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**Center for Satellite
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The ABI (Advanced Baseline Imager) on the GOES-R series

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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



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



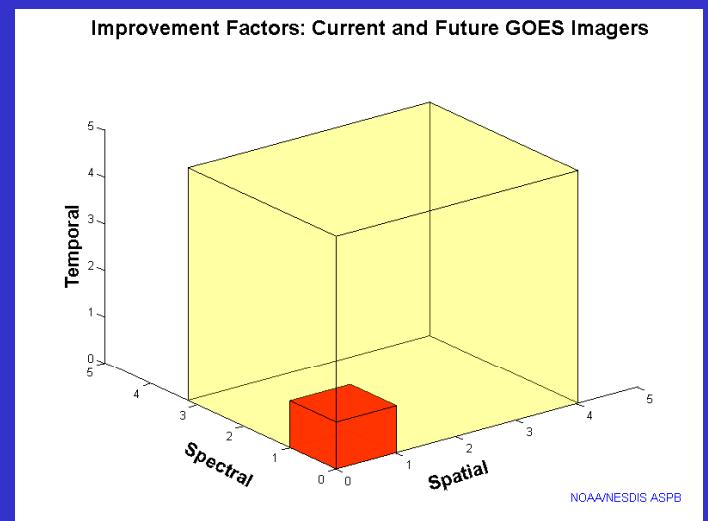
UW-Madison

Also Thanks to...

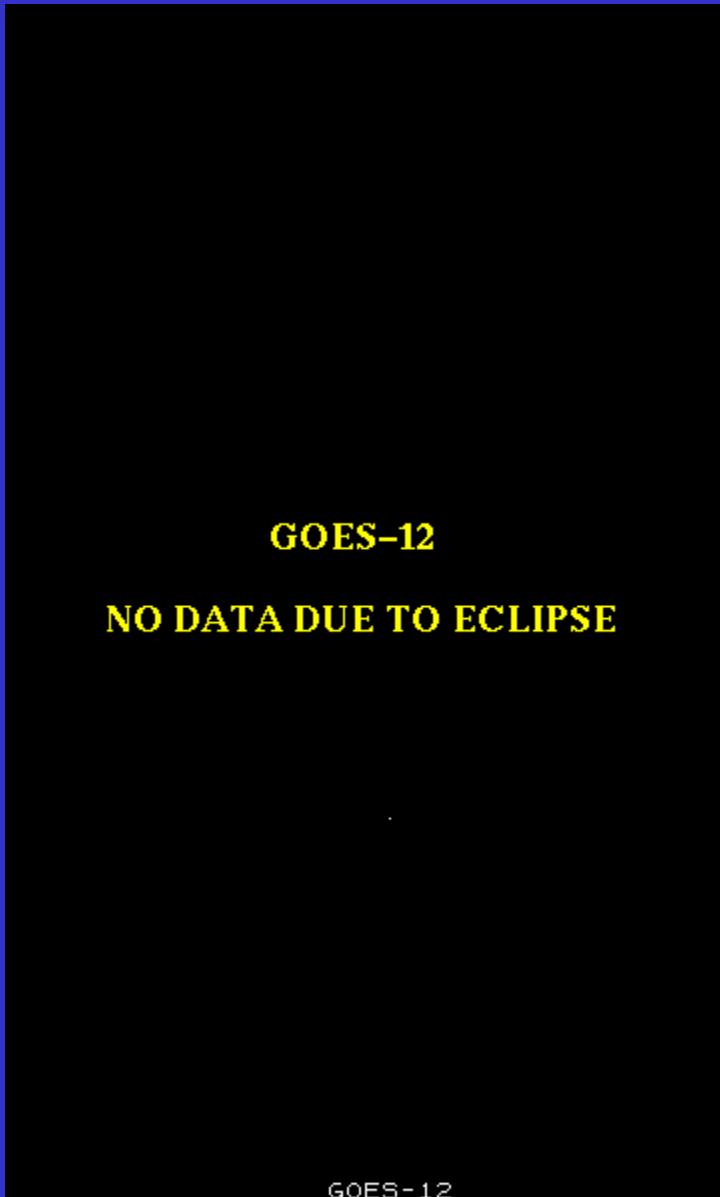
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- Mitch Goldberg, AWG co-chairs, AWG Leads, GPO, GUC committee team(s), Jordan Gerth, Chian-Yi Liu, Jason Otkin, Thomas Greenwald, Monica Coakley, Bill Smith, ASPB, PG, SSEC data center, etc.

Overview

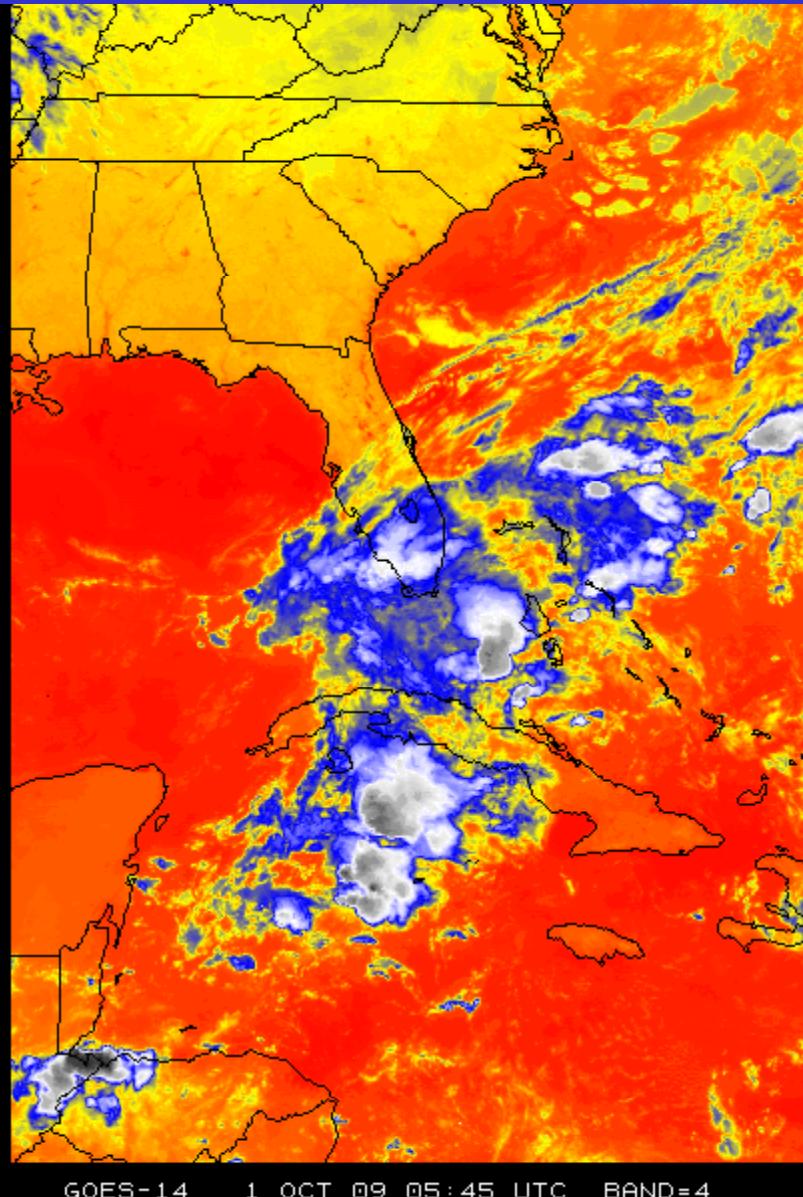
- GOES-14
- ABI (Advanced Baseline Imager)
 - Temporal
 - Spatial
 - Spectral
 - Imagery
- Summary
 - More information



GOES-12/14 (Around eclipse period)

