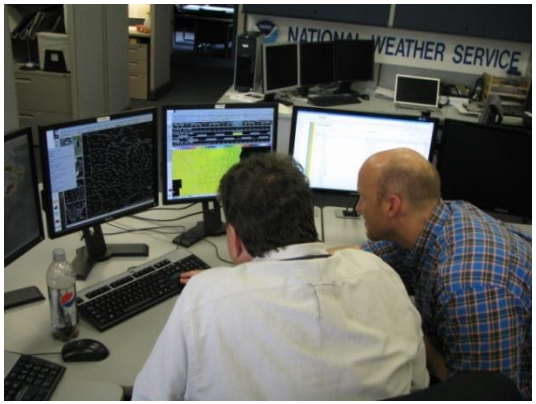
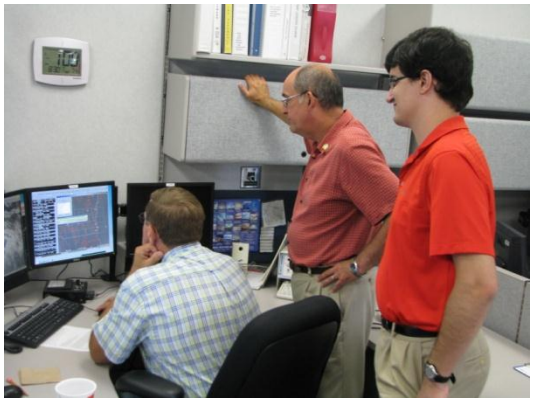
NWS Field Perspective of the GOES-R Proving Ground



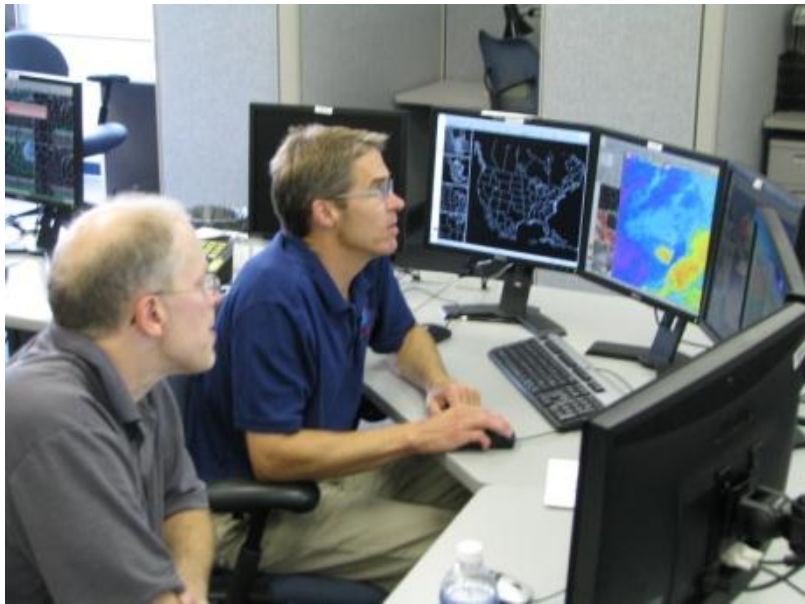


Jeff Craven, Marcia Cronce, and Steve Davis
NOAA/NWS Milwaukee-Sullivan WI

7th GOES Users' Conference (GUC) Oct 20th 2011

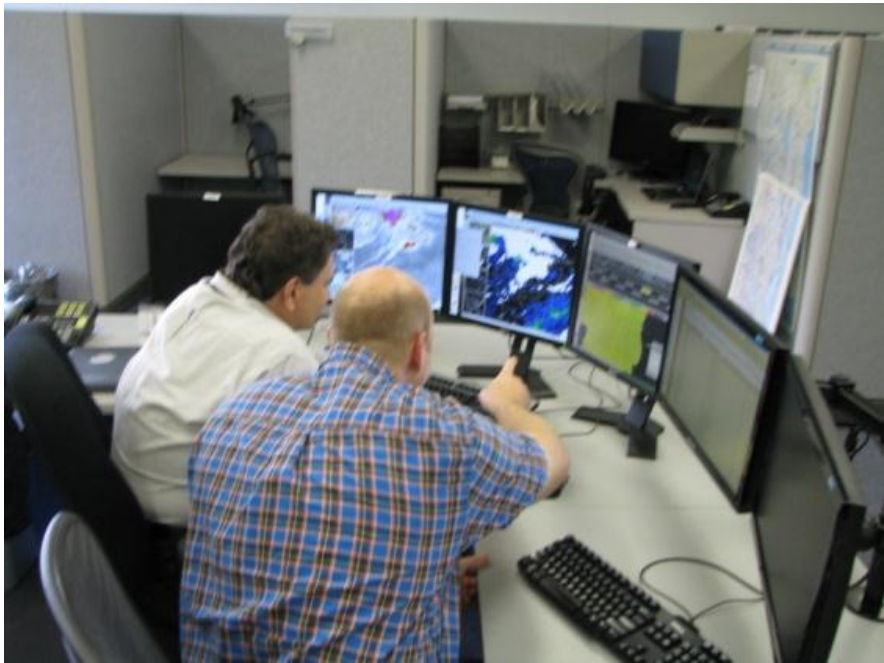
2010 CIMSS MKX GOES-R Proving Ground

- May to August 2010
- 27 CIMSS GRPG shifts scheduled (6-8 hours)
- One-on-one forecaster and developer
- CIMSS developers traveled to MKX (45 miles)



2010 CIMSS MKX GOES-R Proving Ground

- Analyzed: Convective Initiation, Convective Cloud Top Cooling Rate, and Differential Theta-e Nearcast products
- Completed formal feedback surveys



Joint CIMSS MKX poster at NWA 2010

GOES R Proving Ground: The CIMSS/NWS Sullivan 2010 Testbed

Jeffrey P. Craven and Marcia R. Cronce, NOAA/NWS WFO Milwaukee/Sullivan, WI

Wayne F. Feltz and Jordan J. Gerth, University of Wisconsin, Madison, SSEC/CIMSS

Convective Cloud-Top Cooling Rate

1825Z IR Image over TN. Field of cumulus and towering cumulus. IR temp -7 C on cloud of interest.

1833Z IR Image. Instantaneous cooling rate of -6 C/15 min with towering cumulus over southern middle TN. IR temp -19 C.

1840Z IR Image. IR temp -24 C with a positive and negative lightning strike noted.

May – August 2010

A GOES R Proving Ground shift was scheduled nearly every Tuesday and Thursday during the four month period. A WFO MKX meteorologist was teamed with a CIMSS developer, who traveled to the NWS Sullivan Office to sit side-by-side with the forecasters to evaluate the products using real time data in AWIPS. The CIMSS developers presented background information about how the products were derived and what they were designed to accomplish.

Six different CIMSS developers and ten NWS forecasters participated in this exercise. There were a total of 27 evaluation shifts. The forecasters completed a daily evaluation form to provide feedback on the strengths and weaknesses of each product.

