



**STAR** Center for Satellite  
Applications and Research  
formerly ORA — Office of Research and Applications



# The ABI (Advanced Baseline Imager) on the GOES-R series

Timothy J. Schmit

NOAA/NESDIS/Satellite Applications and Research

Advanced Satellite Products Branch (ASPB)

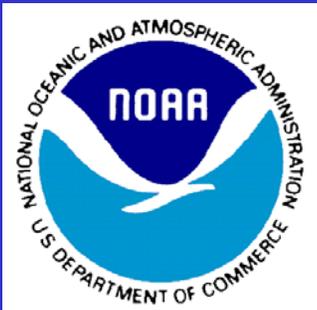
Kaba Bah, Mathew M. Gunshor, Jun Li, Scott Bachmeier, etc.

CIMSS, Madison, WI

James J. Gurka, Steve Goodman, etc.

GOES-R Program Office

*6<sup>th</sup> Annual Symposium on  
Future National Operational  
Environmental Satellite  
Systems-NPOESS and GOES-R  
20-January-2010*



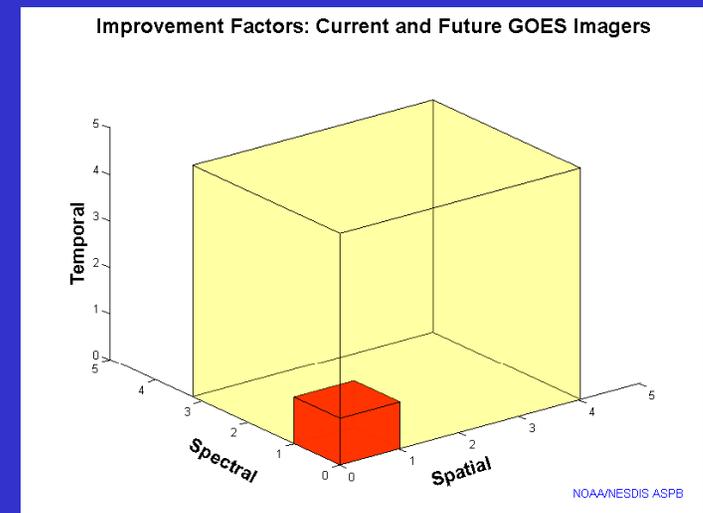
UW-Madison

# Also Thanks to...

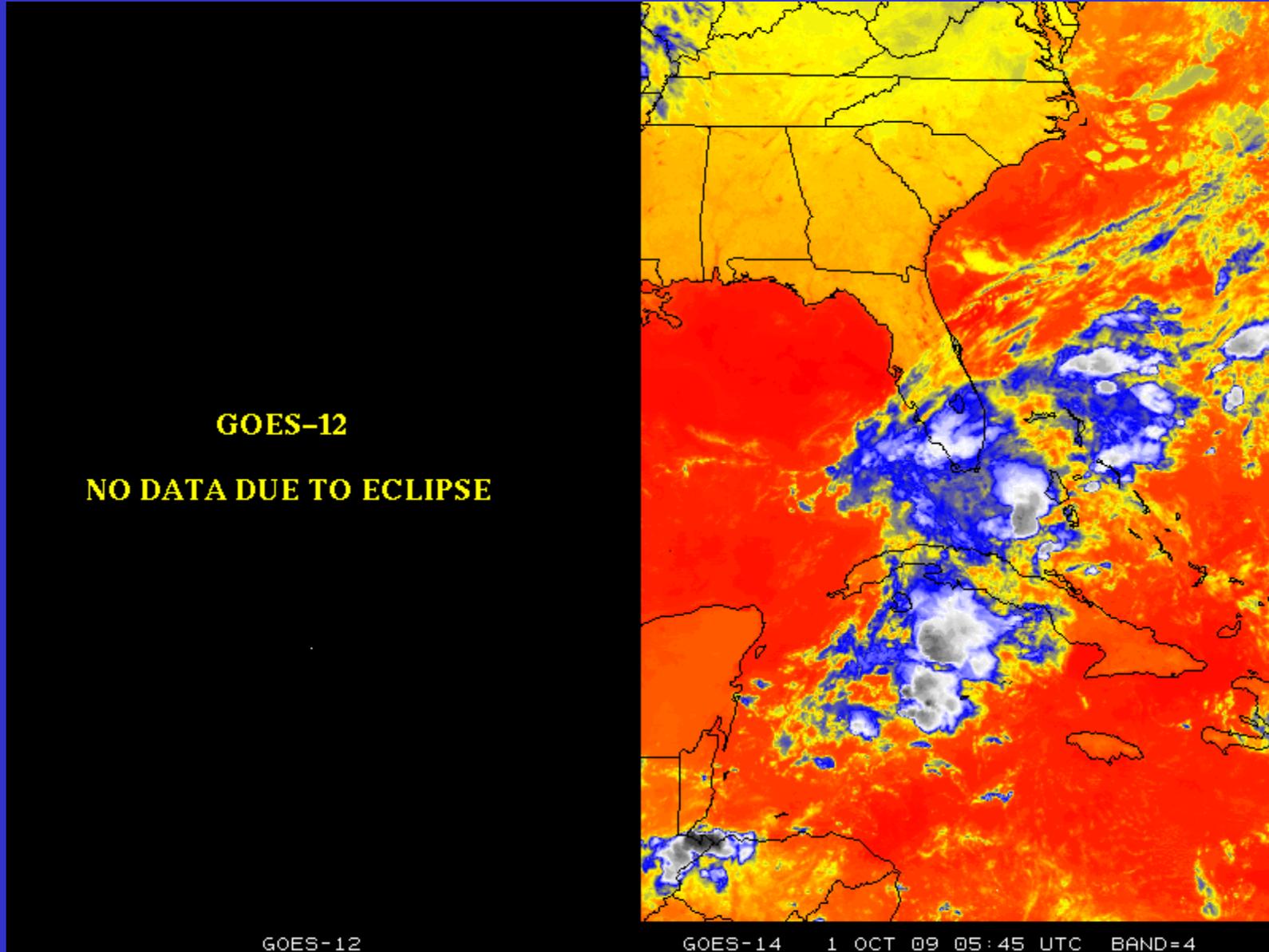
- Achtor, Tom; Ackerman, Steve; Antonelli, Paolo; Aune, Bob; Baggett, Kevin; Baum, Bryan; Ellrod, Gary; Feltz, Joleen; Feltz, Wayne; Frey, Rich; Griffin, Michael K.; Gumley, Liam; Heymann, Roger; Hilger, Don; Huang, Allen; Key, Jeff; Knuteson, Bob; Mecikalski, John; Menzel, Paul; Moeller, Chris; Mosher, Fred; Nelson, James; Nasiri, Shaima; Olander, Tim; Plokhenko, Youri; Prins, Elaine; Rabin, Bob; Revercomb, Hank; Schmidt, Chris; Schreiner, Tony; Seemann-Wetzel, Suzanne; Sieglaff, Justin; Strabala, Kathy; Sun, Fengying; Tobin, Dave; Velden, Chris; Wade, Gary; Whittaker, Tom; Woolf, Hal, Jason Otkin, etc.
- Mitch Goldberg, AWG co-chairs, AWG Leads, GPO, GUC committee team(s), Jordan Gerth, Chian-Yi Liu, Jason Otkin, Thomas Greenwald, Monica Coakley, Bill Smith, ASPB, PG, SSEC data center, etc.

# Overview

- GOES-14
- ABI (Advanced Baseline Imager)
  - Temporal
  - Spatial
  - Spectral
  - Imagery
- Summary
  - More information



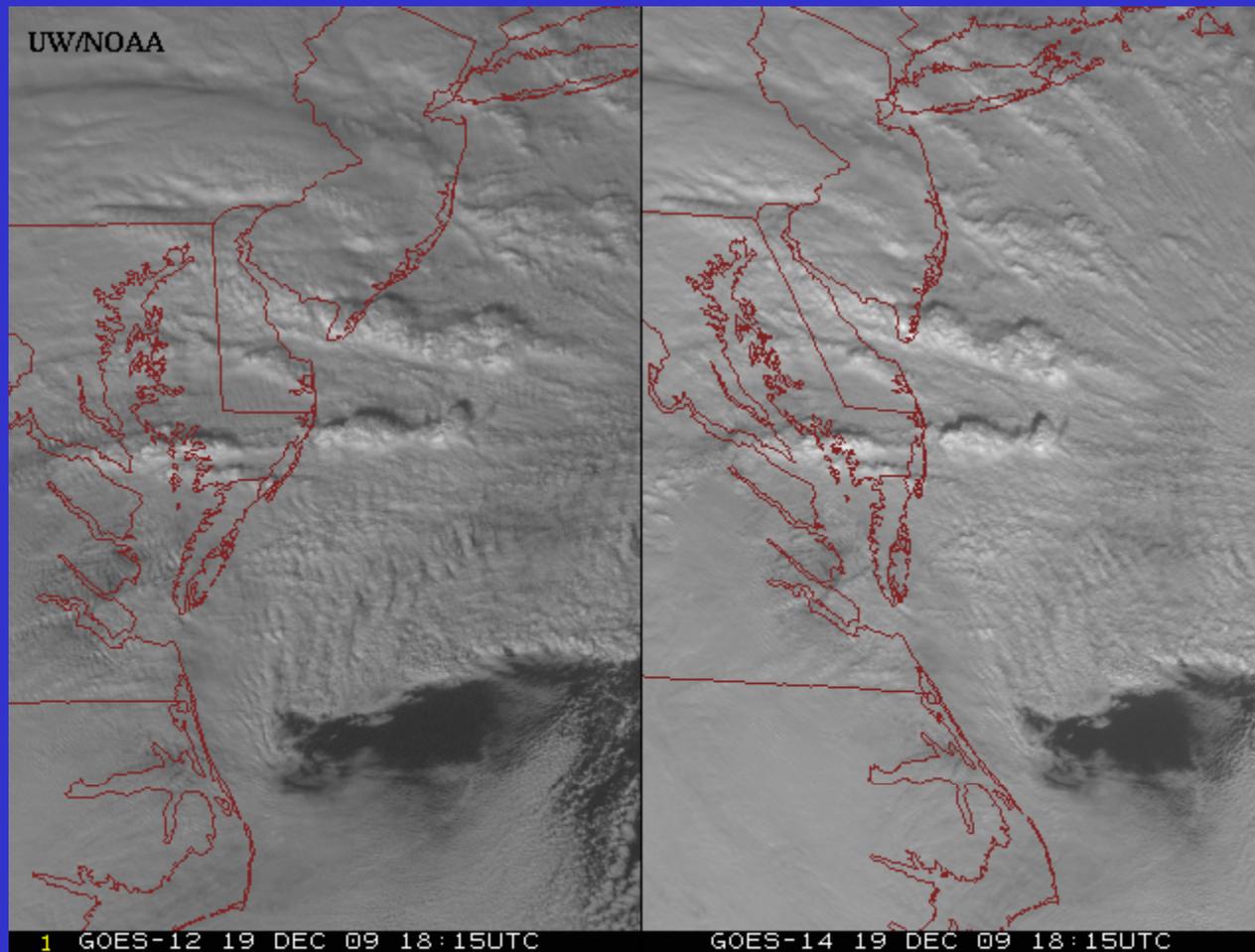
# GOES-12/14 (Around eclipse period)