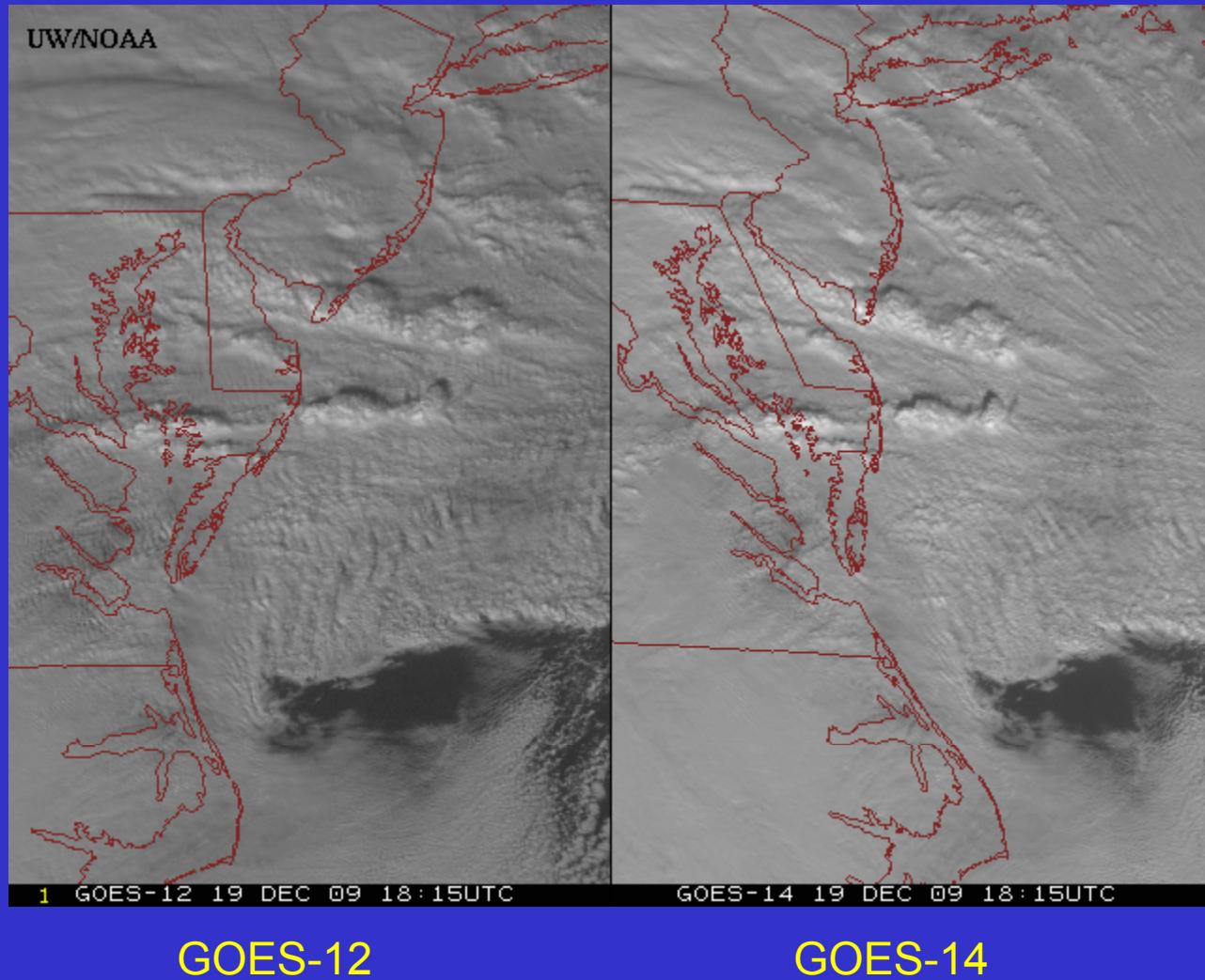


GOES-12



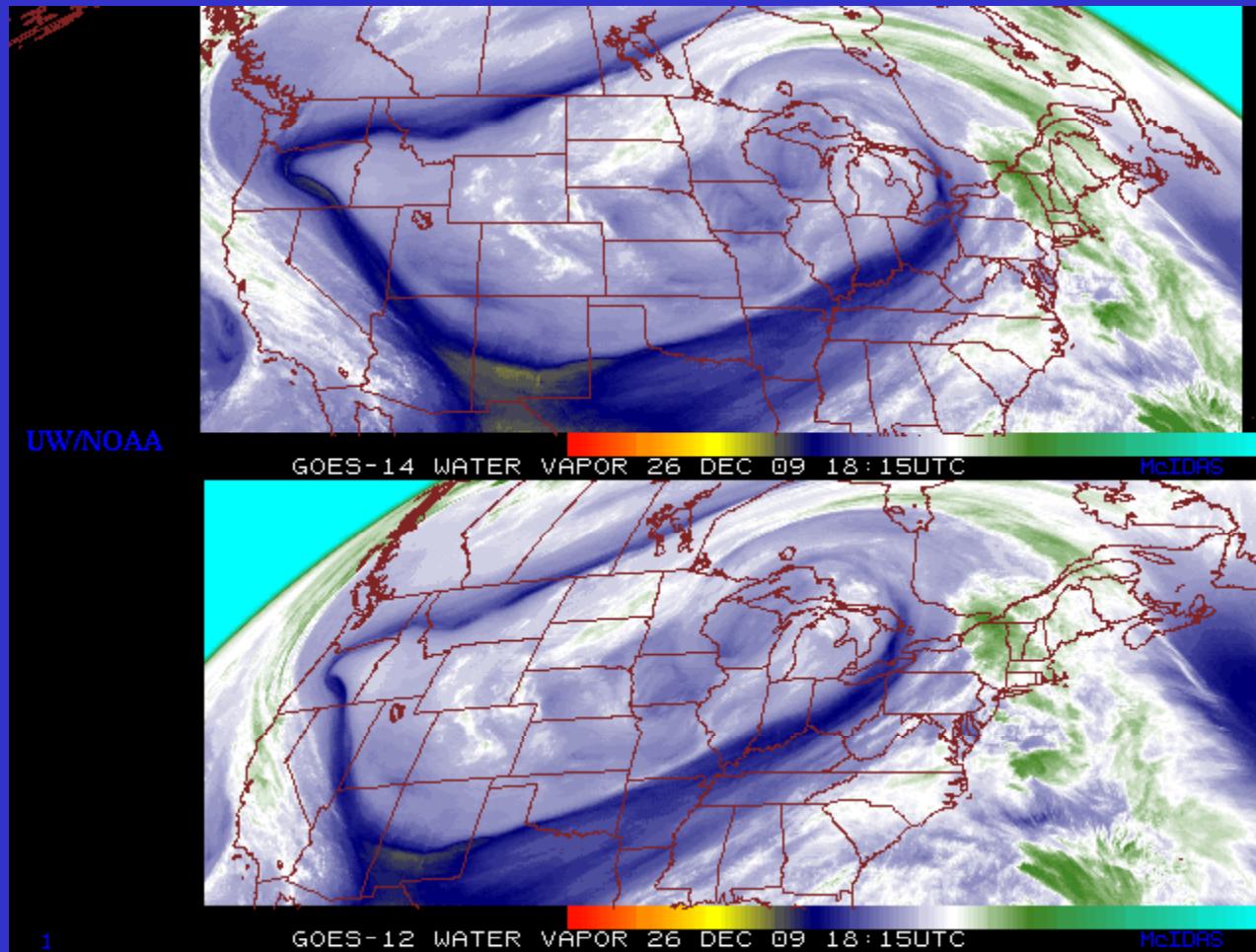
GOES-14

GOES-14: Sample “1-min” imagery



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

GOES-14: Sample “5-min” imagery

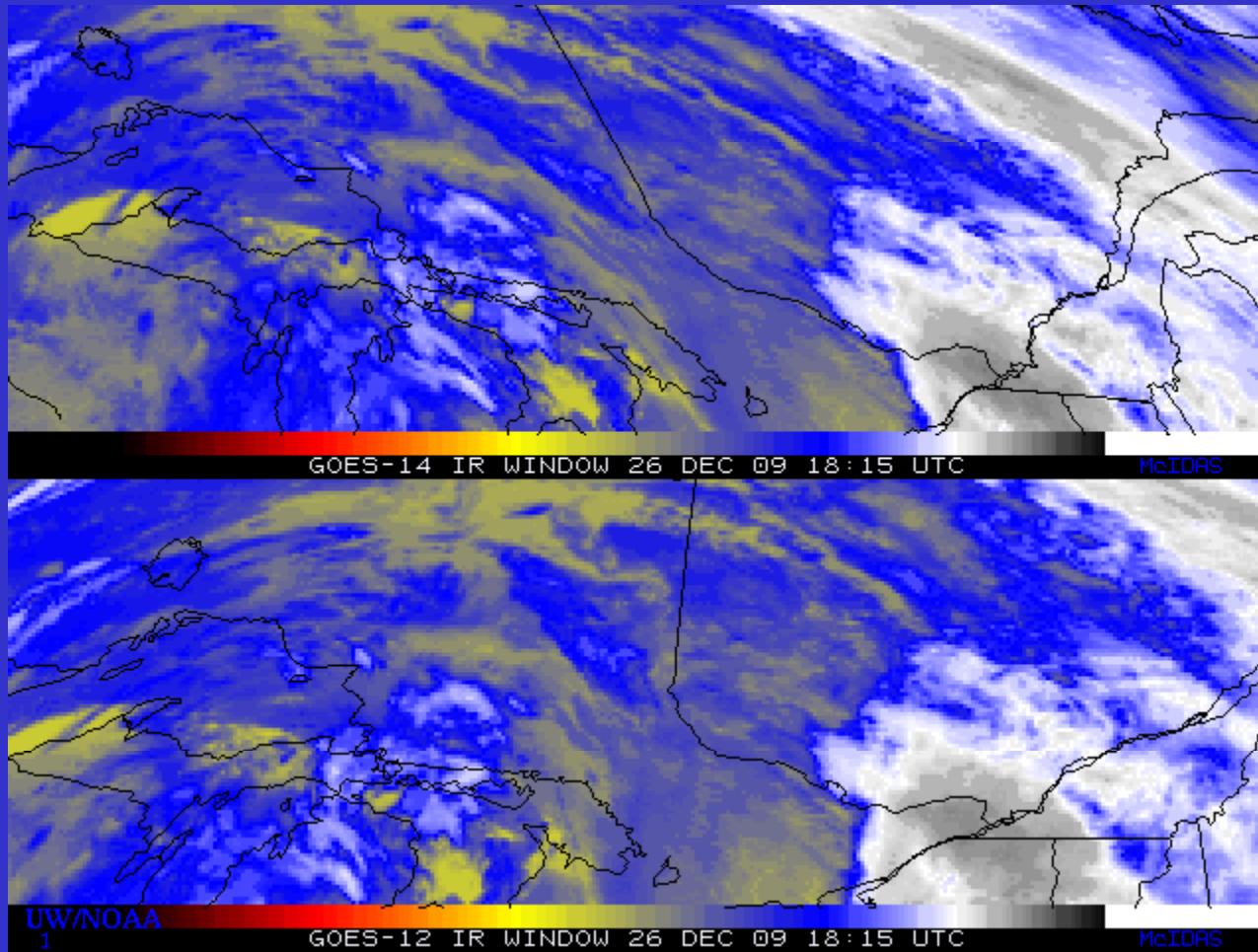


GOES-14

GOES-12

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

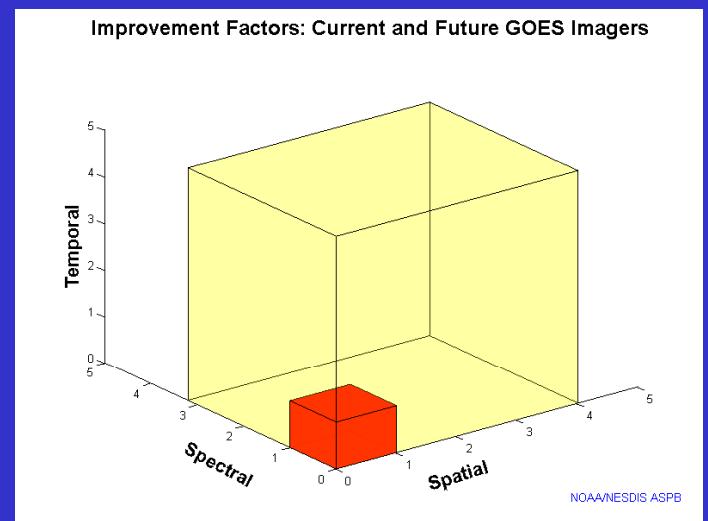
GOES-14: Sample “5-min” imagery



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

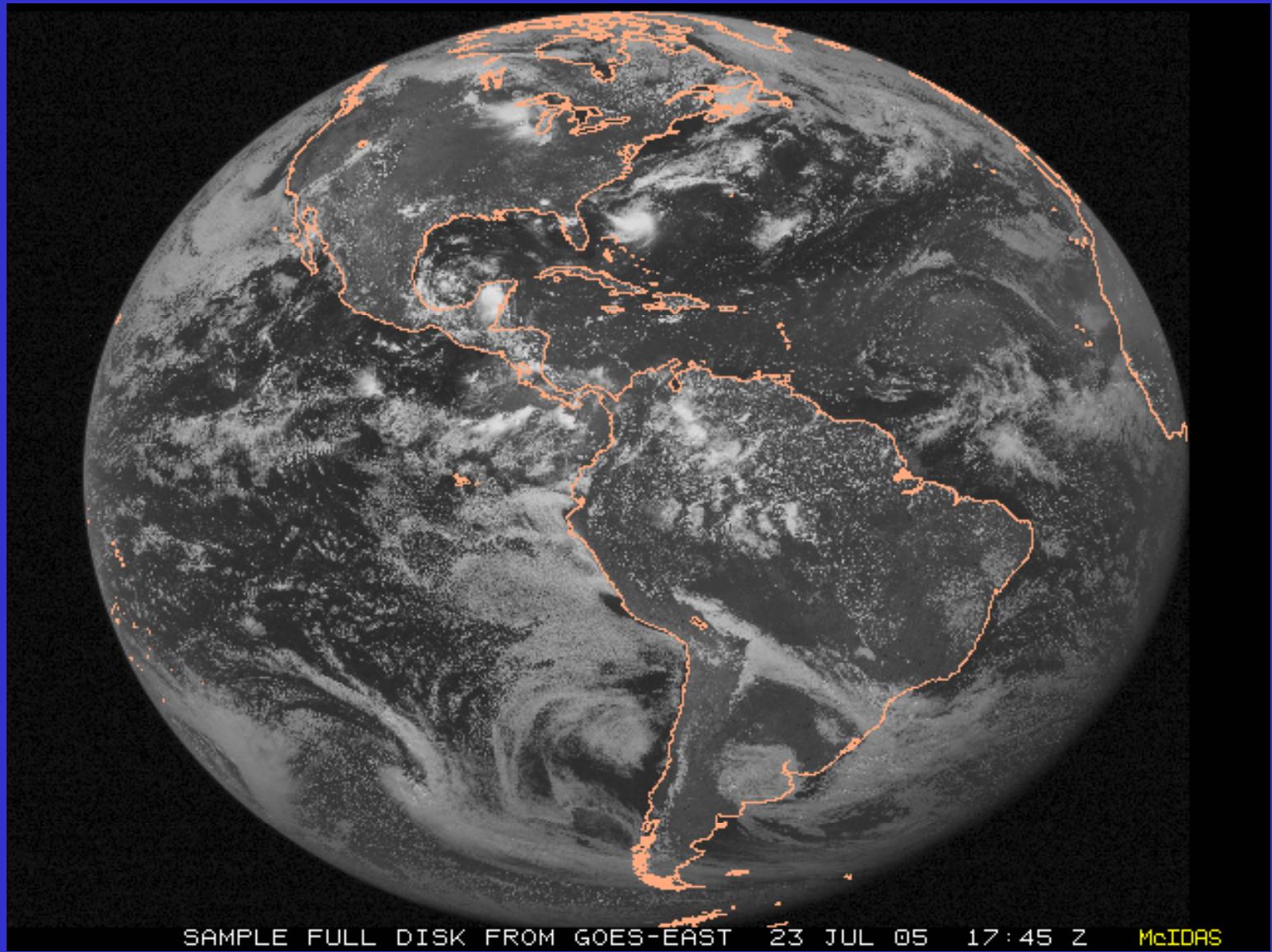
