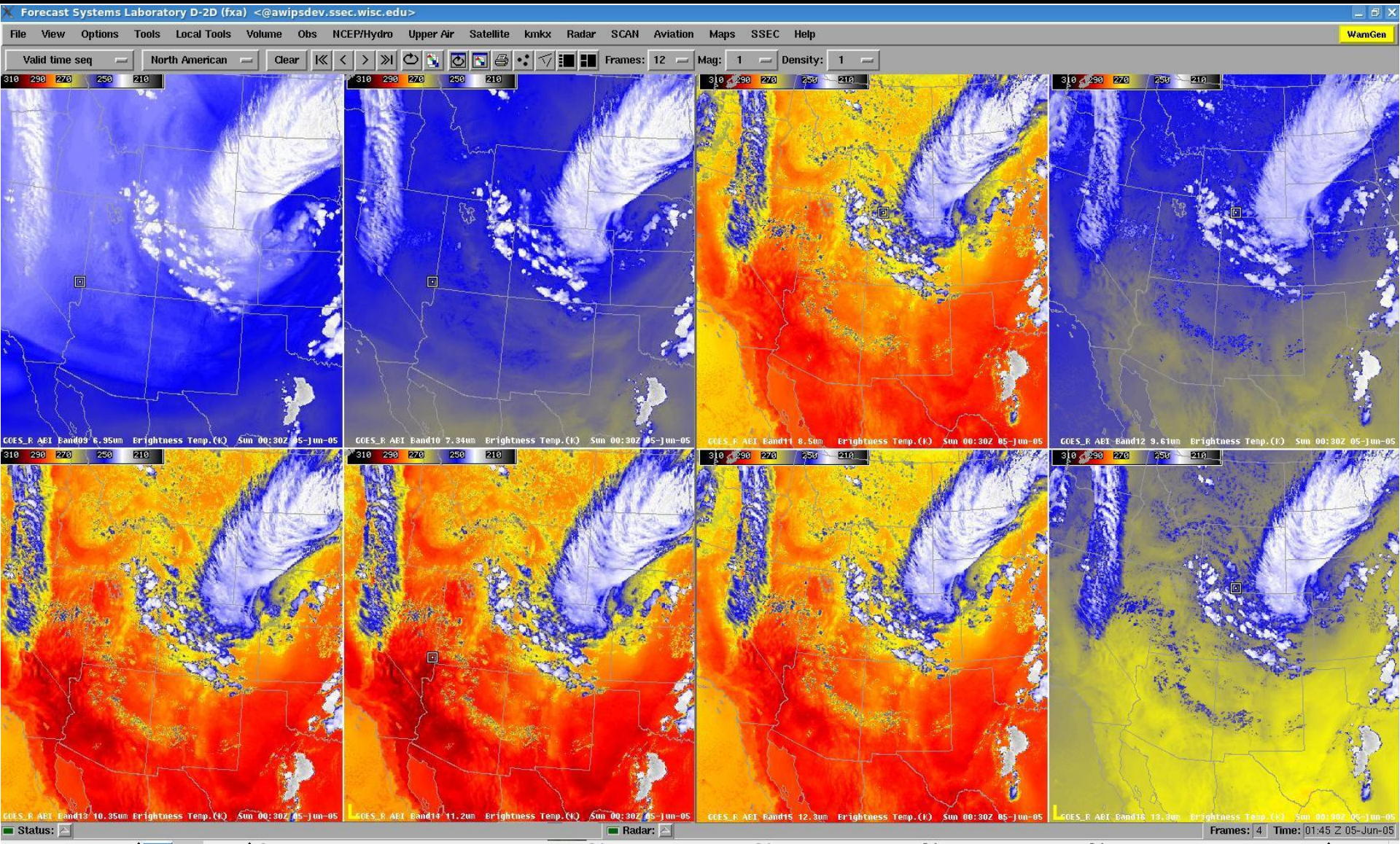
http://cimss.ssec.wisc.edu/goes_r/proving-ground.html

The GOES-R Proving Ground will facilitate the testing and validation of new ideas, technologies and products before they become integrated into operational use. This proving ground is an essential component of GOES-R risk reduction, which will help to ensure that users are ready for the new types of satellite imagery and products that will be available in the upcoming GOES-R era.

Sample Visible and Near-IR Bands
of the Advanced Baseline Imager in AWIPS



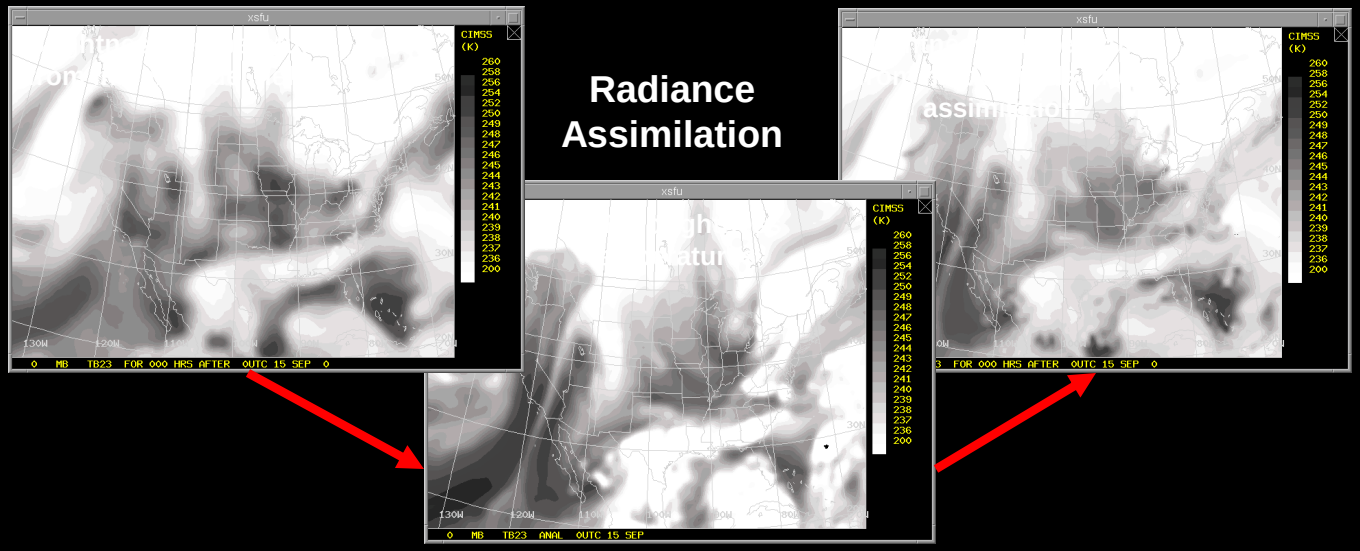
Sample IR Bands of the Advanced Baseline Imager in AWIPS

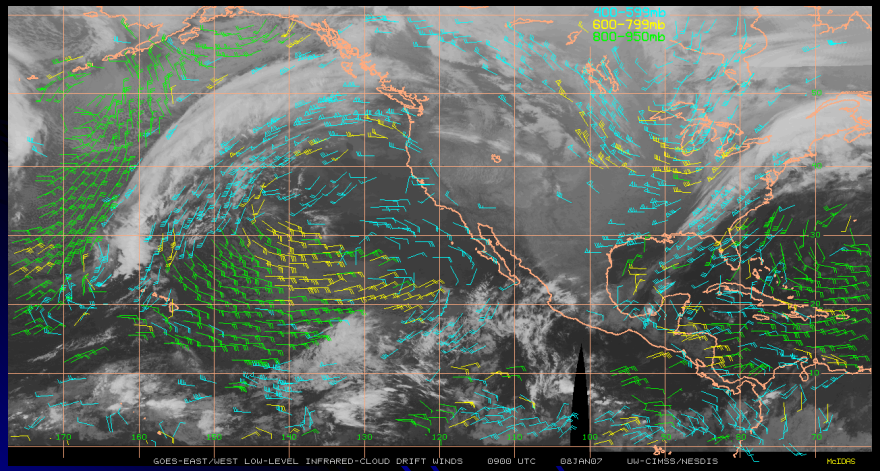


Information Extracted from Satellites

Radiances

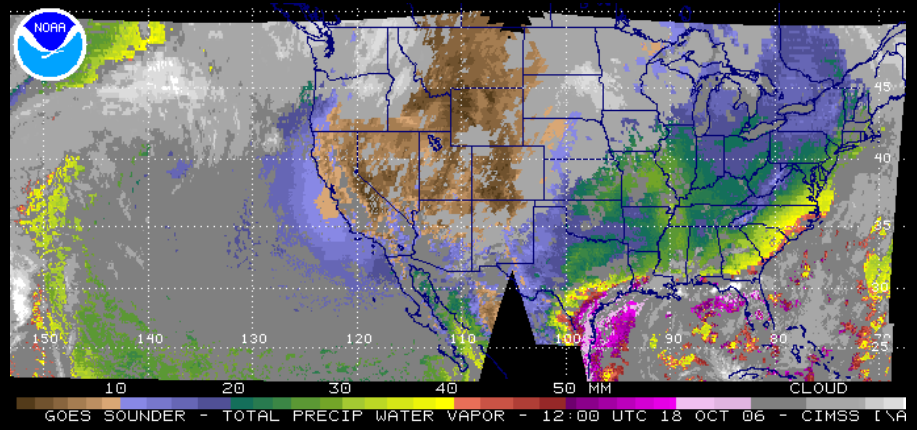
- Direct assimilation (3Dvar)
- Requires knowledge of errors
- Scale dependence
- Surface type restrictions