**GOES-12**

**GOES-14**

# GOES-14: Sample “1-min” imagery

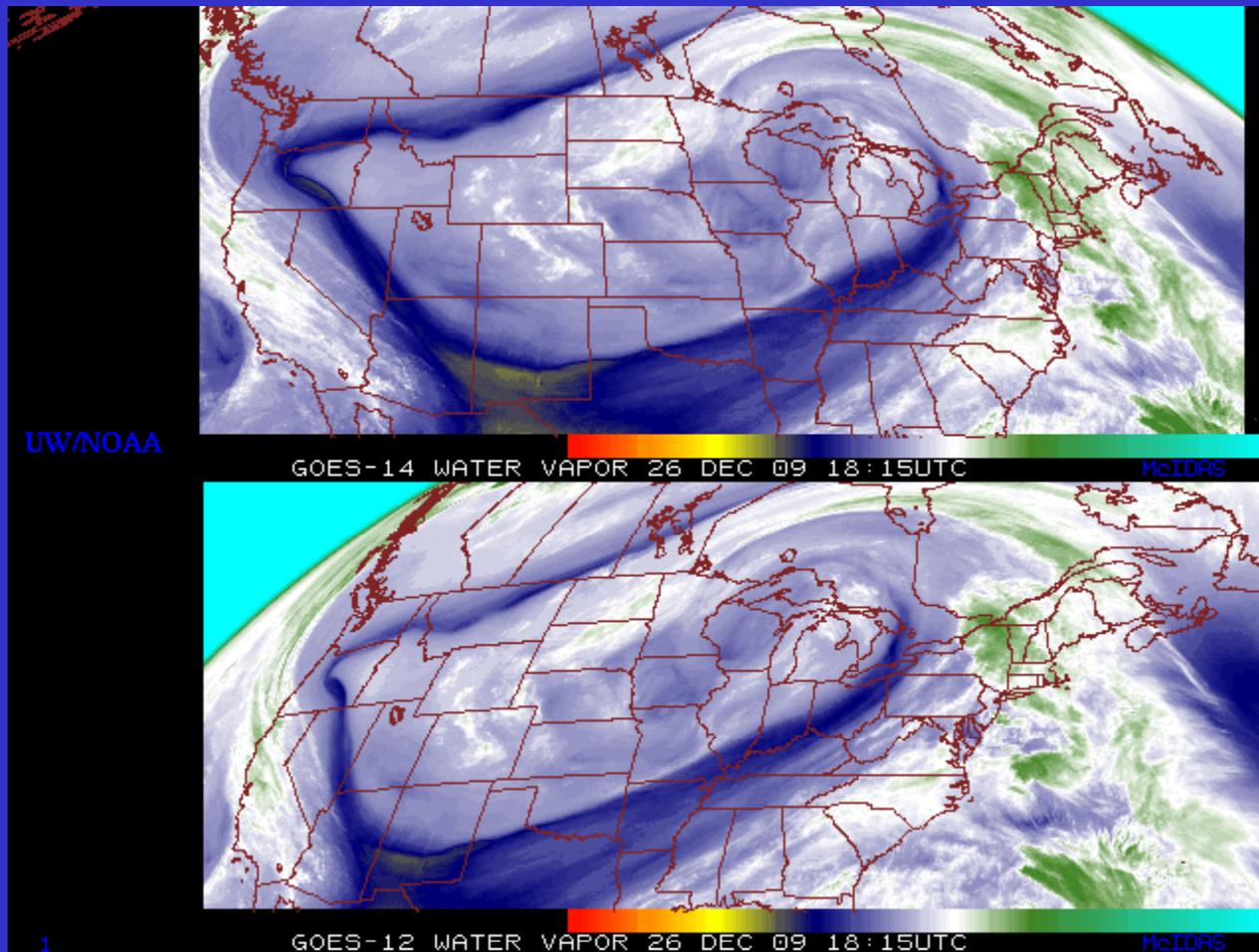


GOES-12

GOES-14

Visible data from the recent NOAA Science Test, lead by Hillger and Schmit

# GOES-14: Sample “5-min” imagery

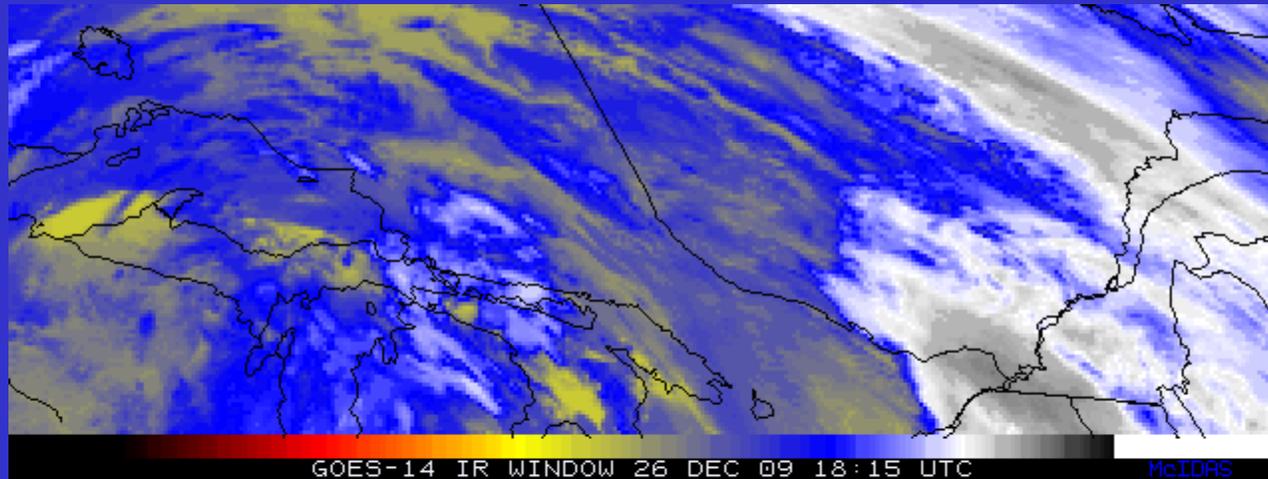


GOES-14

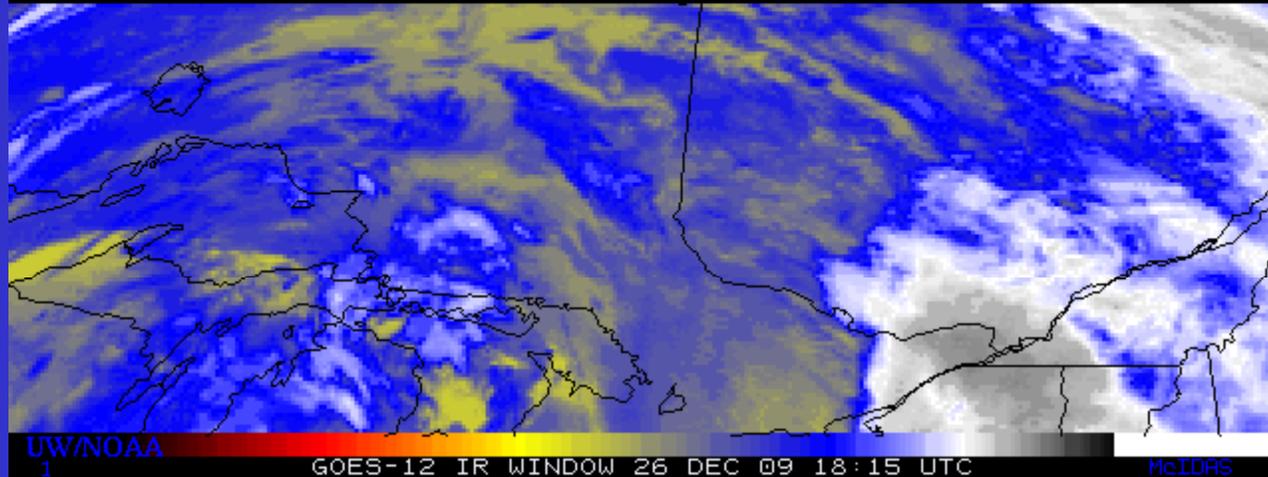
GOES-12

“Water vapor” data from the recent NOAA Science Test, lead by Hillger and Schmit

# GOES-14: Sample “5-min” imagery



GOES-14

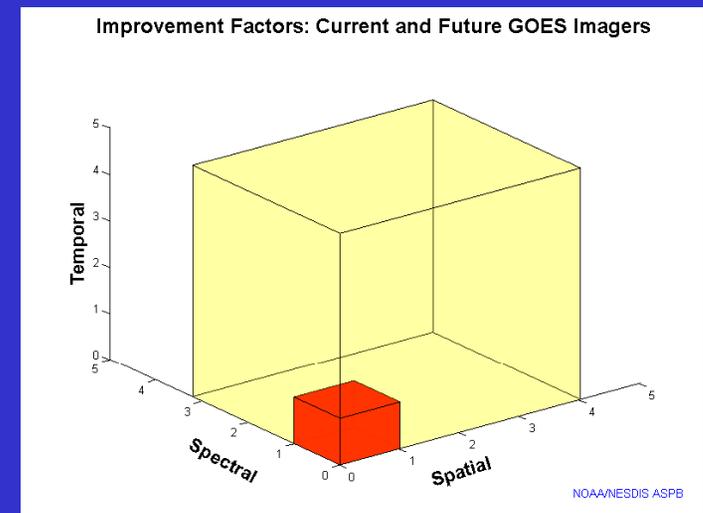


GOES-12

IR window data from the recent NOAA Science Test, lead by Hillger and Schmit

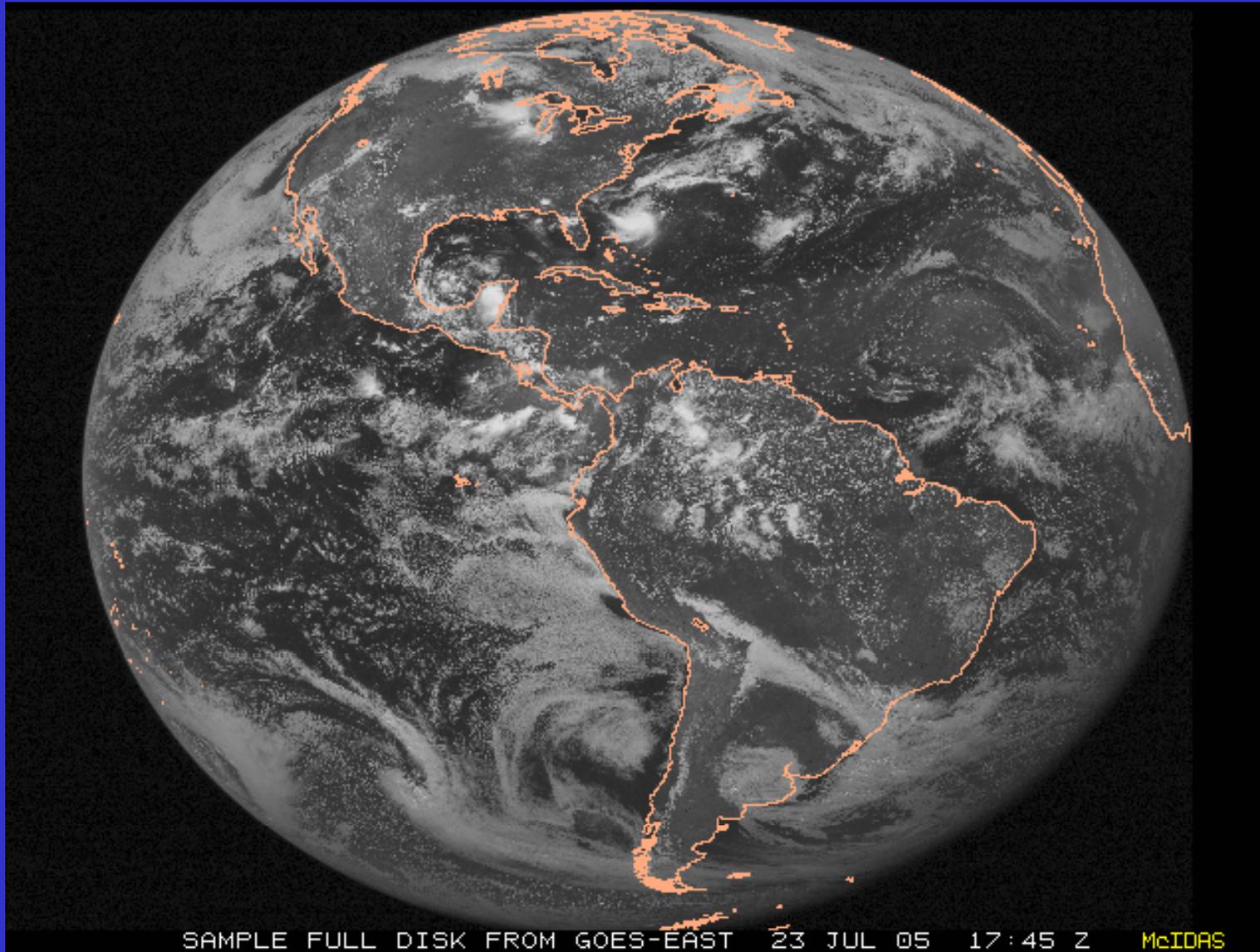
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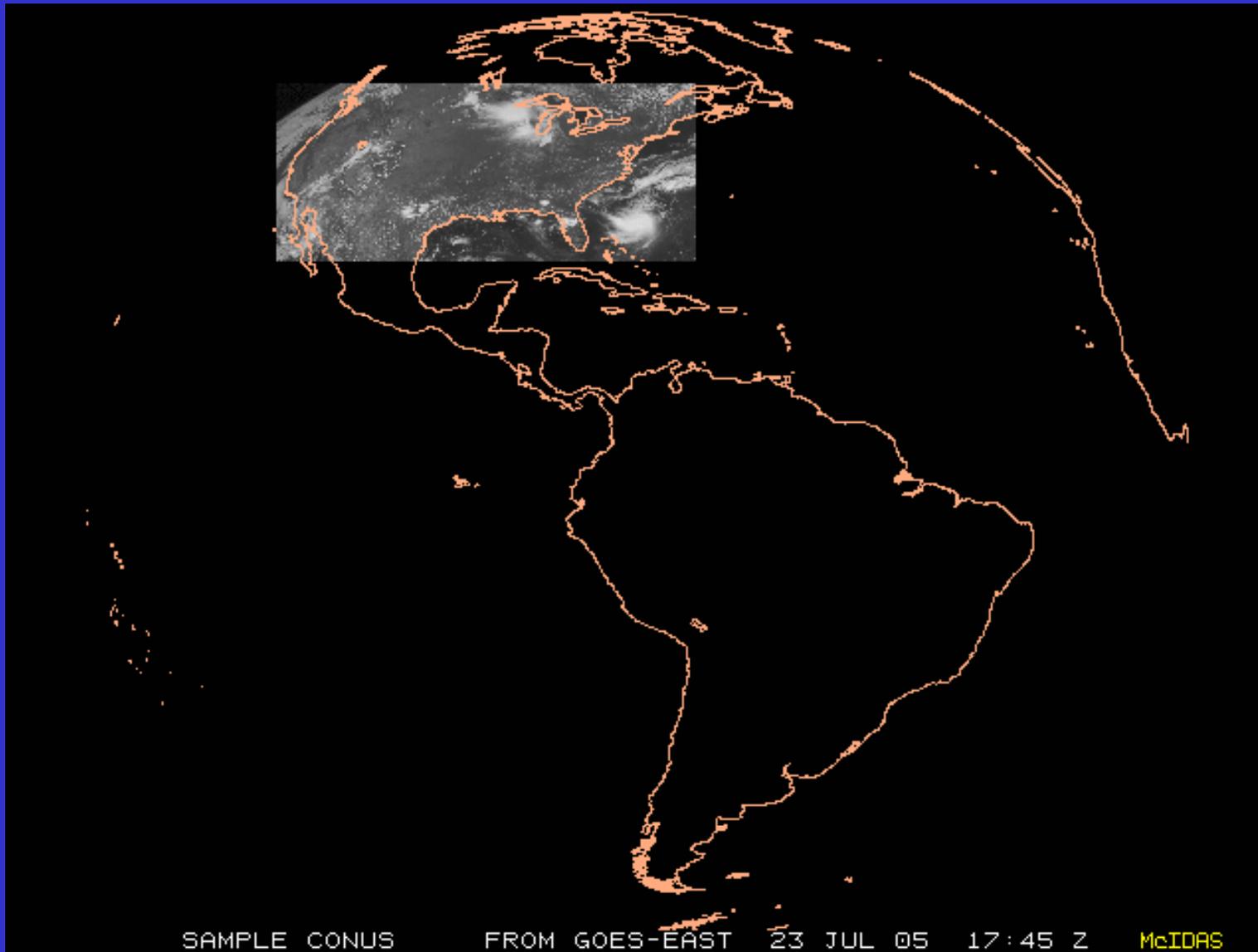
# The Advanced Baseline Imager:

	ABI	Current
<b>Spectral Coverage</b>		
	16 bands	5 bands
<b>Spatial resolution</b>		
0.64 $\mu\text{m}$ Visible	0.5 km	Approx. 1 km
Other Visible/near-IR	1.0 km	n/a
Bands ( $>2 \mu\text{m}$ )	2 km	Approx. 4 km
<b>Spatial coverage</b>		
Full disk	4 per hour	Scheduled (3 hrly)
CONUS	12 per hour	~4 per hour
Mesoscale	Every 30 sec	n/a
<b>Visible (reflective bands)</b>		
On-orbit calibration	Yes	No