Overview

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The Advanced Baseline Imager:

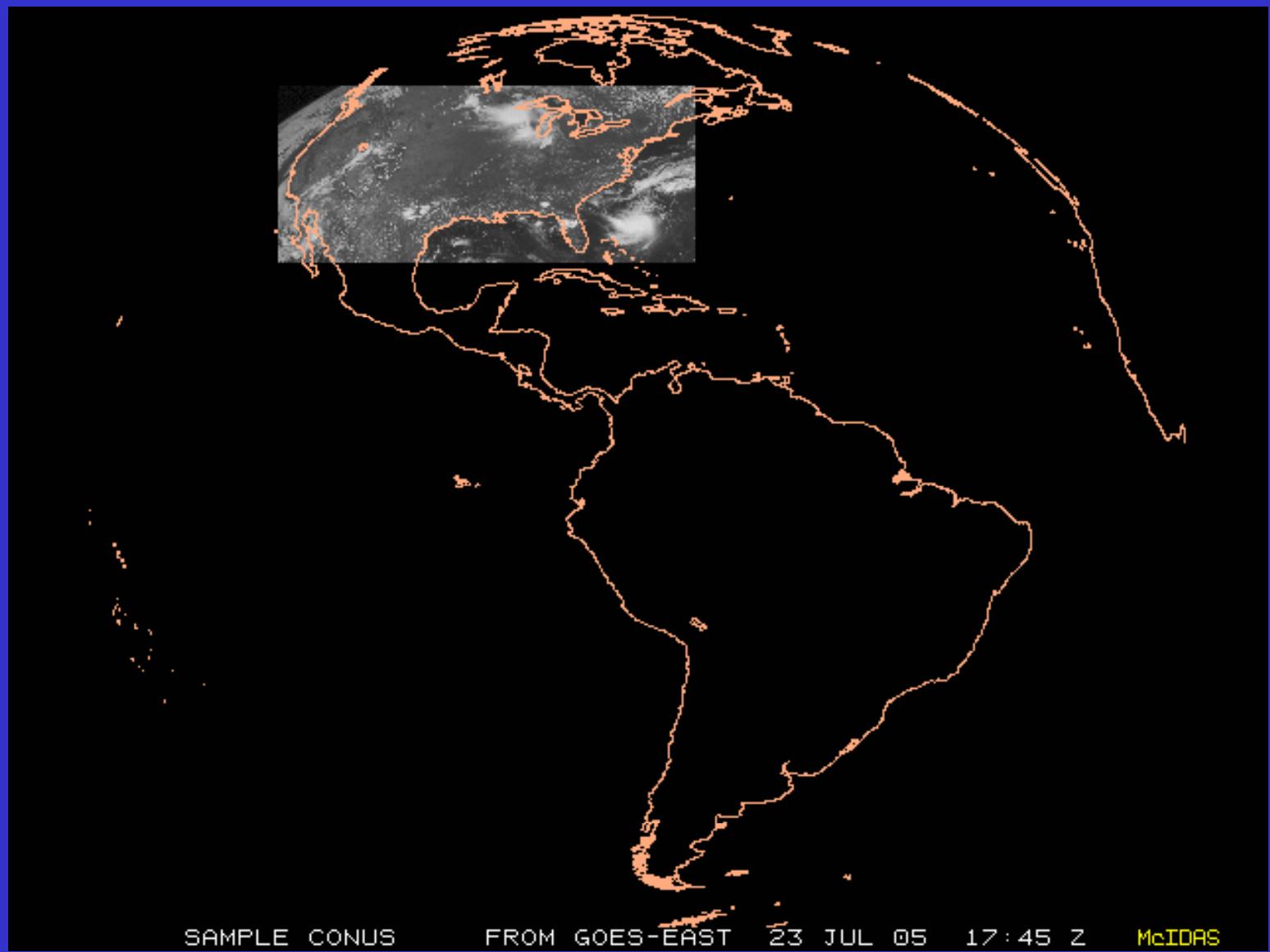
	ABI	Current
Spectral Coverage	16 bands	5 bands
Spatial resolution		
0.64 μm Visible	0.5 km	Approx. 1 km
Other Visible/near-IR	1.0 km	n/a
Bands ($>2 \mu\text{m}$)	2 km	Approx. 4 km
Spatial coverage		
Full disk	4 per hour	Scheduled (3 hrly)
CONUS	12 per hour	~4 per hour
Mesoscale	Every 30 sec	n/a
Visible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