Area of study- AWIPS Regional Map

Products delivered from CIMSS to WFO MKX

MODIS 1km images and 4km derived products

AVHRR 1km imagery and products

CRAS 4km IR and Water Vapor forecasts

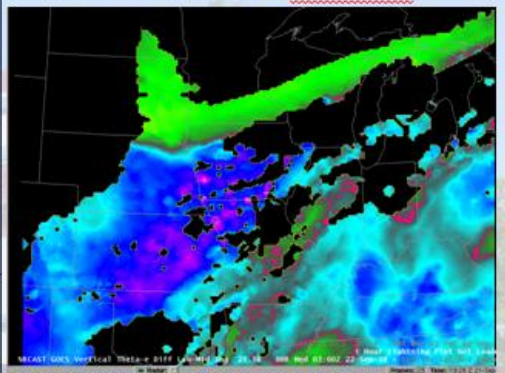
GOES sounder 8km CAPE and Total Ozone

CIMSS convective initiation and cloud top cooling

GOES sounder nearcast differential theta-e/PW

GOES winds products

Differential Theta-e Nearcasts



GOES Sounder difference between Theta-e at ~780mb and ~500 mb. Measure of convective instability. Strongest convective instability shown from Kansas into Iowa in dark blue and purple tones. Theta-e difference of 20 to 25 K indicating strong convective instability.

Nearcast: A multi-layer Lagrangian nearcasting model which moved point observations, or retrievals, of moisture from the GOES Sounder forward in time, out to 9 hours, based on winds from the Rapid Update Cycle, RUC. This technique can be used to identify broader areas of instability based on varying moist and dry air advection in the lower and middle levels of the troposphere, filling a gap where traditional numerical weather prediction methods are lacking in skill.

Strengths

* Often provides better spatial resolution than models on gradients in instability.
* There were often differences in the nearcast instability maximum location versus NWP models such as the RUC. Given that the nearcast is based on observed satellite data, discrepancies were normally in favor of the nearcast and the NWP was misplaced.

Weaknesses

* Lack of information in continuously cloudy areas. GOES sounder requires nearly clear field of view to retrieve information.
* Although nearcast shows instability maxima and gradients, it does not give you an indication of when the deep convection will develop.
* At times did not provide an indication of where thunderstorms would develop. Deep convection would sometimes develop over a wide range of differential theta-e values.

Convective Initiation Nowcast

Strengths

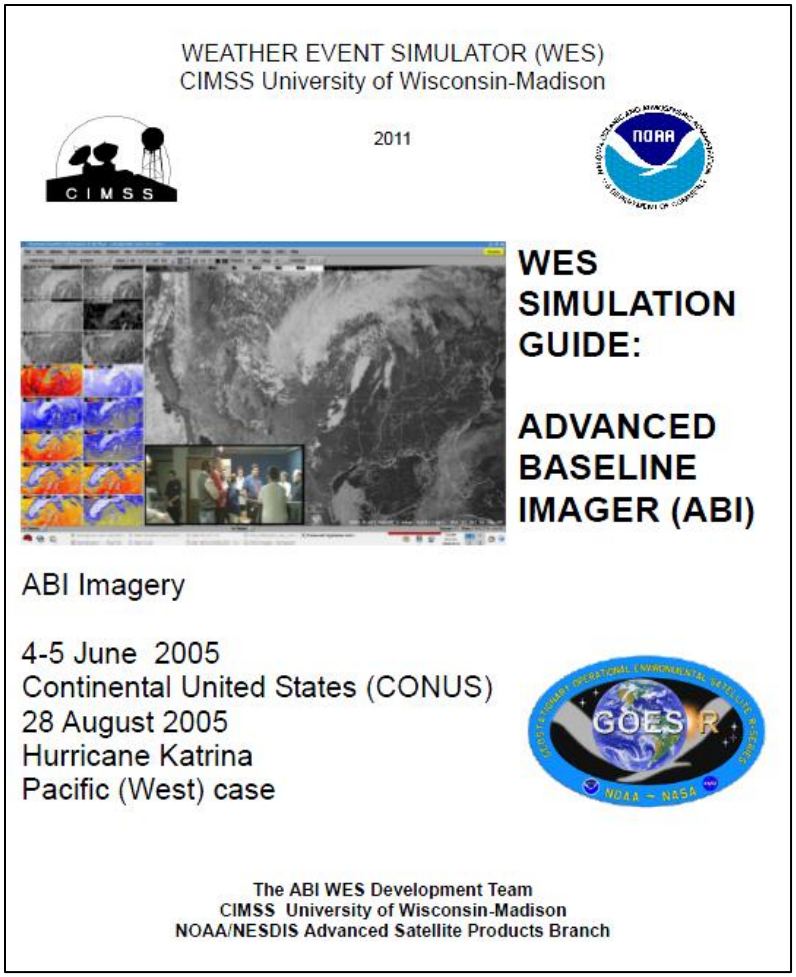
* Can precede lightning or radar echo formation in growing deep convection by as much as 20 minutes.
* Performs best in rapid scan strategy, which provides images about every 7 minutes as opposed to typical 15 minute temporal resolution. GOES R will have 5 minute routine imagery.
* Helps highlight fastest growing TCU/CB elements
* Performance did not seem to be tied to amount of shear or instability
* Provides value during nocturnal events when visible imagery not available

Weaknesses

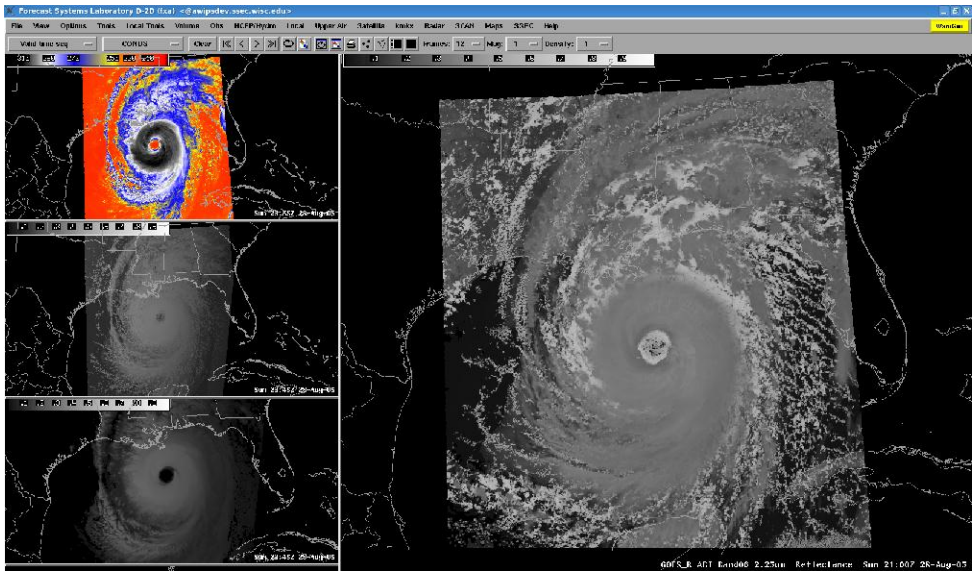
* Presence of cirrus, even very thin cirrus, can prevent algorithms from detecting convective initiation.
* In most cases, has no additional lead time in detecting convective initiation over what radar can offer. This is especially true when images are 15 minutes apart per current GOES imagery.
* Provides little to no lead time in tropical airmass (warm rain process)

"Meeting on a regular basis was a productive and enjoyable interaction between the academic and operational meteorology communities."

