

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

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**Cooperative Institute for Meteorological Satellite Studies**

**Space Science and Engineering Center**

**University of Wisconsin – Madison, WI**

**NWA Session 5B**

**October 14, 2008**



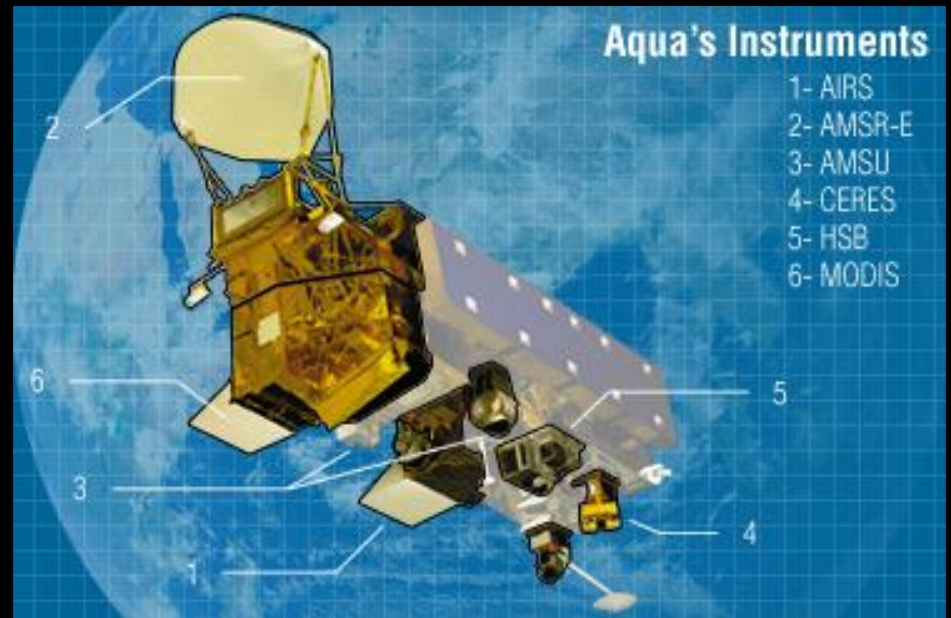
# The CIMSS Team

- **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



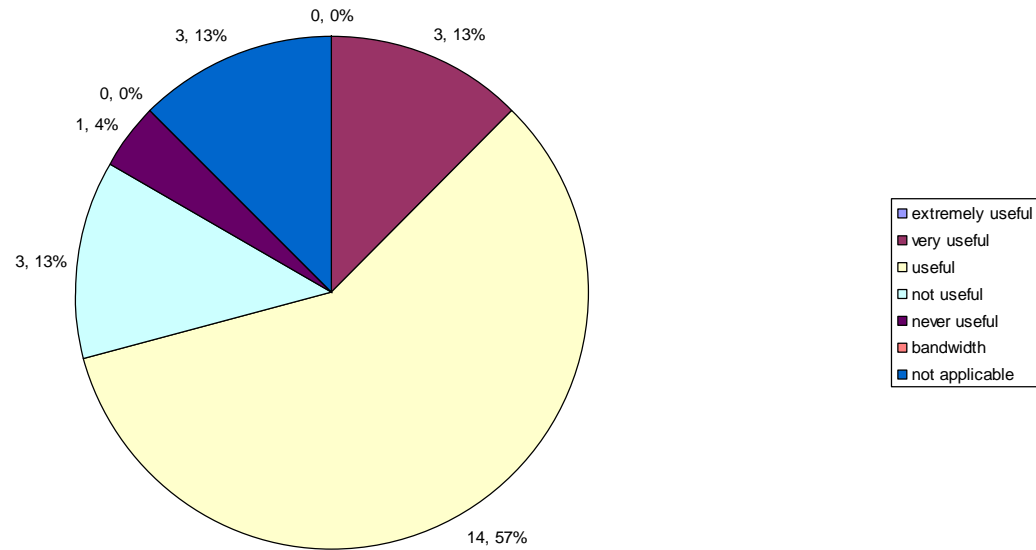
# MODIS

## MODerate resolution Imaging Spectroradiometer

Primary Use	Band	Bandwidth <sup>1</sup>
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 <sup>1</sup>
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

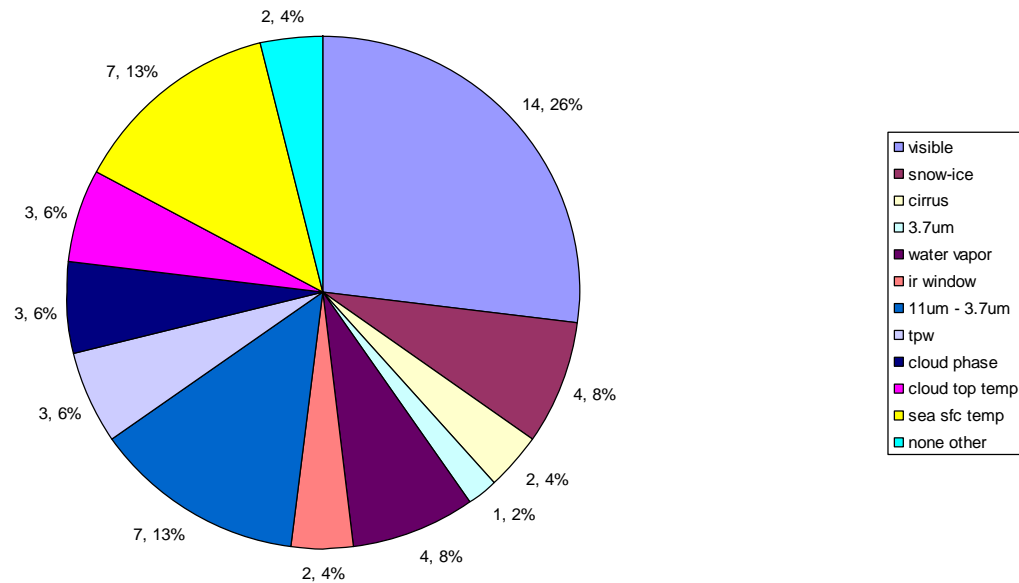
In general, how useful are MODIS images and products in daily operations?



***“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.”***

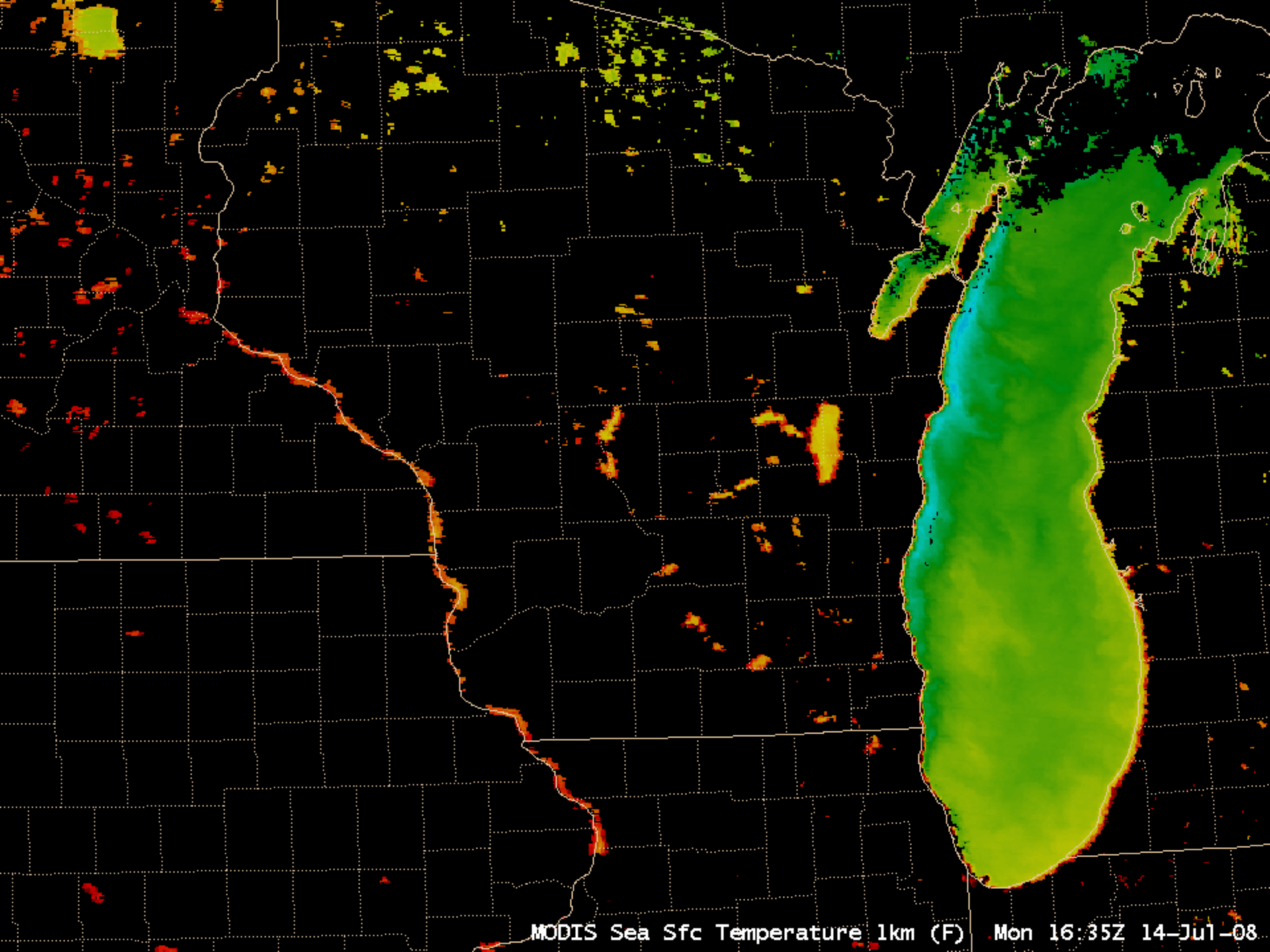
From National Weather Service Forecast Office in Indianapolis, Indiana

What MODIS images and products in AWIPS do you use most frequently?



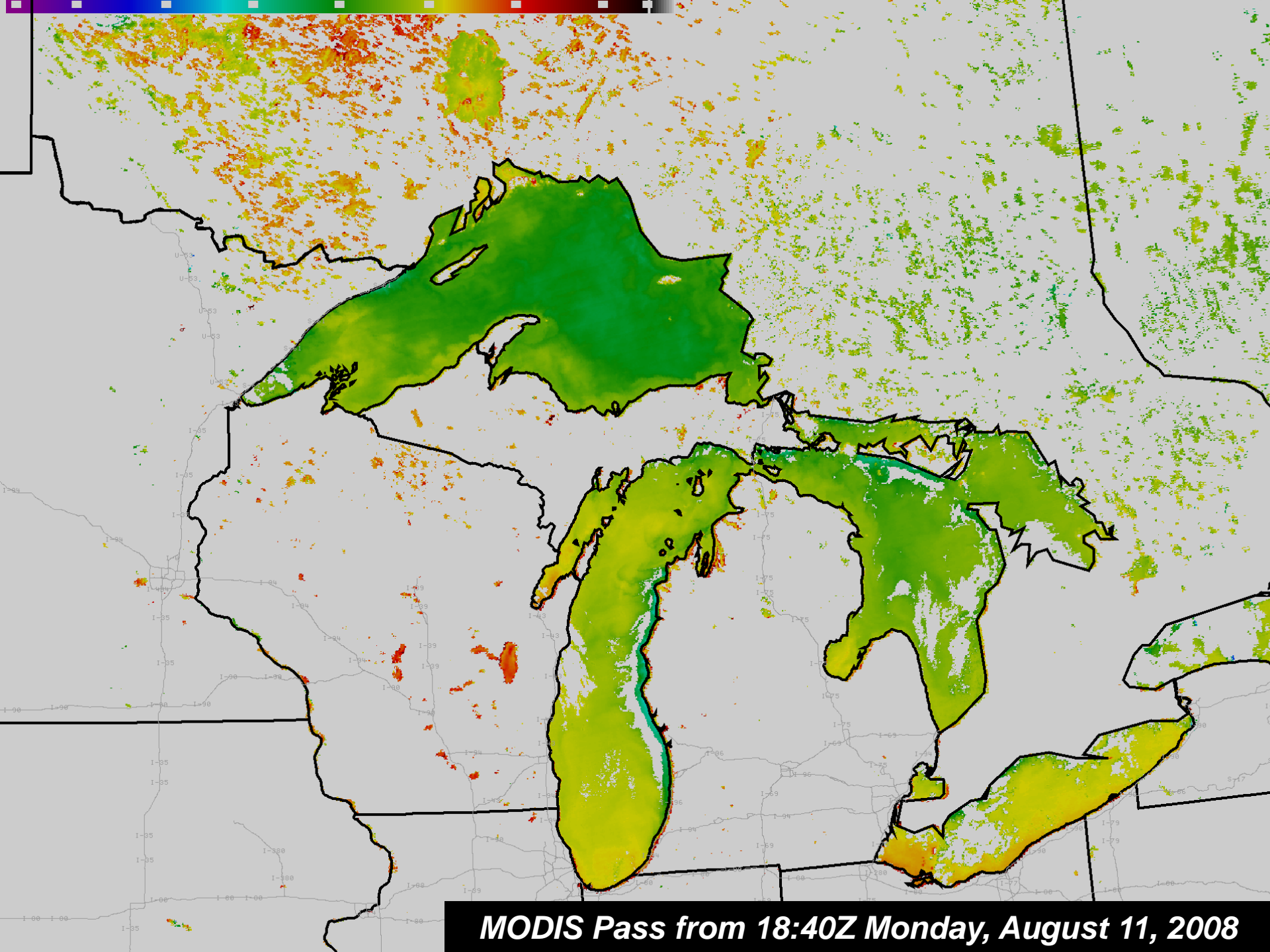
***“This is a great dataset for WFO Operations. We would love to continue to see more and more data get into AWIPS. The Fog product I have found to be especially useful, as well as the Snow/Ice Band 7. Great stuff!”***

From National Weather Service Forecast Office in La Crosse, Wisconsin



MODIS Sea Sfc Temperature 1km (F)