ABI
scans
about 5
times
faster
than the
current
GOES
imager

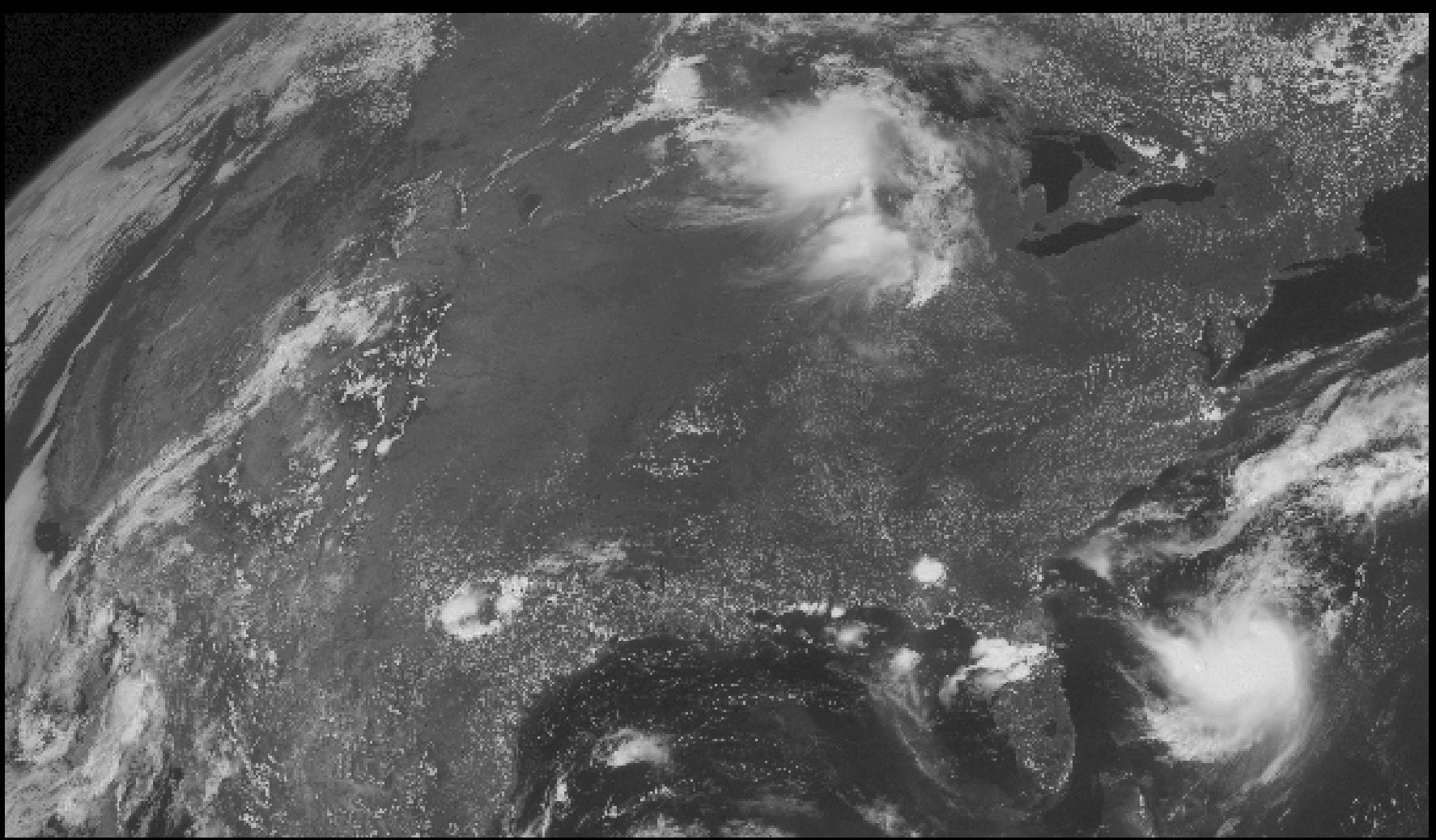
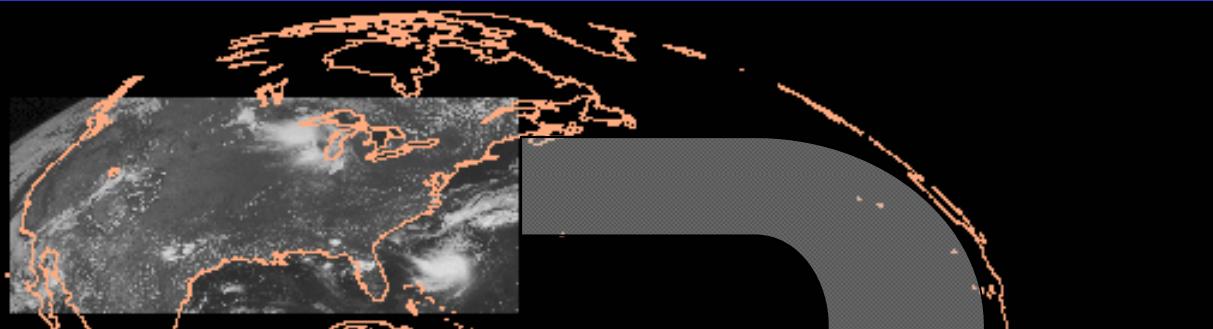
There are two anticipated scan modes for the ABI:

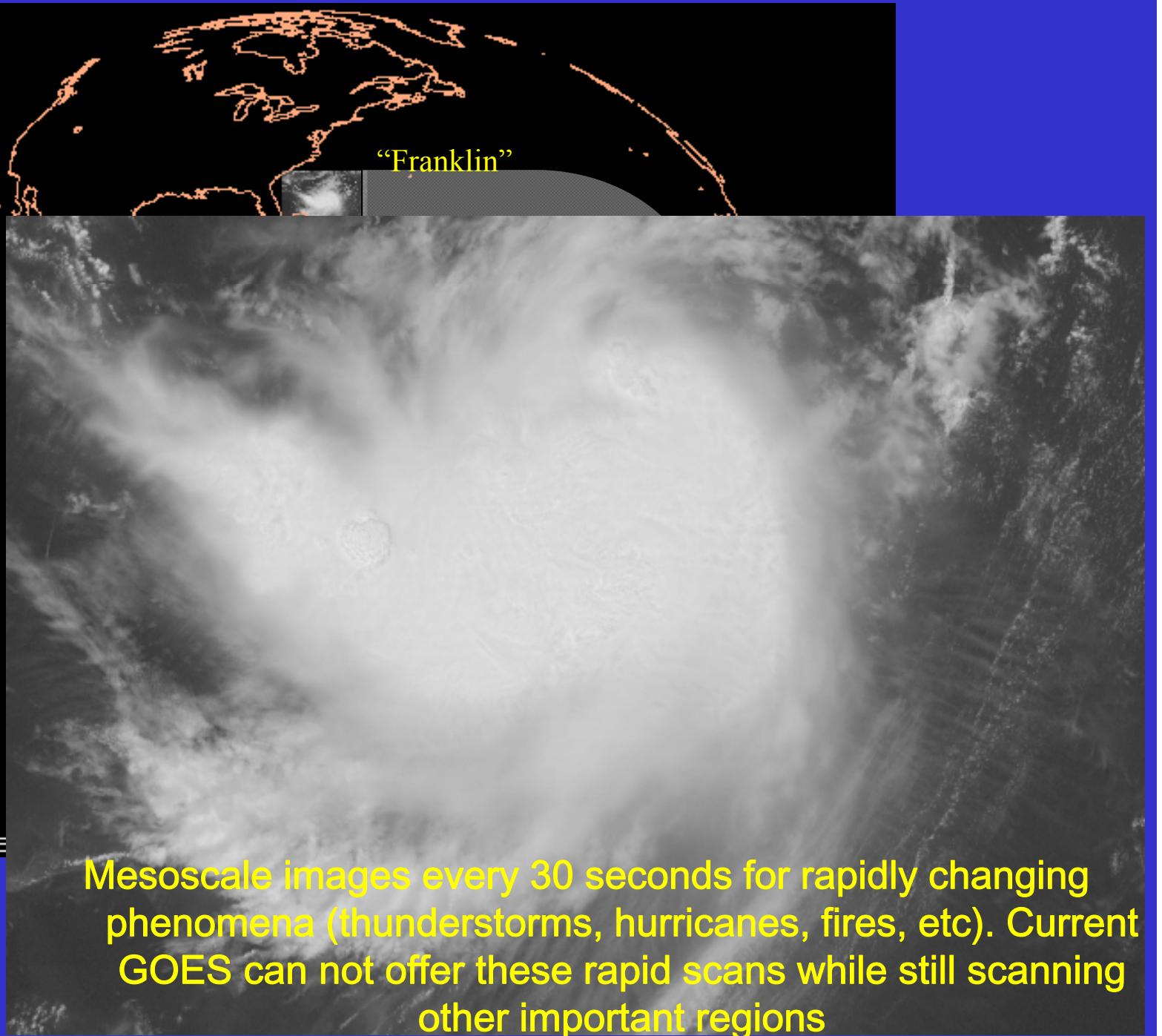
- Full disk images every 15 minutes + 5 min CONUS images + mesoscale.
or - Full disk every 5 minutes.