Motion

- Cloud track, bright temperature
- Geo and Polar
- Height assignment errors
- Radiance tracking (4Dvar)

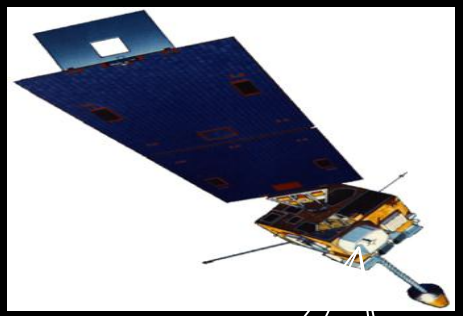


Retrieved parameters

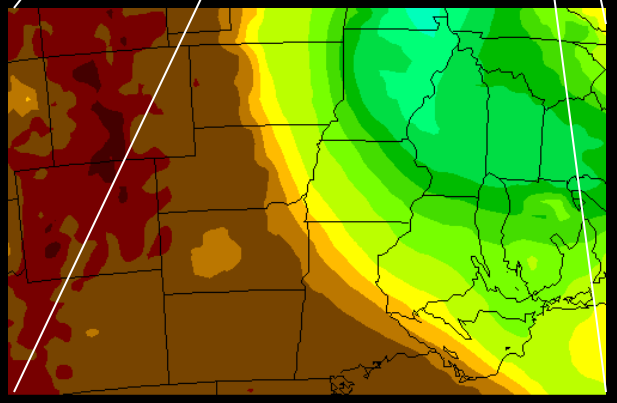
- Dependent variable assimilation (1,3Dvar)
- Requires knowledge of ***retrieval errors***
- Physical accuracy, non-linearity
- Bypass surface type restrictions

CIMSS Regional Assimilation System

CRAS

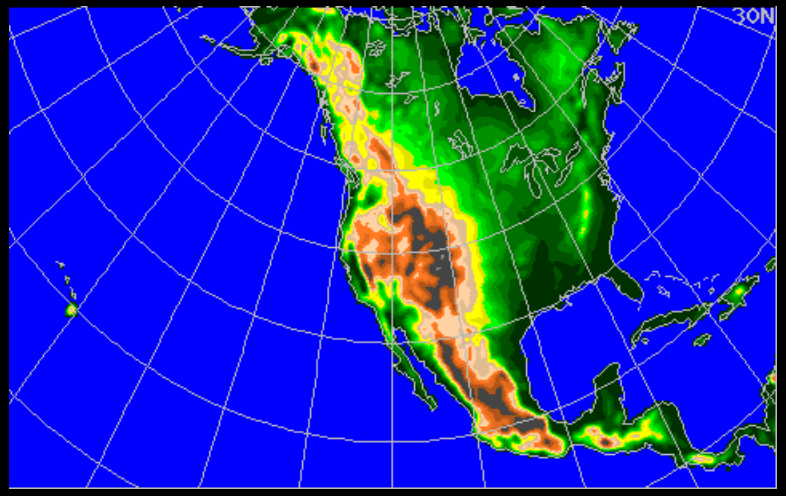


The Cooperative Institute for Meteorological Satellite Studies (CIMSS) uses the CIMSS Regional Assimilation System (CRAS) to assess the impact of space-based observations on numerical forecast accuracy.



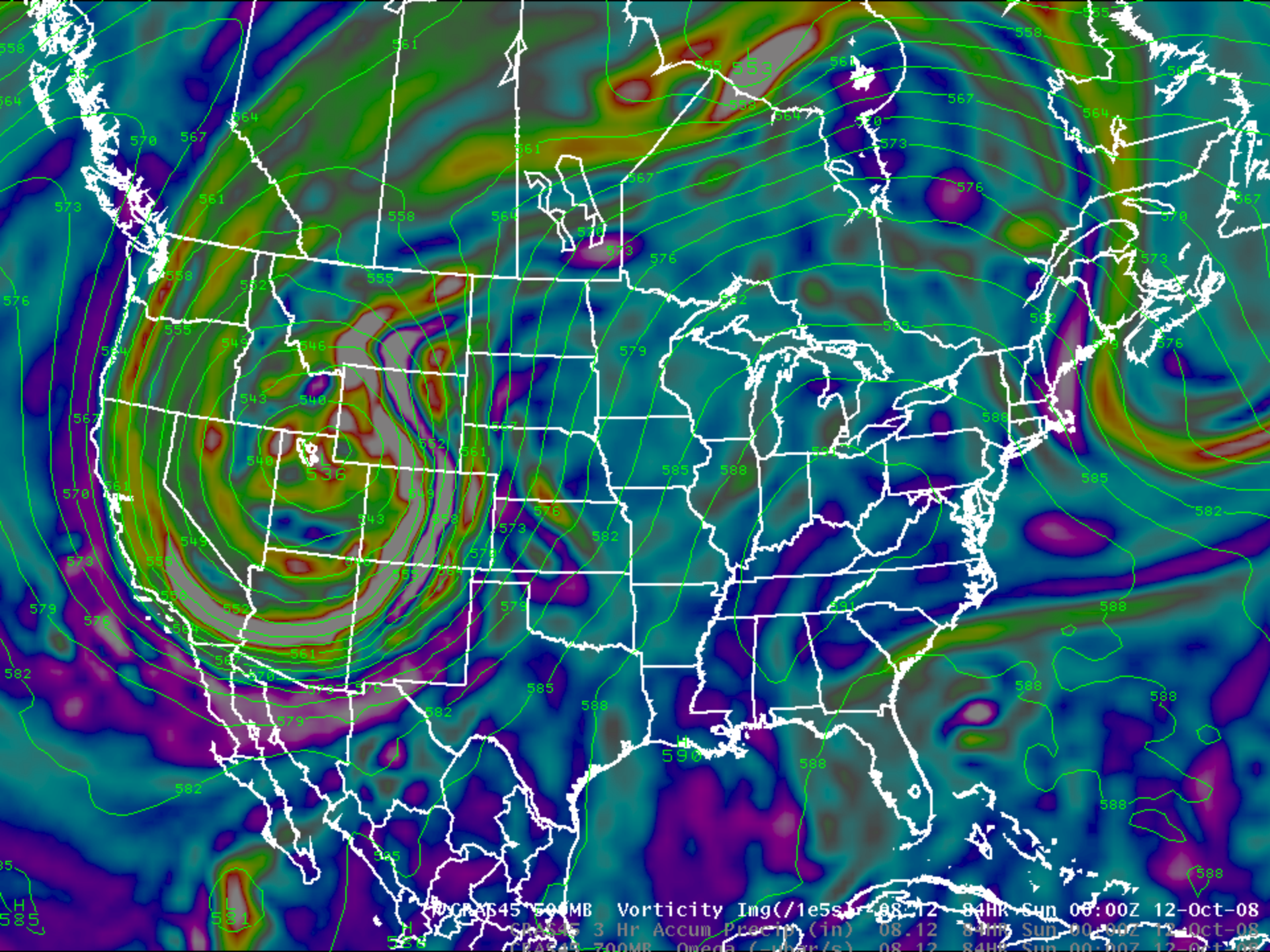
CRAS is unique in that, since 1996, it's development was guided by validating forecasts using information from GOES.