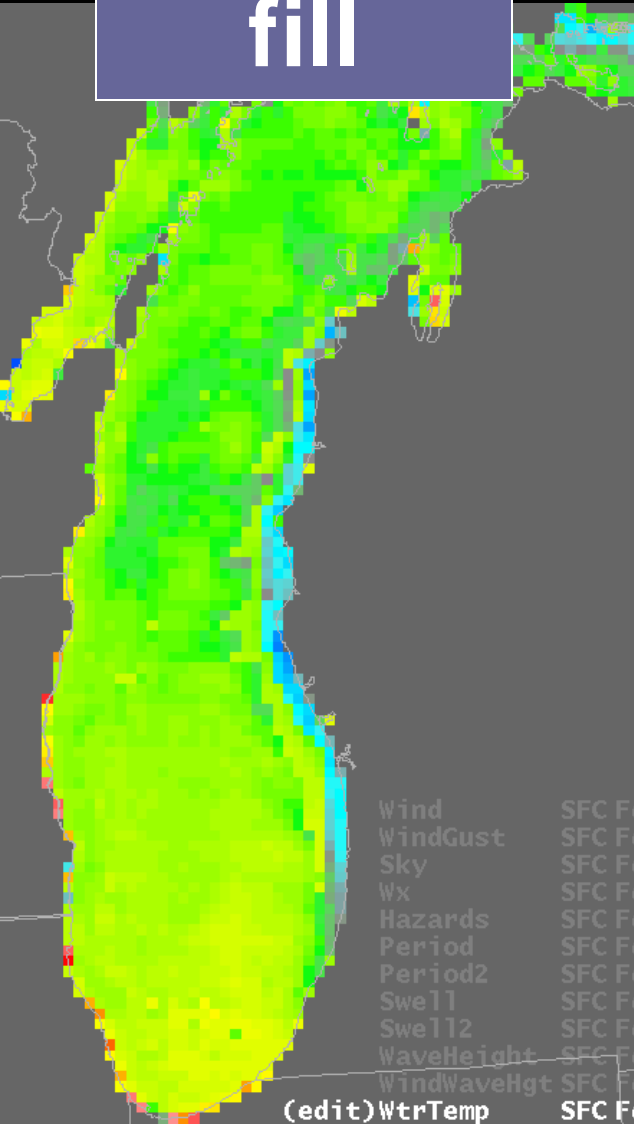
Mon 16:35Z 14-Jul-08



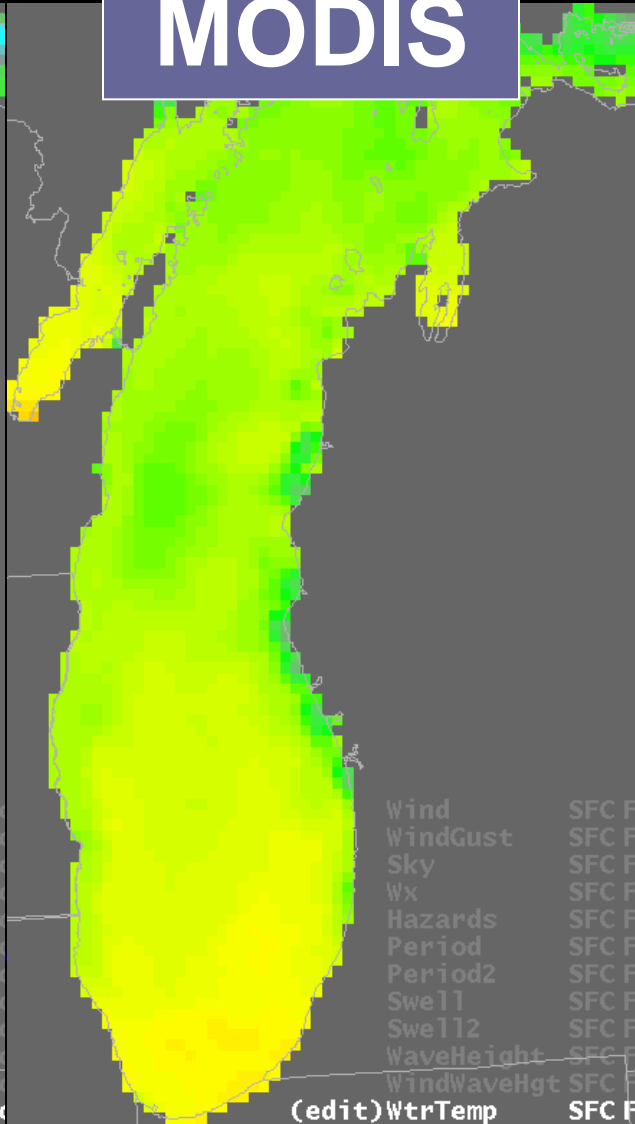
**MODIS Pass from 18:40Z Monday, August 11, 2008**