GOES-R ABI WES

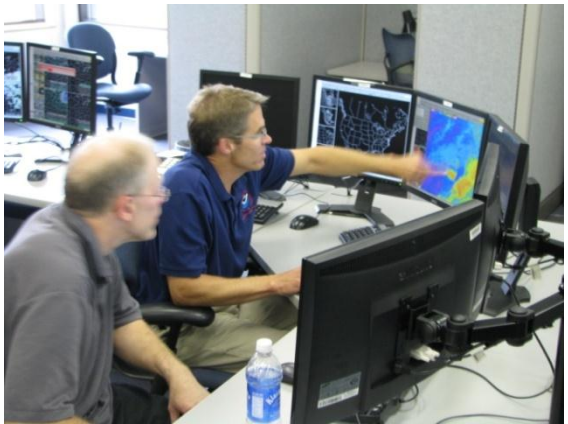


- Marcia Cronce (MKX) worked with CIMSS/ASPB in developing a GOES-R ABI WES (Weather Event Simulator), which used simulated images to showcase possible uses of each band.



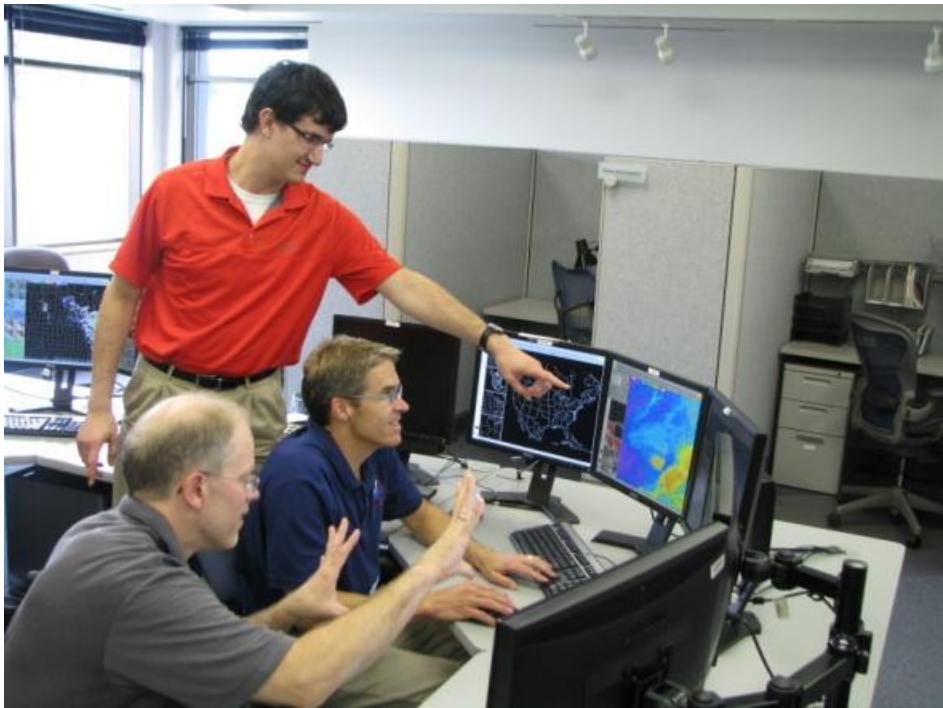
2011 CIMSS MKX GOES-R Proving Ground

- August to October 2011
- Emphasis was on GOES-R AWG low cloud product and Synthetic GOES-R imagery
- Developers trained on how the products are derived and how they should be used
- Products viewed on AWIPS and on-line
- Forecaster feedback: blog entries



GOES-R – Why are forecasters excited?

- Think of having MODIS images every 5 minutes!
- Spatial: 500 meter resolution visible
- Spatial: 2 km resolution water vapor
- Temporal: 5 minute routine, 1 minute meso sector
- GLM available ~ 1 min!



GOES-R – Why are forecasters excited?

- Ability to sync satellite, radar, lightning, profiler, and ASOS/mesonet observations every 5 minutes
- Potential to change analysis standard (RTMA) from hourly to 5 minute by 2020? (Draft of NWS S&T Roadmap)

Bottom Line

- We want the highest spatial resolution
- We want the fastest temporal resolution
- We want the smallest lag time

- Bandwidth is always a challenge

- If you can't ship the whole image, send a high resolution clip. We'd prefer that the native resolution is preserved

Proving Ground thoughts

- In general, the raw products are preferred over derived products
- One exception is the fog product, which is still at rather high resolution
- Preference for items that have quantitative properties, rather than “yes/no”
- (ie Cloud Top Cooling Rate versus Convective Initiation Likely)

Examples of products and use

- Sometimes the developers (and SOO) are surprised at:
- What will be popular?
- How we might use a product?

The GOES-R Proving Ground Blog

- CIMSS/MKX GRPG Blog entries are made in the HWT PG Blog but are easily found using Blog Archive search menu function

- This feedback appears to be much more popular for the forecaster and easier to use for the developers

The GOES-R Proving Ground Blog

http://goesrhwt.blogspot.com/

The GOES-R Proving Ground at NOAA's Hazardous Weather Testbed

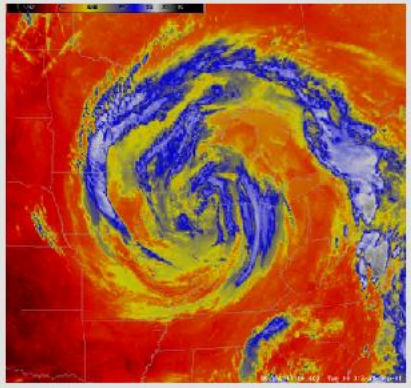
Tuesday, September 27, 2011

Notes from 9/27/11 CIMSS/NWS Testbed Session

We discussed many different ideas and made notes about improvements that each of us can make to help in forecast operations.

One question to ask yourself when working on the short term shift is, "Will there be some clearing in the clouds tonight?" A stationary upper low pressure system has been sitting over southern Lake Michigan and northern Illinois for the past 4 days at least. Timing the clearing skies vs. the cloudy skies has been a big challenge, to say the least. It makes a big difference when forecasting minimum temperatures. There are some products provided by the CIMSS group that are available in AWIPS that can help us with our sky cover forecast for tonight.