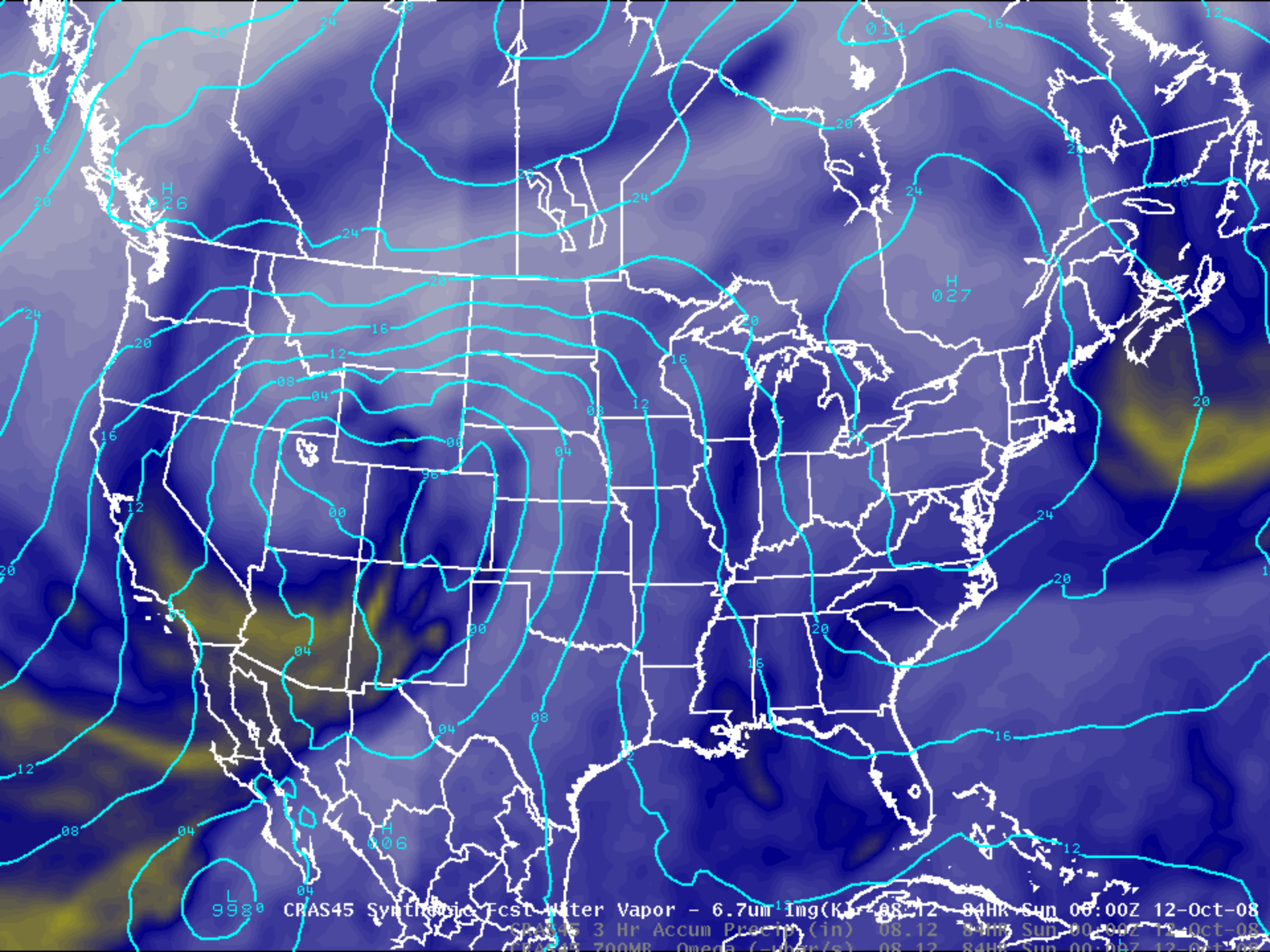
North America Configuration providing Forecast imagery for NWS AWIPS