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

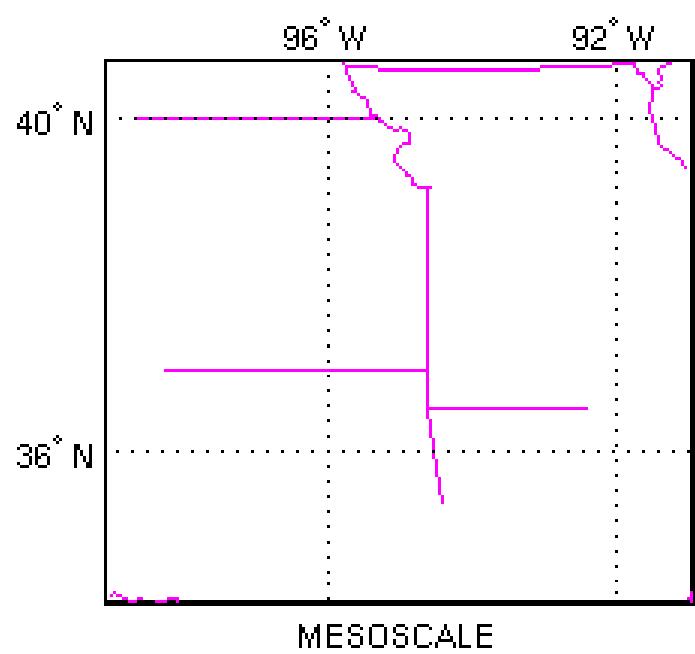
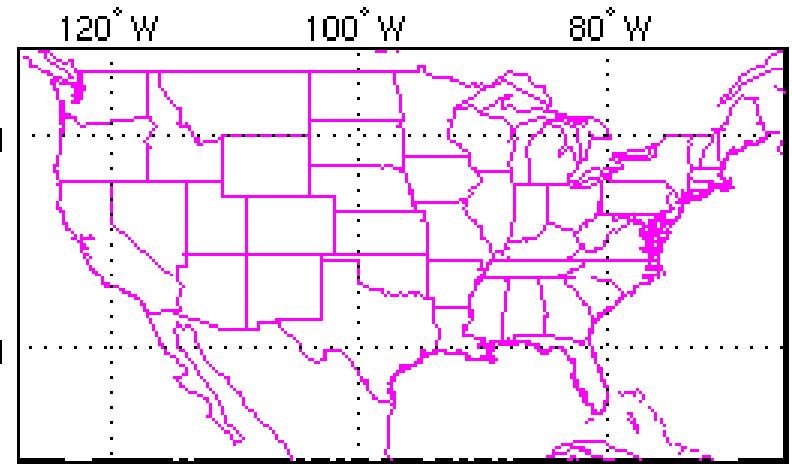
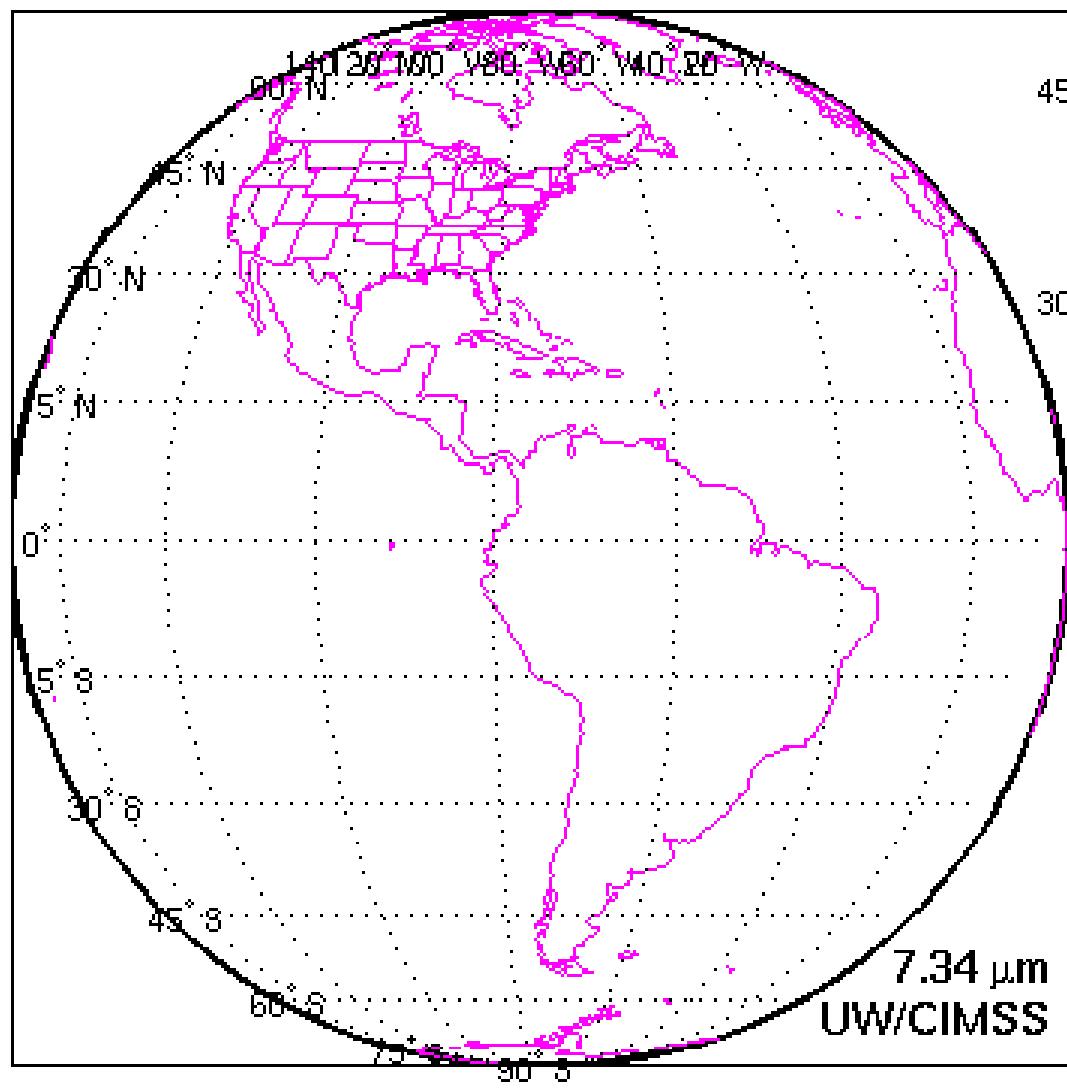