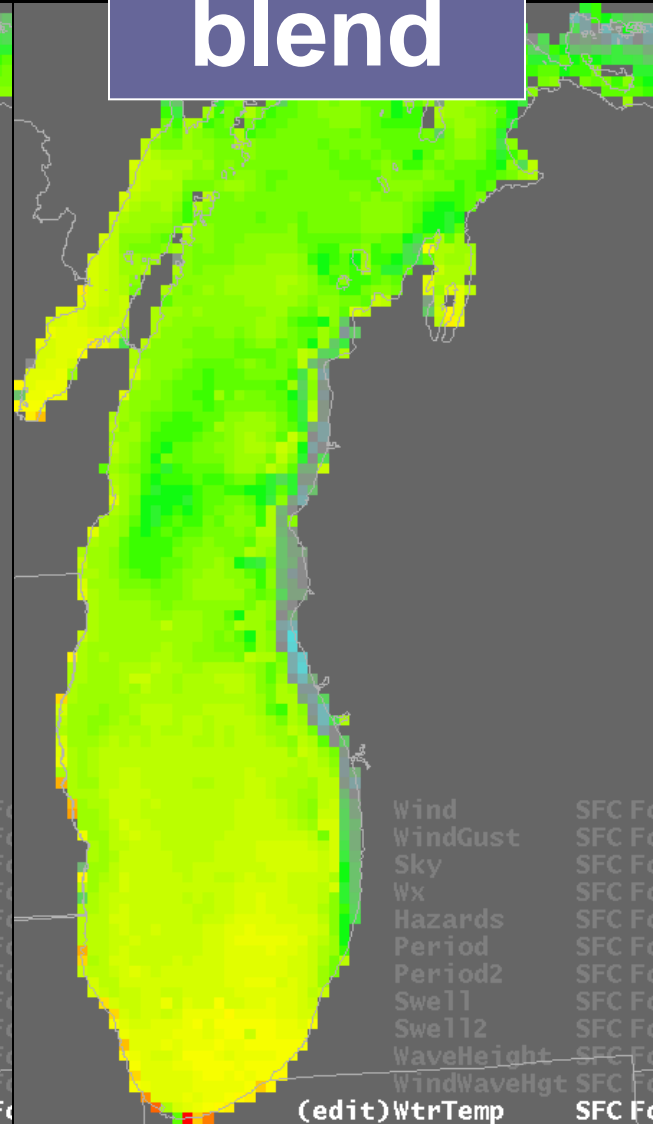
**MODIS,  
GLERL  
fill**

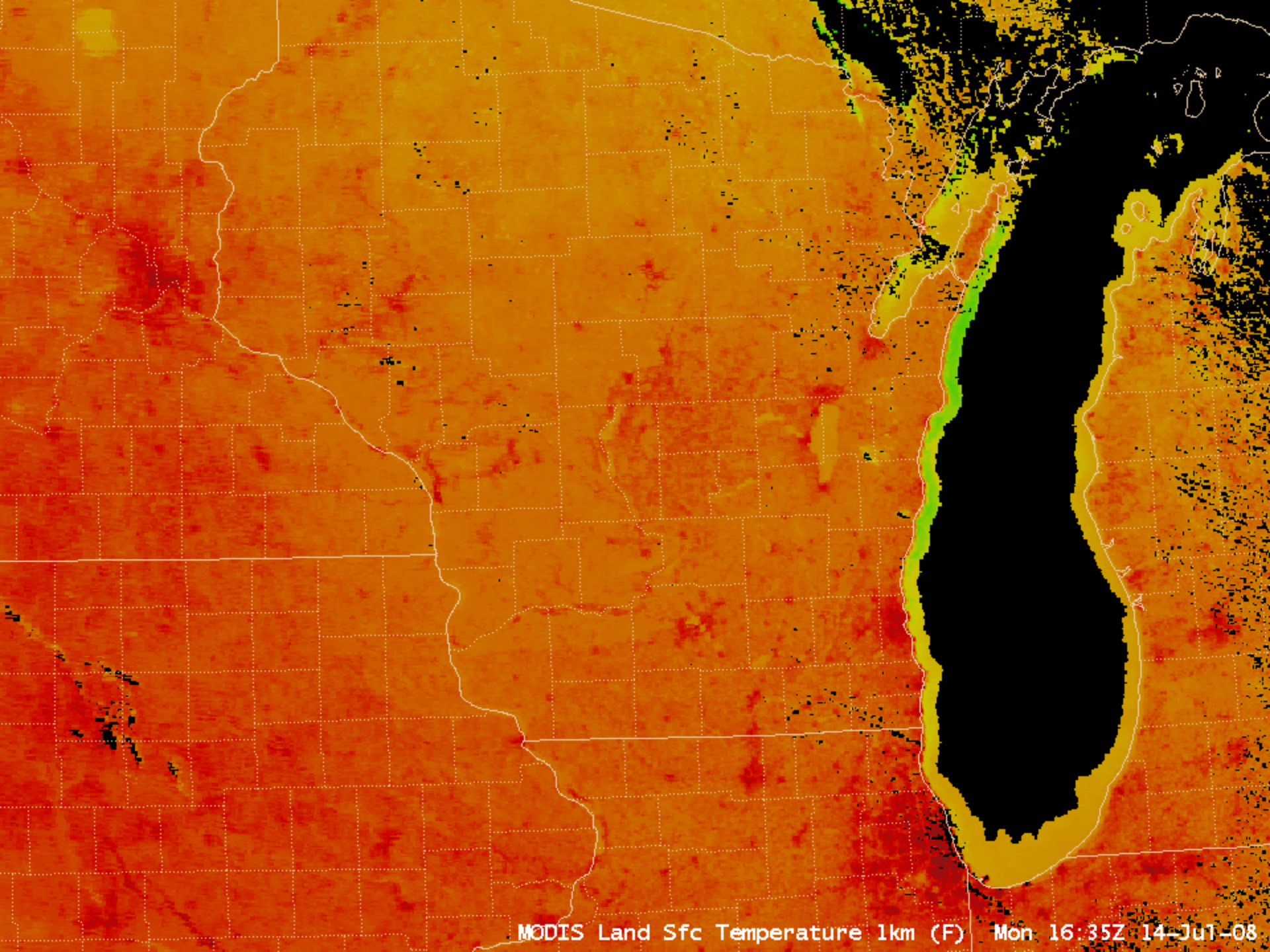


**GLERL,  
no  
MODIS**

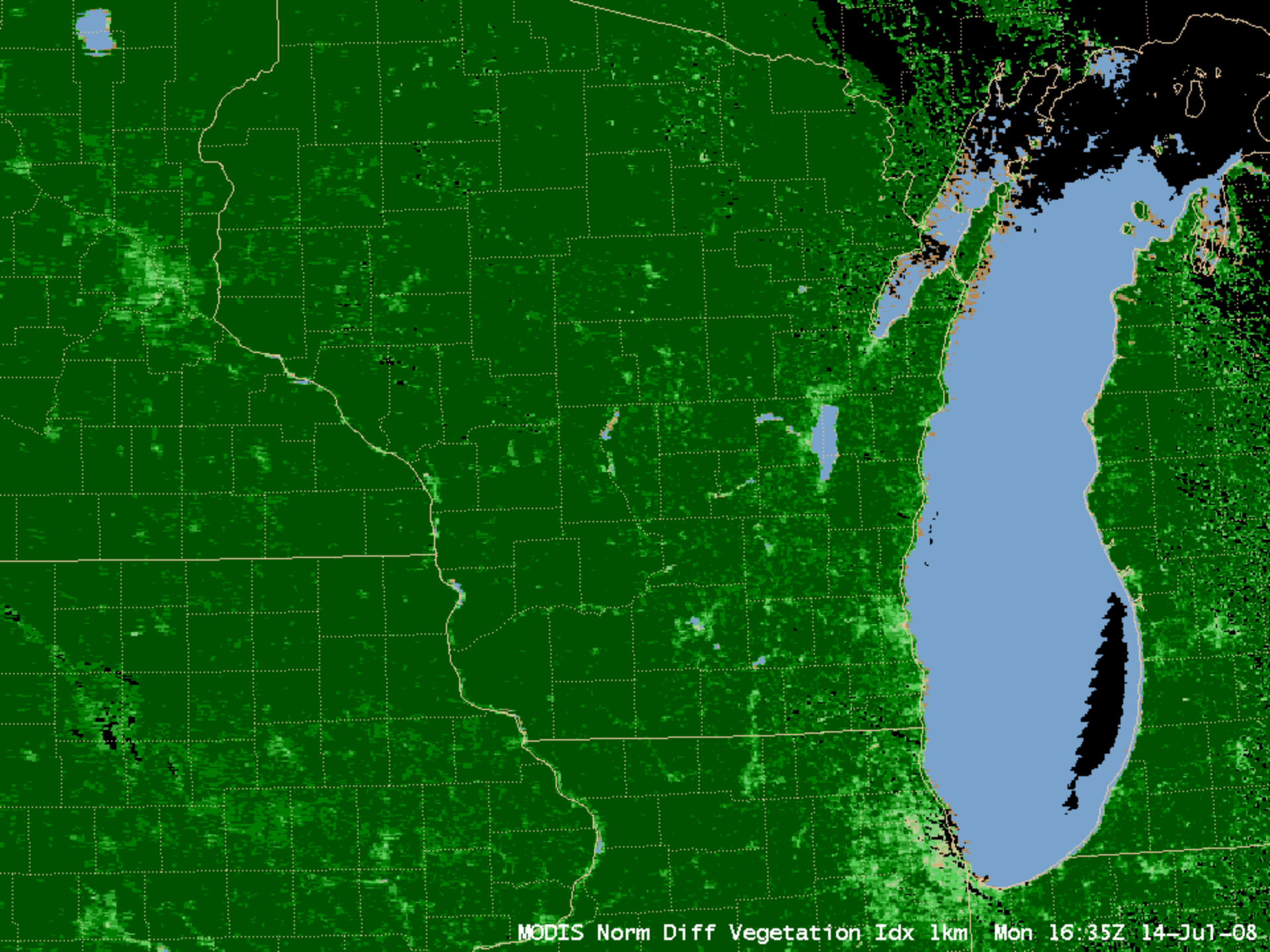


**MODIS,  
GLERL  
blend**

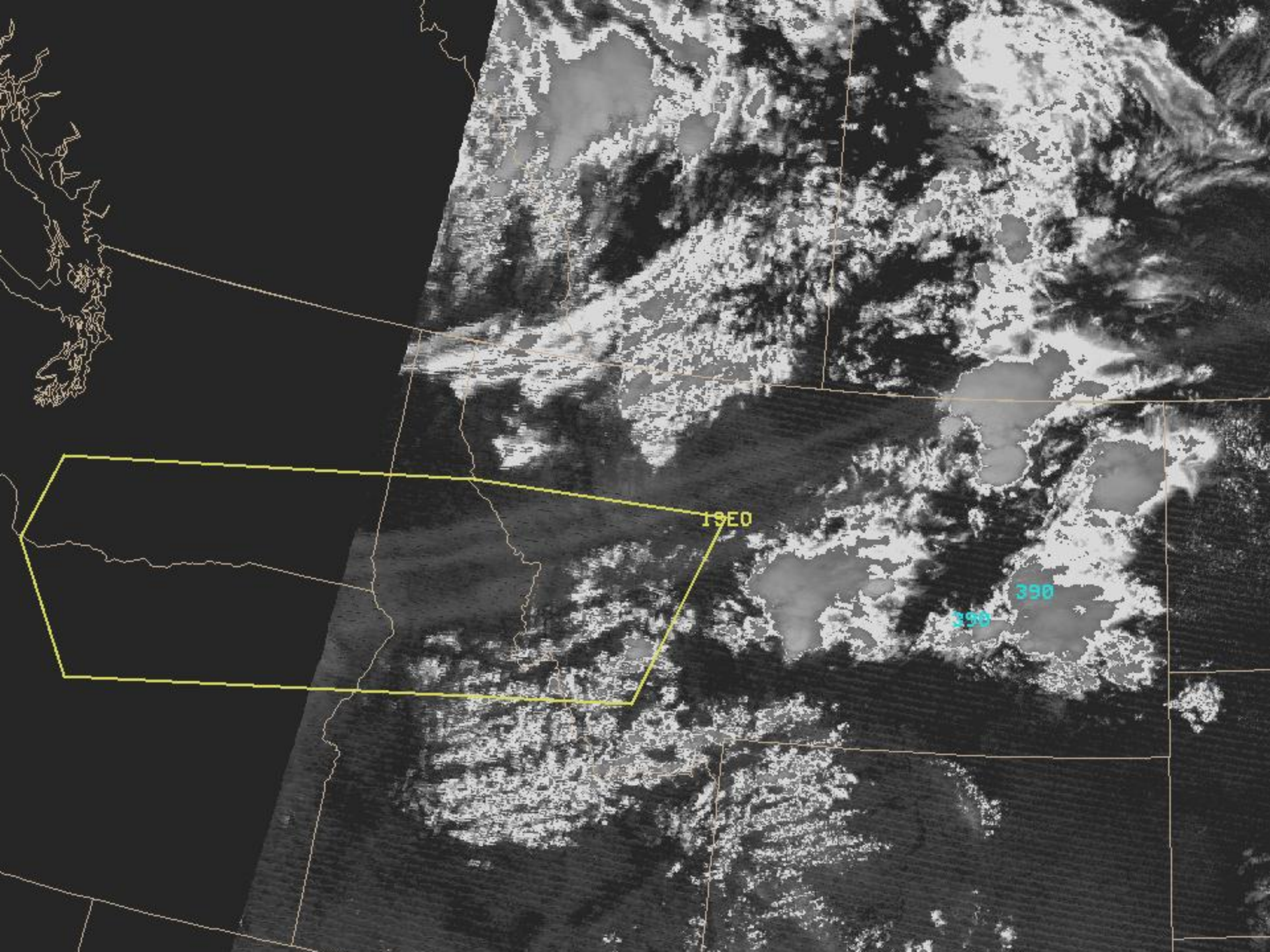




MODIS Land Sfc Temperature 1km (F) Mon 16:35Z 14-Jul-08



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

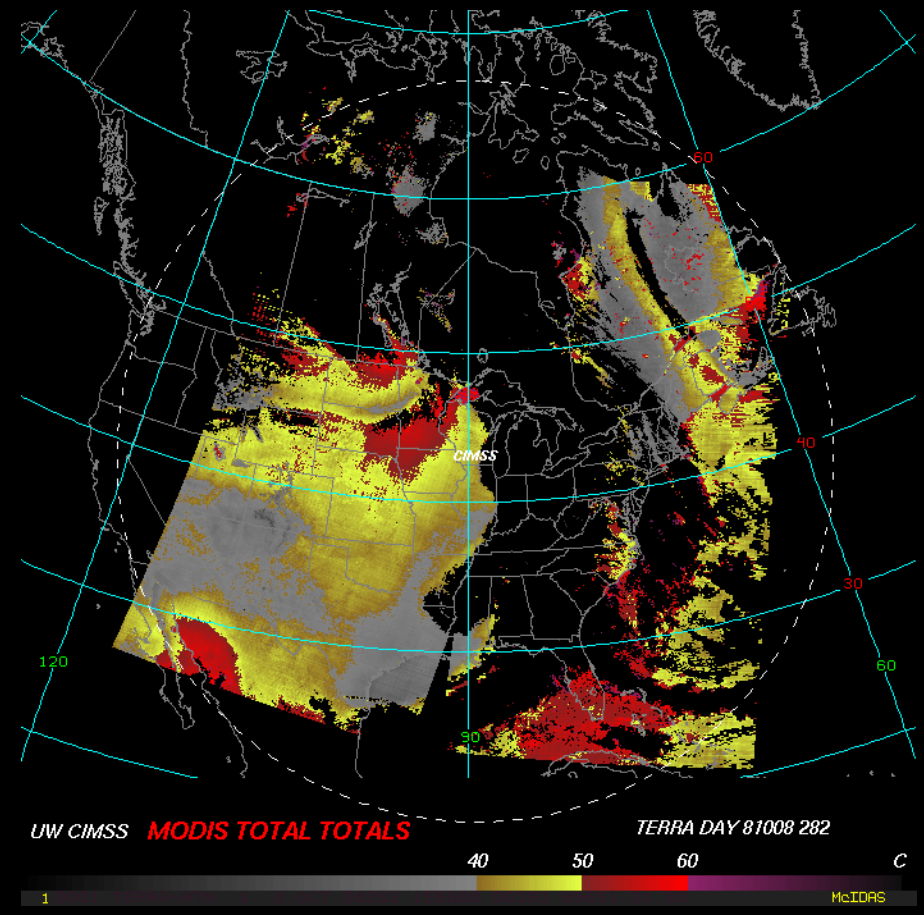
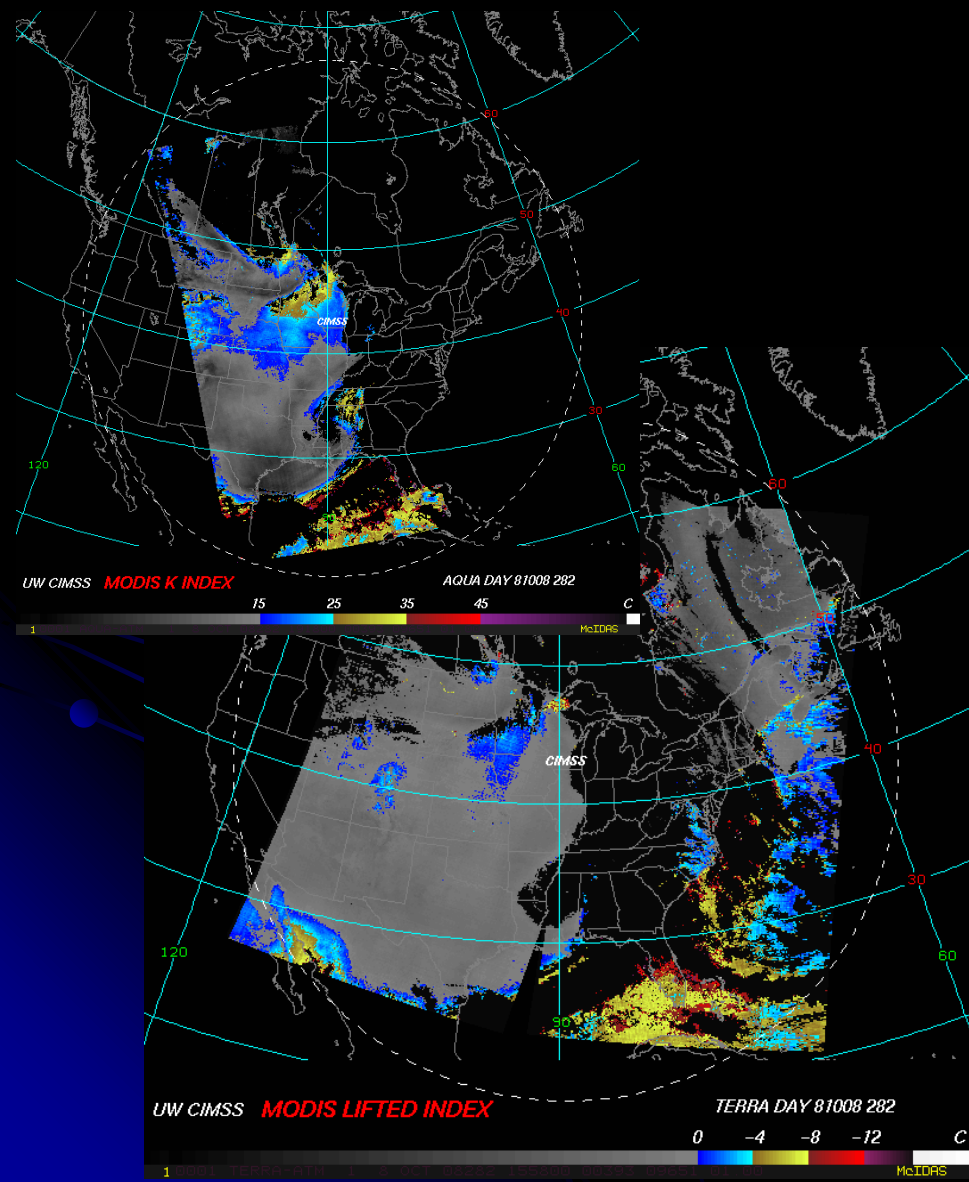