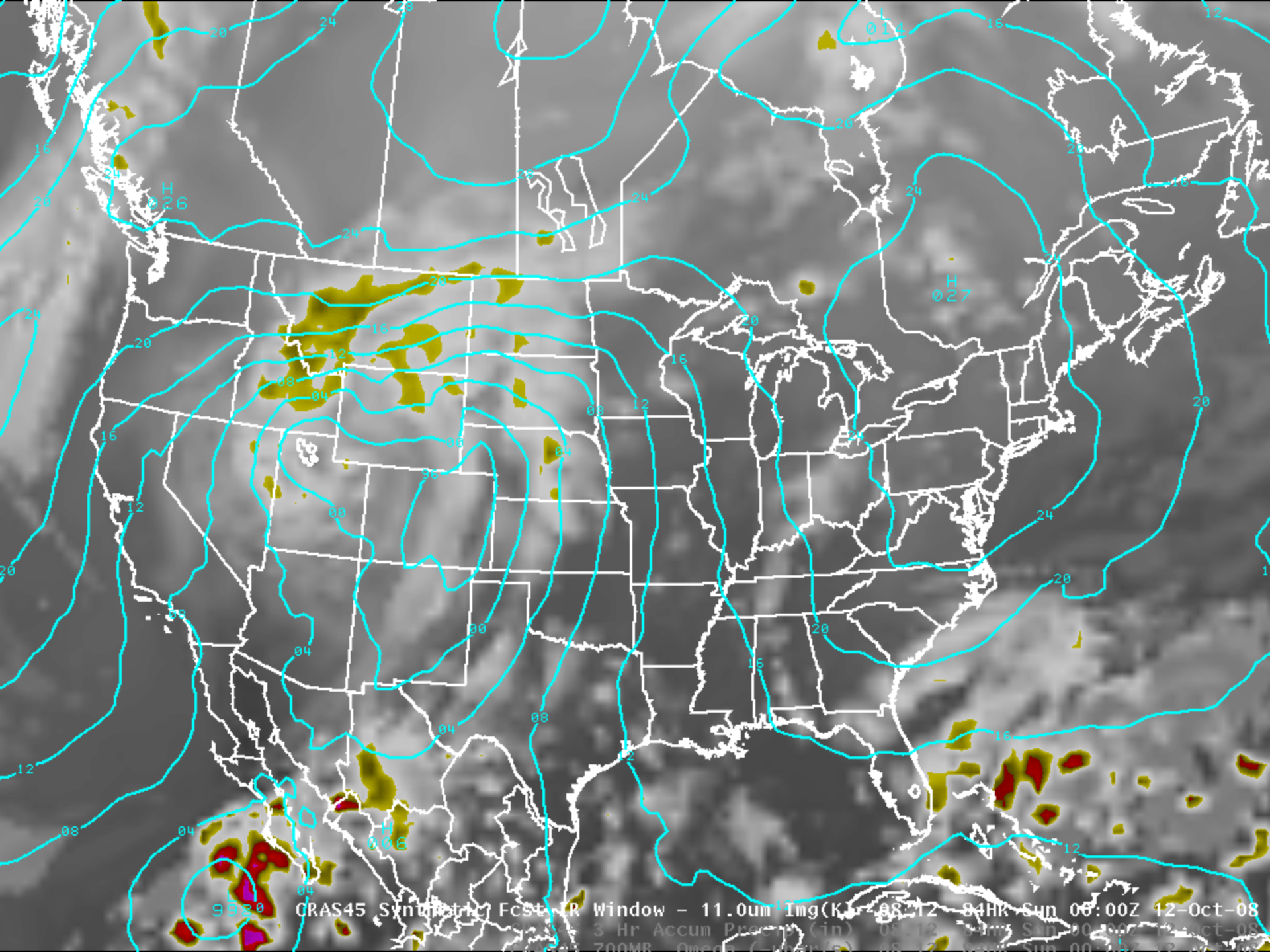


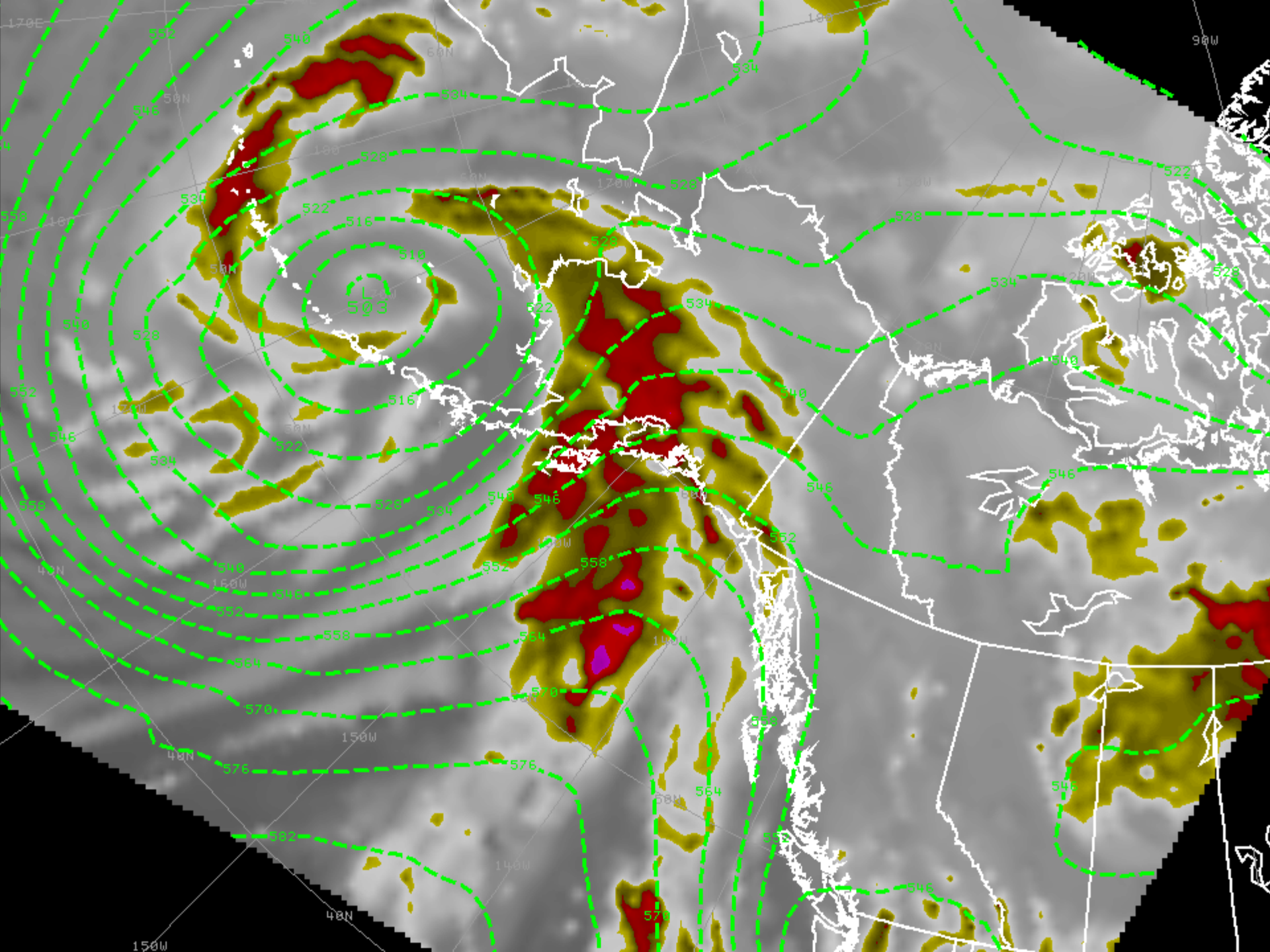
Resolution:	48 km
Sigma levels:	38
Grid Size	275x150
Time-step:	200 seconds
Forecast length:	84 hours
Initialization:	12-hr spin-up, five data inserts
Output:	3 hourly
Initial times (UTC):	00/12
Start times (UTC):	01:15/13:15
Initial conditions:	One degree GFS, 6 hr Forecast
Bndry conditions:	6 hourly, one degree GFS Forecasts
Input obs:	Surface, RAOBs GOES sounder 3-layer PW, cloud-top pressure
Verification:	RAOBs, Surface, GOES, MODIS

Note: Multiple high-resolution nests can be placed anywhere in the 48 km grid.


HPCGFS45 500MB Vorticity Img(/1e5s) 08.12 84HR Sun 00:00Z 12-Oct-08
SPCGFS45 3 Hr Accum Precip (in) 08.12 84HR Sun 00:00Z 12-Oct-08
TPCGFS45 700MB Omega (-ubar/s) 08.12 84HR Sun 00:00Z 12-Oct-08


CRAS45 Synthetic Fcst Water Vapor - 6.7um Img(K) 08.12 84HR Sun 00:00Z 12-Oct-08
CRAS45 3 Hr Accum Precip (in) 08.12 84HR Sun 00:00Z 12-Oct-08
CRAS45 700MB Omega (-ubar/s) 08.12 84HR Sun 00:00Z 12-Oct-08


CRAS45 Synthetic Fcst IR Window - 11.0um Img(K) 48 12 84HR Sun 00:00Z 12-Oct-08
3 Hr Accum Prec (in) 08 12 Sun 00:00Z 12-Oct-08
700MB Omeg (-ub/s) 08 12 Sun 00:00Z 12-Oct-08