The first image is actual, current infrared (IR) satellite imagery of the midwest at 1930Z Tue Sep 27 (230 pm). The second image is the GOES-R ABI simulated IR imagery Band 11 (8.5 um) for 0400Z Wed Sep 28 (11 pm Tue Sep 27). The simulated imagery shows clearing in the lower/mid levels over central WI tonight. This actually verifies with several other model output, including NAM and GFS sky cover grids available in the Gridded Forecast Editor. We can infer that this Band 11 imagery is showing clearing in the low levels because we also looked at Bands 8, 9 and 10 which show more of the water vapor-type imagery, and there were no high clouds depicted in that area either.



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Links

GOES-R Homepage

GOES-R Proving Ground

NOAA's Storm Prediction Center

NOAA's Hazardous Weather Testbed

Experimental Forecast Program

EFP Blog

Experimental Warning Program

EWP Blog

NSSL Realtime WRF model forecasts

UW-CIMSS Satellite Blog

RAMMB GOES-R Proving Ground Blog

Blog Archive

▼ 2011 (107)

▼ September (2)

Notes from 9/27/11 CIMSS/NWS Testbed Session

Notes From 9/6/11 Training Session

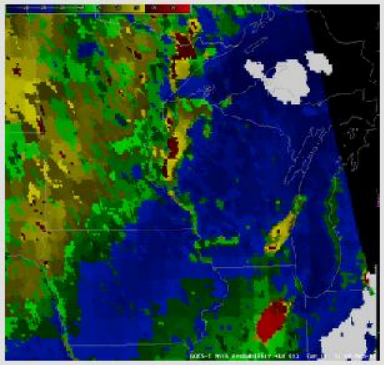
► August (14)

► July (2)

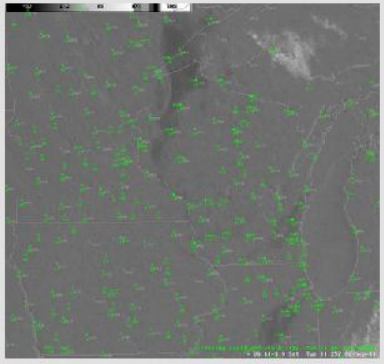
► June (20)

This is a simulated water vapor ABI image, band 10, forecast at 1800z on 9/6/11. This simulated water vapor image shows moisture in the low to mid levels of the atmosphere. Thus, it shows a lot of dry air in the southern high plains and western Texas. It also shows this dry air wrapping around the circulation with the remnants of Lee over the Ohio River Valley. From these images, it can be concluded that just some high clouds were moving into the southern high plains and western Texas, with the dry conditions in the lower to mid levels continuing. One could also say that the dry air wrapping into the remnants of Lee may reduce the clouds and precipitation associated with it.

Example 2:



In this GOES-R probability of MVFR ceilings product, from 1115z on Tuesday, September 6, 2011, several areas of higher probabilities were noted. These areas included parts of northwest Wisconsin, southeast Wisconsin, north central Illinois and far northeast Minnesota. There was also a large area of higher probabilities over Minnesota back into the northern Plains. Let's compare with an operational GOES East image below:



This visible GOES East image was taken at 1125z on 9/6/11, 10 minutes later than the MVFR probability

EWP interactions (90)

UWCI (54)

SATCAST (48)

Overshooting-tops / Thermal Couplet (42)

Convective Initiation (41)

Pseudo-GLM total lightning (39)

EFP interactions (37)

UAH CI (32)

Simulated Satellite Imagery (29)

PGLM (16)

Nearcast (14)

NSSL-WRF lightning threat (13)

CIMSS-MKX (12)

Fire Weather Applications (9)

Probability of severe hail (6)

Aviation Applications (4)

Fire Rating Product (4)

Surface Dryness (4)

CI (3)

NDVI (3)

Satellite (3)

Simulated Band Difference (3)

total lightning (2)

MFD (1)

Maximum Flash Density (1)

PGLM flash extent density (1)

SPoRT (1)

WES (1)

ceiling (1)

fog (1)

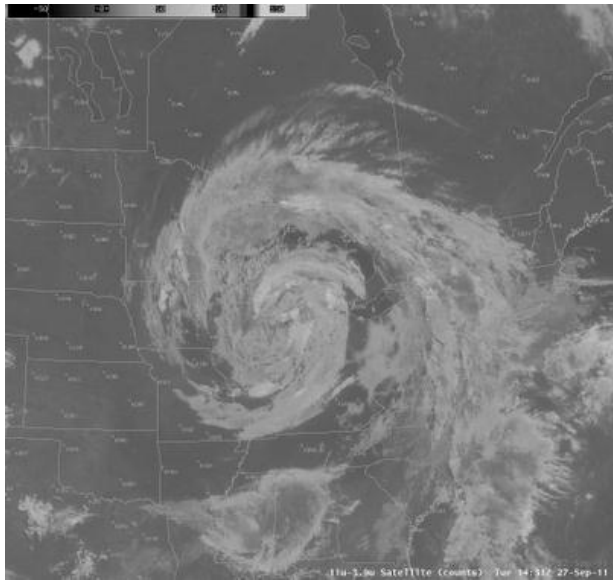
lightning jump (1)

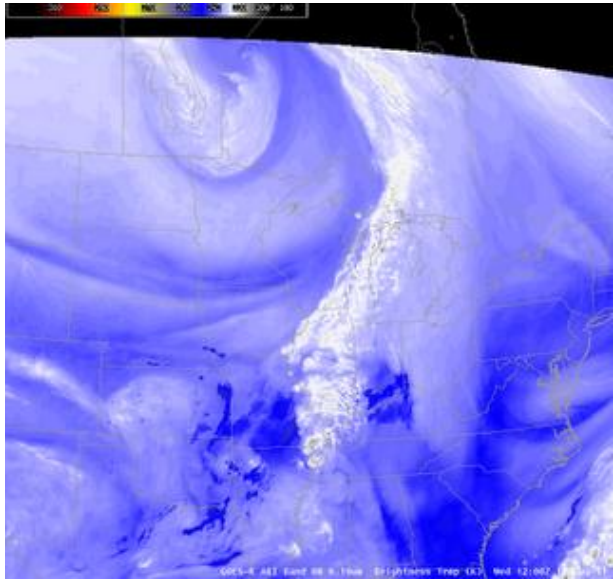
marine (1)

training (1)

Forecaster comments 2011

- Synthetic Forecast GOES-R Imagery
- “It would…be useful if the fog product could be simulated into the future (using the ABI simulated bands)”
- “The simulated water vapor imagery serves as a proxy for identifying and tracking the evolution of upper level jets without having to rely solely on model data.”