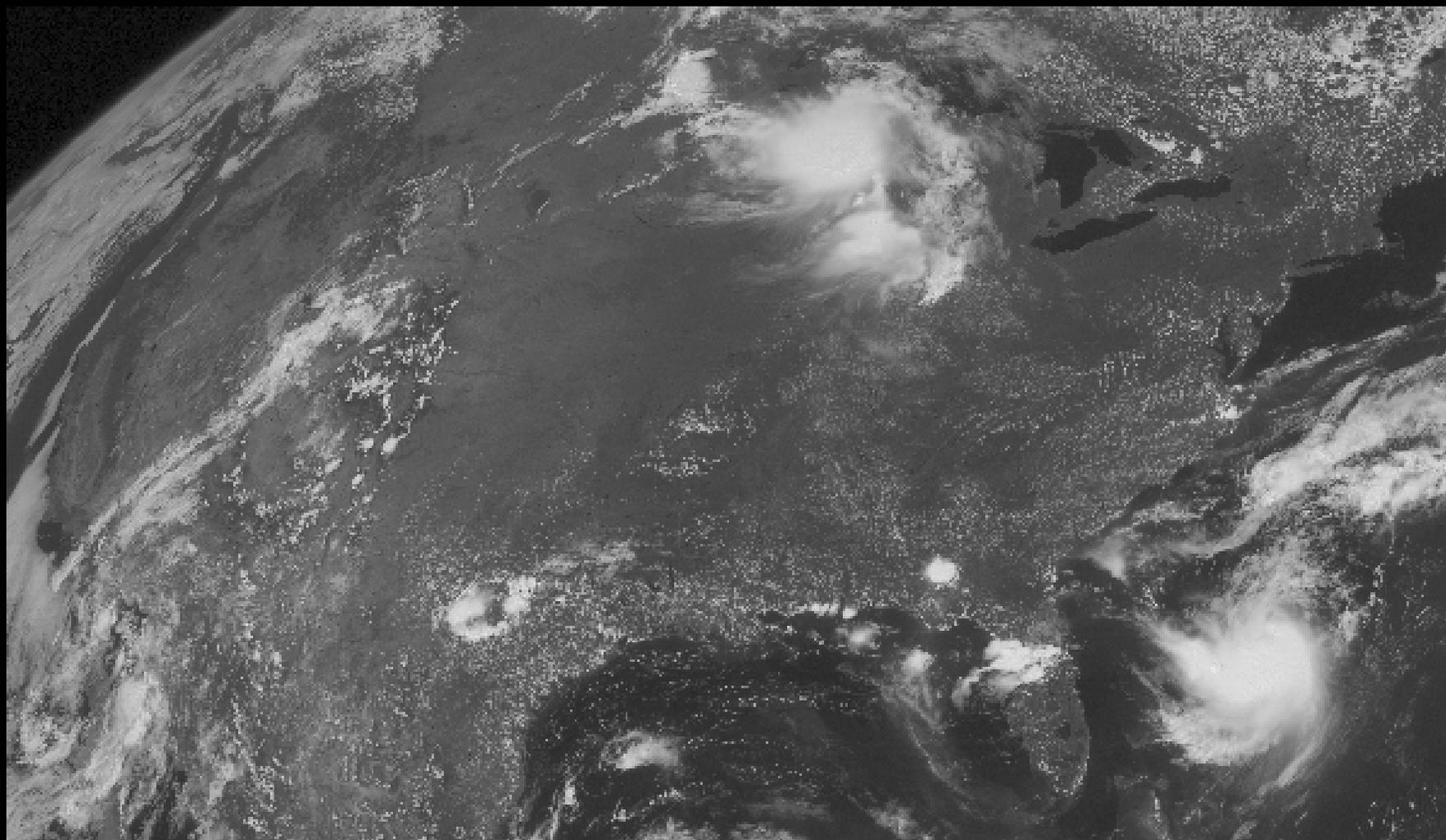
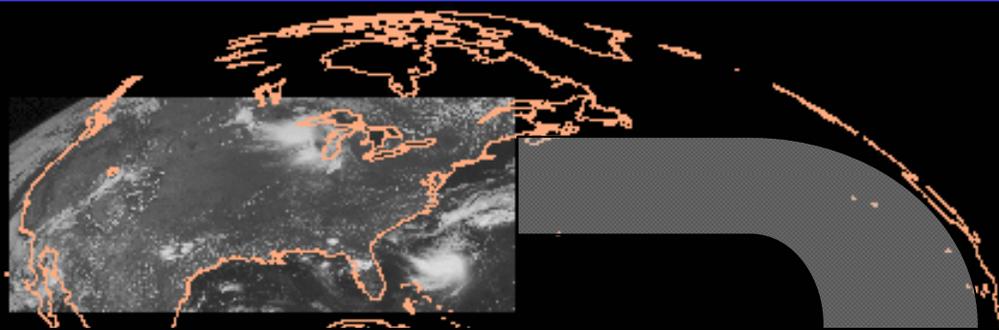


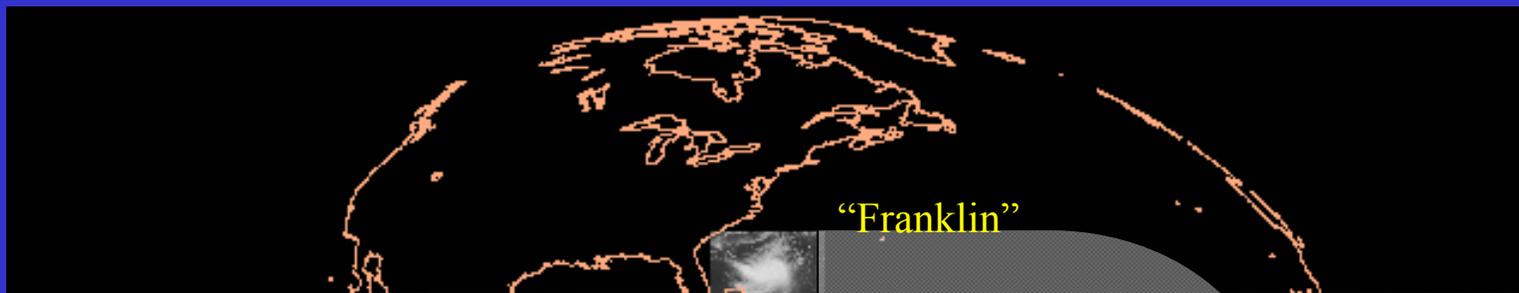
ABI  
scans  
about 5  
times  
faster  
than the  
current  
GOES  
imager

There are two anticipated scan modes for the ABI:  
- Full disk images every 15 minutes + 5 min CONUS images + mesoscale.  
or - Full disk every 5 minutes.



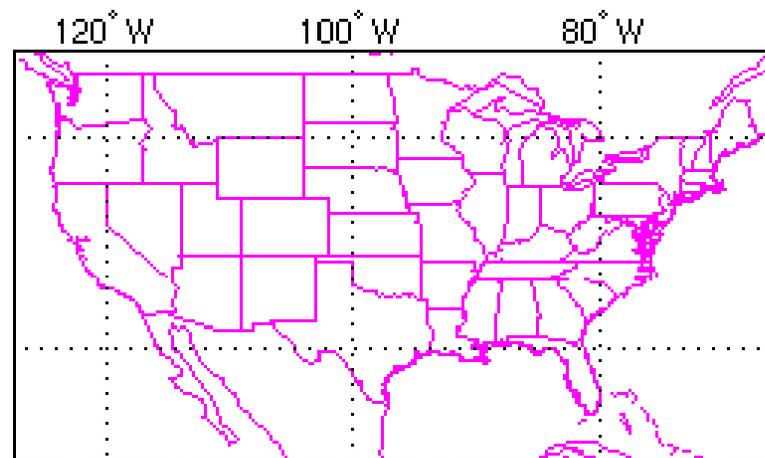
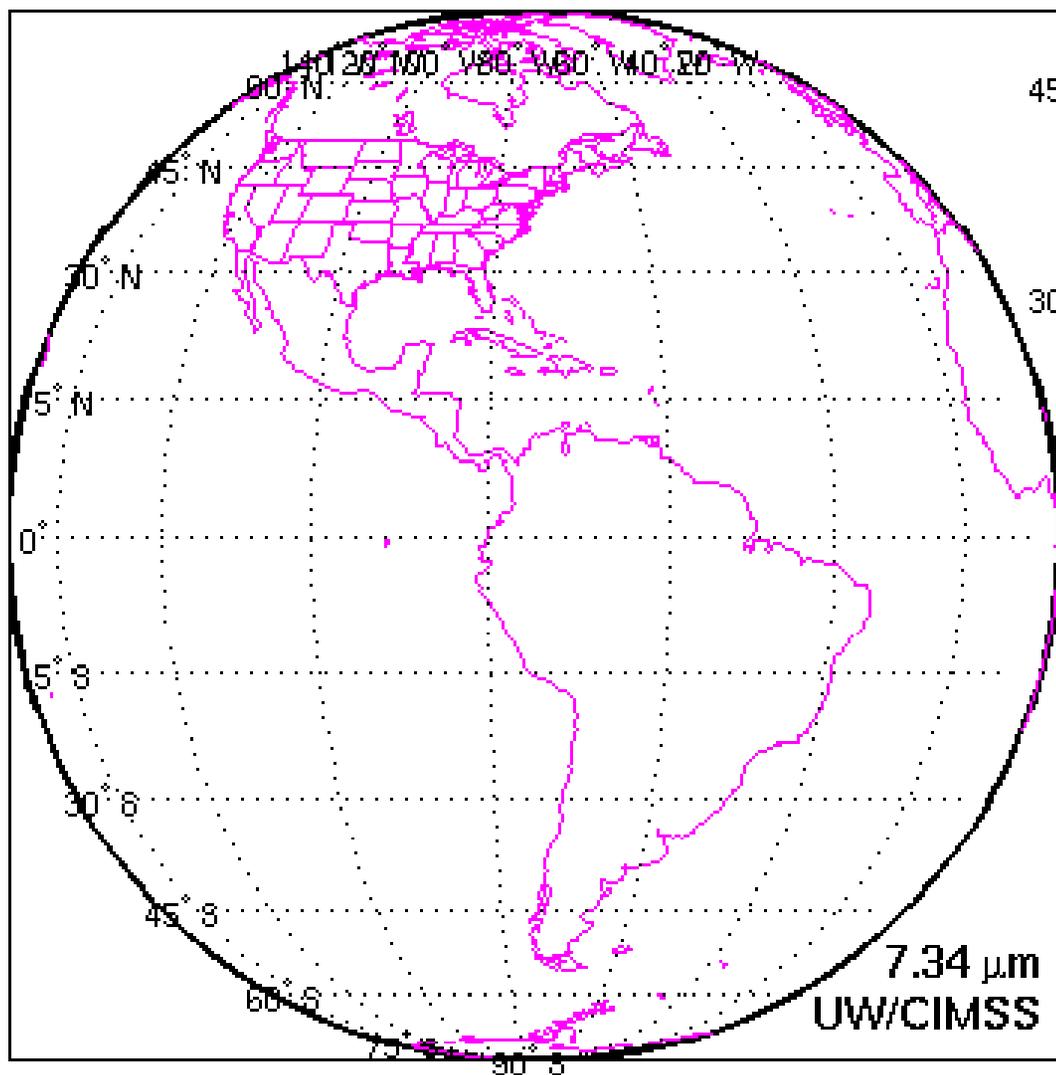
ABI can offer Continental US images every 5 minutes for routine monitoring of a wide range of events (storms, dust, clouds, fires, winds, etc).  
This is every 15 or 30 minutes with the current GOES in routine mode.



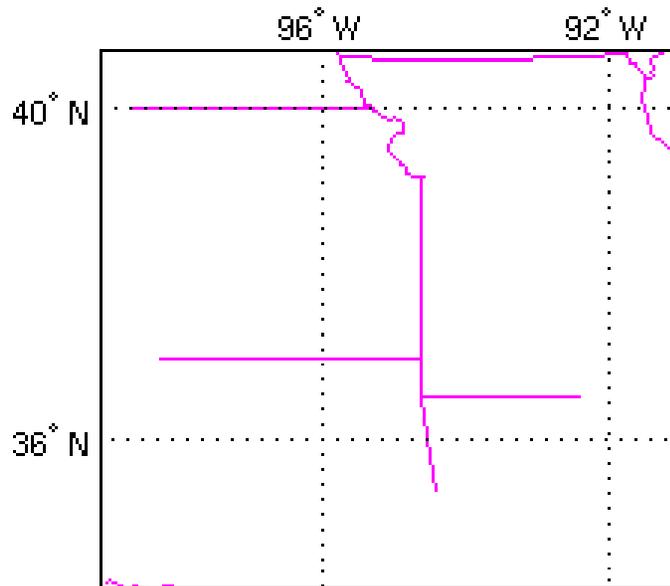


Mesoscale images every 30 seconds for rapidly changing phenomena (thunderstorms, hurricanes, fires, etc). Current GOES can not offer these rapid scans while still scanning other important regions

4 JUNE 2005  
23:00:00.000 UTC



CONUS



MESOSCALE

Figure courtesy of J. Li, CIMSS

Concept of flex mode scanning animation

“ABI”