19E0

390

390

# Proposed and in Development



# Involved Weather Forecast Offices

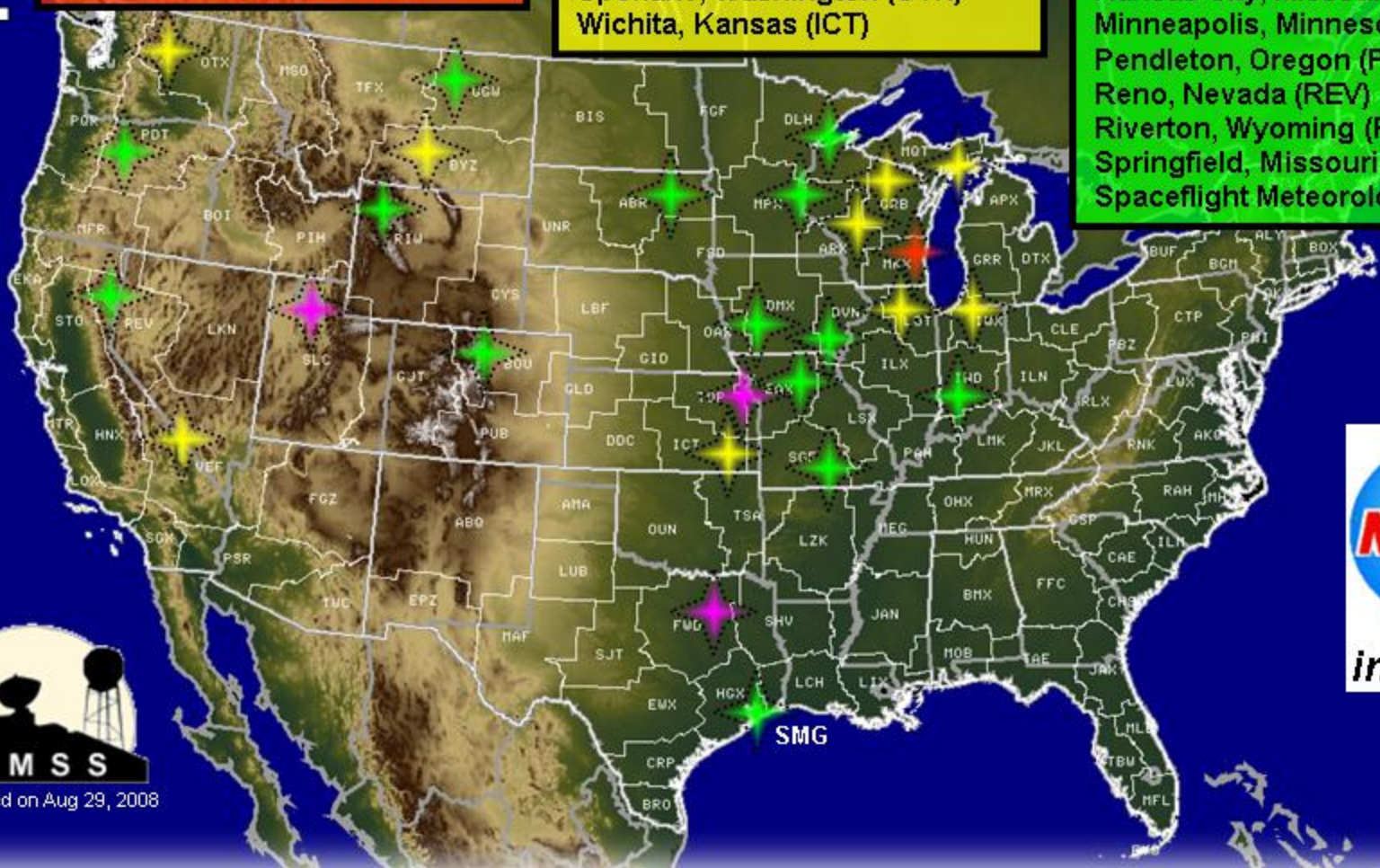
**27**  
**TOTAL**

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



Last updated on Aug 29, 2008

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

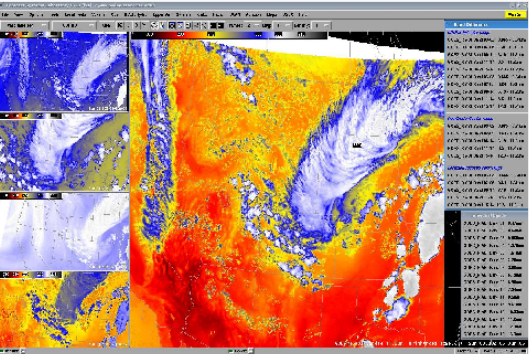
# GOES-R Proving Ground

GOES-R Proving Ground - Windows Internet Explorer

http://cimss.ssec.wisc.edu/goes\_r/proving-ground.html

GOES-R Proving Ground

Home >> GOES-R Proving Ground



Simulated GOES-R ABI Imagery in AWIPS

### GOES-R Satellite Proving Ground Mission Statement

The Geostationary Operational Environmental Satellite (GOES-R) Satellite Proving Ground project engages the National Weather Service (NWS) forecast and warning community in an interactive demonstration of selected capabilities anticipated from the next generation of National Oceanic and Atmospheric Administration (NOAA) geostationary earth observing systems.

The Proving Ground project objective is to bridge the gap between research to operations by:

- Utilizing current systems (satellite, terrestrial, or model/synthetic) to emulate various aspects of future GOES-R capabilities
- Focusing on environmental applications bearing highest practical value to NWS users
- Infusing GOES-R products and techniques into the NWS operational platform, the Advanced Weather Information Processing System (AWIPS).

A key element of this activity is a sustained interaction between Proving Ground team and NWS users for the purposes of training, product evaluation, and solicitation of user feedback. The Proving Ground relies on close coordination with the GOES-R Algorithm Working Group (AWG) and Risk Reduction

Resc

- CIMSS F Ground Pr
- CIRA Proving Ground Products

Real-time GOES-13 data

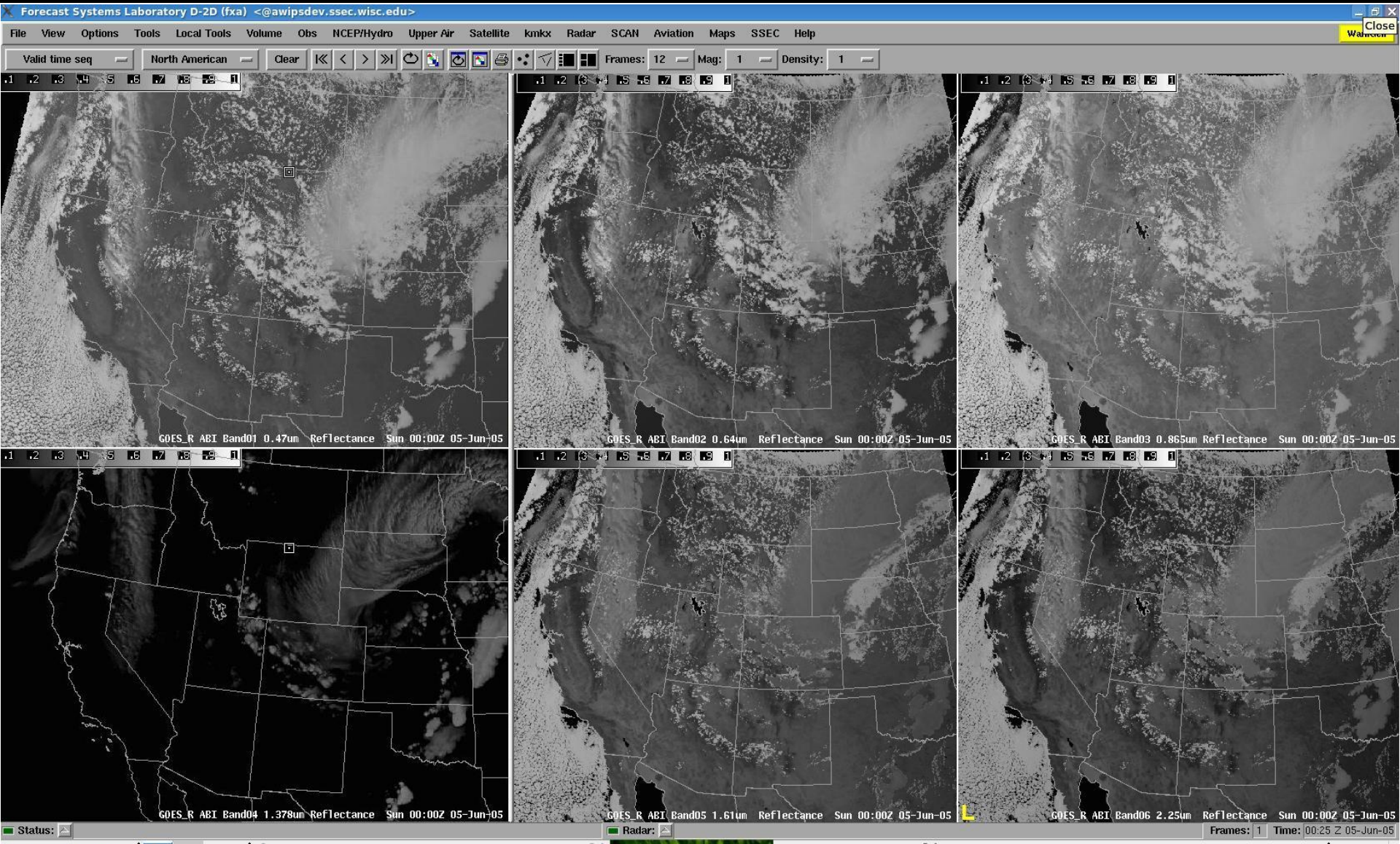
- GOES-13 Image Browser
- GOES-13 ("GOES-Central") Sounder DPI
- GOES-13 Visible Imagery

Internet 100%

[http://cimss.ssec.wisc.edu/goes\\_r/proving-ground.html](http://cimss.ssec.wisc.edu/goes_r/proving-ground.html)

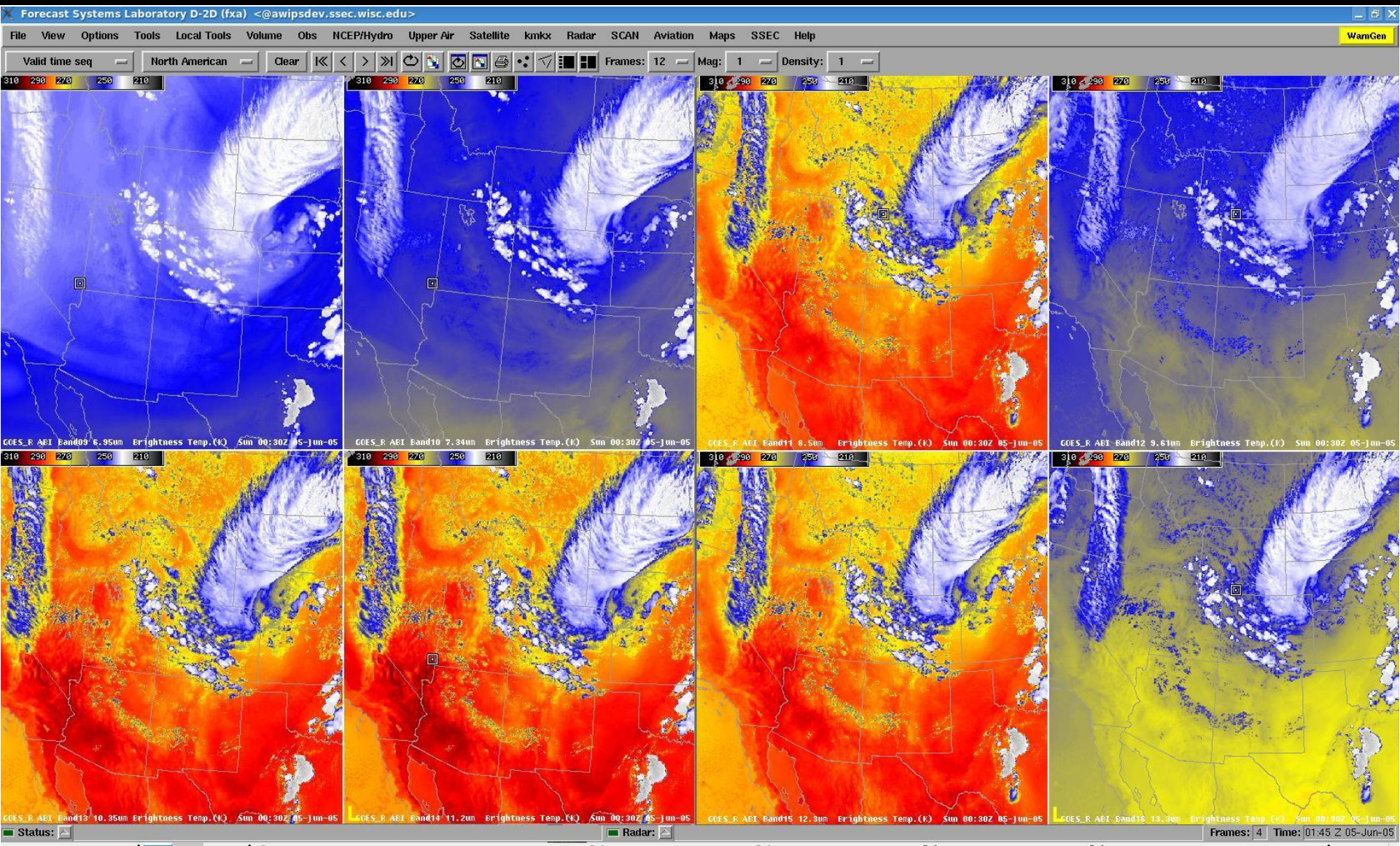
The GOES-R Proving Ground will facilitate the testing and validation of new ideas, technologies and products before they become integrated into operational use. This proving ground is an essential component of GOES-R risk reduction, which will help to ensure that users are ready for the new types of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





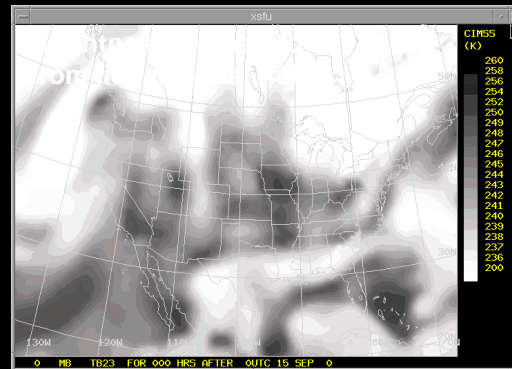
# Sample IR Bands of the Advanced Baseline Imager in AWIPS



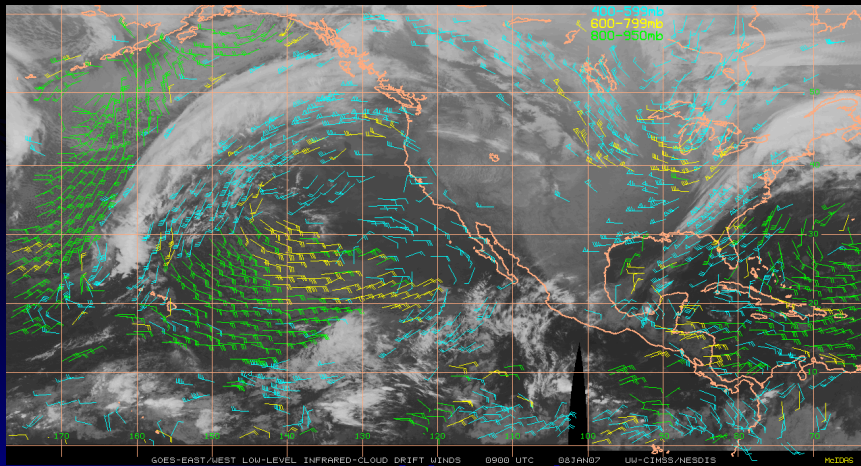
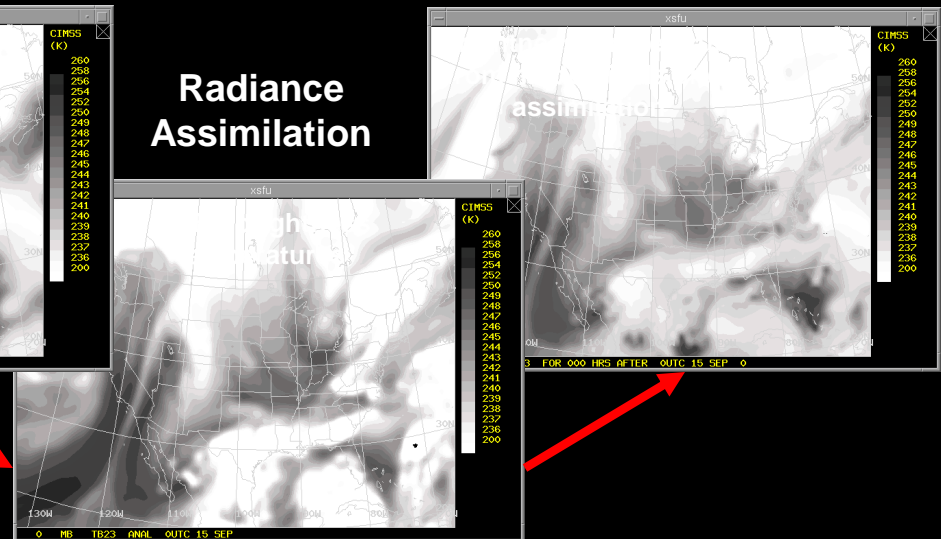
# Information Extracted from Satellites