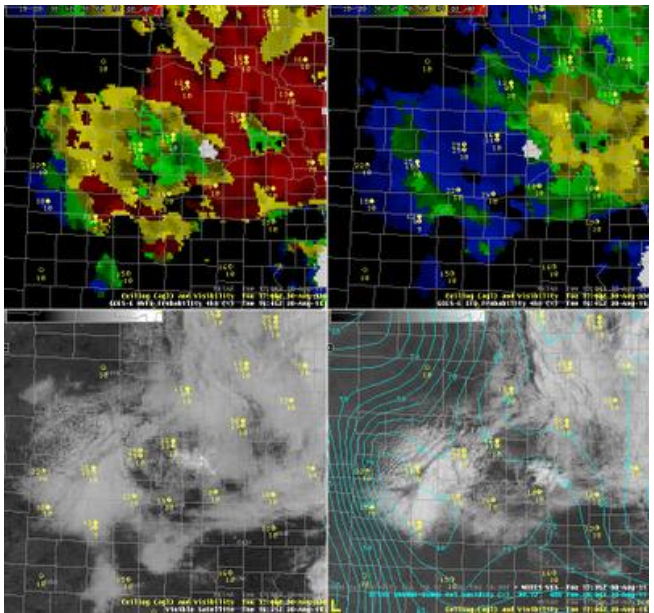


Forecaster comments 2011

- GOES-R probability of MVFR and IFR products

- "…it appears to me that not enough influence is given to the current observations *(METAR cloud heights)*. This is a great product and has lots of potential for the operational environment."

- "I suspect the holes forming in the overcast …were responsible for the more optimistic probabilities. …I don't believe these holes are near big enough to bring scattered or better than MVFR conditions… All of the surface obs across the area are bkn-ovc between 10kft-22kft. "

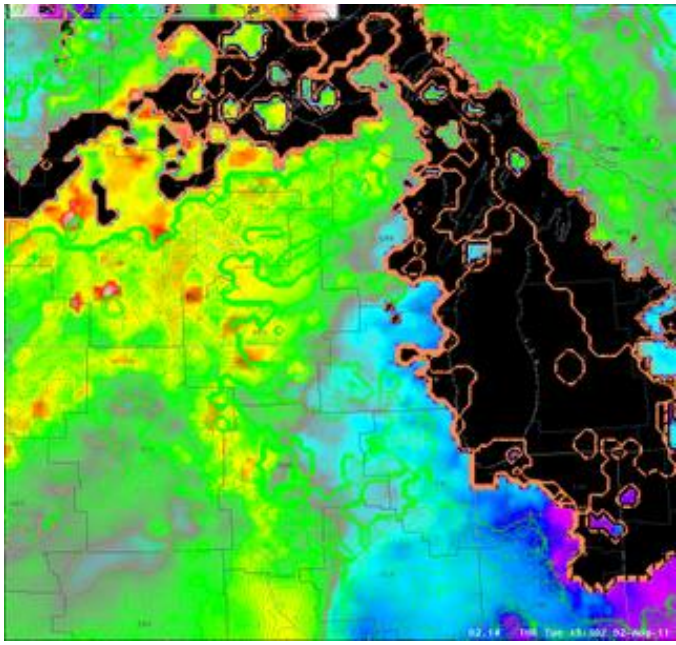


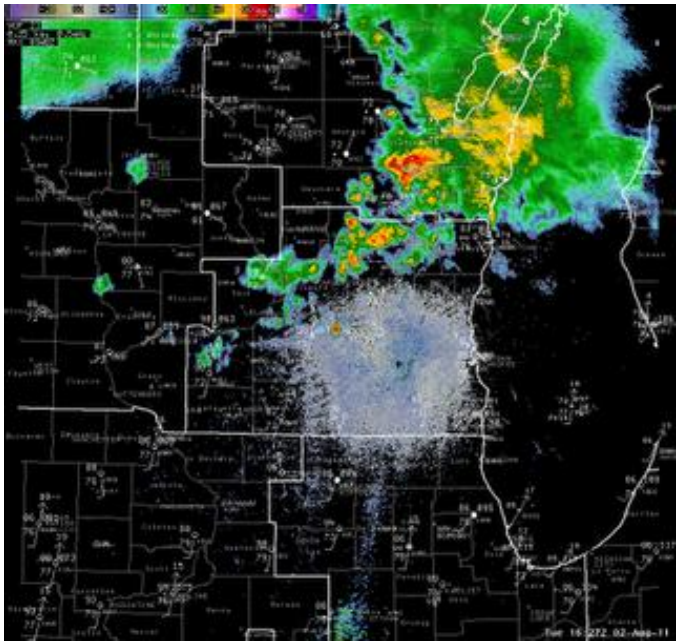
Forecaster comments 2011

- Theta-e difference Nearcast

- “The NearCast … of Theta-e differences …shows a region of stronger stability over the MKX WFO -- suggesting that any convection will struggle to develop. …suggests the convection over Dane County will not persist. …no lightning occurred. ”

- “If a general convective initiation time is known, this (Theta-e Nearcast) gradient forecast could be useful in locating the areas where storms will fire.”





Final Remarks

- These researcher/forecaster interactions are critical to best understand how and when to use a given product

- Adjustments to current products and development of new products have already resulted from these valuable interactions

- This iterative process works well with a continuous process of improvement on the GOES-R product suite

Thank you for your kind attention

- Acknowledgments

- GOES-R Program Office (GPO)

- CIMSS: Jordan Gerth, Wayne Feltz, Lee Cronce, Daniel Hartung, Justin Sieglaff, Corey Calvert, Kathy Strabala

- NESDIS/STAR/CRPD/ASPB: Tim Schmit, Gary Wade, Bob Aune, Andrew Heidinger, Mike Pavolonis

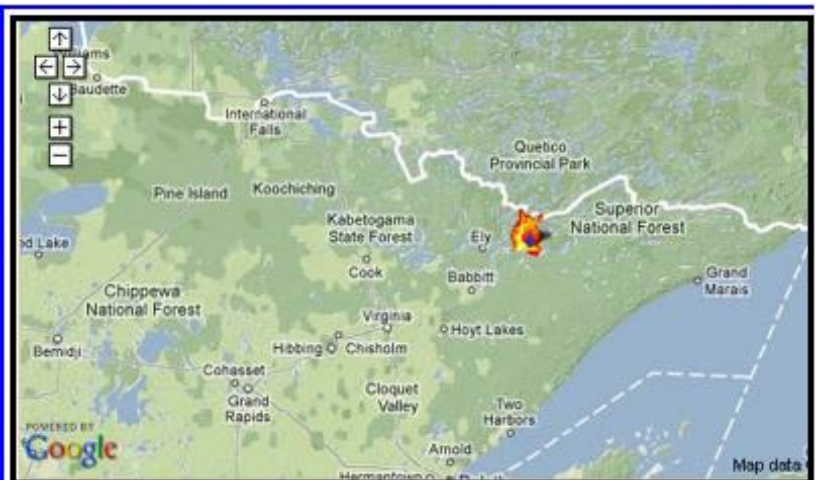
- NWS/OCWWS/TD/FDTB: Scott Bachmeier, Scott Lindstrom