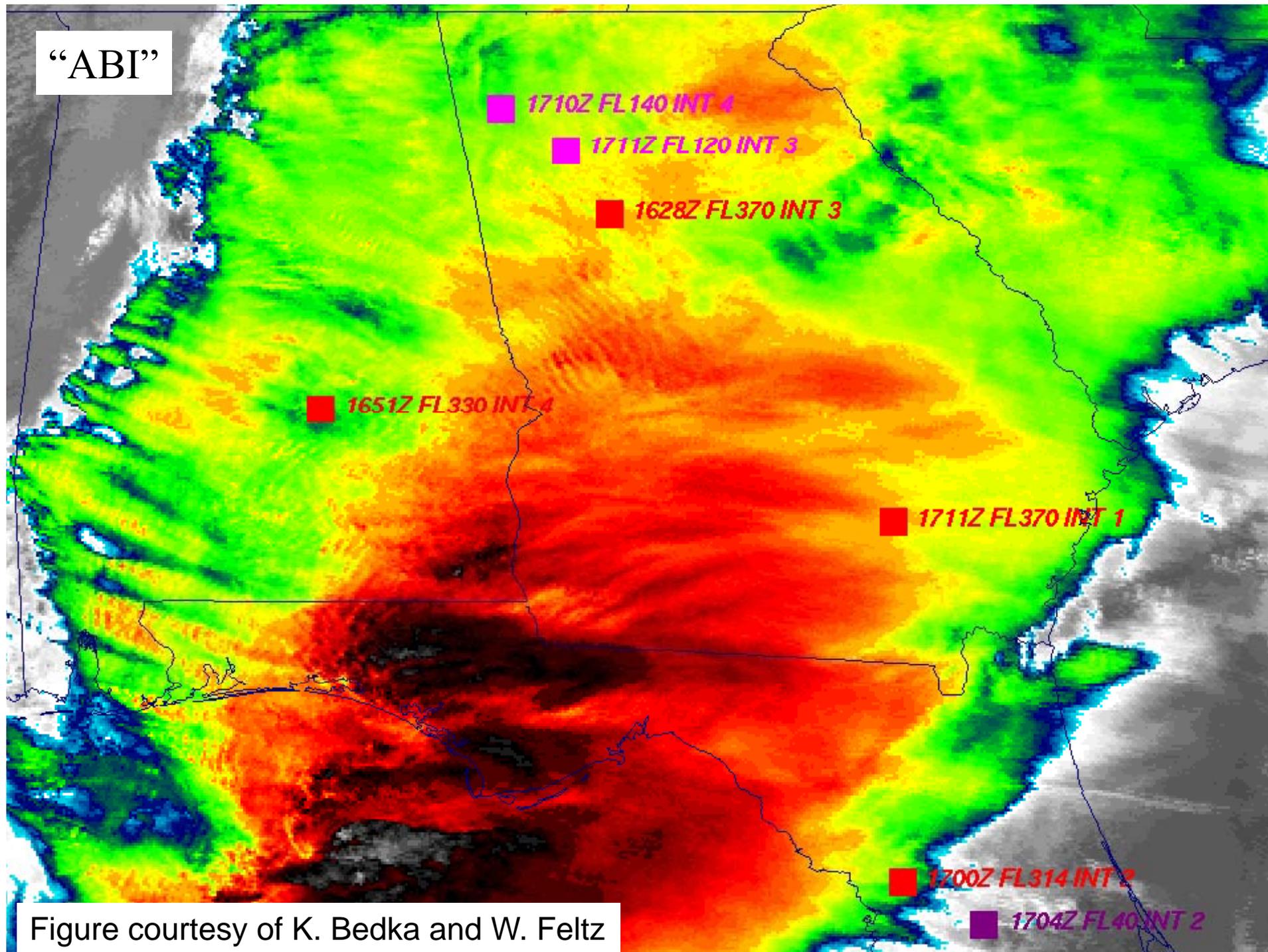


Figure courtesy of K. Bedka and W. Feltz

GOES

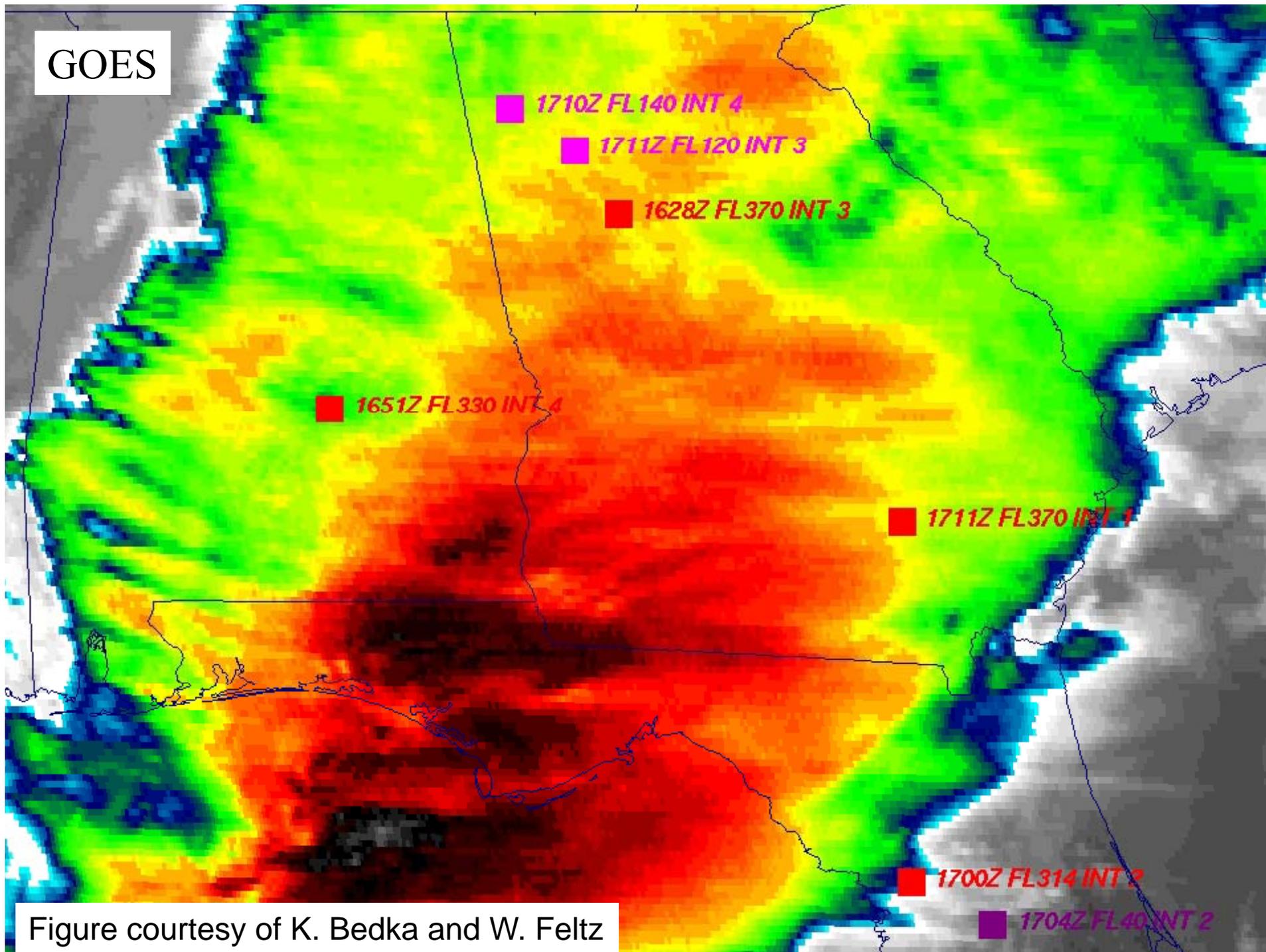


Figure courtesy of K. Bedka and W. Feltz

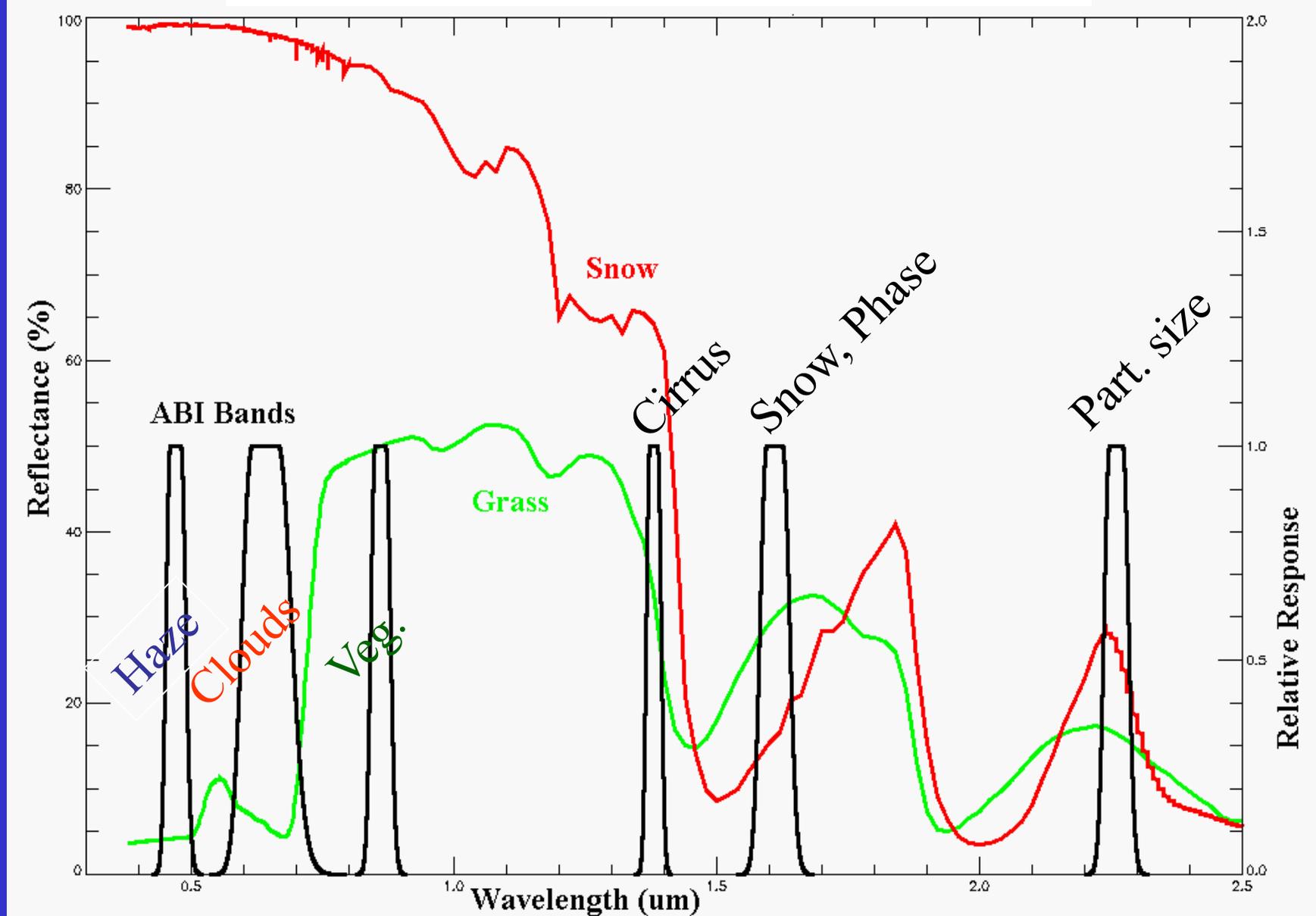
# ABI Visible/Near-IR Bands

Future GOES imager (ABI) band	Wavelength range ( $\mu\text{m}$ )	Central wavelength ( $\mu\text{m}$ )	Nominal subsatellite IGFOV (km)	Sample use
1	0.45–0.49	0.47	1	Daytime aerosol over land, coastal water mapping
2	0.59–0.69	0.64	0.5	Daytime clouds fog, insolation, winds
3	0.846–0.885	0.865	1	Daytime vegetation/burn scar and aerosol over water, winds
4	1.371–1.386	1.378	2	Daytime cirrus cloud
5	1.58–1.64	1.61	1	Daytime cloud-top phase and particle size, snow
6	2.225–2.275	2.25	2	Daytime land/cloud properties, particle size, vegetation, snow

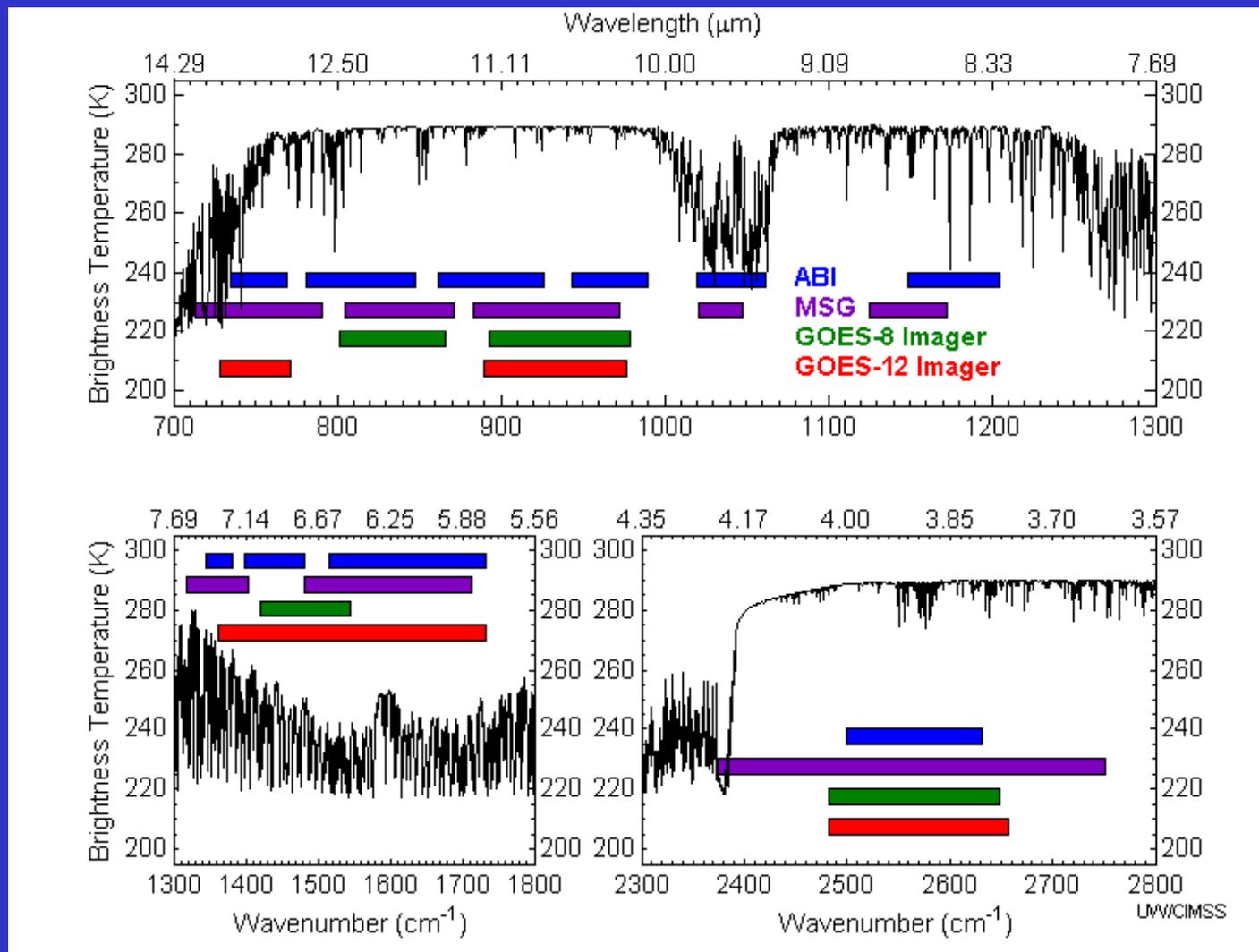
# ABI IR Bands

7	3.80–4.00	3.90	2	Surface and cloud, fog at night, fire, winds
8	5.77–6.6	6.19	2	High-level atmospheric water vapor, winds, rainfall
9	6.75–7.15	6.95	2	Midlevel atmospheric water vapor, winds, rainfall
10	7.24–7.44	7.34	2	Lower-level water vapor, winds, and SO <sub>2</sub>
11	8.3–8.7	8.5	2	Total water for stability, cloud phase, dust, SO <sub>2</sub> rainfall
12	9.42–9.8	9.61	2	Total ozone, turbulence, and winds
13	10.1–10.6	10.35	2	Surface and cloud
14	10.8–11.6	11.2	2	Imagery, SST, clouds, rainfall
15	11.8–12.8	12.3	2	Total water, ash, and SST
16	13.0–13.6	13.3	2	Air temperature, cloud heights and amounts

## Visible and near-IR channels on the ABI

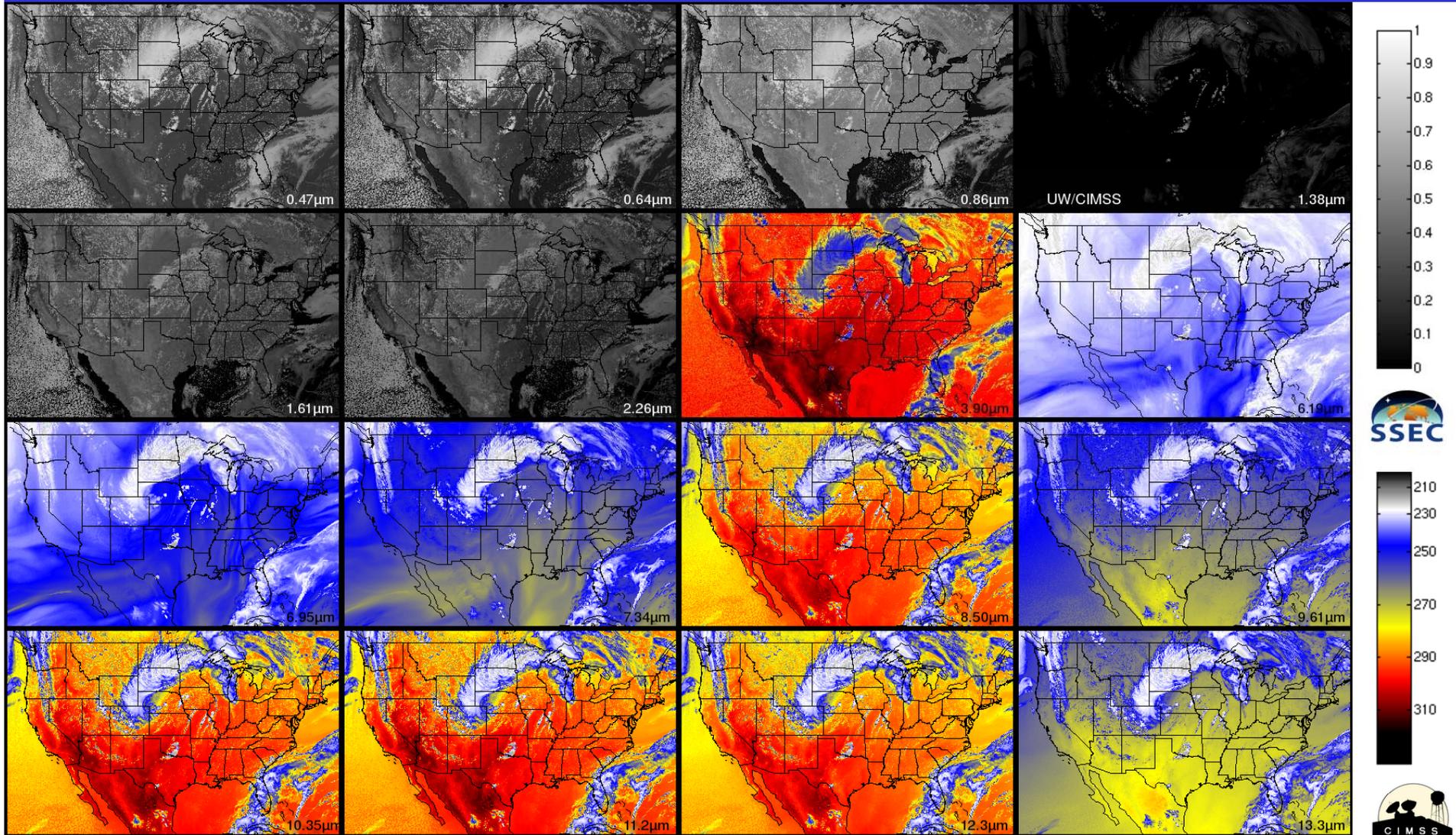


The ABI visible and near-IR bands have many uses.