## Radiances

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

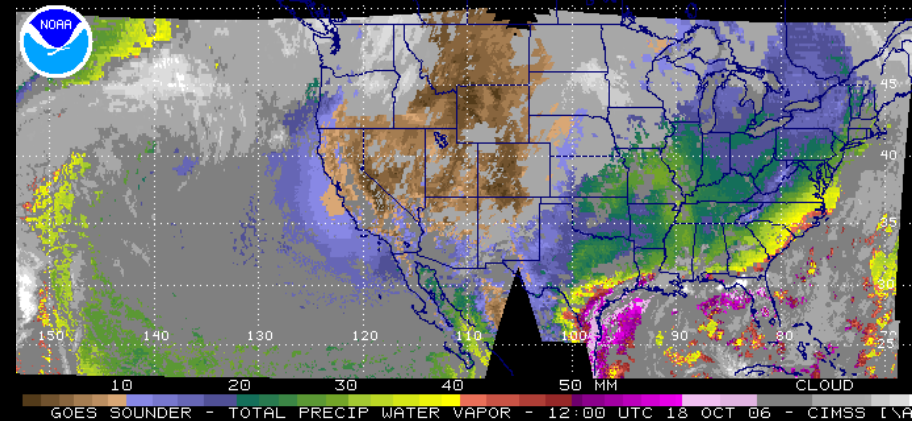


## Radiance Assimilation



## Motion

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



## Retrieved parameters

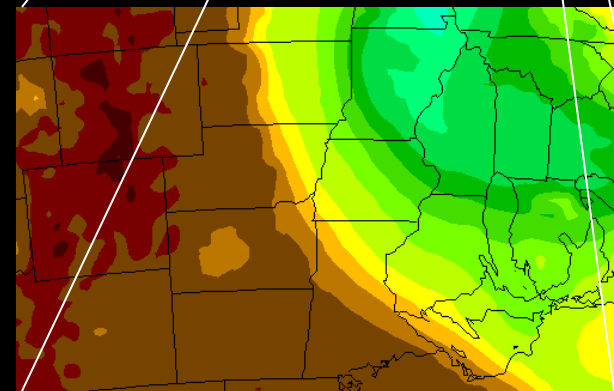
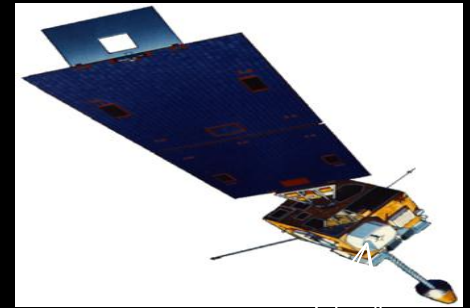
- Dependent variable assimilation (1,3Dvar)
- Requires knowledge of retrieval errors
- Physical accuracy, non-linearity
- Bypass surface type restrictions

# CIMSS Regional Assimilation System

## CRAS

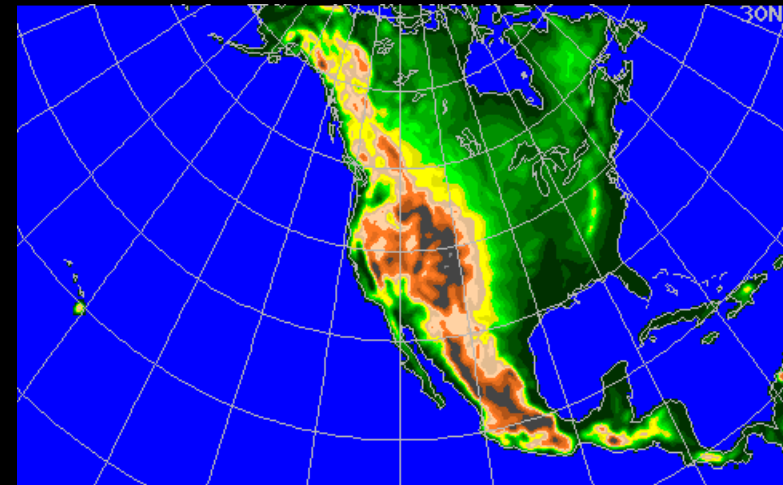
The Cooperative Institute for Meteorological Satellite Studies (CIMSS) uses the CIMSS Regional Assimilation System (CRAS) to assess the impact of space-based observations on numerical forecast accuracy.

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

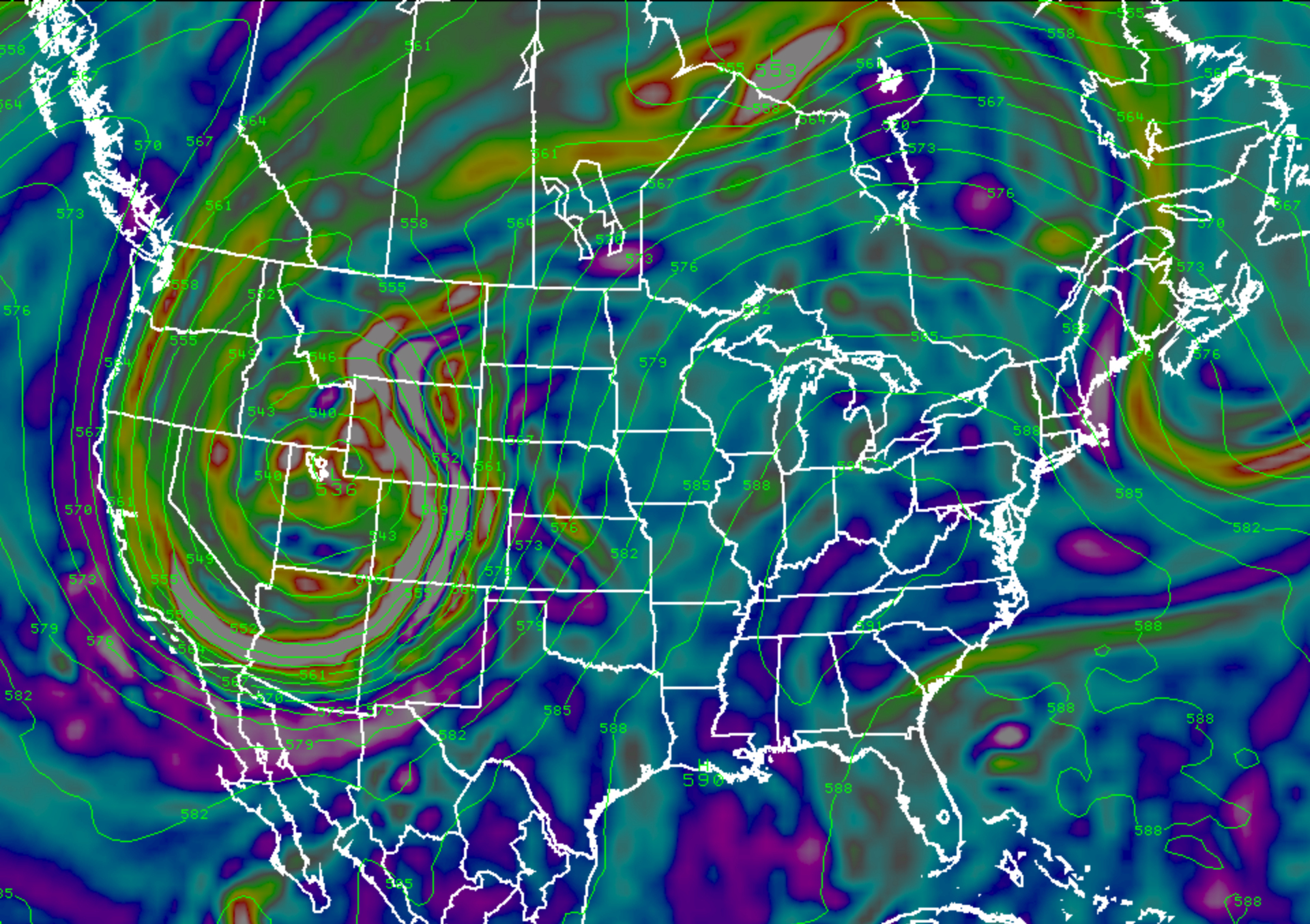


# North America Configuration providing Forecast imagery for NWS AWIPS

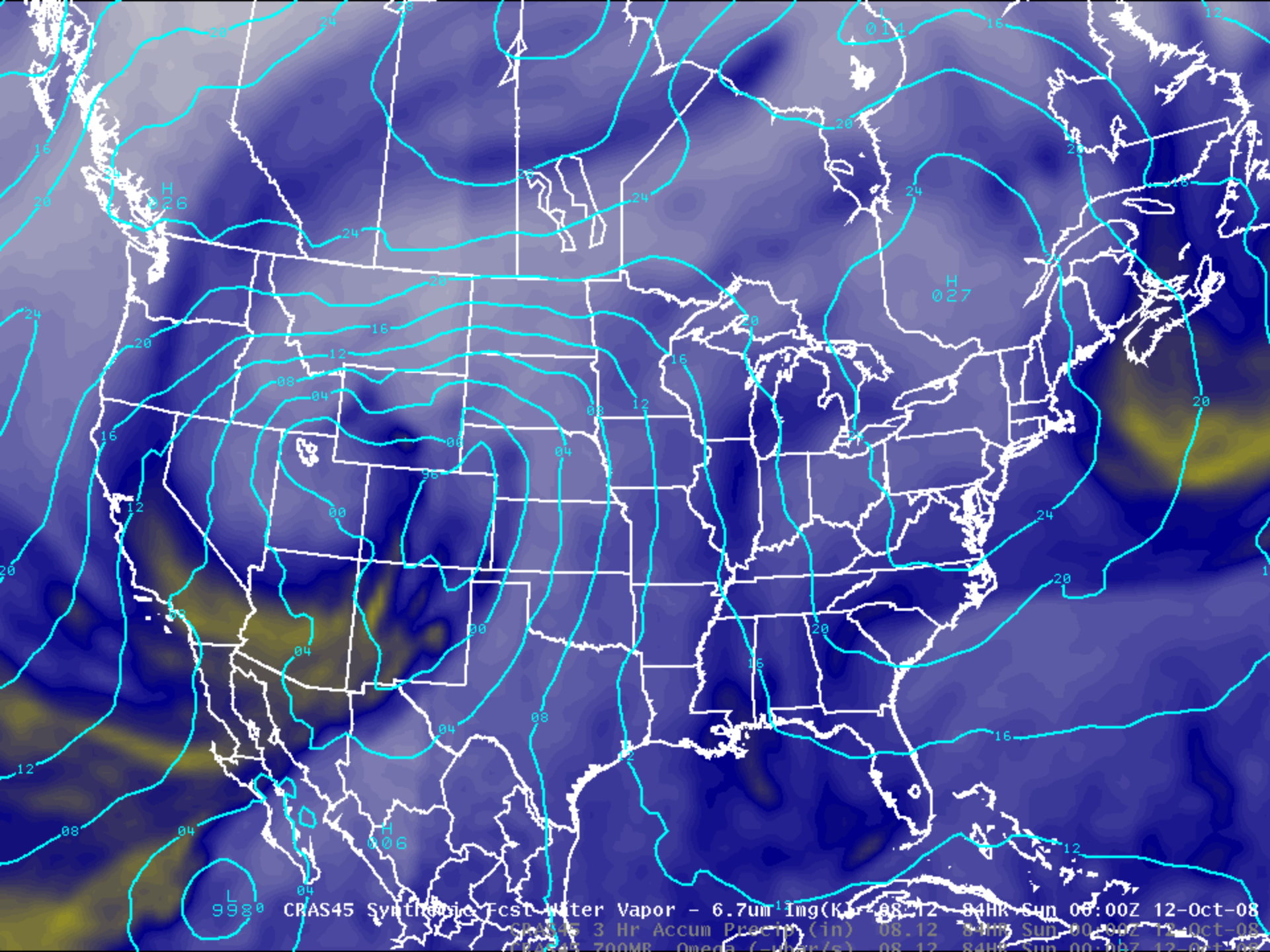
Resolution:	48 km
Sigma levels:	38
Grid Size	275x150
Time-step:	200 seconds
Forecast length:	84 hours
Initialization:	12-hr spin-up, five data inserts
Output:	3 hourly
Initial times (UTC):	00/12
Start times (UTC):	01:15/13:15
Initial conditions:	One degree GFS, 6 hr Forecast
Bndry conditions:	6 hourly,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



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



08.12 84HK Sun 00:00Z 12-Oct-08  
08.12 84HK Sun 00:00Z 12-Oct-08  
08.12 84HK Sun 00:00Z 12-Oct-08