BACKUP Slides to follow

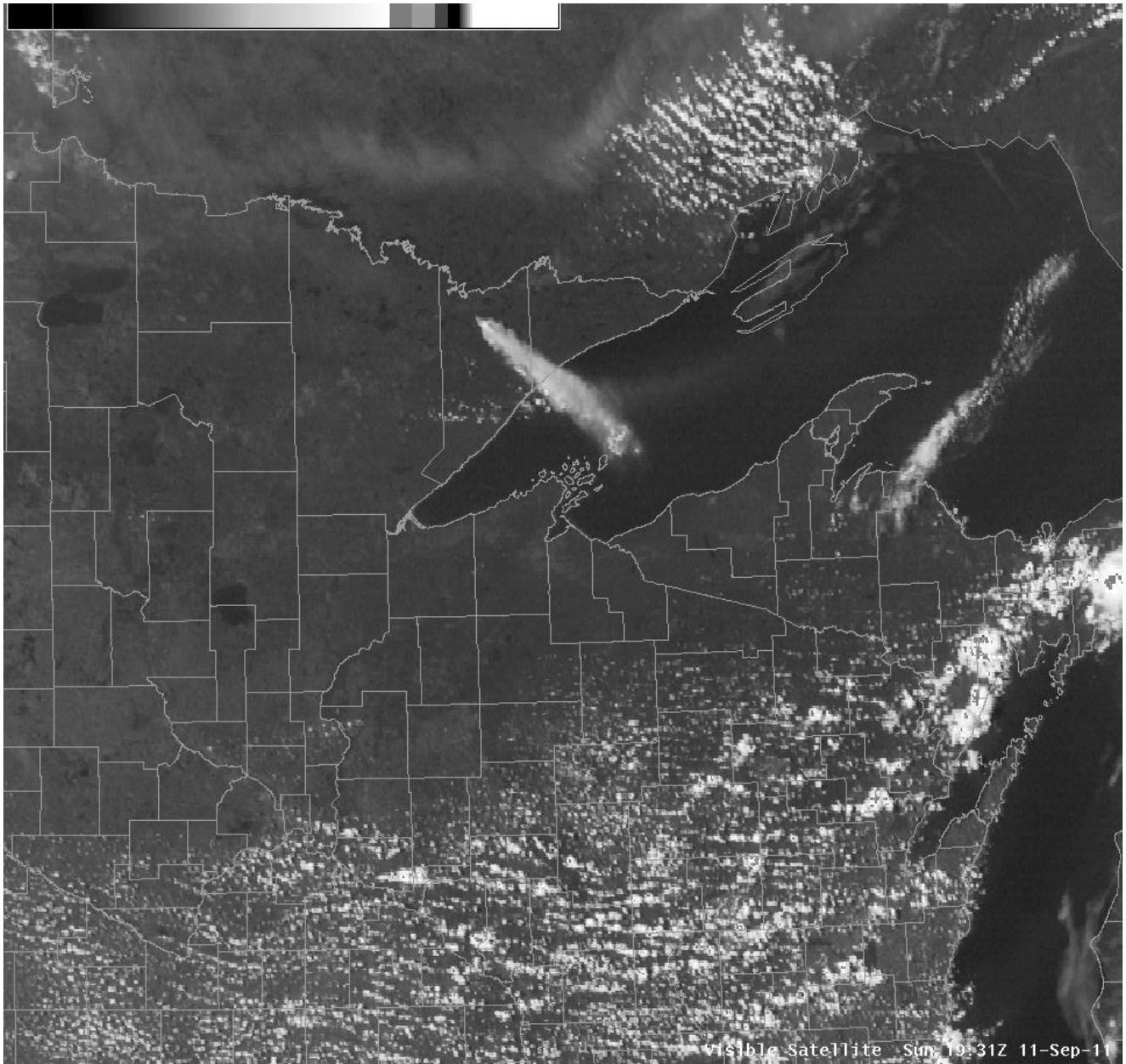
- NOTES
- Probably no time for these, and the examples are not really within the scope of the talk.
- But here are some cool examples from the day of the big NE MN fire