170E
160W
150W
140W
130W
120W
110W
100W
90W
60N
50N
40N
30N
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570
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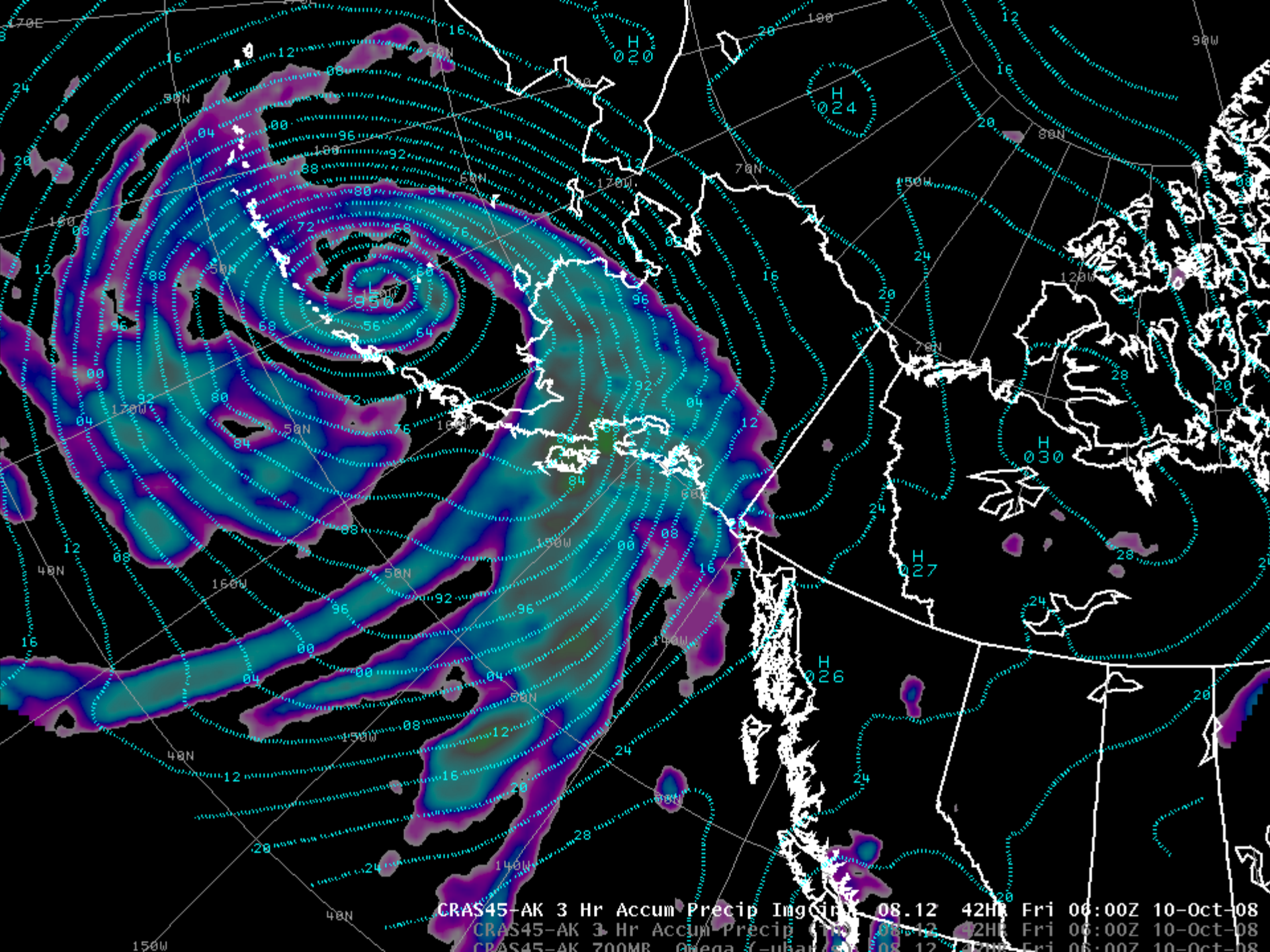
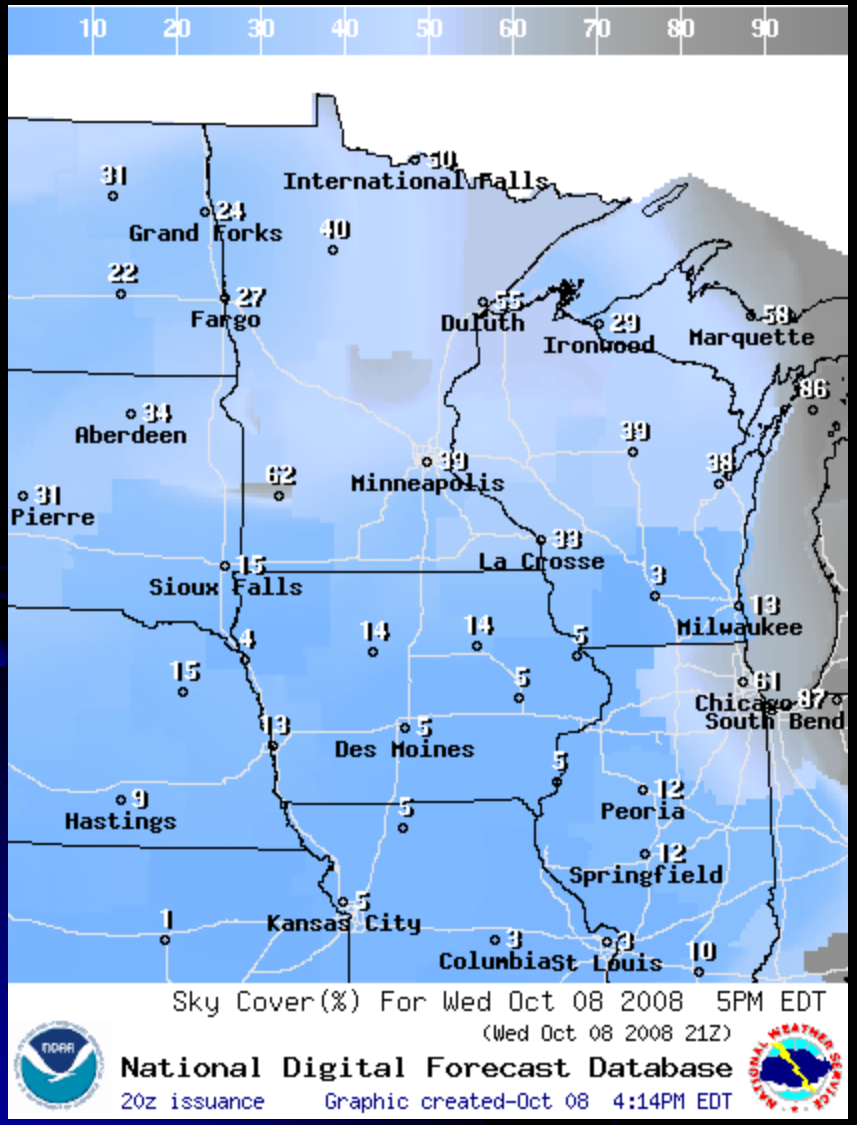
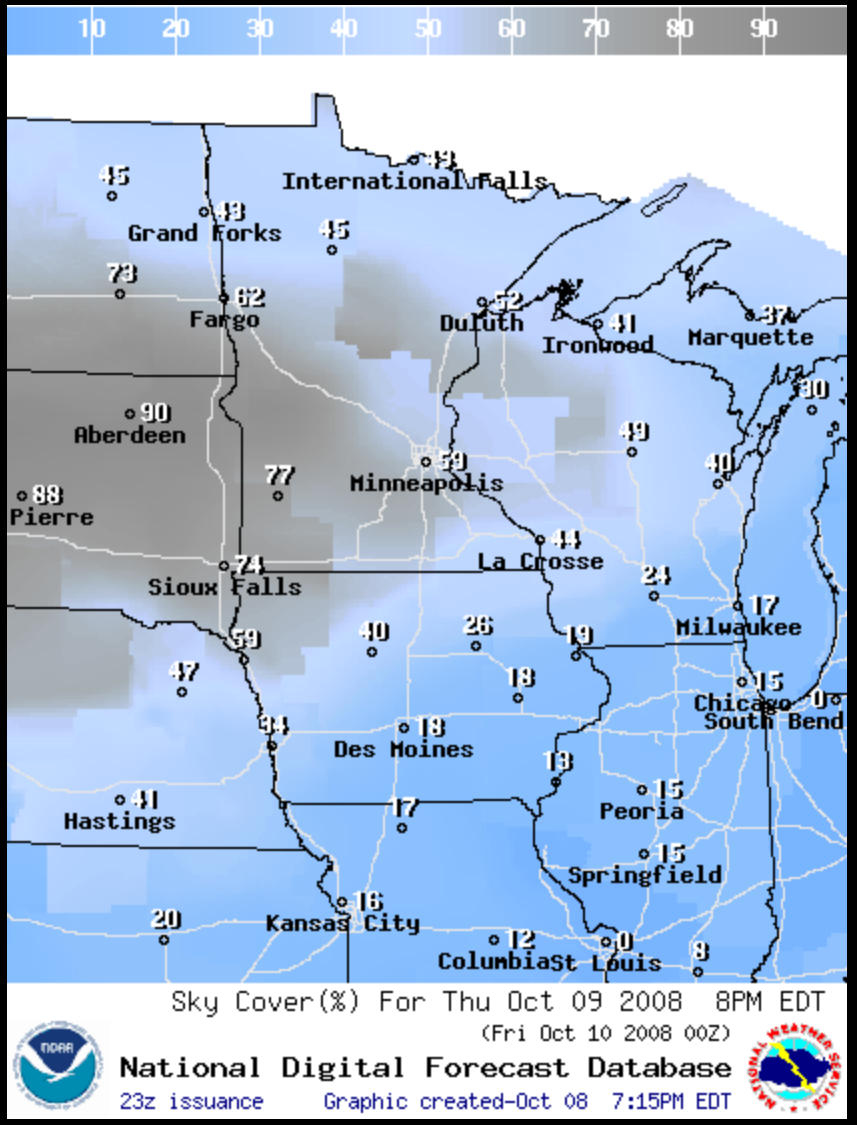
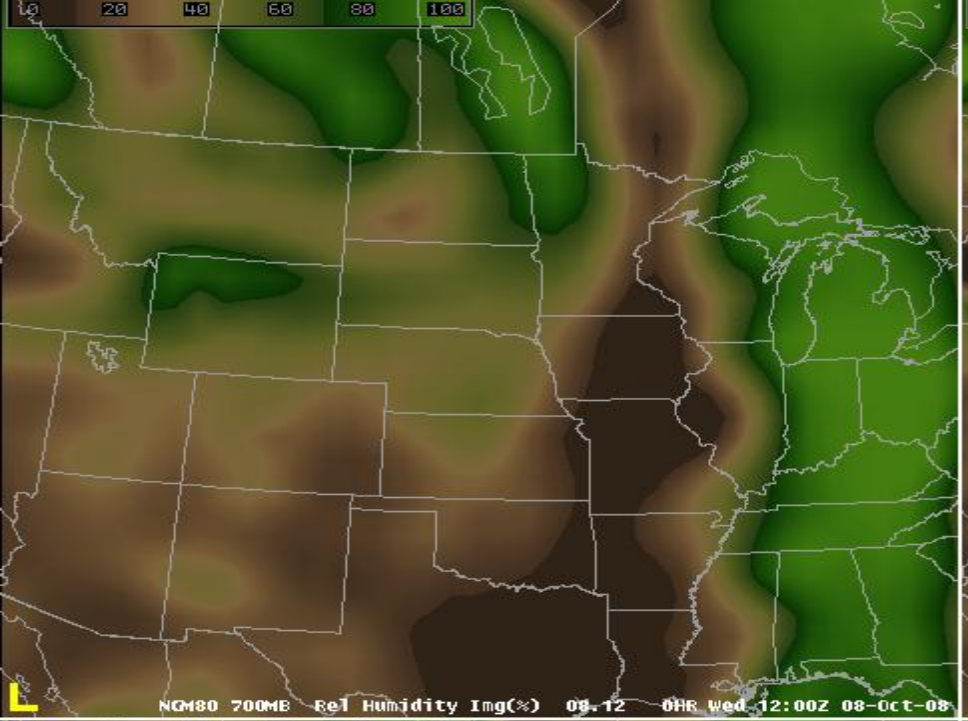
582

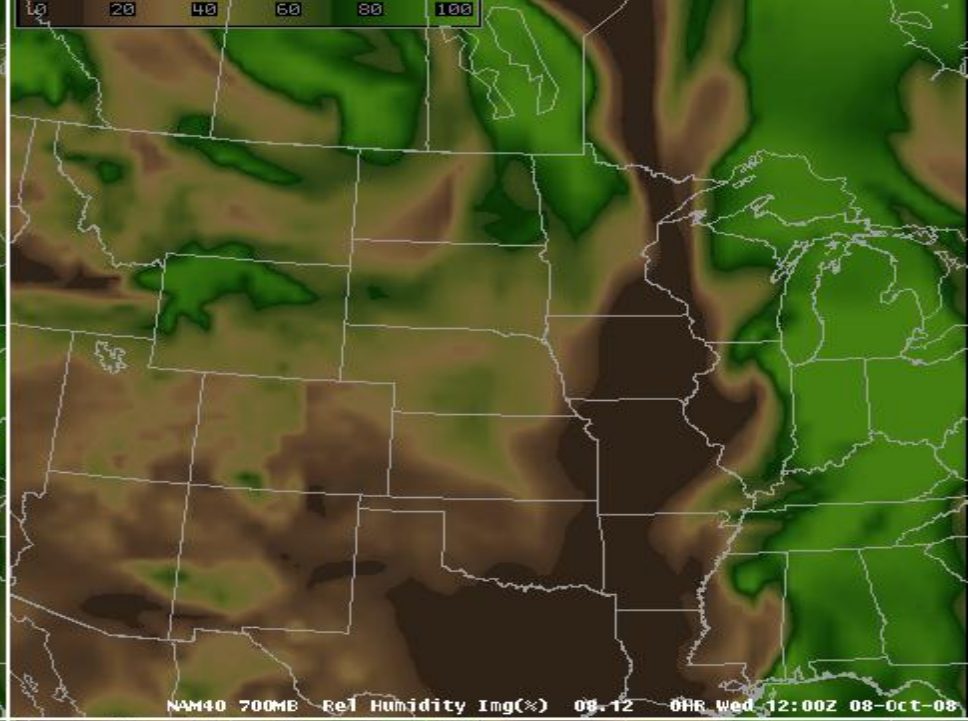

CRAS45-AK 3 Hr Accum Precip Img(in) 08.12 42HR Fri 06:00Z 10-Oct-08
CRAS45-AK 3 Hr Accum Precip (in) 08.12 42HR Fri 06:00Z 10-Oct-08
CRAS45-AK 700MB Omega (-ubar) 08.12 42HR Fri 06:00Z 10-Oct-08