While there are differences, there are also many similarities for the spectral bands on MET-8 and the Advanced Baseline Imager (ABI). Both the MET-8 and ABI have many more bands than the current operational GOES imagers.

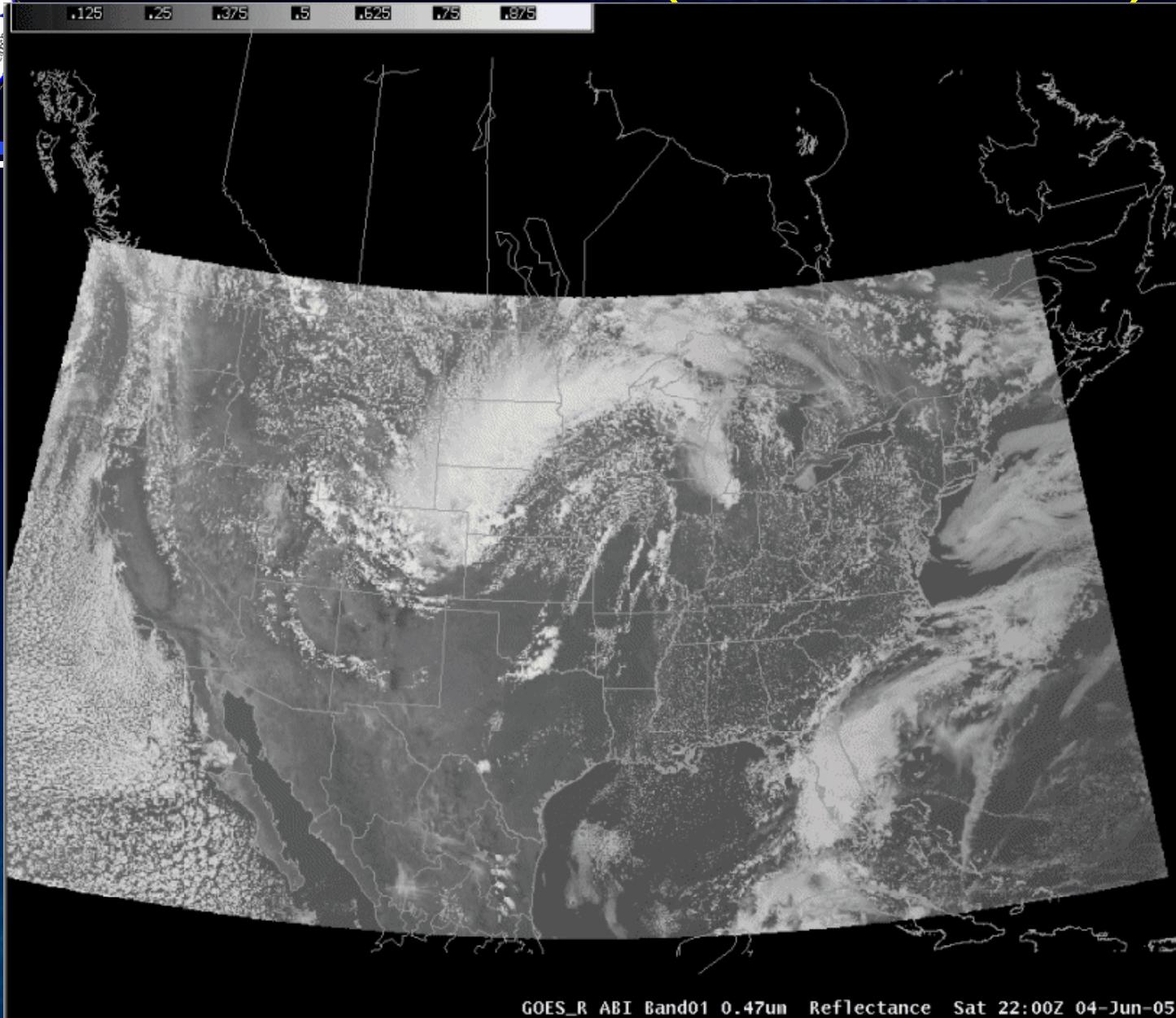
# ABI bands via NWP simulation (CIMSS AWG Proxy Team)



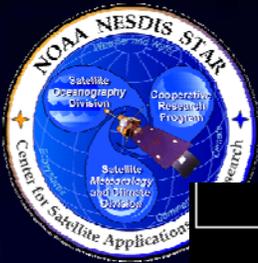
ABI band data for 2005 June 04 22:00 UTC



# ABI in AWIPS (via netCDF)

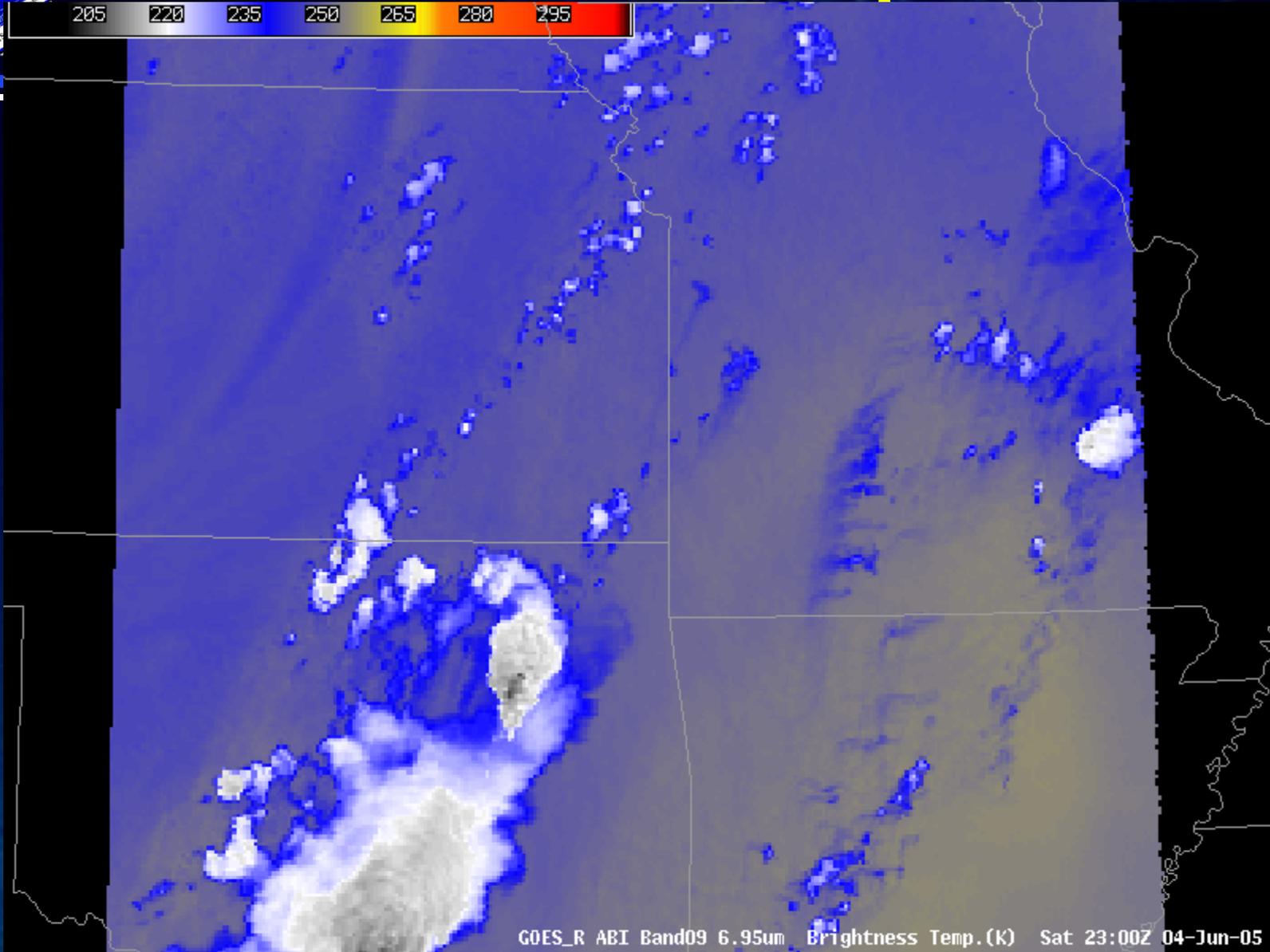


Simulated Advanced Baseline Imager (ABI) bands shown; in the legacy AWIPS.