Pagami Creek Wildfire NE MN

Photos courtesy Carl Karasti

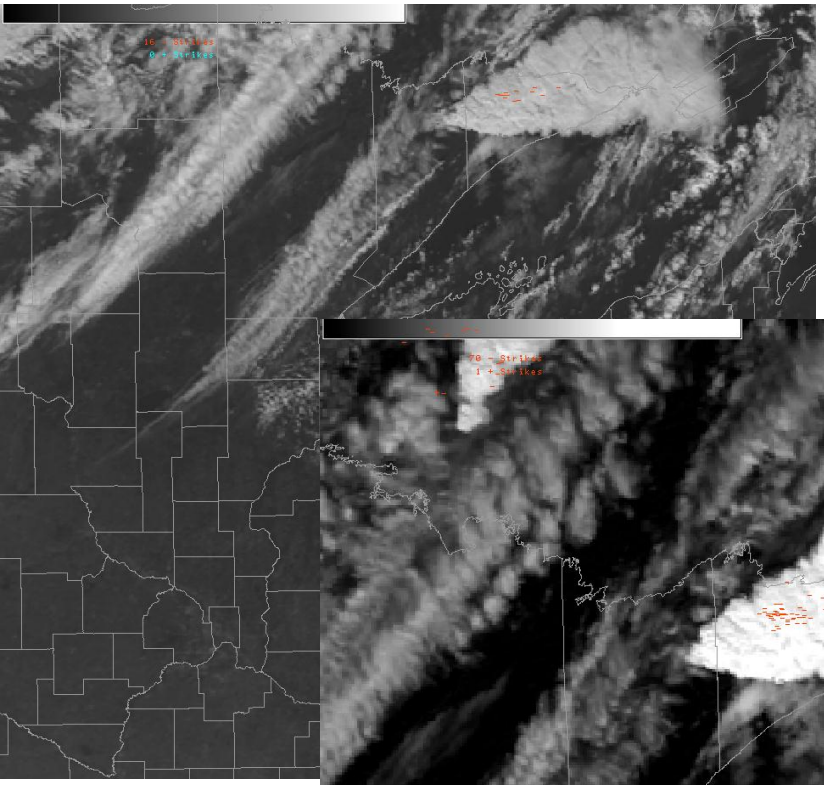


Visible on Sept 11th-1931Z

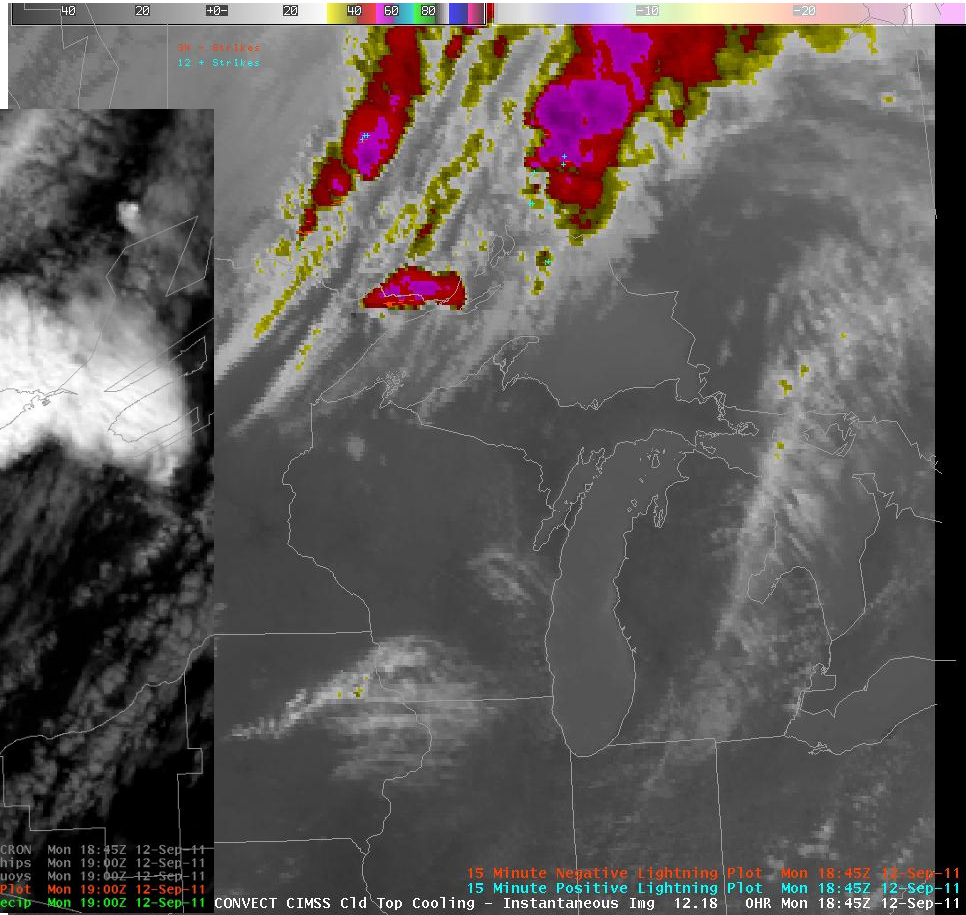


Images on Sept 12th-1845Z

MODIS 1km Vis

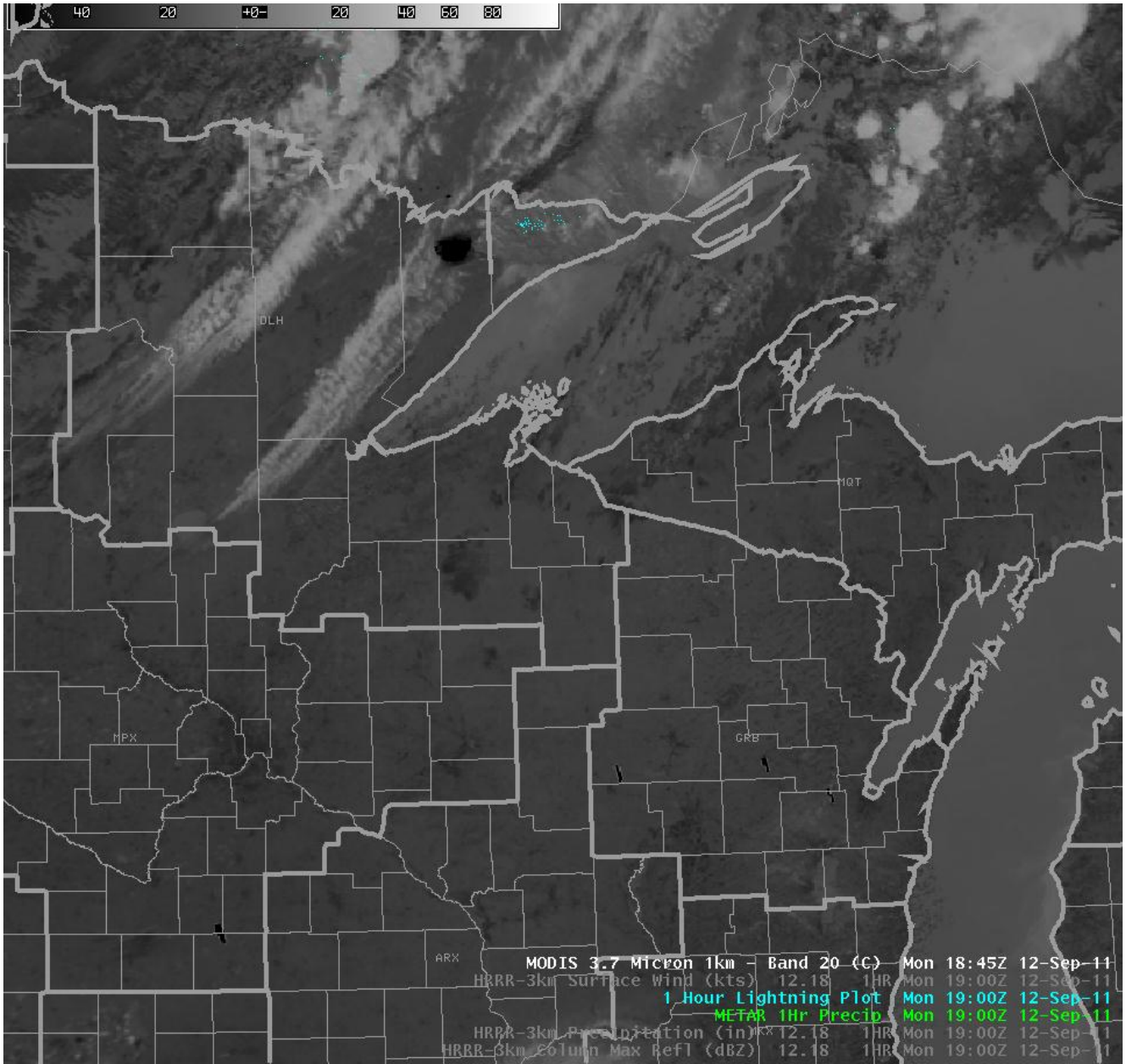


4km GOES E/13 IR

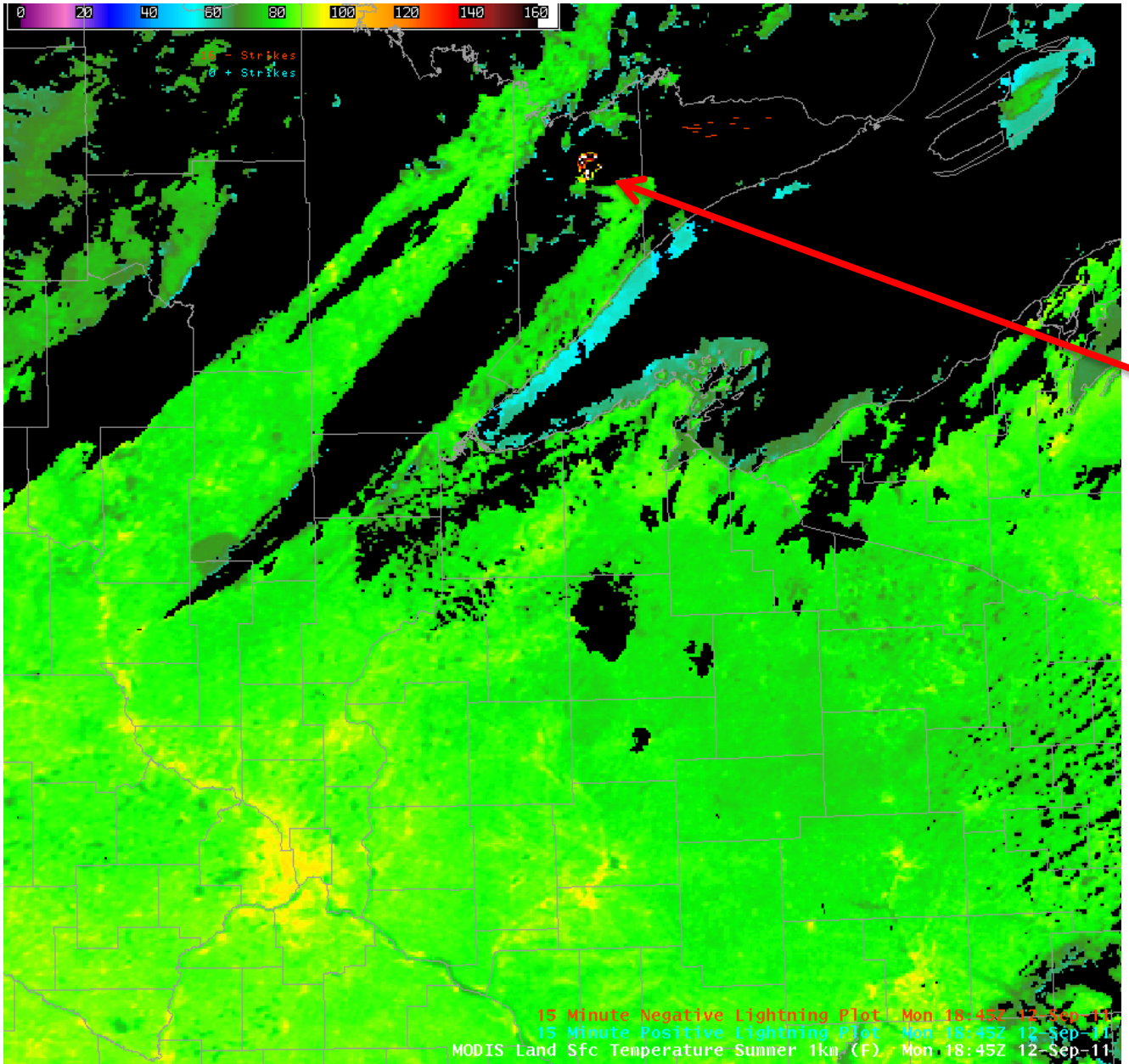