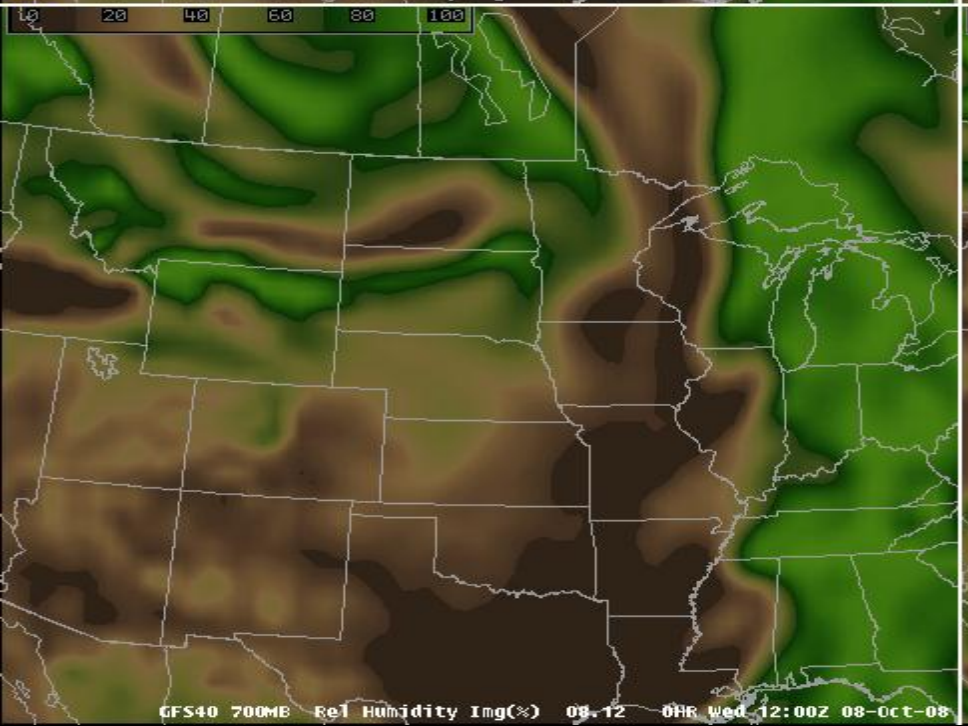
Can the CRAS help?

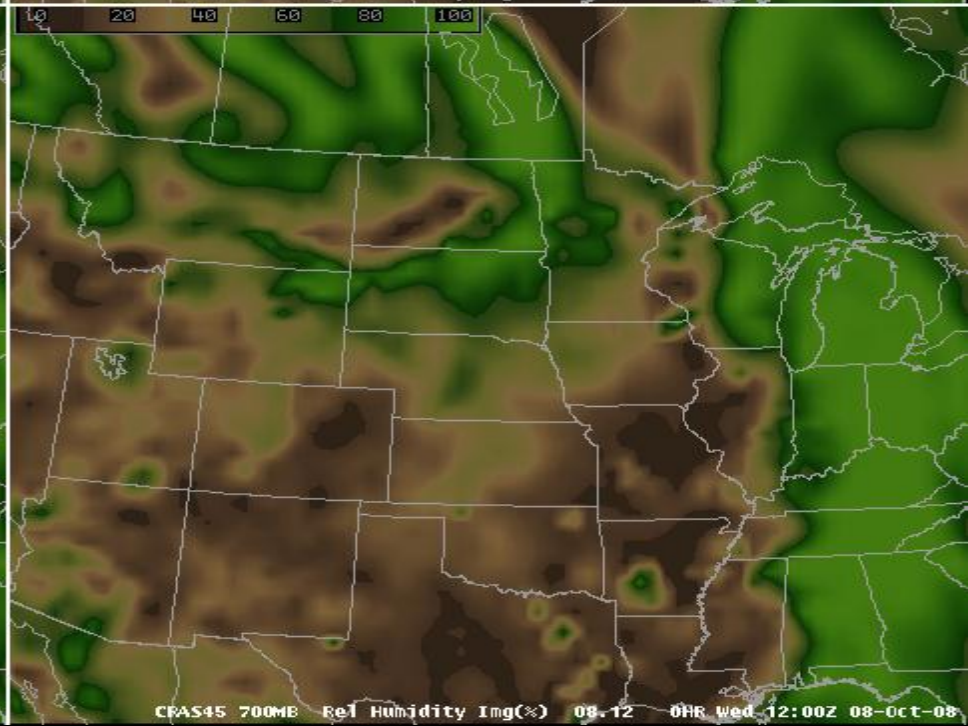


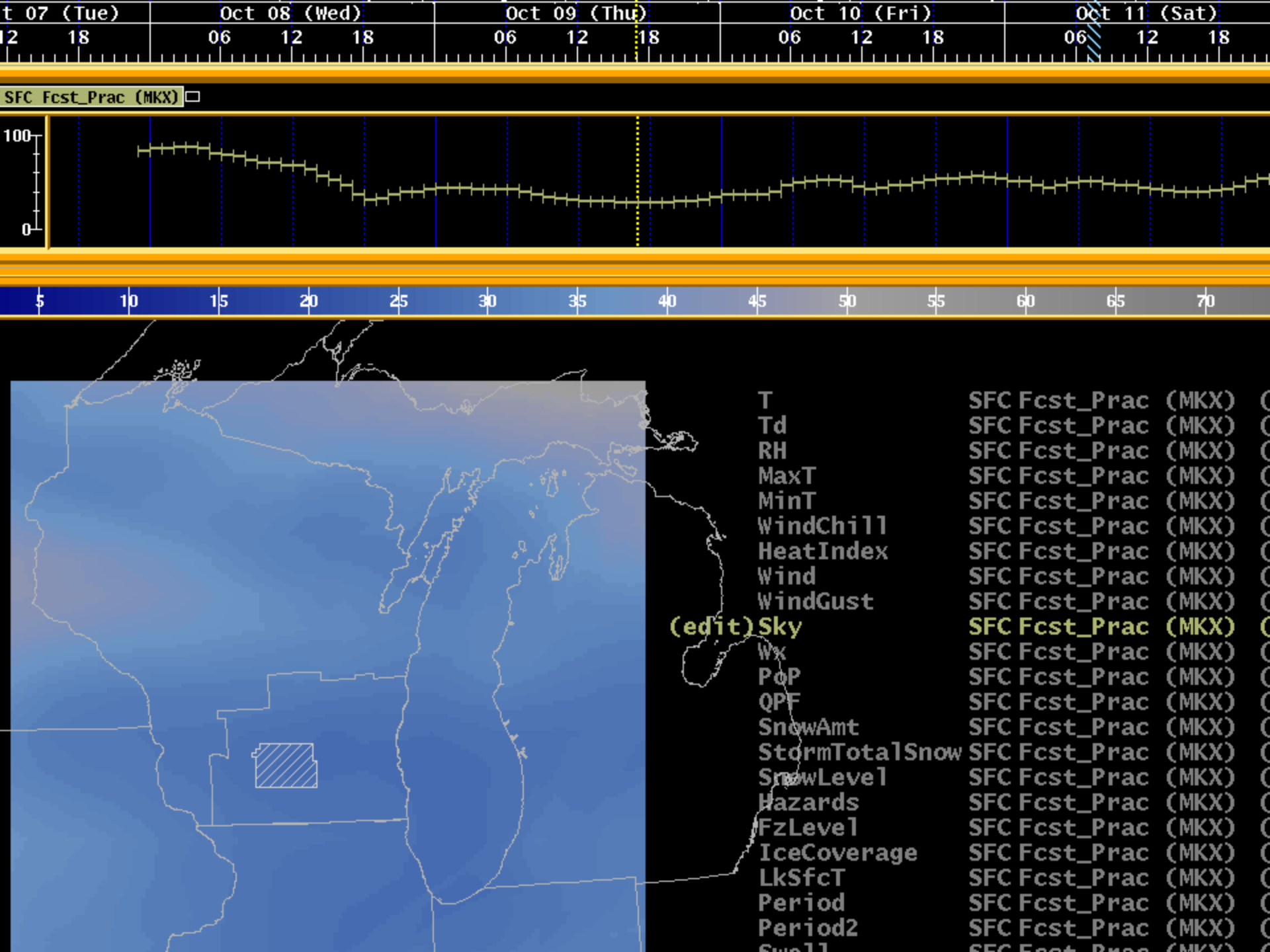



0 20 40 60 80 100
NGM80 700MB Rel Humidity Img(%) 08.12 0HR Wed 12:00Z 08-Oct-08


0 20 40 60 80 100
NAM40 700MB Rel Humidity Img(%) 08.12 0HR Wed 12:00Z 08-Oct-08


0 20 40 60 80 100
GFS40 700MB Rel Humidity Img(%) 08.12 0HR Wed 12:00Z 08-Oct-08


0 20 40 60 80 100
CPAS45 700MB Rel Humidity Img(%) 08.12 0HR Wed 12:00Z 08-Oct-08