# 1-min Simulated ABI 'mesoscale' loop

205 220 235 250 265 280 295

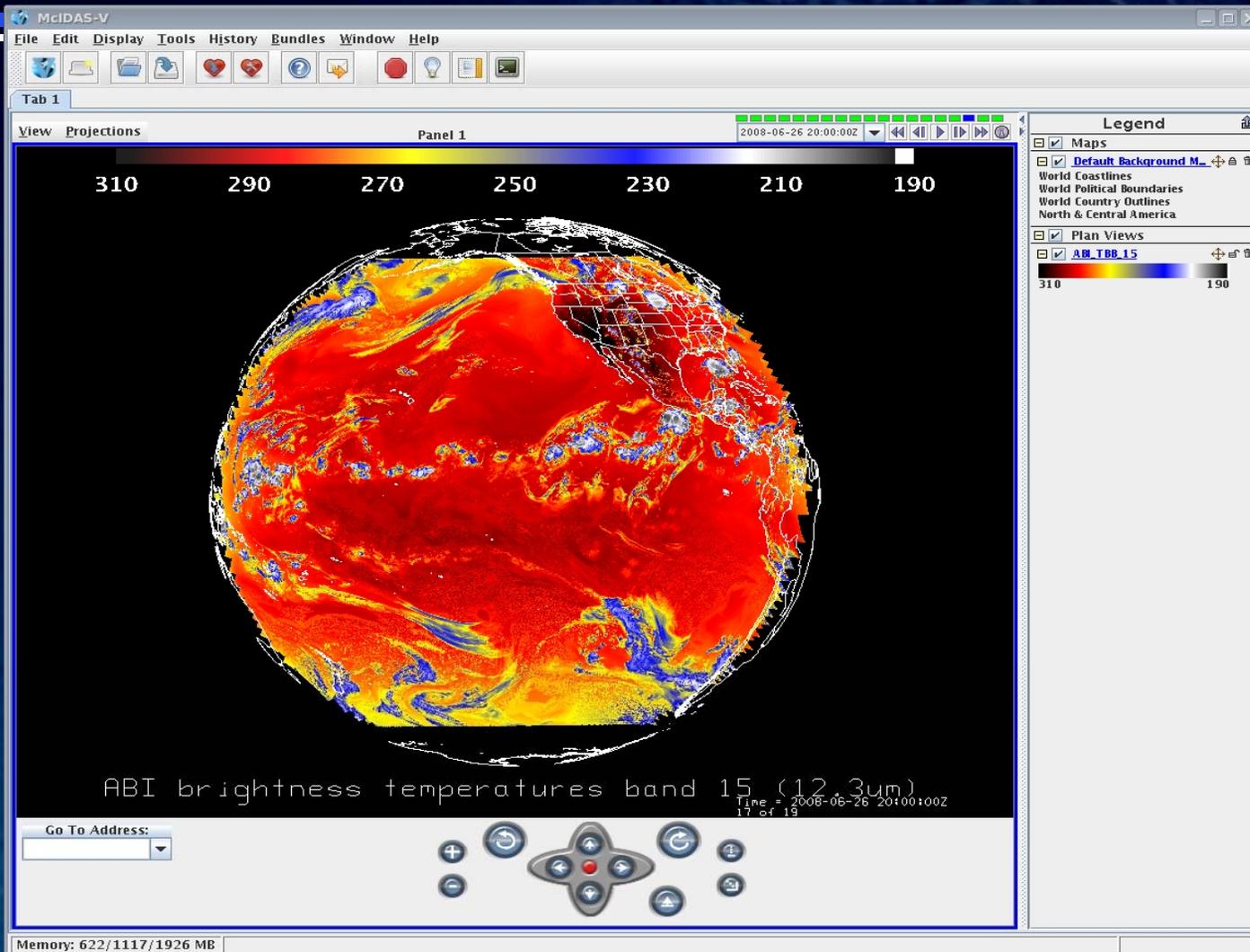


GOES\_R ABI Band09 6.95um Brightness Temp.(K) Sat 23:00Z 04-Jun-05



# Full disk simulation

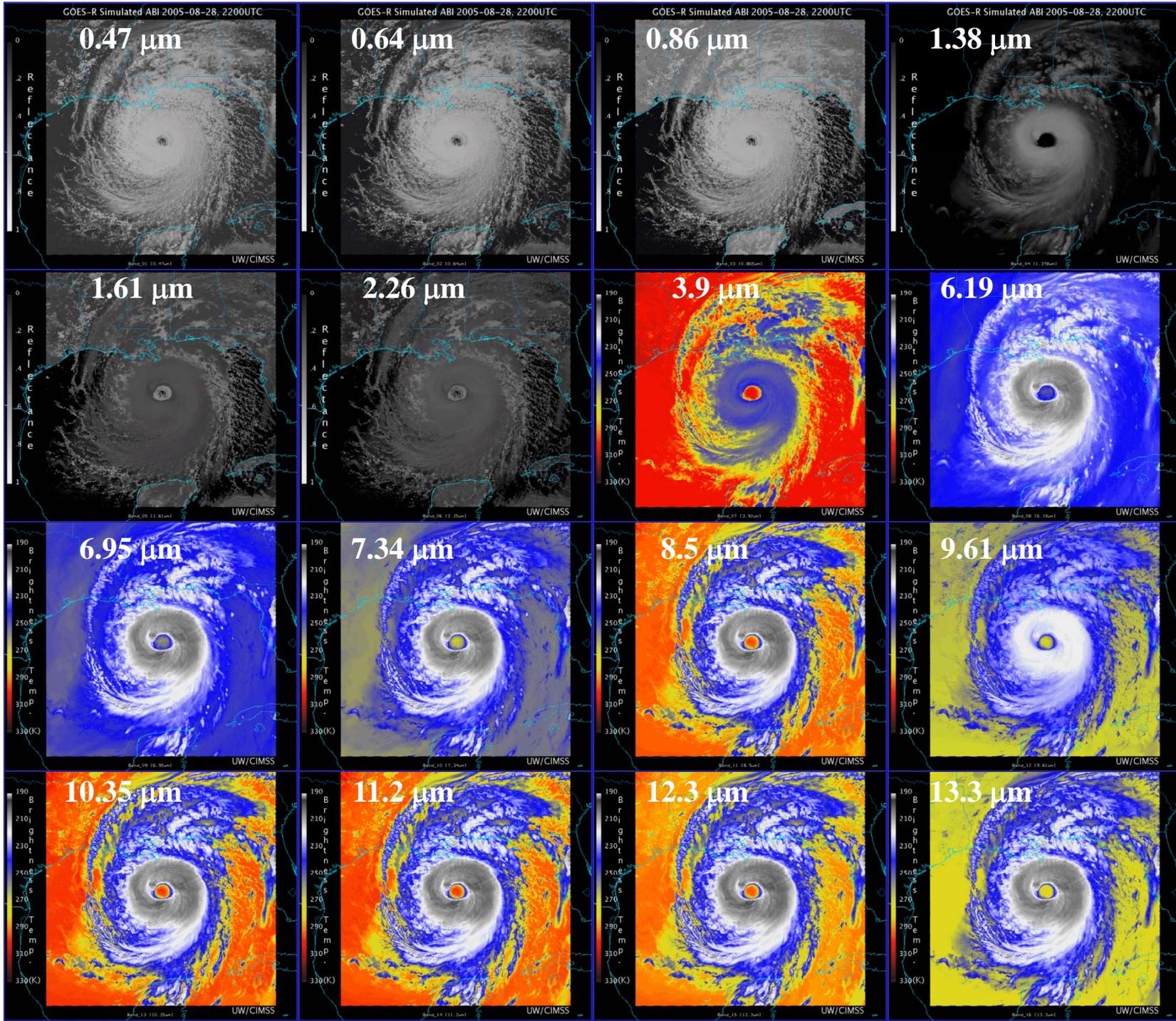
ABI band 15 (12.3um) June 26 2008 at 20:00UTC.



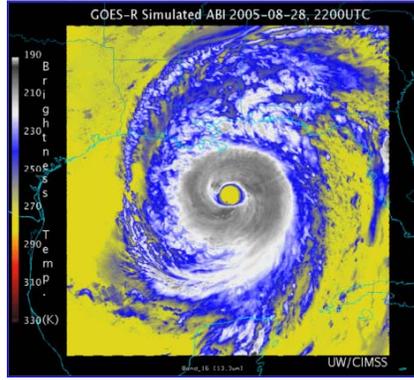
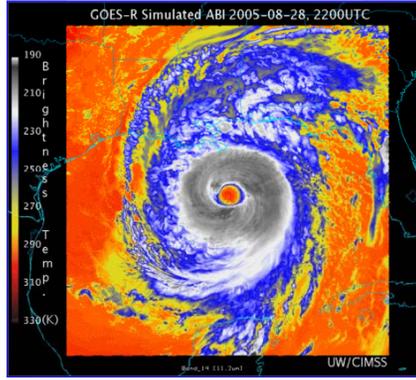
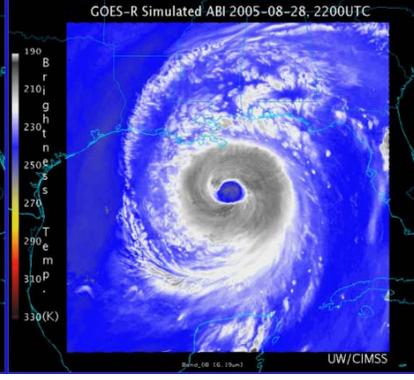
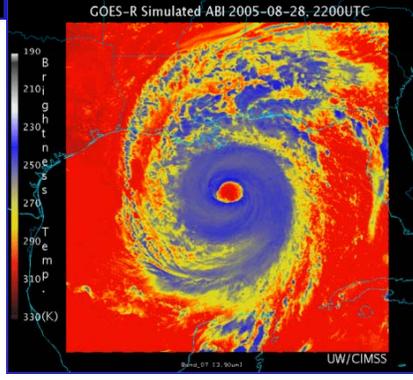
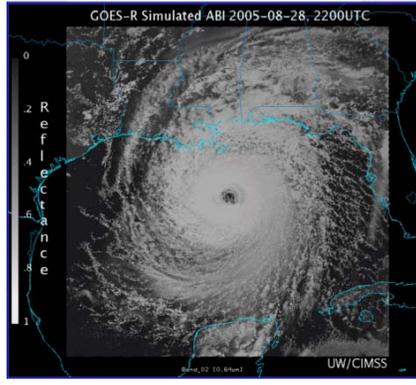
<Project>

J. Oktin et al., CIMSS

# AWG Proxy ABI Simulations of Hurricane Katrina

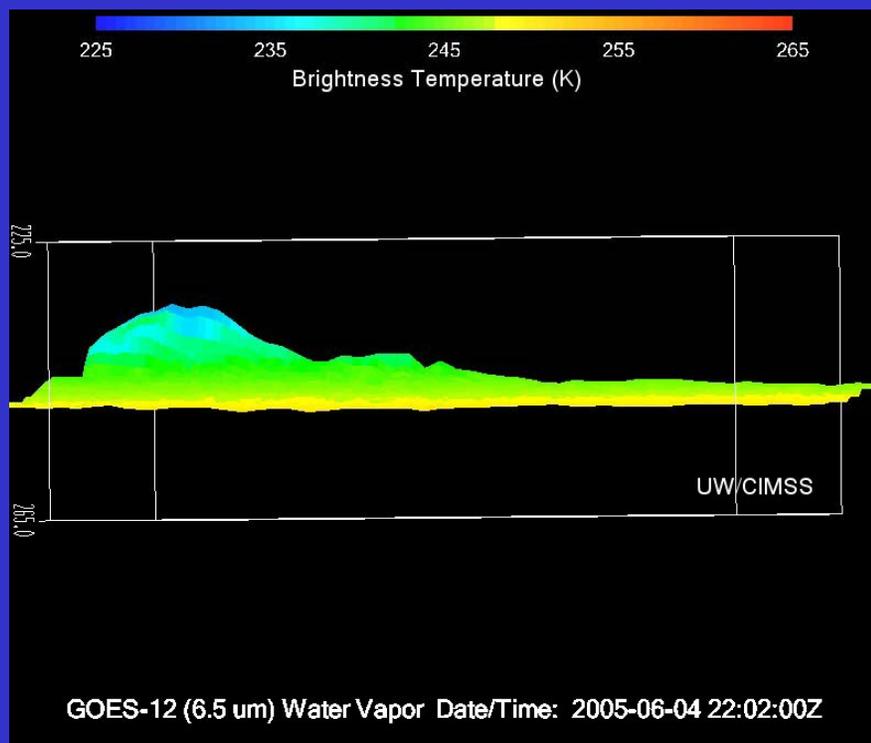


# Corresponding current Imager bands of Hurricane Katrina

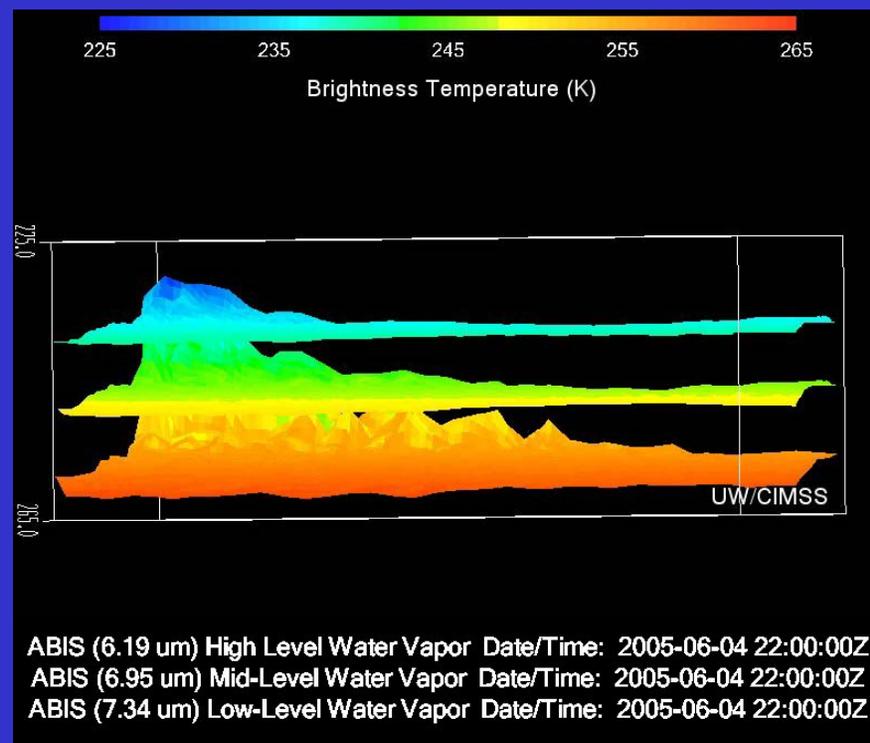




# Three ABI water vapor bands



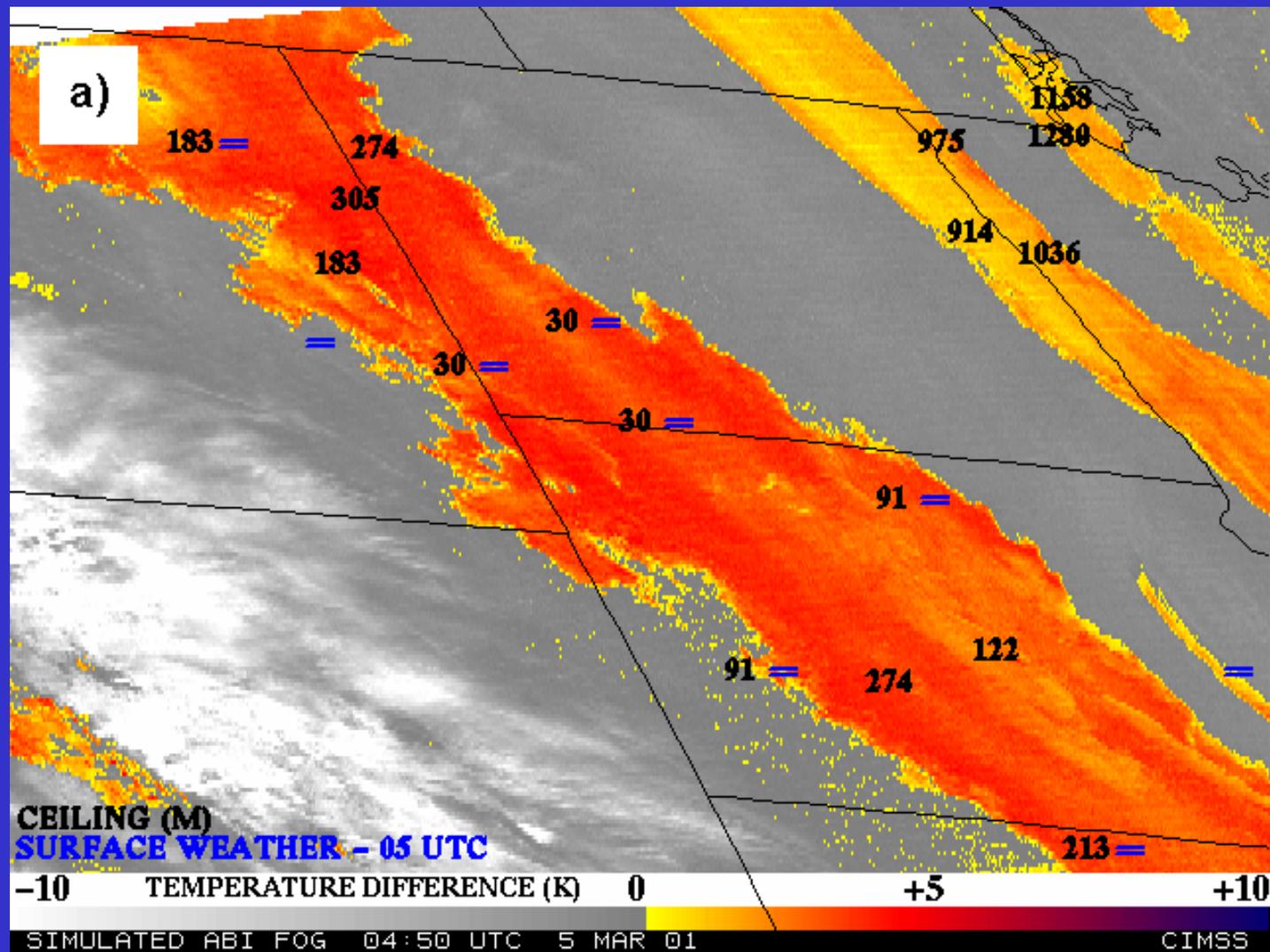
Current GOES



Future GOES

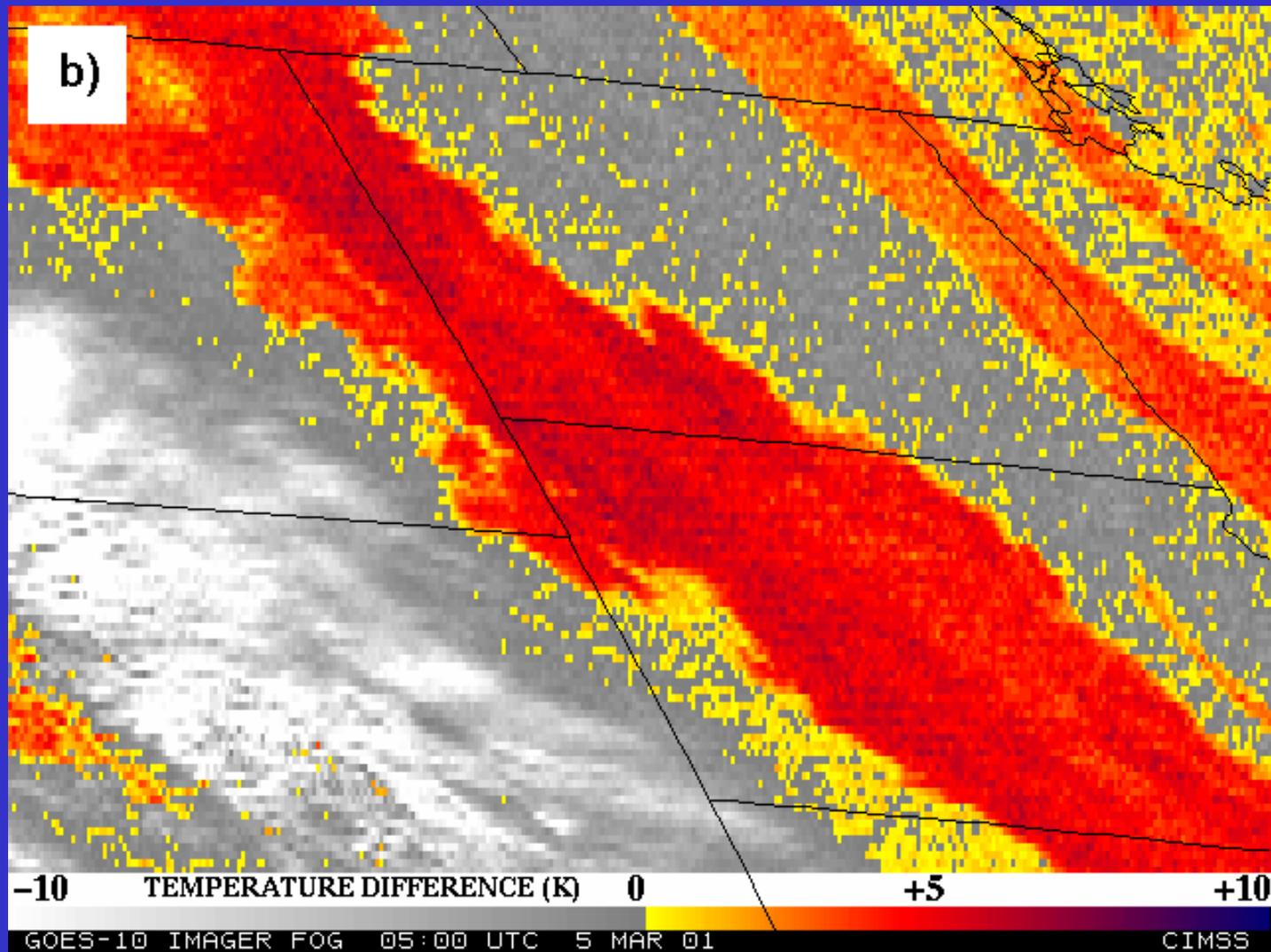
Images from J. Feltz

## Nocturnal Fog/Stratus Over the Northern Plains



“ABI” 4 minus 11  $\mu\text{m}$  Difference  
ABI image (from MODIS) shows greater detail in structure of fog.