MODIS Cirrus

MODIS Fog Product on Sept 11th-1845Z

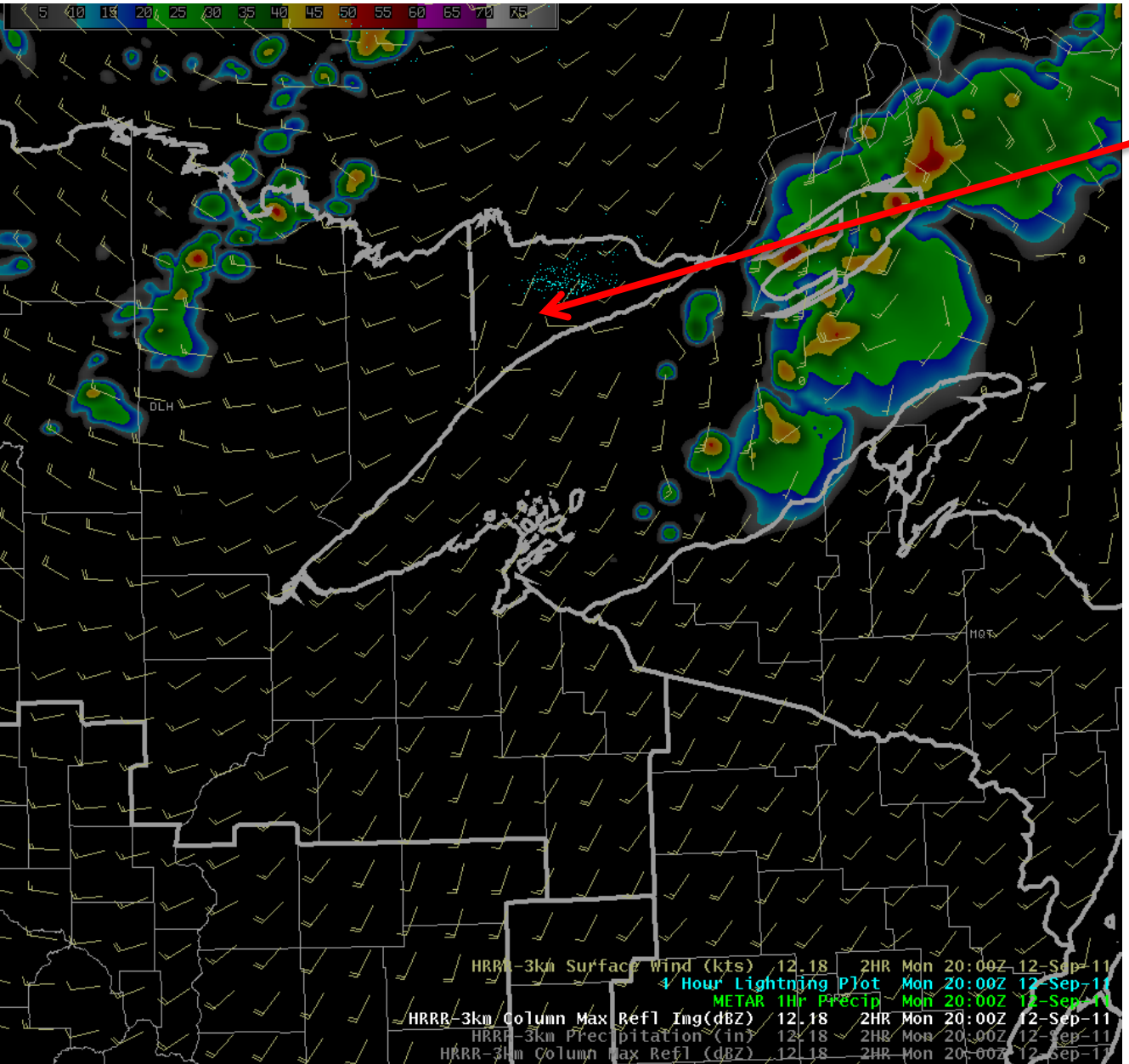


MODIS Land SFC Temp



160F!

HRRR 2 hour forecast valid 20Z



HRRR says “what thunderstorm?”

Think the fire had anything to do with the CAPE near the thunderstorm?

CTC Rate on Radar images