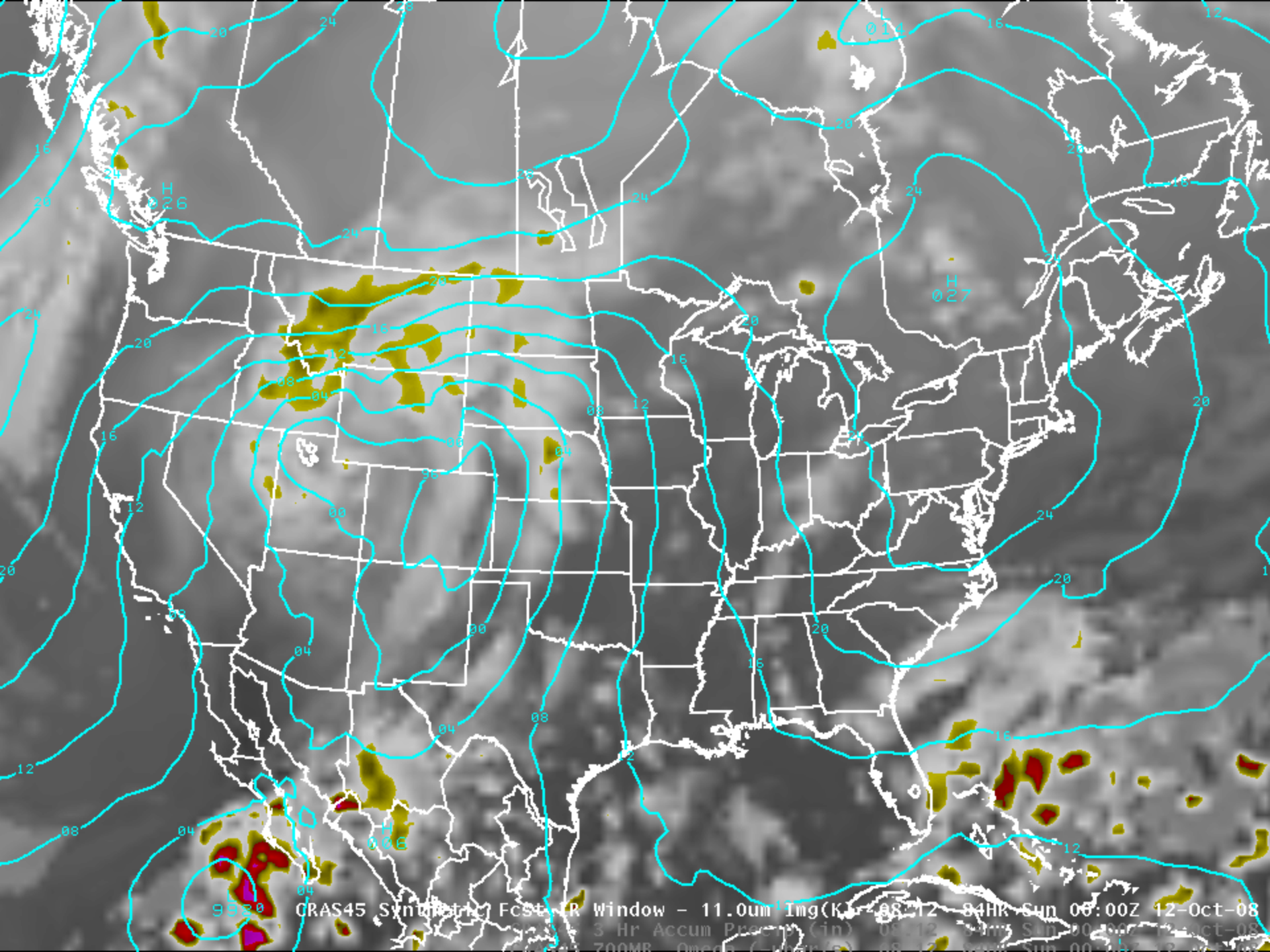


9980

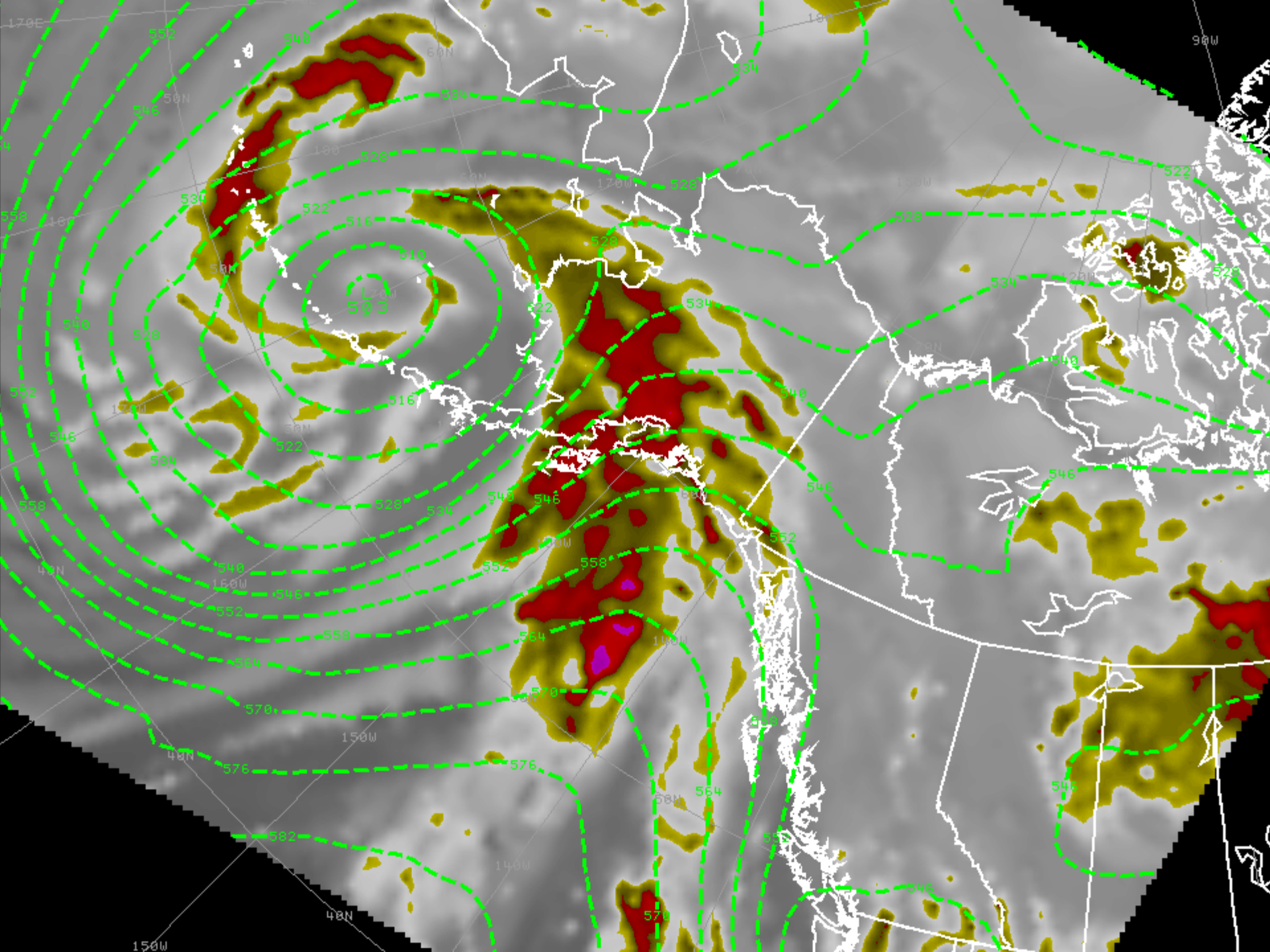
CRAS45 Synthetic Fcst Water Vapor -  $6.7 \text{um}^{-1} \text{mg(K}^{-1})$  08:12 84HK Sun 00:00Z 12-Oct-08

CRAS45 3 Hr Accum Precip (in) 08:12 84HK Sun 00:00Z 12-Oct-08

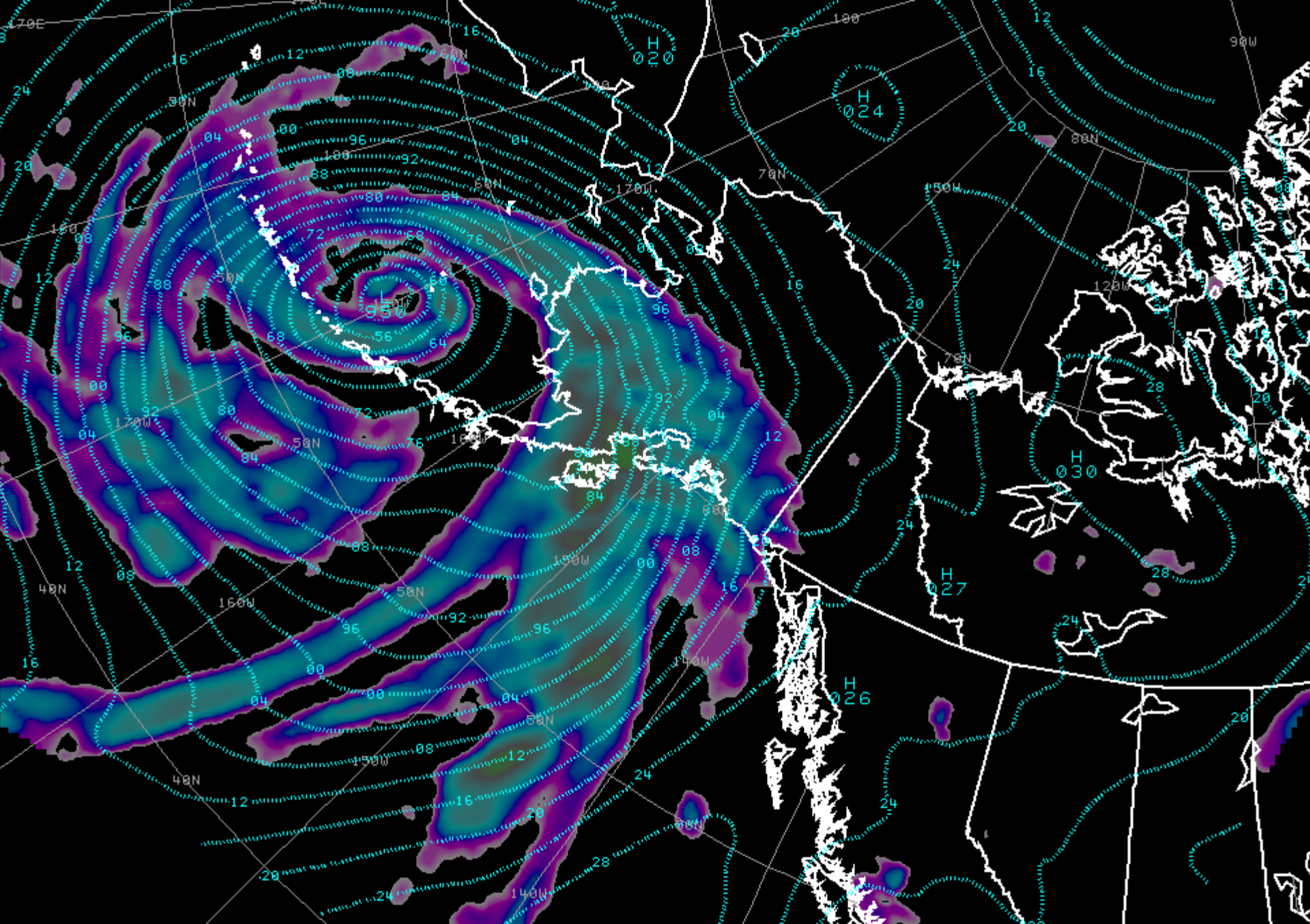
CRAS45 700MB Omega ( $-\text{ubar/s}$ ) 08:12 84HK Sun 00:00Z 12-Oct-08



CRAS45 Synoptic Fcst - R Window - 11.0um Img(K) - 88.12 - 84HK - Sun 06:00Z 12-Oct-08  
3-Hr Accum Precip (in) - 05.12 - 9.4mm - Sun 00:00Z 12-Oct-08  
700MB Omega (hPa/s) - 08.12 - 9.4mm - Sun 00:00Z 12-Oct-08