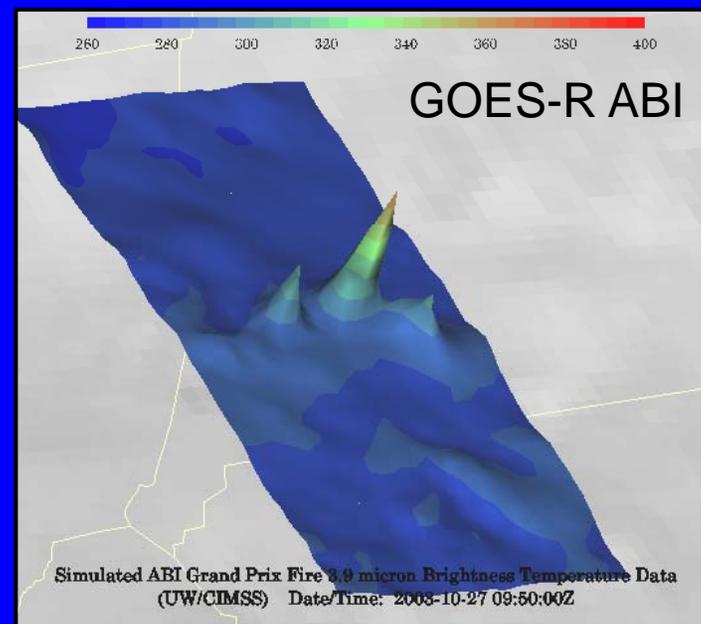
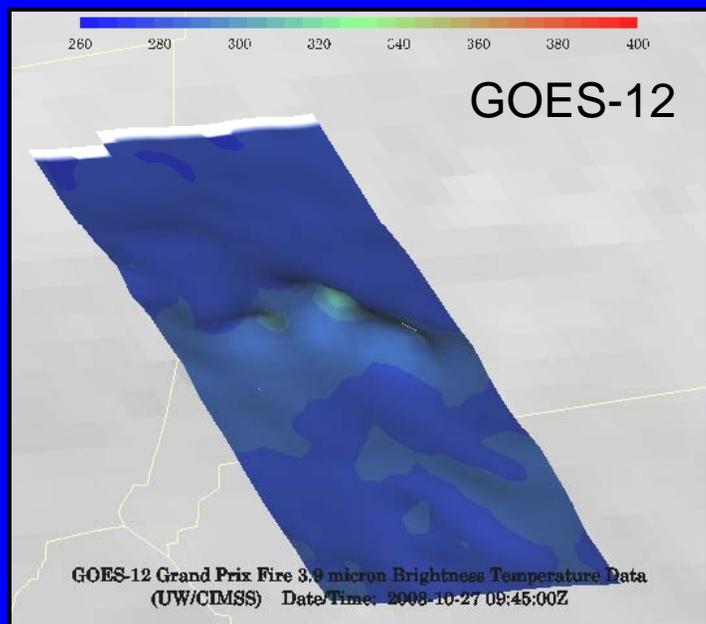
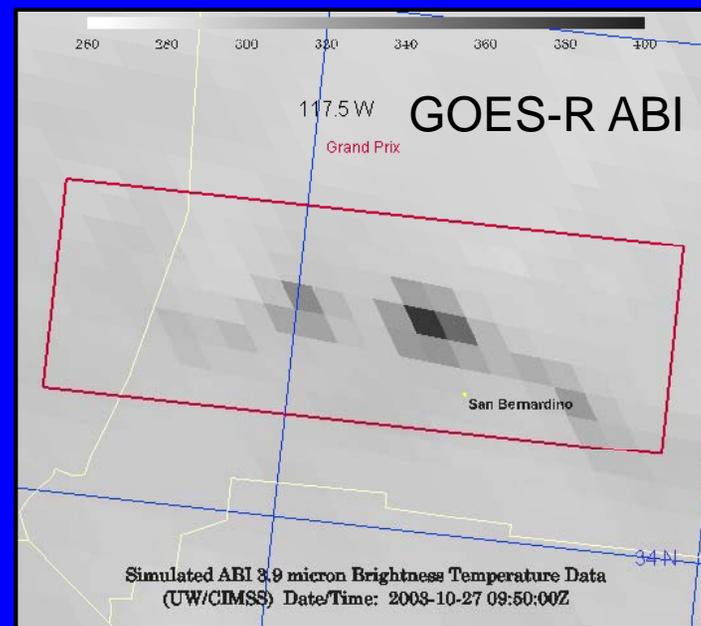
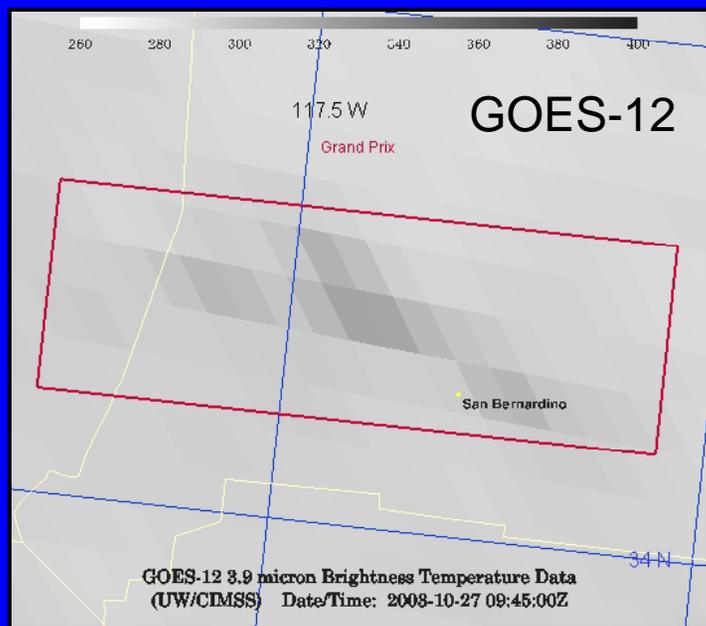
## Nocturnal Fog/Stratus Over the Northern Plains



GOES-10 4 minus 11  $\mu\text{m}$  Difference  
ABI image (from MODIS) shows greater detail in structure of fog.

# GOES-12 and GOES-R ABI

## Simulation of Grand Prix Fire/Southern California

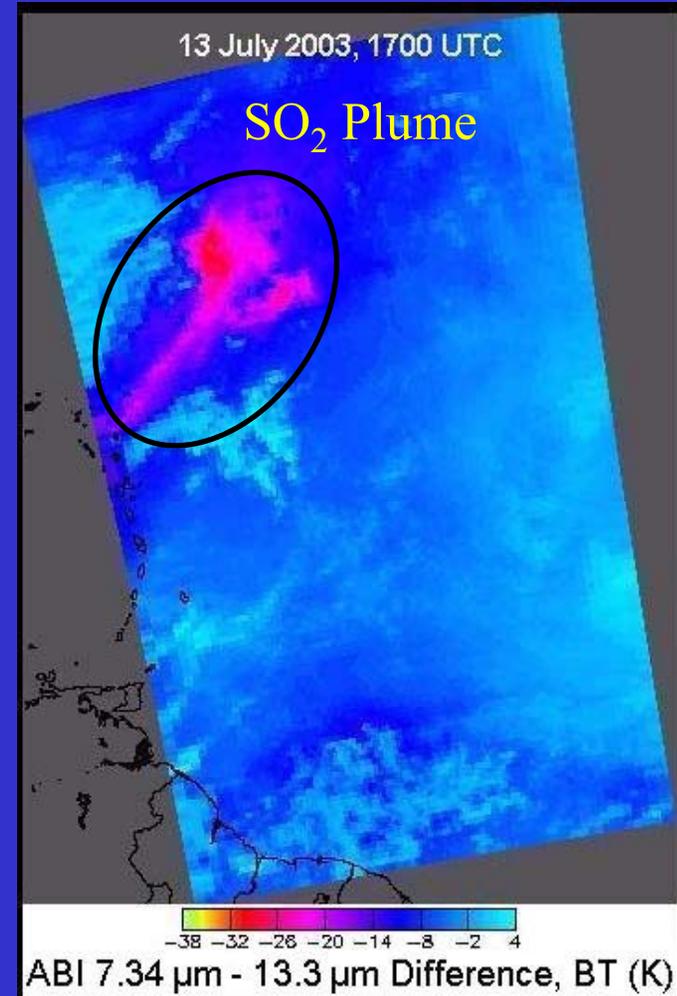


## GOES-R ABI will detect SO<sub>2</sub> plumes

Water Vapor Band Difference convolved from AIRS data  
sees SO<sub>2</sub> plume from Montserrat Island, West Indies