Figure courtesy of J. Li, CIMSS

Concept of flex mode scanning animation

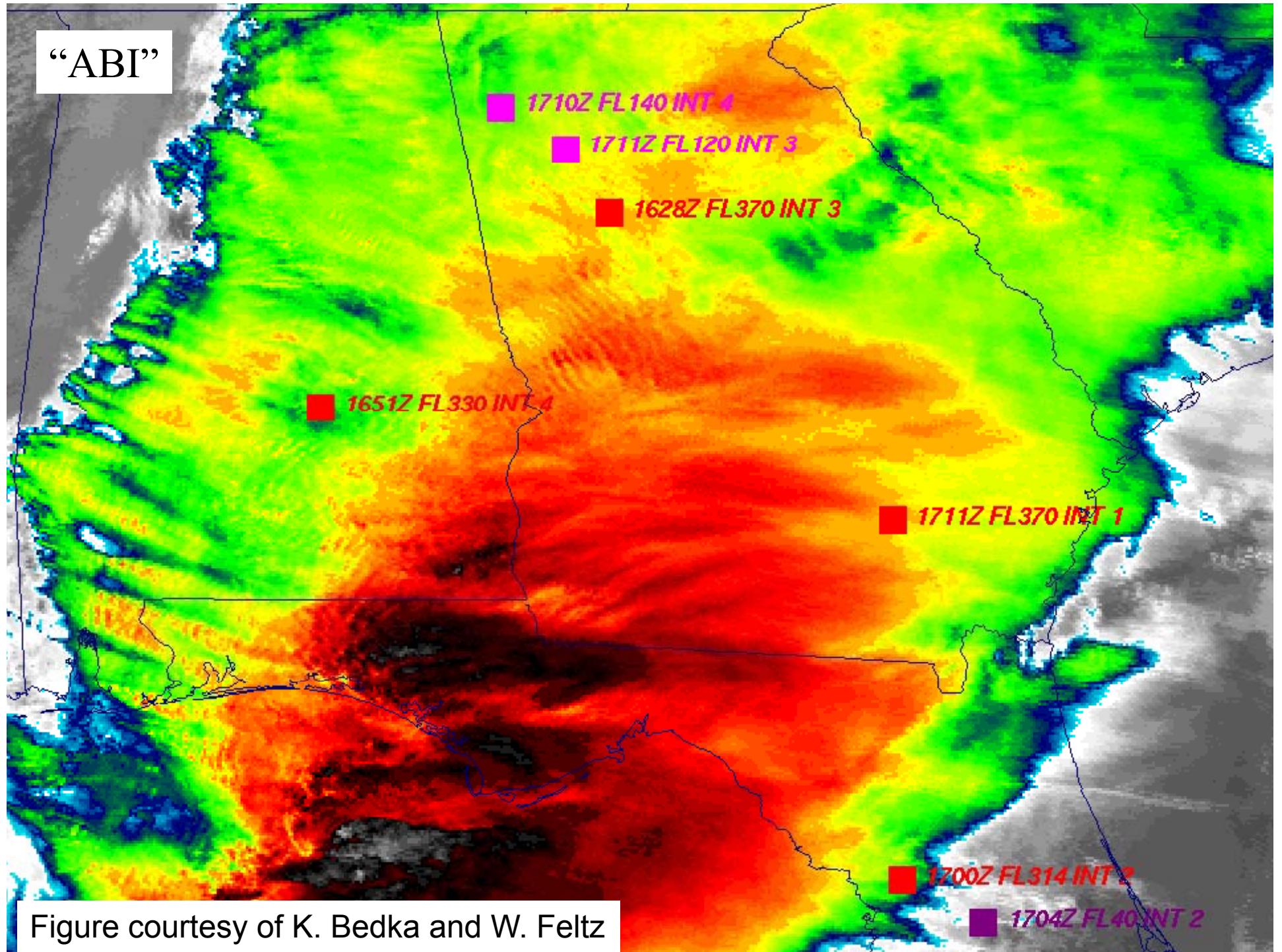


Figure courtesy of K. Bedka and W. Feltz

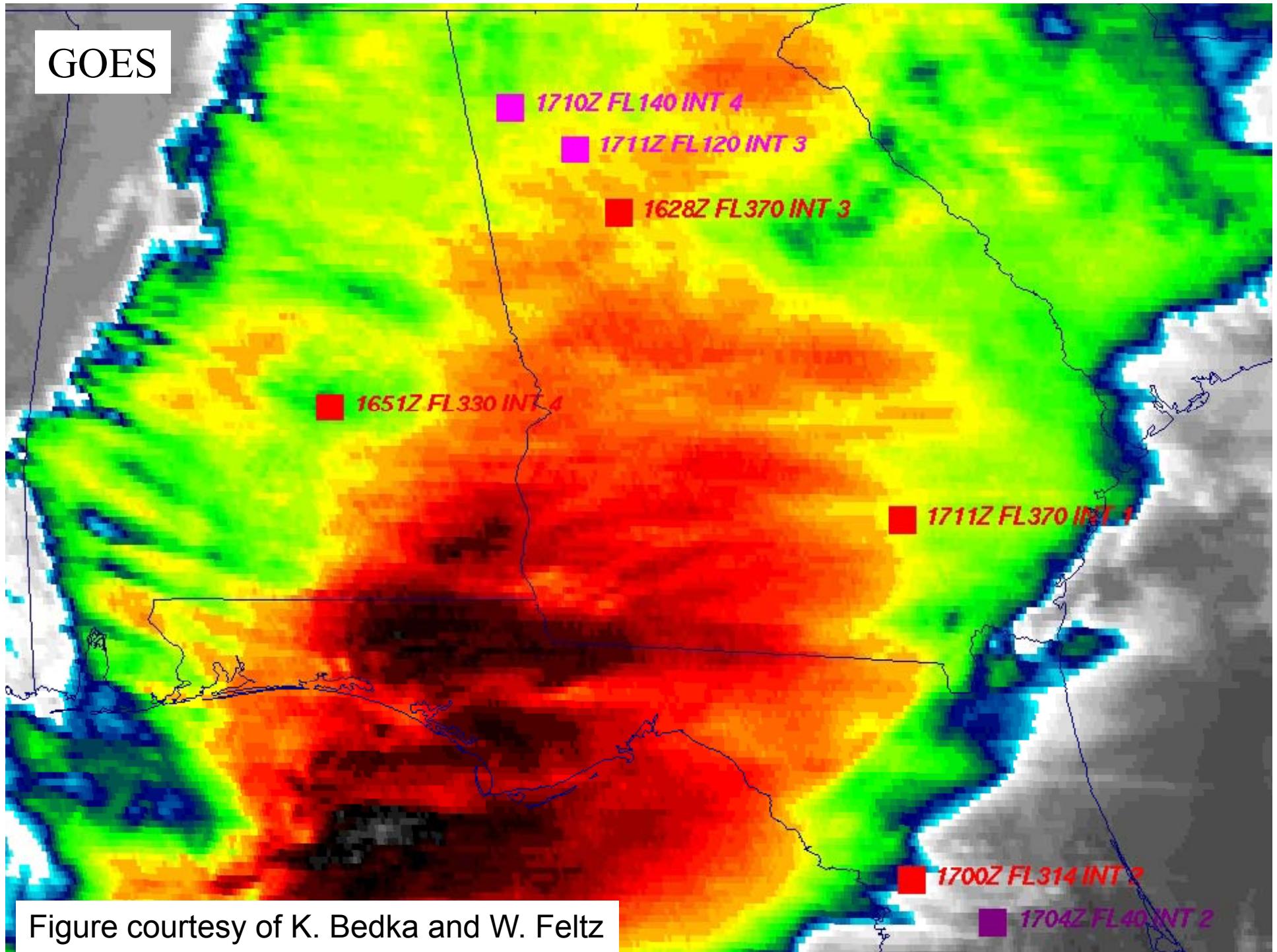


Figure courtesy of K. Bedka and W. Feltz

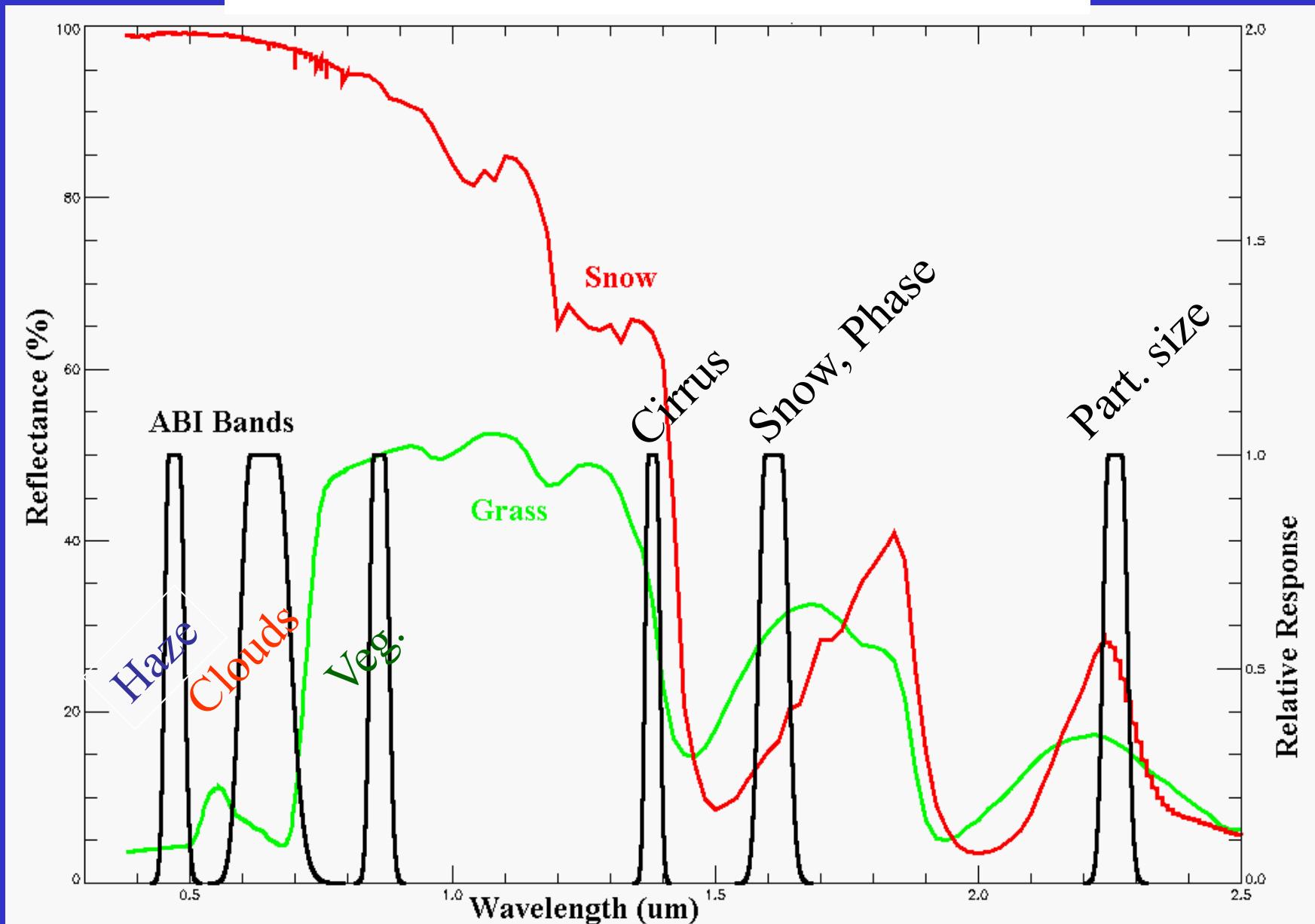
ABI Visible/Near-IR Bands

Future GOES imager (ABI) band	Wavelength range (μm)	Central wavelength (μm)	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, insulation, 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

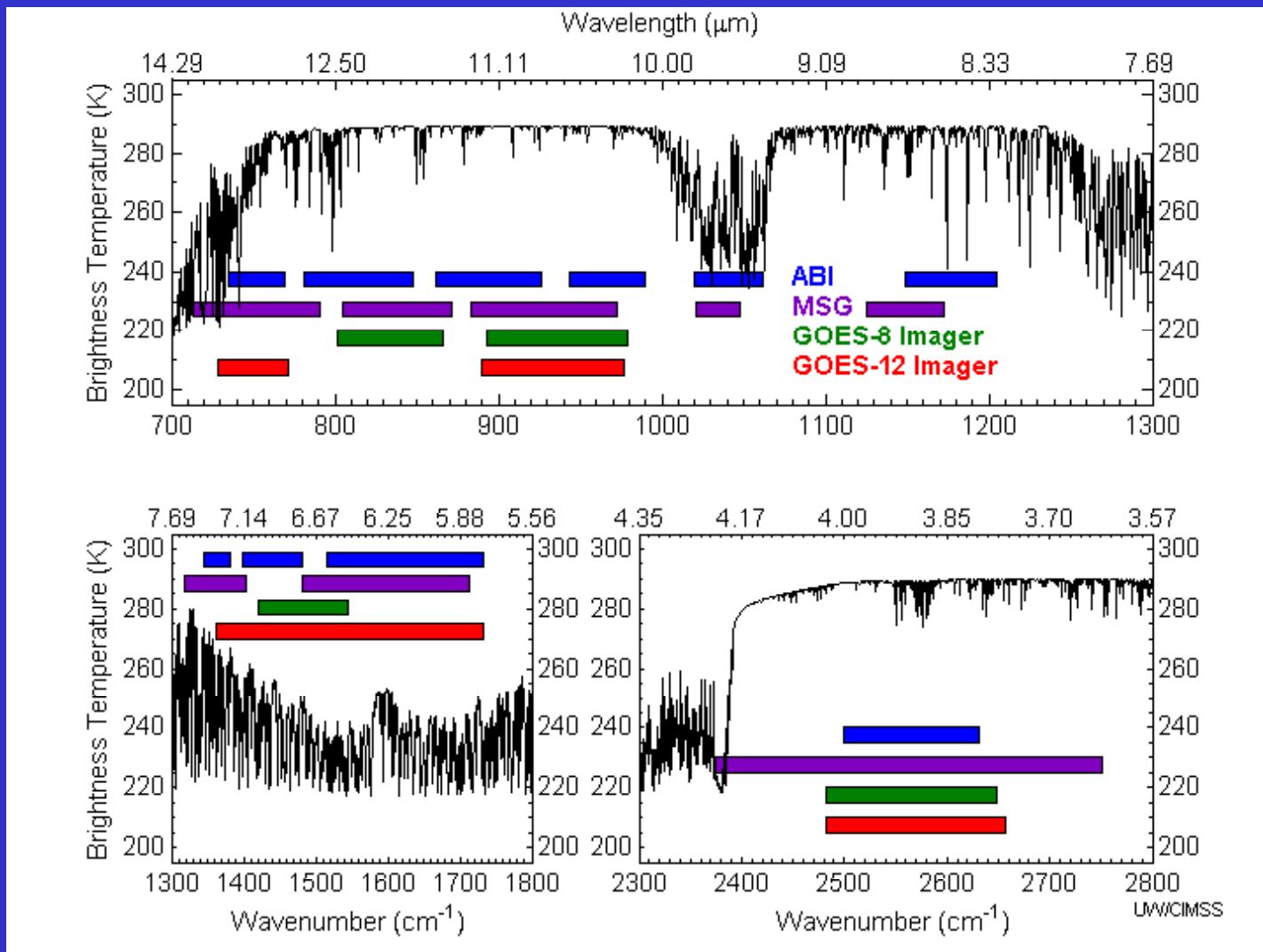
ABI IR Bands

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 ₂
11	8.3–8.7	8.5	2	Total water for stability, cloud phase, dust, SO ₂ , 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