t 07 (Tue)
Oct 08 (Wed)
Oct 09 (Thu)
Oct 10 (Fri)
Oct 11 (Sat)
12
18
06
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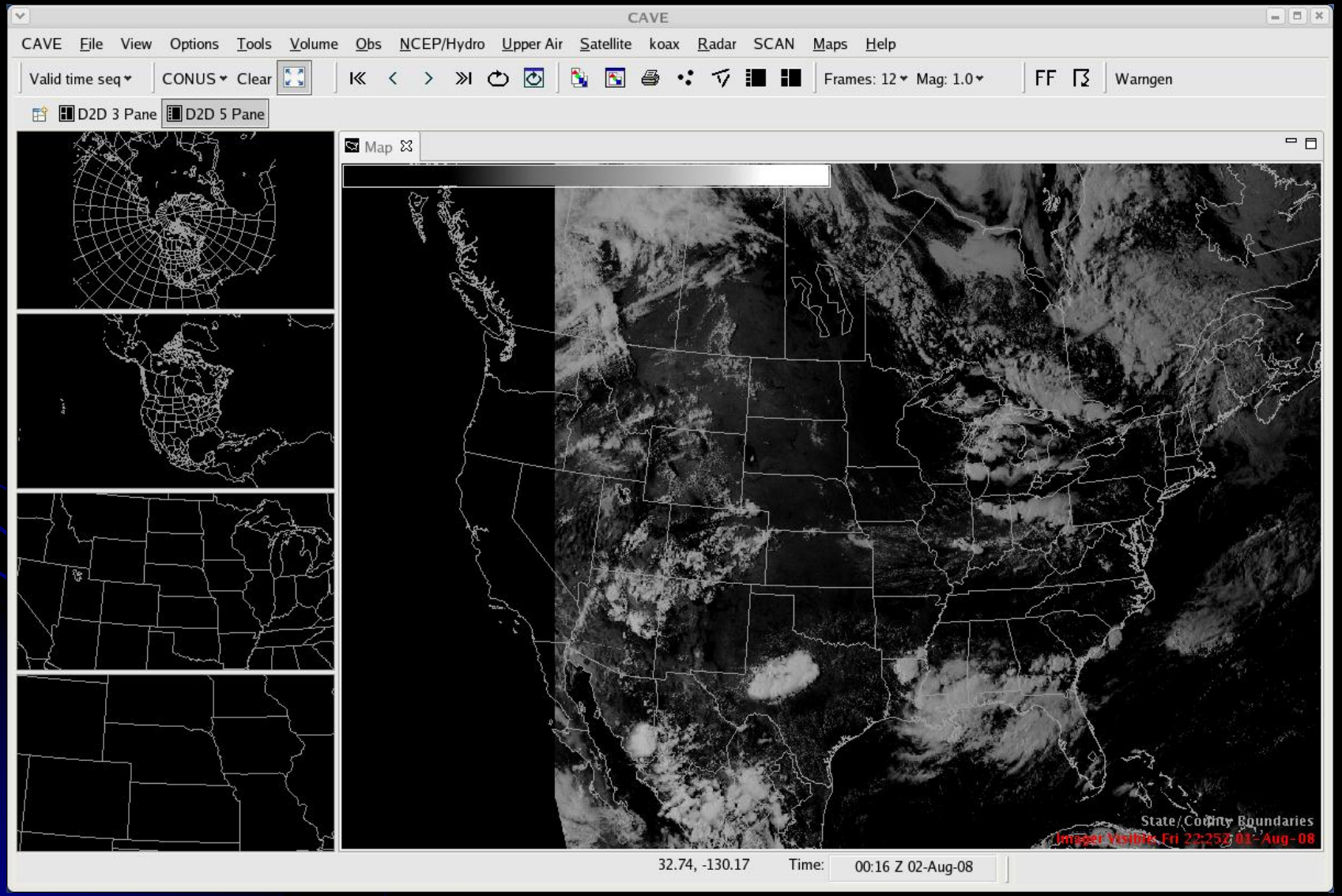
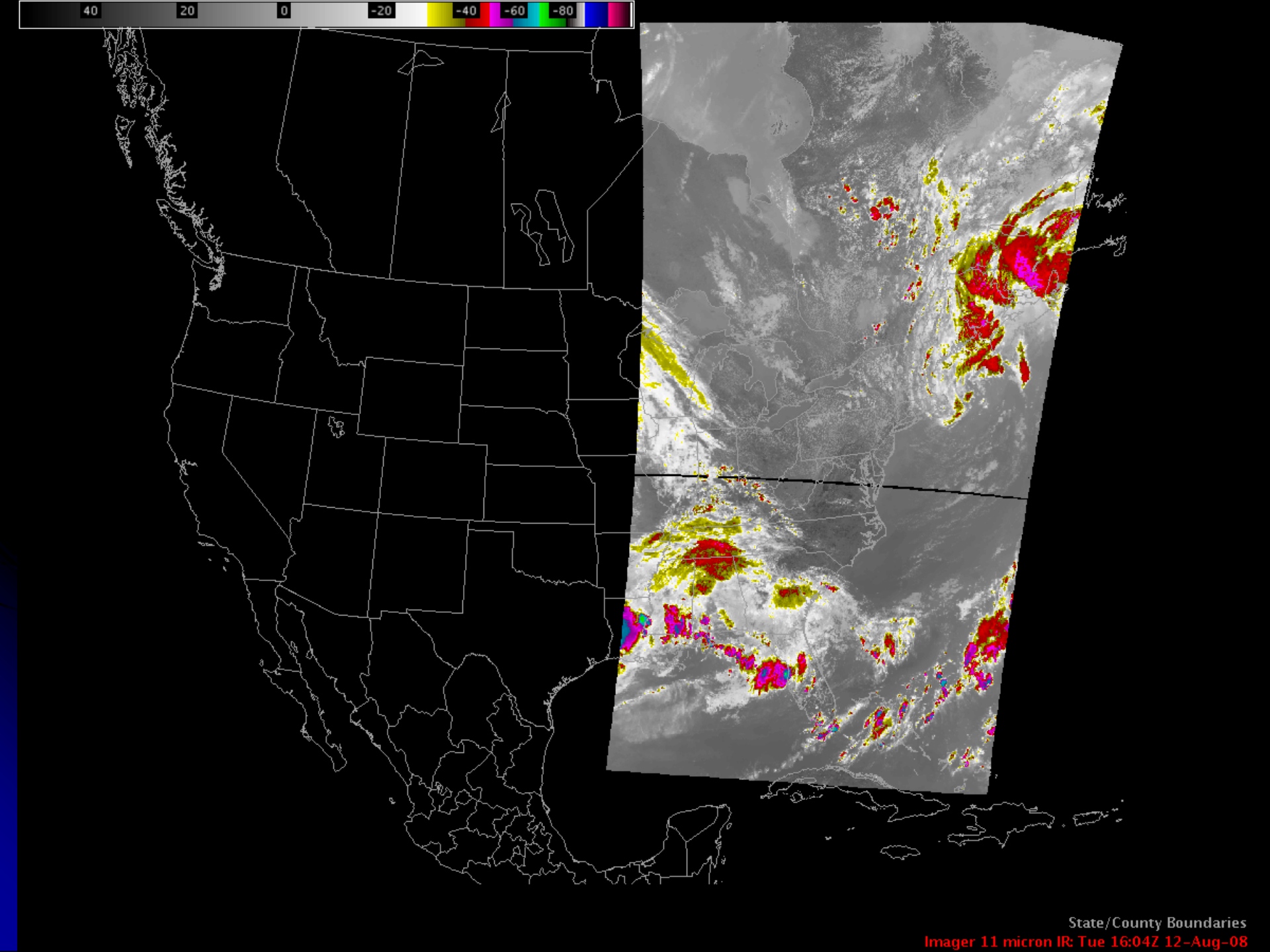
18
06
12
18
06
12
18
SFC Fcst_Prac (MKX)
100
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
T SFC Fcst_Prac (MKX)
Td SFC Fcst_Prac (MKX)
RH SFC Fcst_Prac (MKX)
MaxT SFC Fcst_Prac (MKX)
MinT SFC Fcst_Prac (MKX)
WindChill SFC Fcst_Prac (MKX)
HeatIndex SFC Fcst_Prac (MKX)
Wind SFC Fcst_Prac (MKX)
WindGust SFC Fcst_Prac (MKX)
(edit)Sky SFC Fcst_Prac (MKX)
Wx SFC Fcst_Prac (MKX)
PoP SFC Fcst_Prac (MKX)
QPF SFC Fcst_Prac (MKX)
SnowAmt SFC Fcst_Prac (MKX)
StormTotalSnow SFC Fcst_Prac (MKX)
SnowLevel SFC Fcst_Prac (MKX)
Hazards SFC Fcst_Prac (MKX)
FzLevel SFC Fcst_Prac (MKX)
IceCoverage SFC Fcst_Prac (MKX)
LkSfcT SFC Fcst_Prac (MKX)
Period SFC Fcst_Prac (MKX)
Period2 SFC Fcst_Prac (MKX)