*Current GOES Imager  
No skill in monitoring*

Current GOES Imager can not  
detect SO<sub>2</sub>

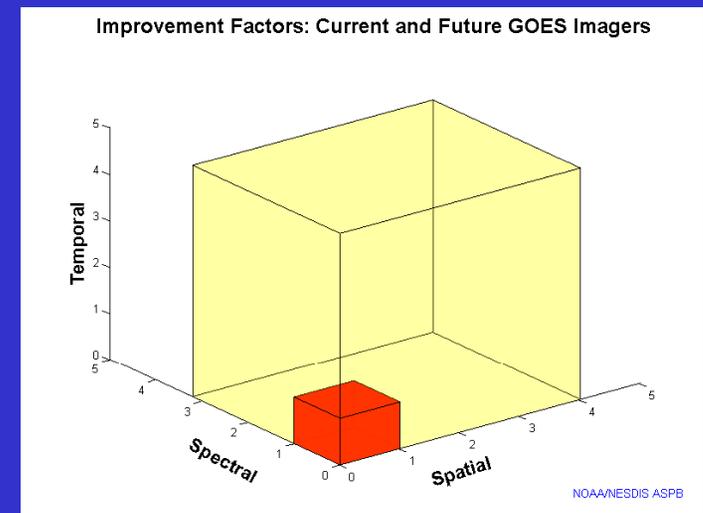


ABI 7.34  $\mu$ m - 13.3  $\mu$ m

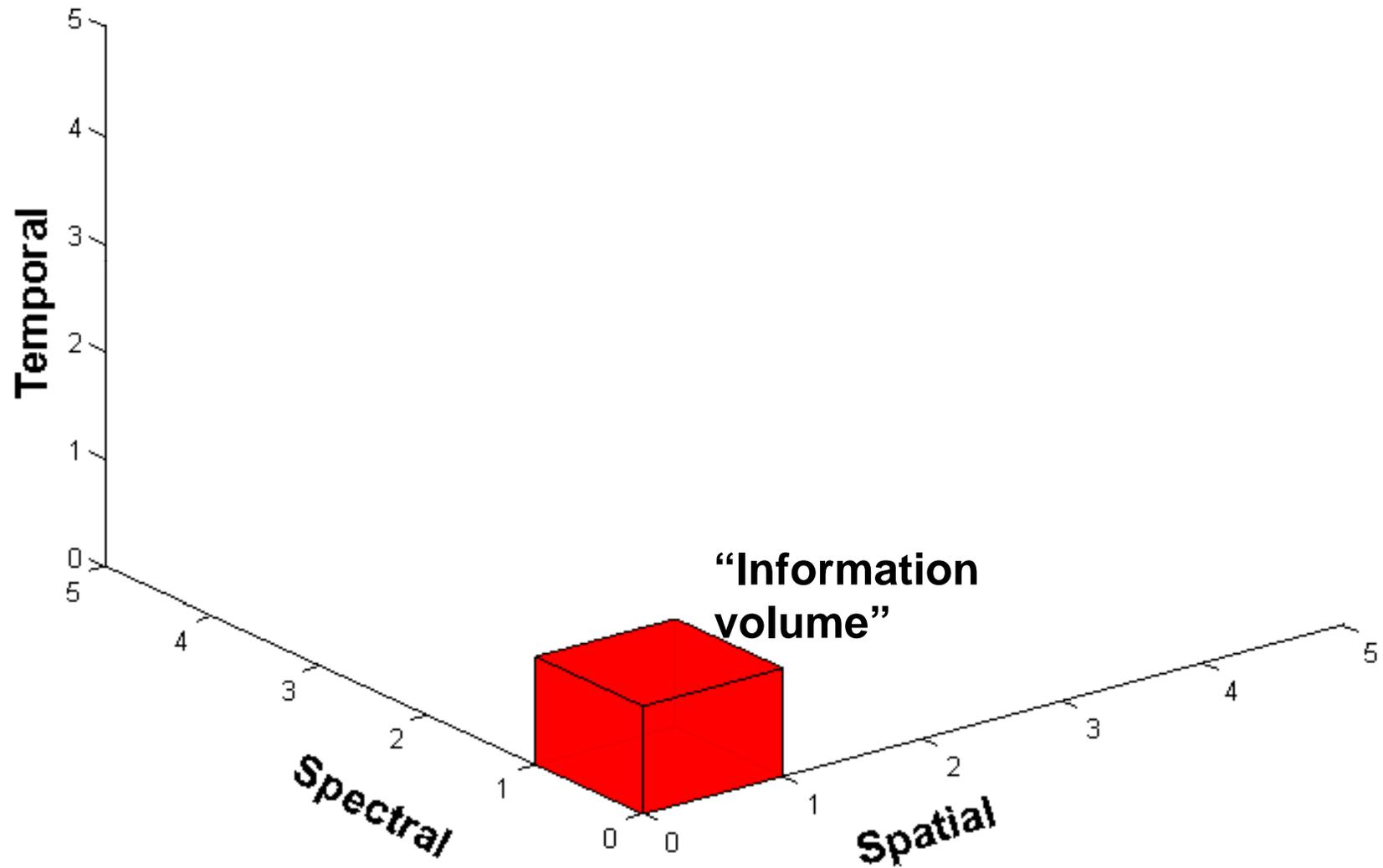
Figure courtesy of Kris Karnauskas

# Overview

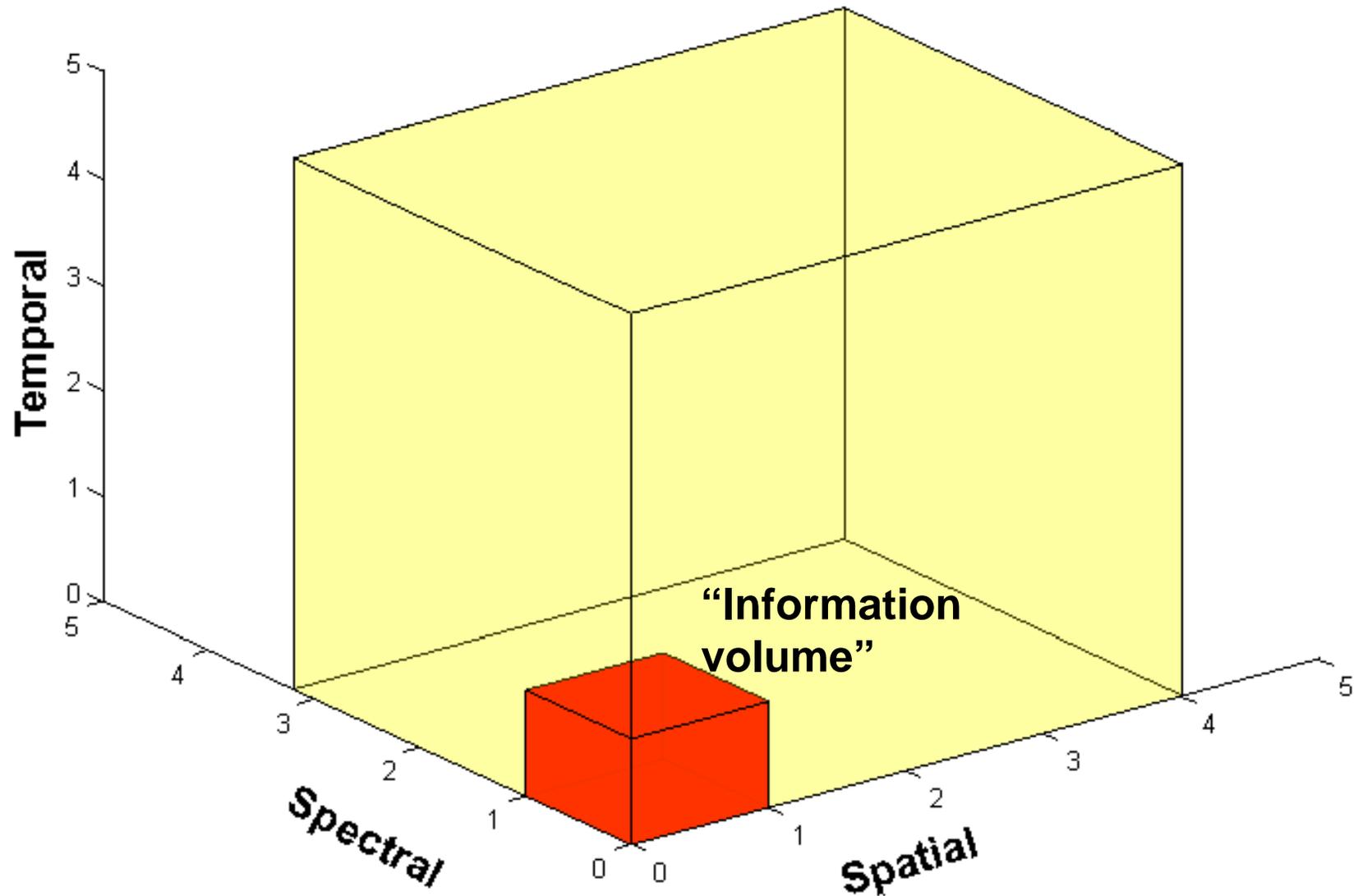
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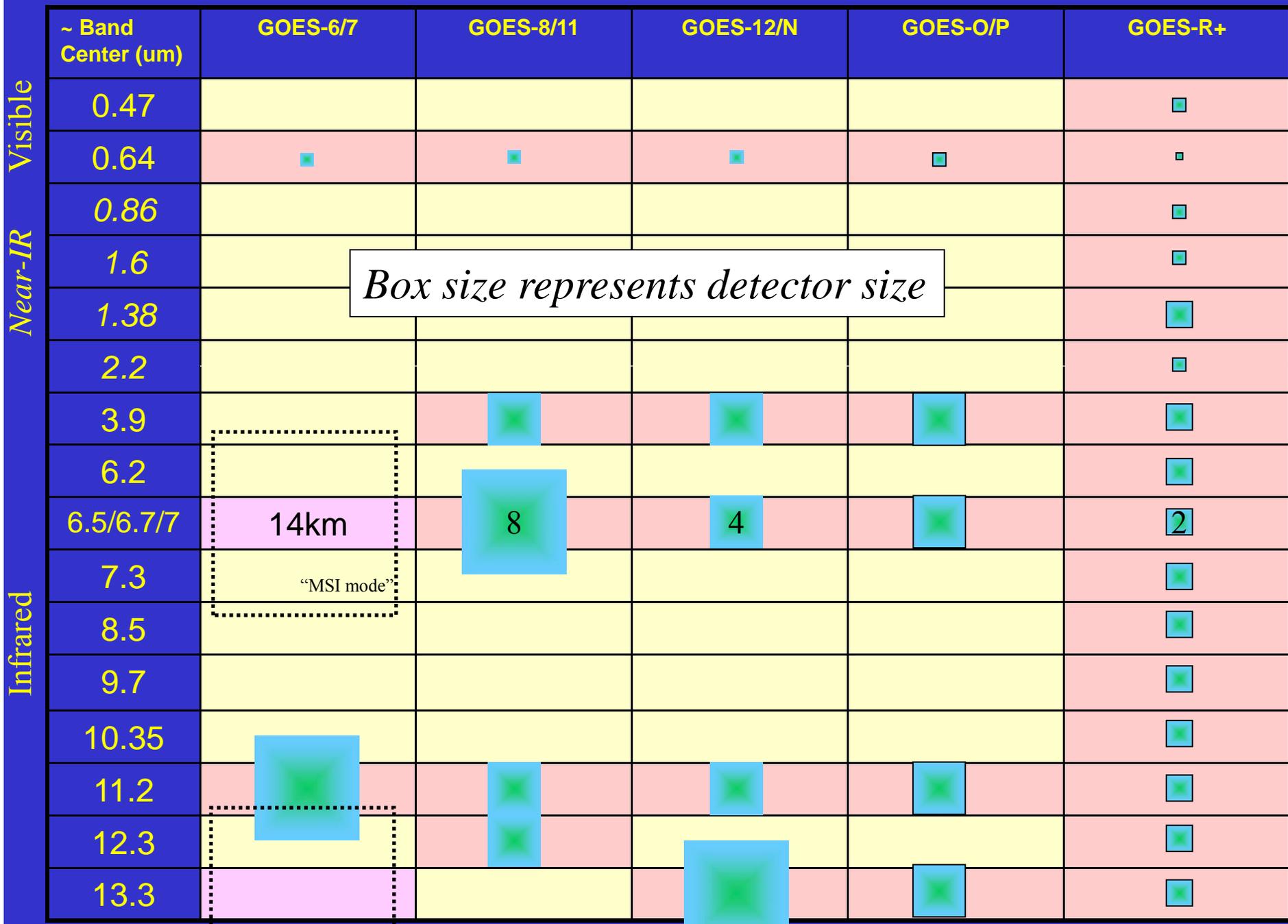
# Current attributes: defined to be 1



# Improved attributes with the Future GOES Imagers



# Approximate spectral and spatial resolutions of US GOES Imagers



# More information

the next generation  
**GOES-R**  
the nation's weather satellite.



## GOES-R:

- <http://www.goes-r.gov>
- <http://www.meted.ucar.edu/index.htm>
- [http://cimss.ssec.wisc.edu/goes\\_r/proving-ground.html](http://cimss.ssec.wisc.edu/goes_r/proving-ground.html)

## GOES and NASA:

- <http://goespoes.gsfc.nasa.gov/goes/index.html>
- <http://goes.gsfc.nasa.gov/text/goes.databookn.html>

## UW/SSEC/CIMSS/ASPB:

- [http://cimss.ssec.wisc.edu/goes\\_r/awg/proxy/nwp/](http://cimss.ssec.wisc.edu/goes_r/awg/proxy/nwp/)
- <http://cimss.ssec.wisc.edu/goes/abi/>
- <http://cimss.ssec.wisc.edu/goes/abi/wf>
- <http://cimss.ssec.wisc.edu/goes/blog/>
- <http://www.ssec.wisc.edu/data/geo/>

*AMS BAMS Article on  
the ABI (Aug. 2005)*

### ARTICLES

#### INTRODUCING THE NEXT-GENERATION ADVANCED-BASELINE IMAGER ON GOES-R

by Denise J. Saven, Thomas R. Chubb, William Hines, Joseph G. Jozala, and A. Scott Bassman

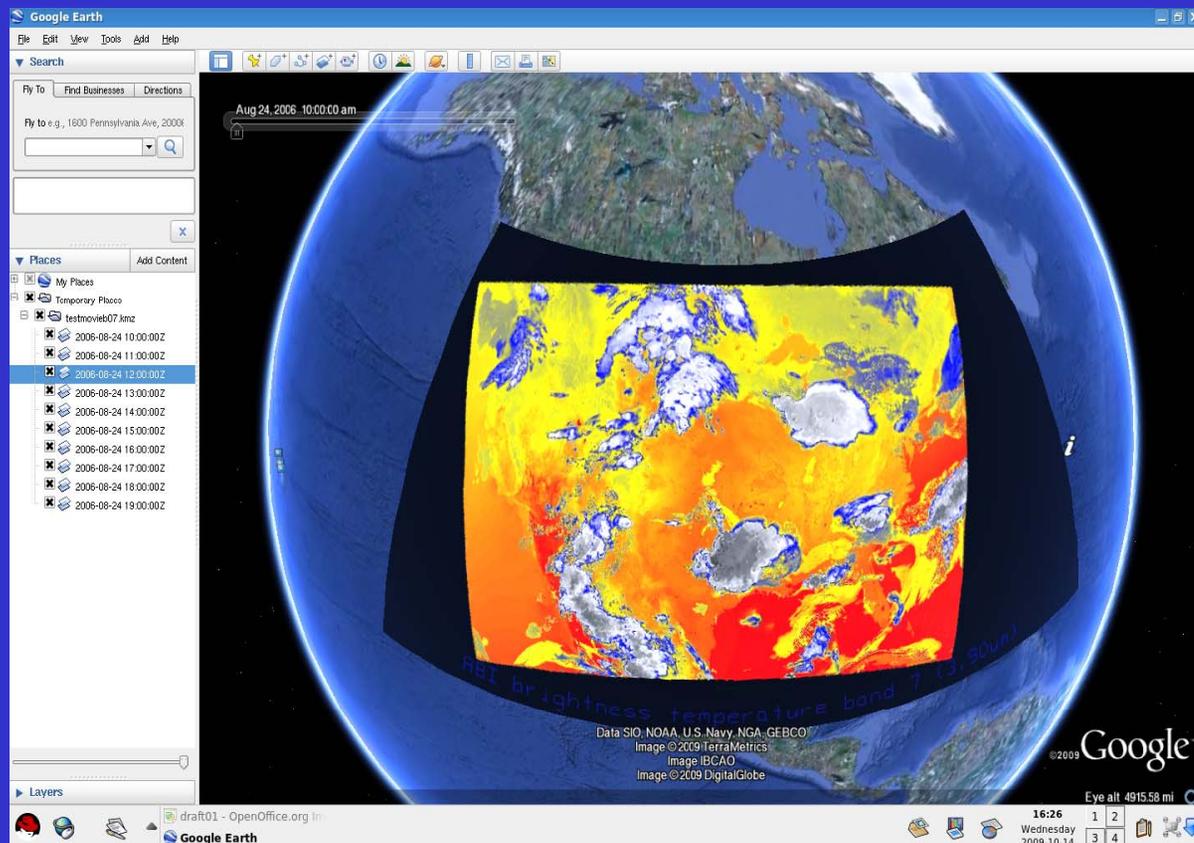
The ABI will help to improve U.S. governmental services using geostationary satellite data, forecasting and higher spatial resolution than the current imager.

The Advanced Baseline Imager (ABI) is being developed by the Center for Global Change and Earth System Science (CGCESS) at the University of Wisconsin-Madison. The ABI will be the primary imager on the GOES-R satellite, providing a wide range of qualitative and quantitative data, including visible and infrared channels, and will also serve as a backup imager for the current GOES imager. The ABI will be the primary imager on the GOES-R satellite, providing a wide range of qualitative and quantitative data, including visible and infrared channels, and will also serve as a backup imager for the current GOES imager.

AMS BAMS Article on the ABI (Aug. 2005)

# Google Earth

- Sample ABI simulated data are available in google Earth format:
  - <http://cimss.ssec.wisc.edu/goes/abi/loops/links.html>



(preliminary)

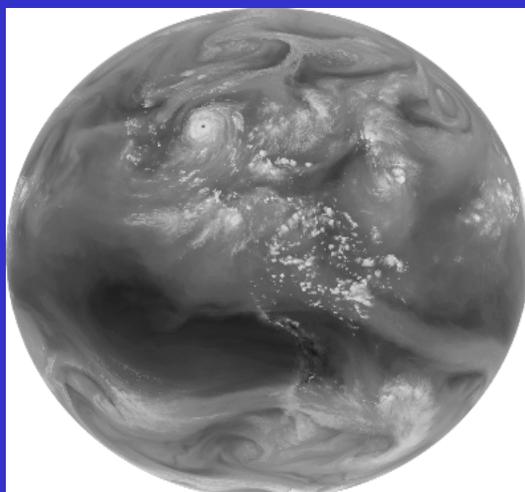
# Summary

- The ABI on GOES-R will improve over the current instrument in many aspects (spatial, temporal, spectral), plus improved image navigation and registration and radiometer performance.
- These improvements will greatly assist a host of applications.
- Thank you for your time.
- Contact information:
  - [tim.j.schmit@noaa.gov](mailto:tim.j.schmit@noaa.gov)



# Acknowledgements

- The authors would like to thank the entire GOES-R team; both within the government, industry and academia.
- The views, opinions, and findings contained in this presentation are those of the authors and should not be construed as an official National Oceanic and Atmospheric Administration or U.S. Government position, policy, or decision.



Improvement Factors: Current and Future GOES Imagers