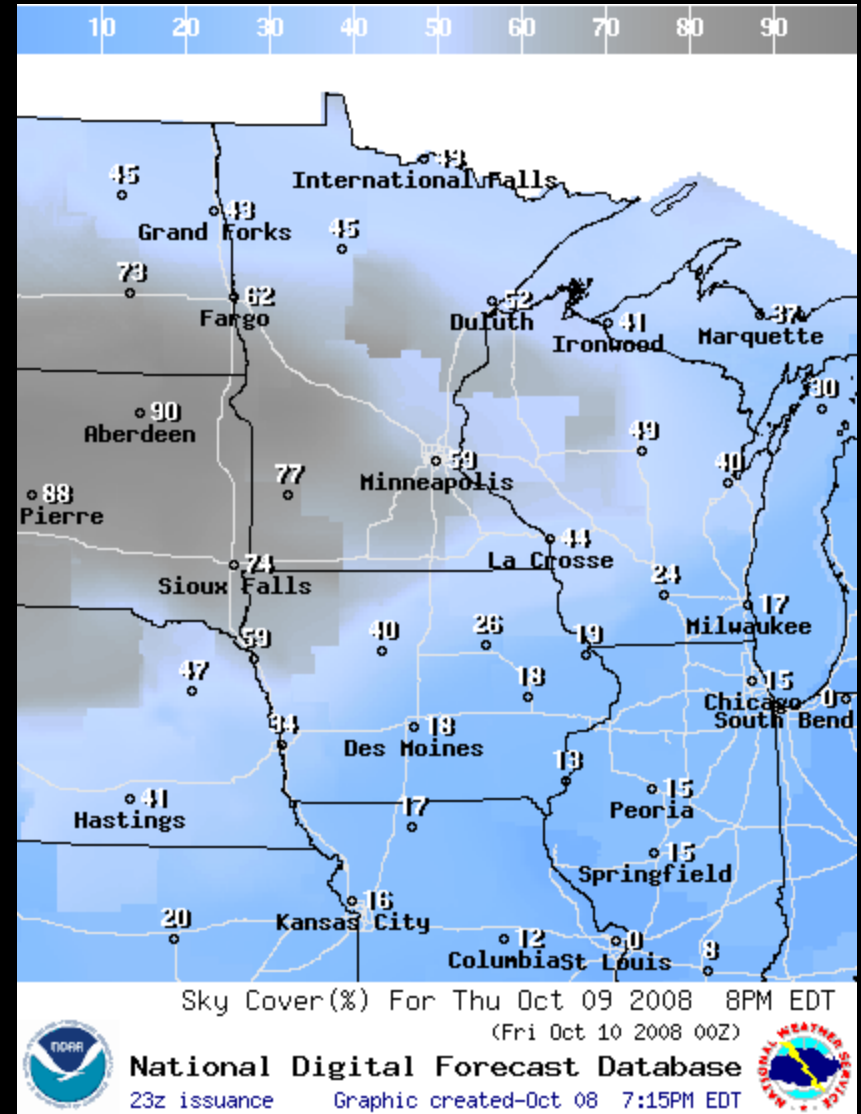
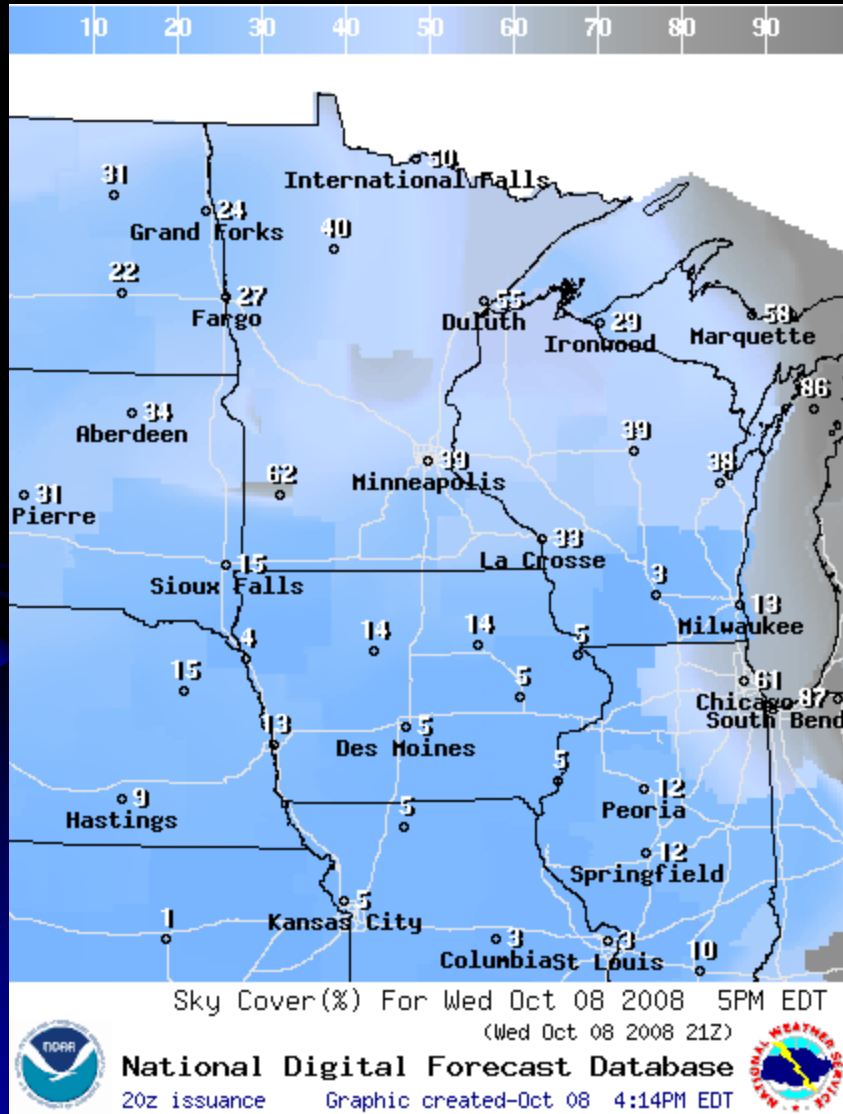
CRAS45-AK 3 Hr Accum Precip Ings 08.12 42Hr Fri 06:00Z 10-Oct-08

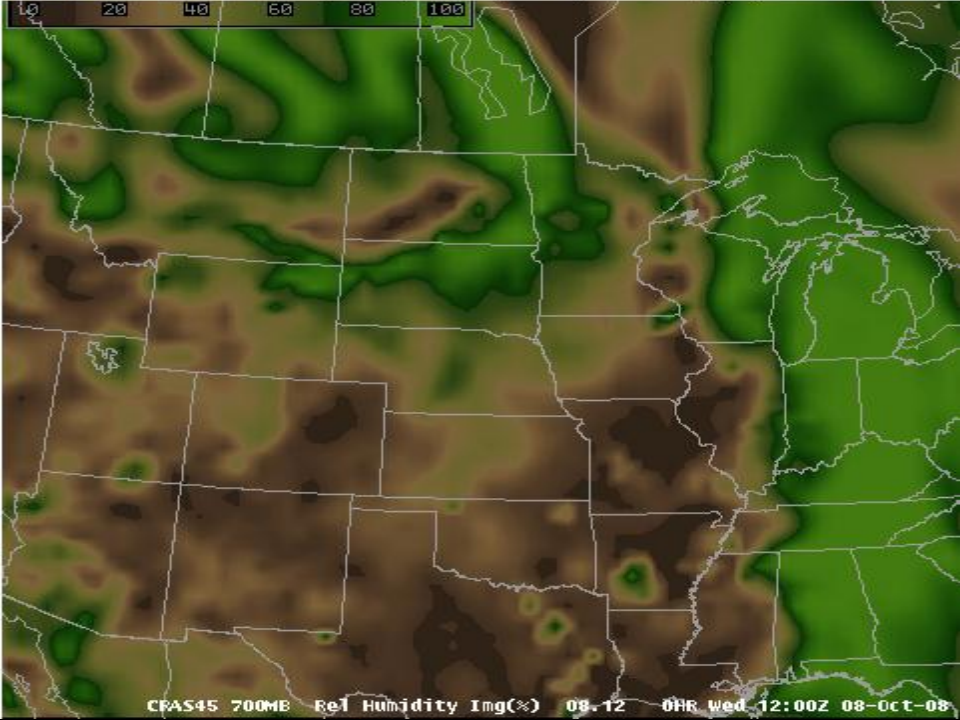
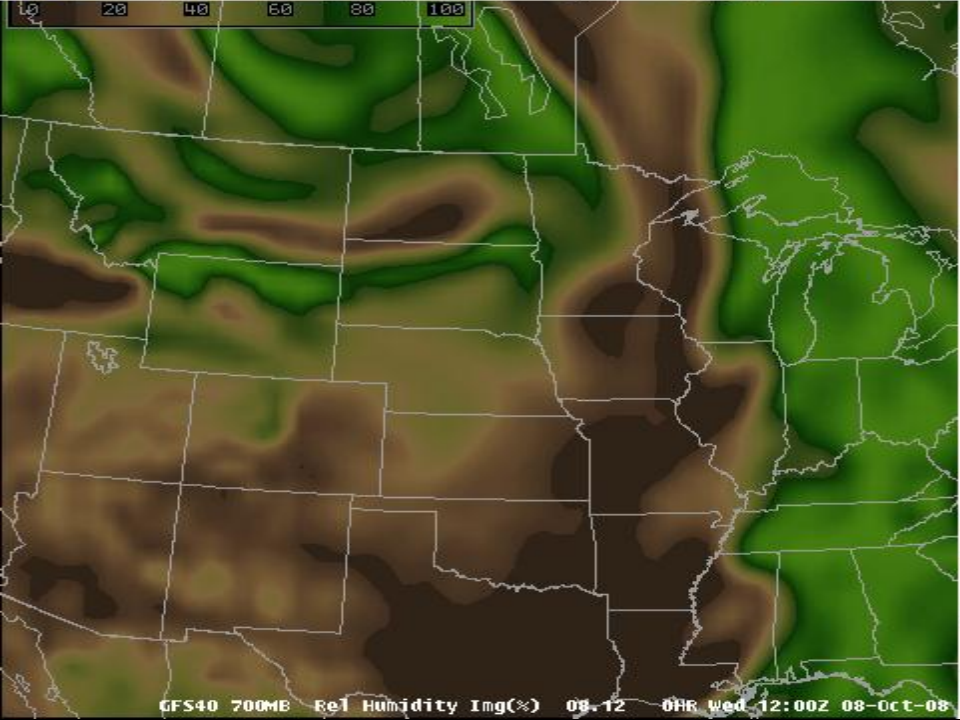
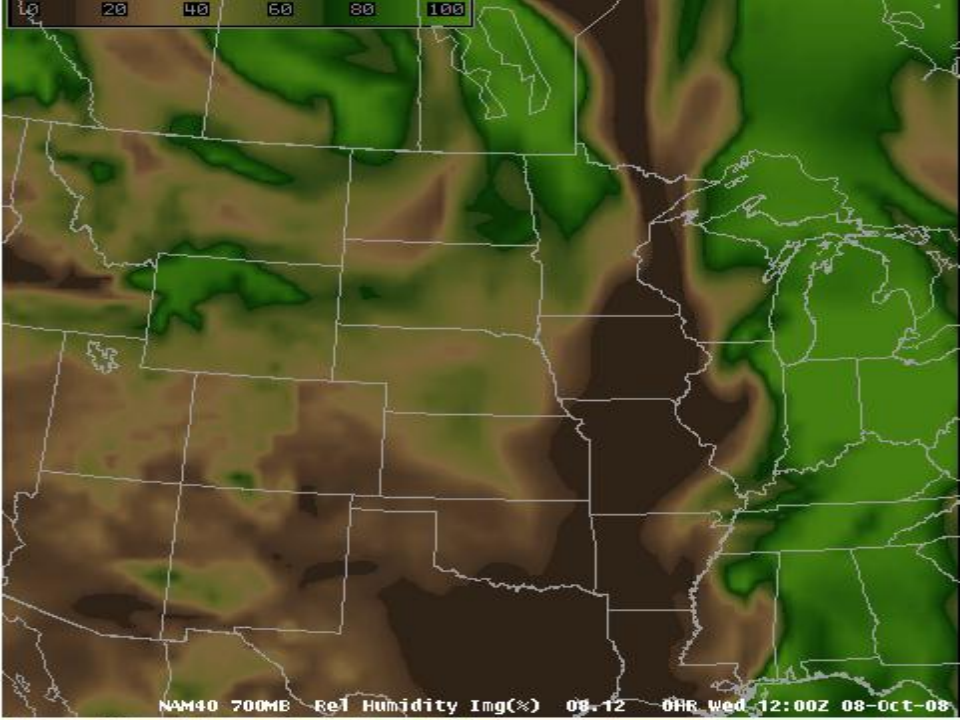
CRAS45-AK 3 Hr Accum Precip Ings 08.12 42Hr Fri 06:00Z 10-Oct-08

CRAS45-AK 700MB Omega (-u/s) 08.12 42Hr Fri 06:00Z 10-Oct-08

150W

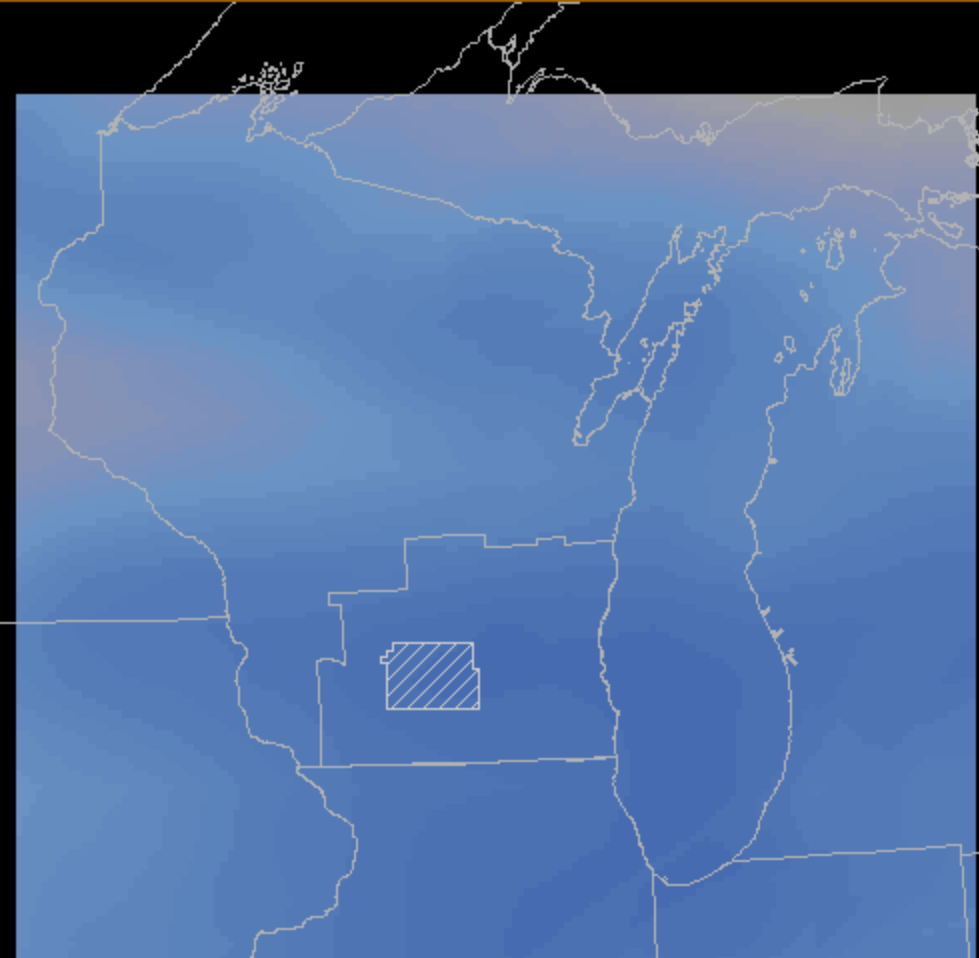
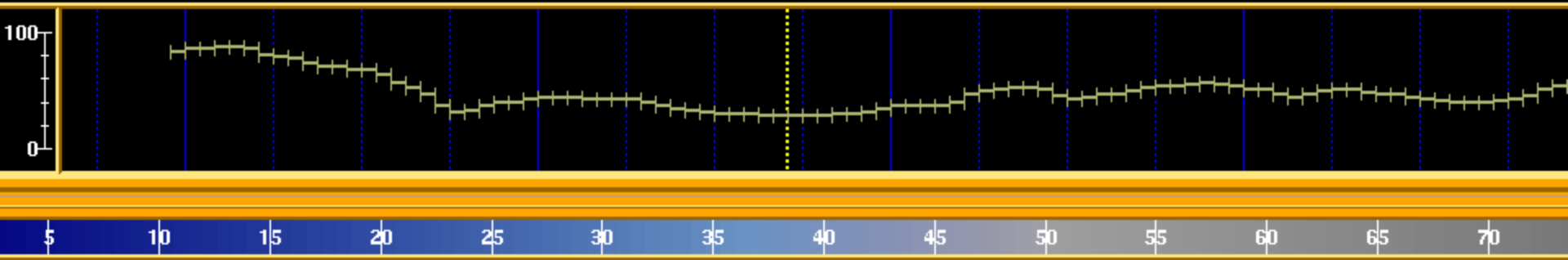
# Can the CRAS help?