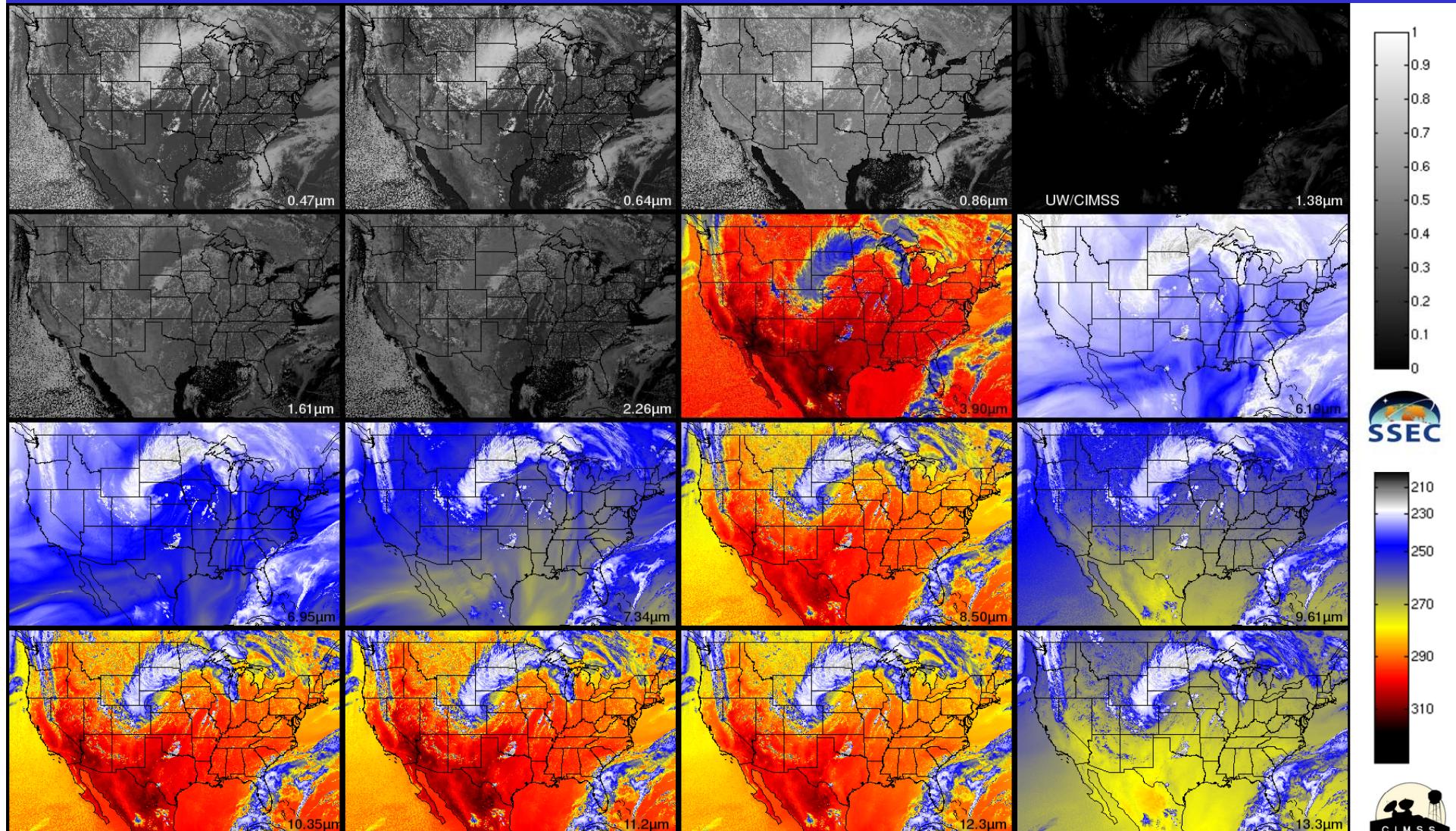


The ABI visible and near-IR bands have many uses.

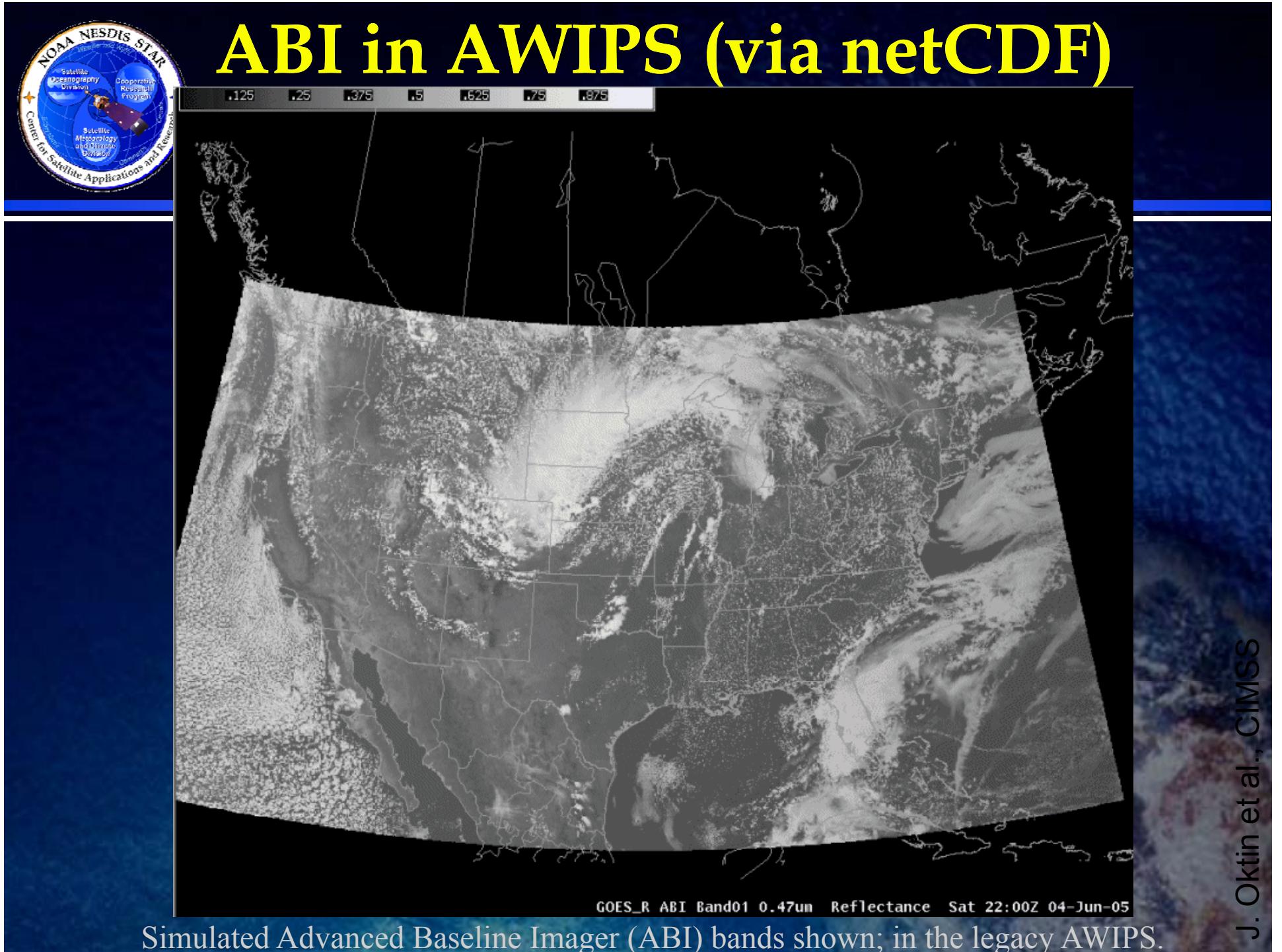


While there are differences, there are also many similarities for the spectral bands on MET-8 and the Advanced Baseline Imager (ABI). Both the MET-8 and ABI have many more bands than the current operational GOES imagers.

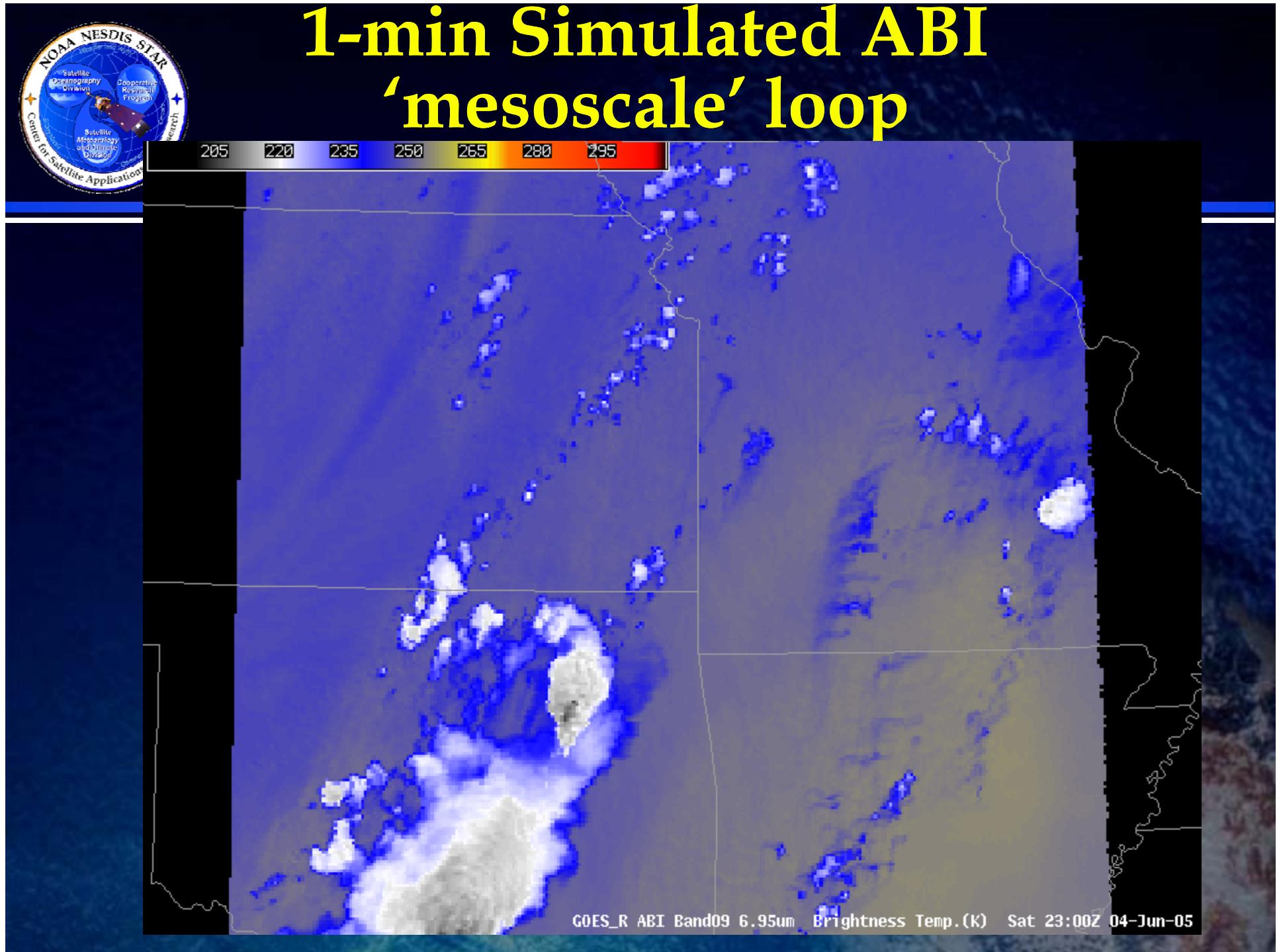
ABI bands via NWP simulation (CIMSS AWG Proxy Team)