AWIPS-II Task Order 8

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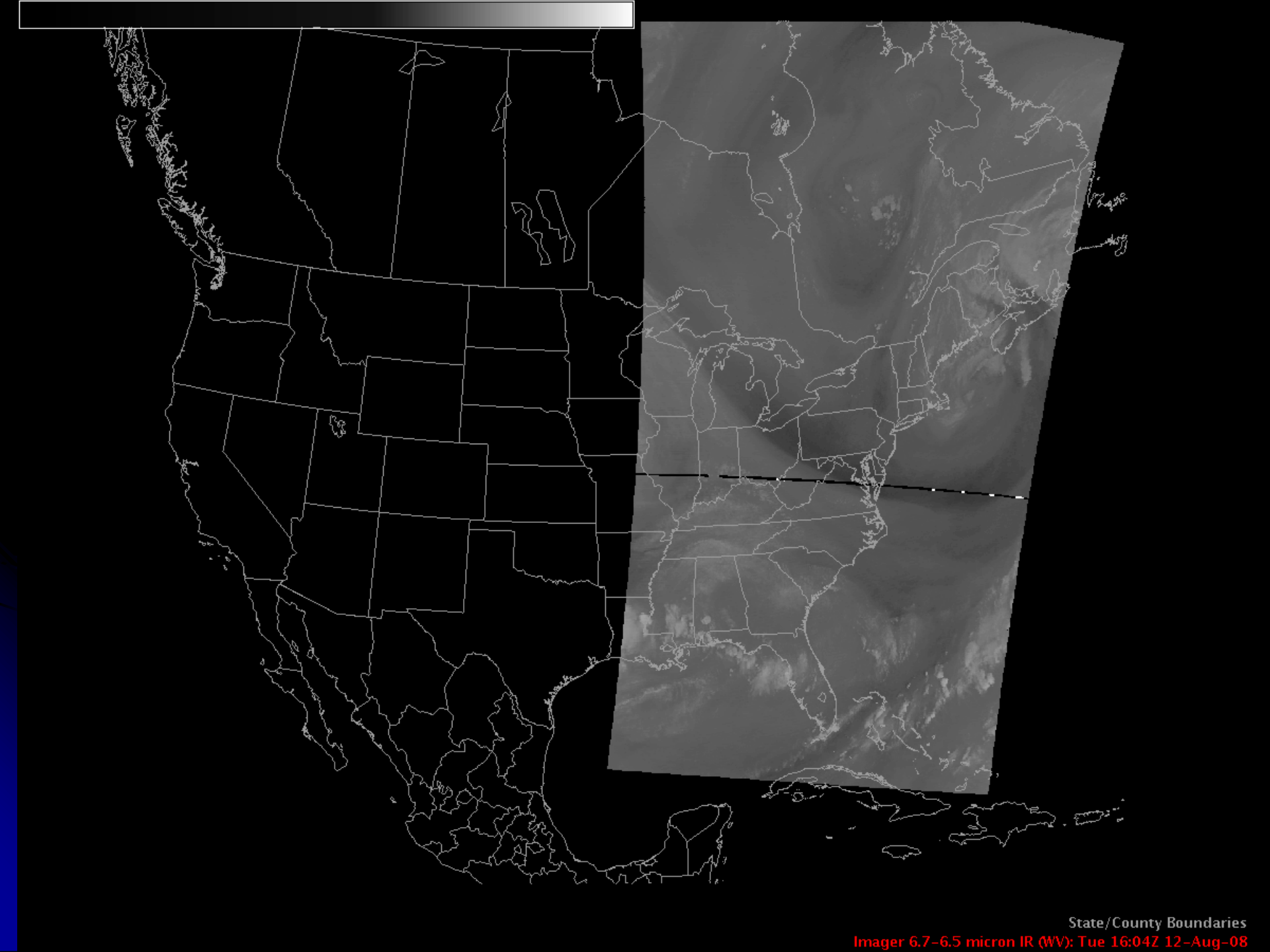
State/County Boundaries
Imager 11 micron IR: Tue 16:04Z 12-Aug-08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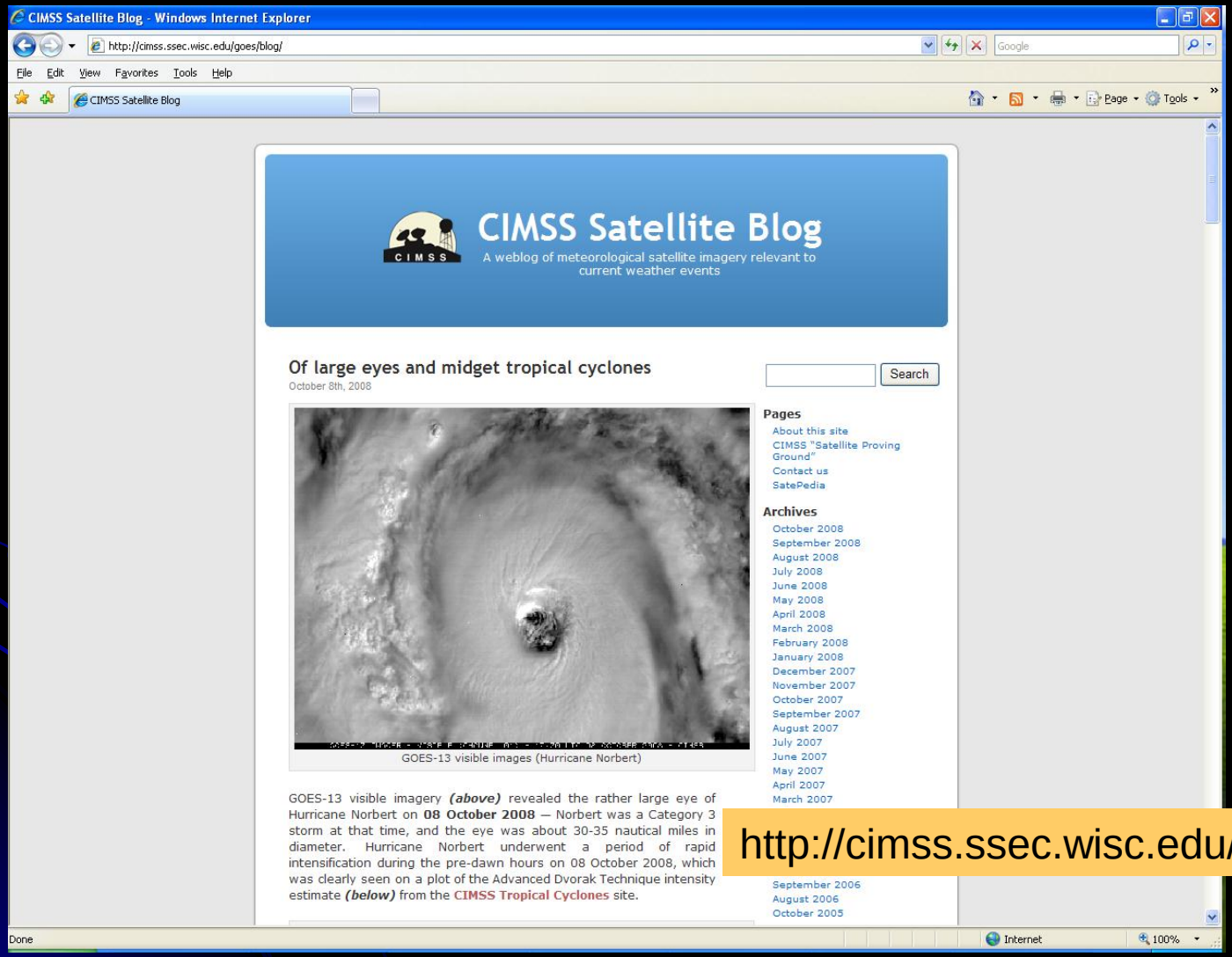
CIMSS Satellite Blog



http://cimss.ssec.wisc.edu/goes/blog/

Comments? Questions?

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