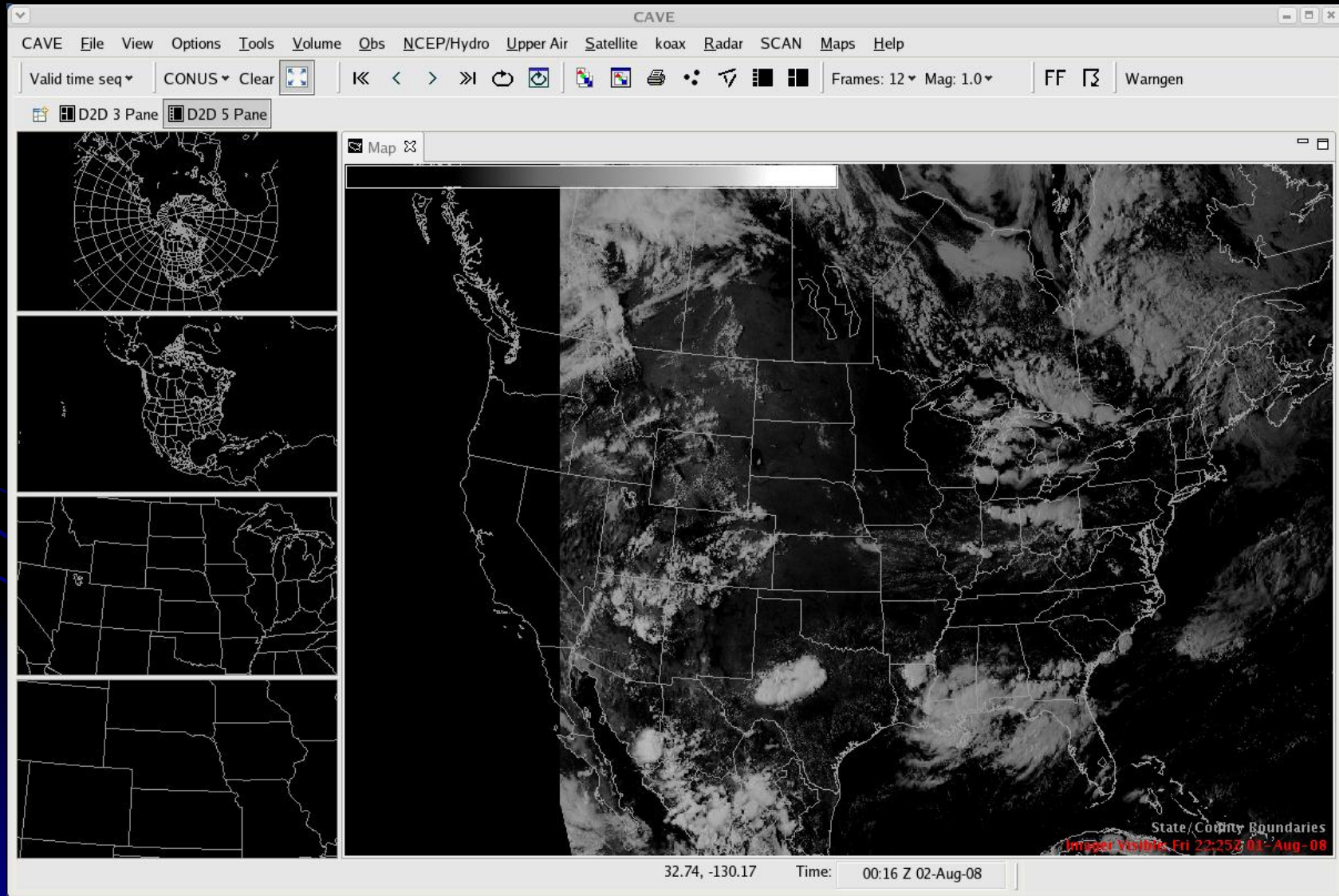
t 07 (Tue)      Oct 08 (Wed)      Oct 09 (Thu)      Oct 10 (Fri)      Oct 11 (Sat)  
 12      18      06      12      18      06      12      18      06      12      18      06      12      18

SFC Fcst\_Prac (MKX)



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)	(
Swel1	SFC Fcst_Prac (MKX)	(

# AWIPS-II Task Order 8



40

20

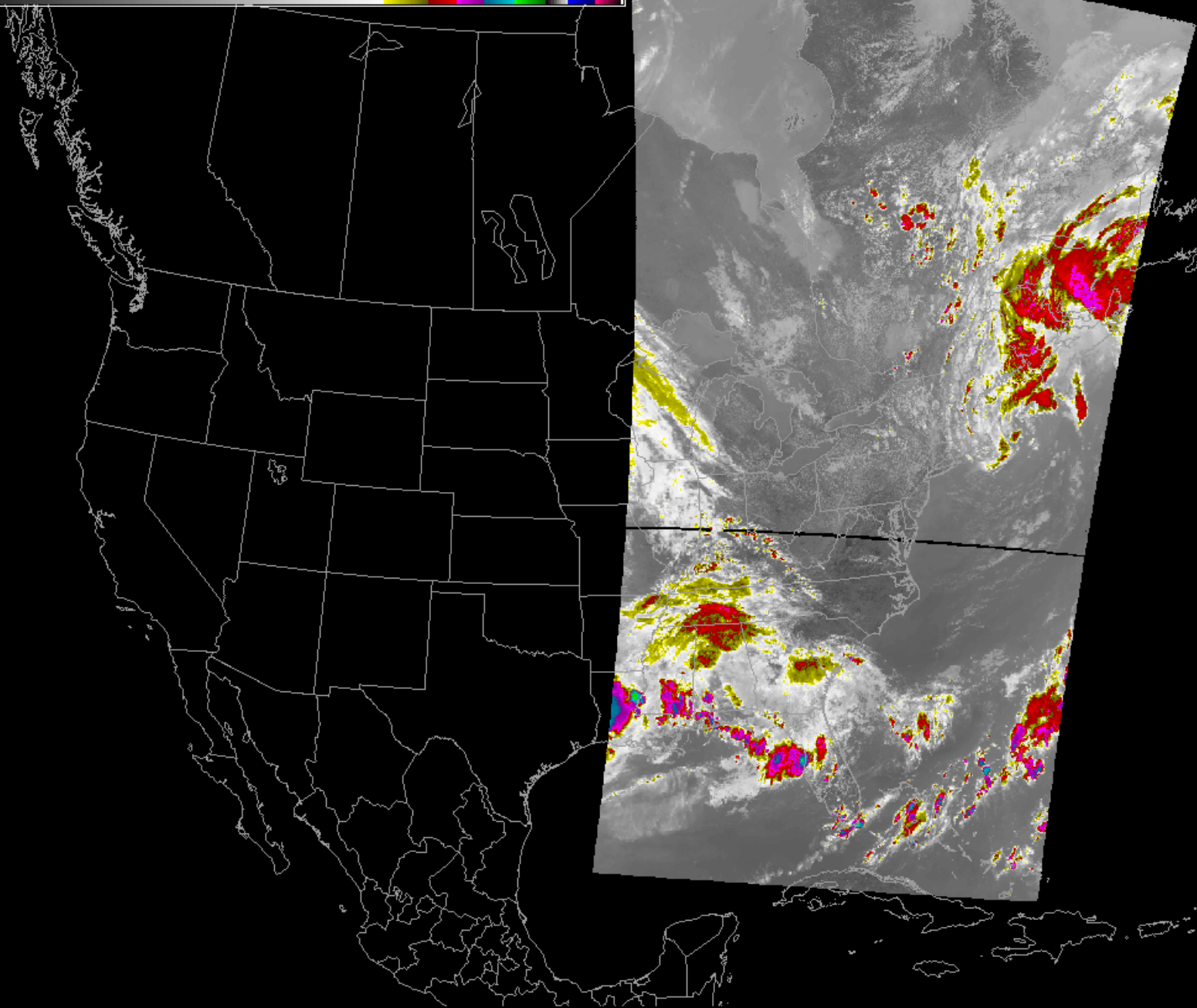
0

-20

-40

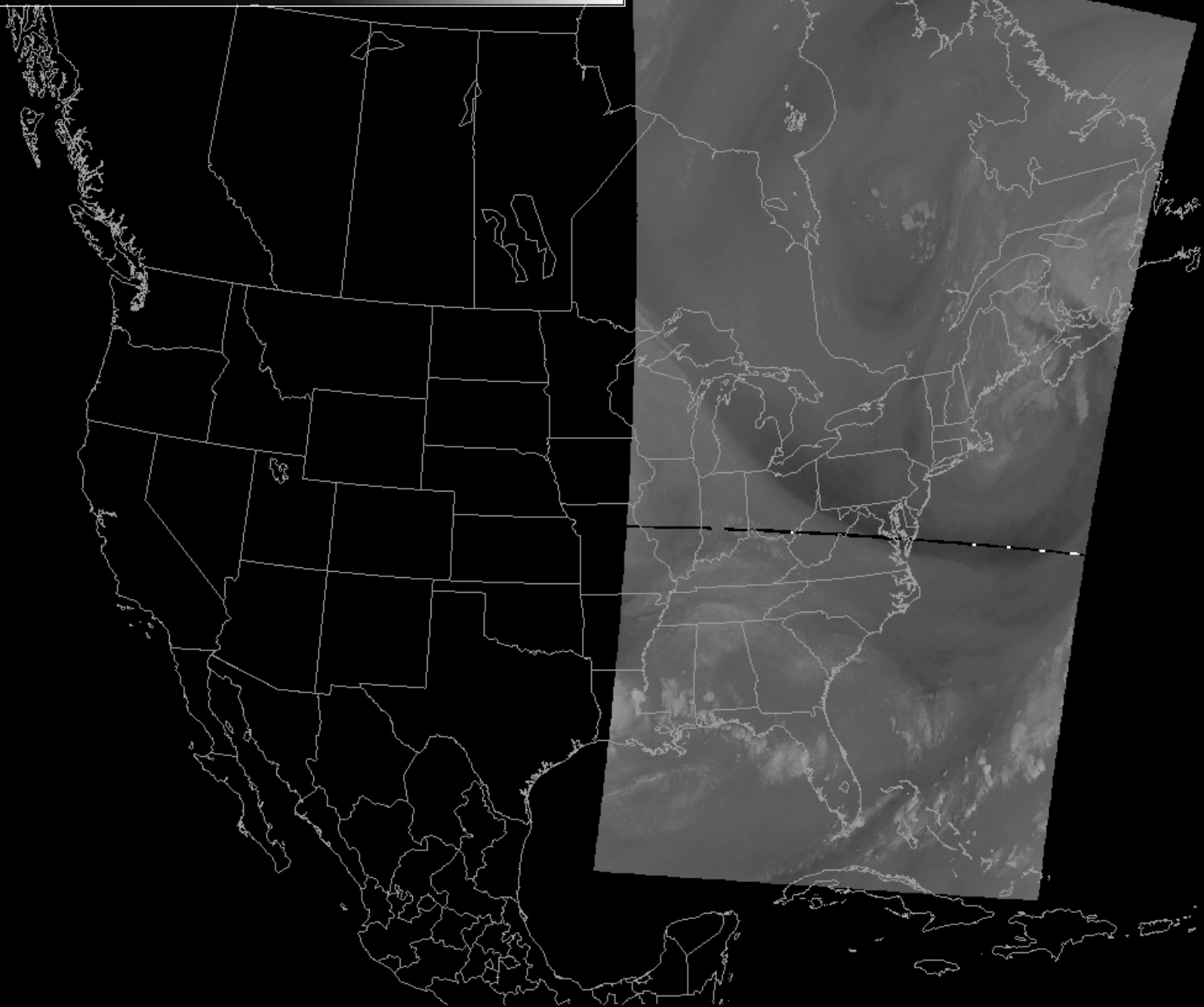
-60

-80



State/County Boundaries

Imager 11 micron IR: Tue 16:04Z 12-Aug-08



# CIMSS Satellite Blog


CIMSS Satellite Blog - Windows Internet Explorer

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

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CIMSS Satellite Blog

Home RSS Print Page Tools

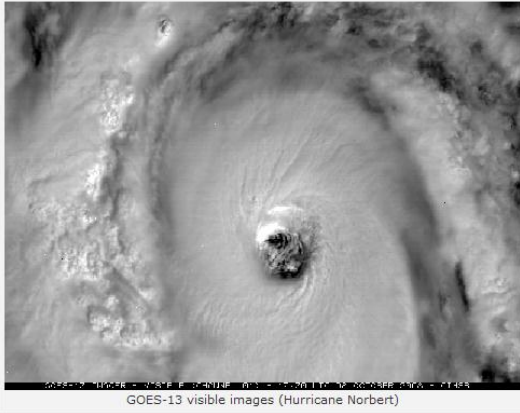


## CIMSS Satellite Blog

A weblog of meteorological satellite imagery relevant to current weather events

### Of large eyes and midget tropical cyclones

October 8th, 2008



GOES-13 visible images (Hurricane Norbert)

GOES-13 visible imagery (*above*) revealed the rather large eye of Hurricane Norbert on **08 October 2008** — Norbert was a Category 3 storm at that time, and the eye was about 30-35 nautical miles in diameter. Hurricane Norbert underwent a period of rapid intensification during the pre-dawn hours on 08 October 2008, which was clearly seen on a plot of the Advanced Dvorak Technique intensity estimate (*below*) from the **CIMSS Tropical Cyclones** site.

**Pages**

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- SatePedia

**Archives**

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- July 2007
- June 2007
- May 2007
- April 2007
- March 2007

- September 2006
- August 2006
- October 2005

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

Done

Internet 100%



Comments? Questions?

Jordan.Gerth@noaa.gov