J. Oktin et al., CIMSS



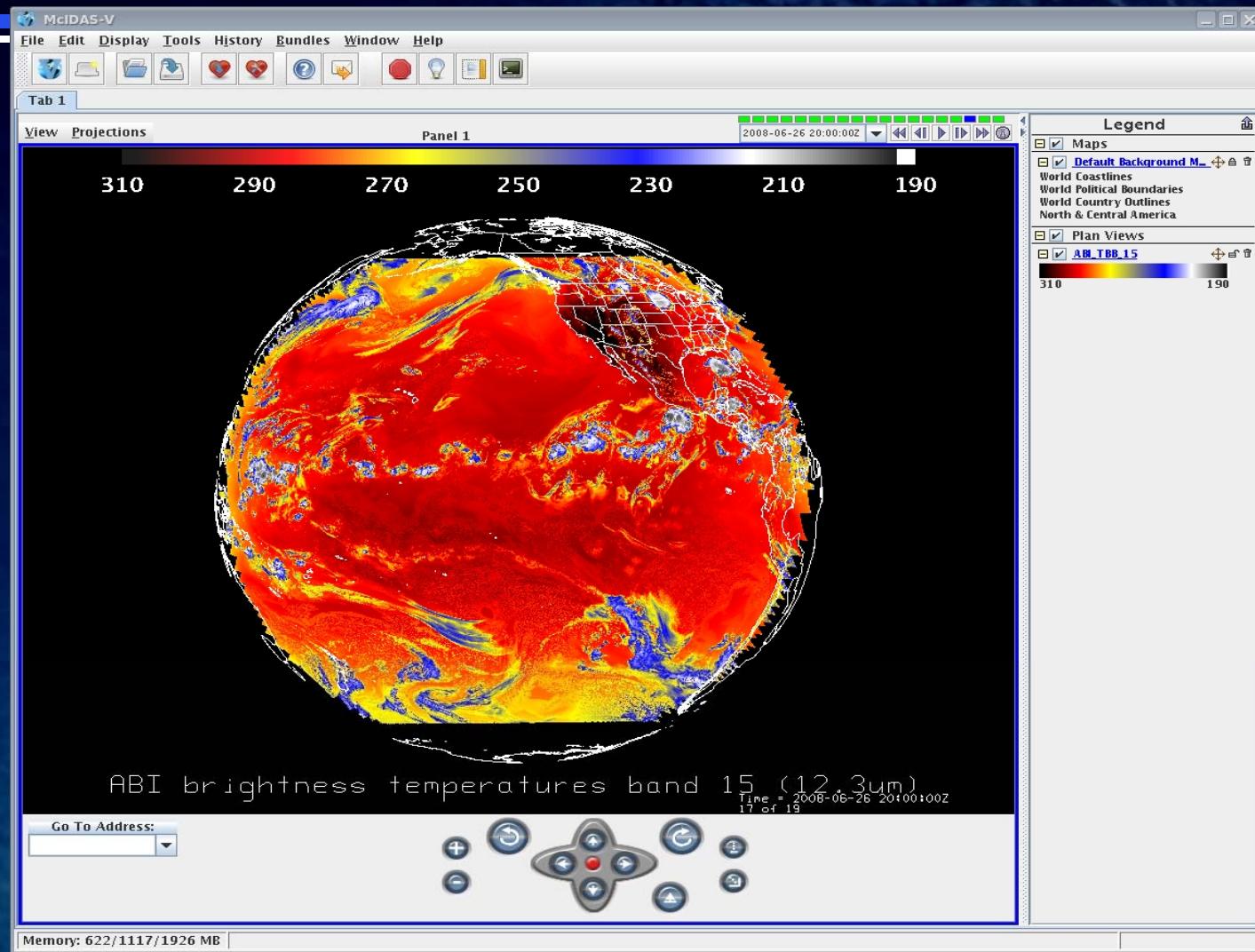
1-min Simulated ABI 'mesoscale' loop





Full disk simulation

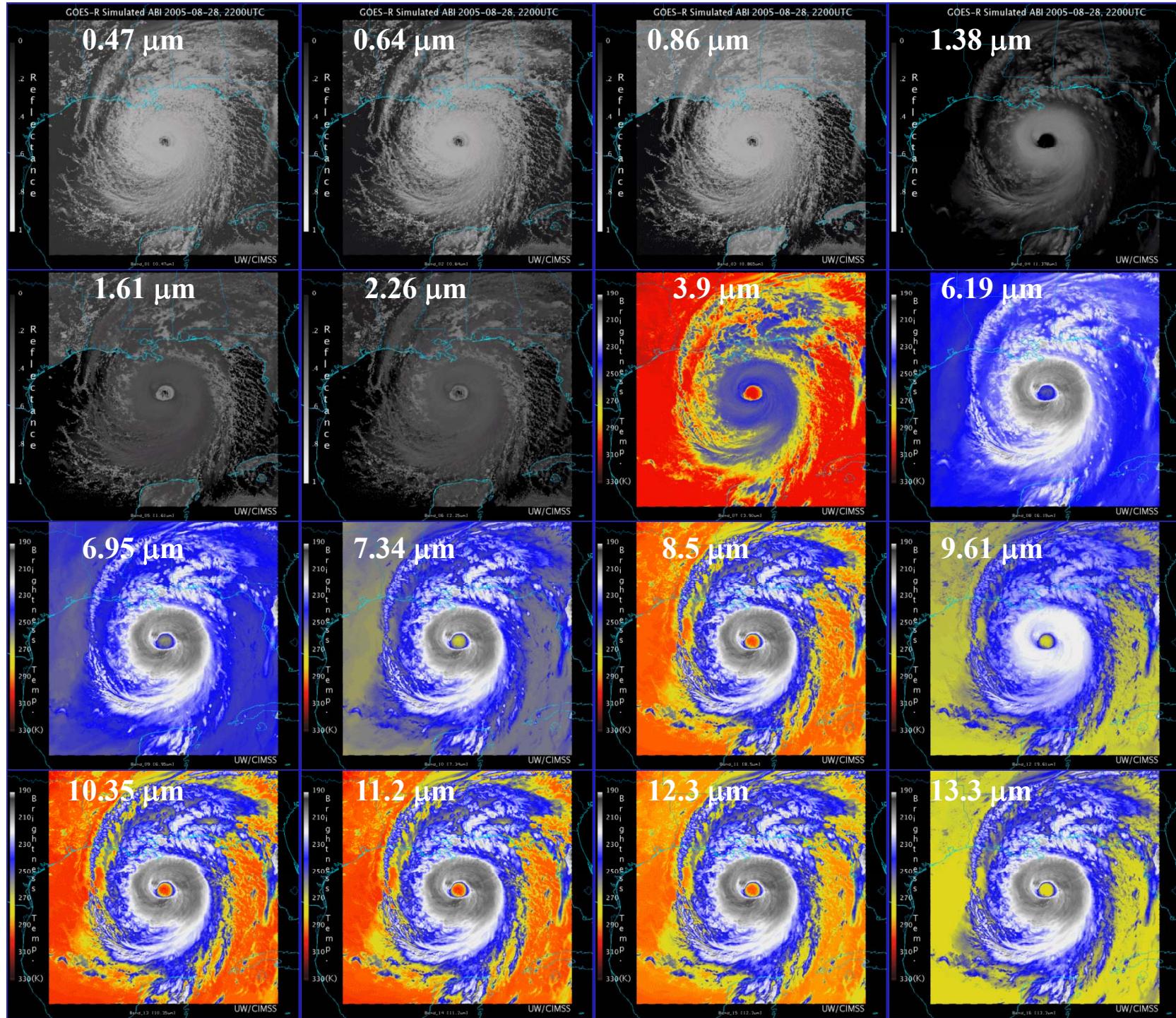
ABI band 15 (12.3um) June 26 2008 at 20:00UTC.



Project

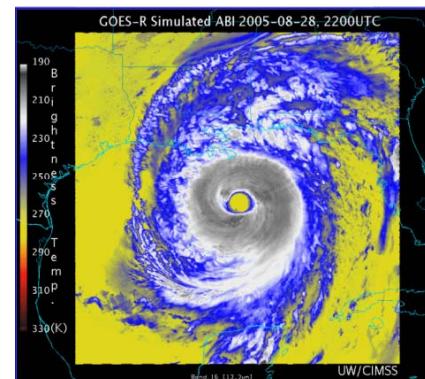
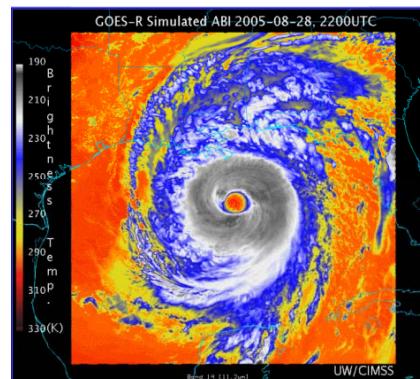
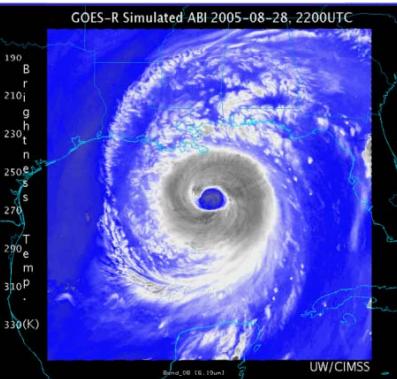
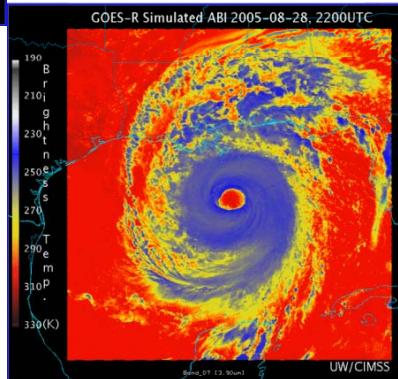
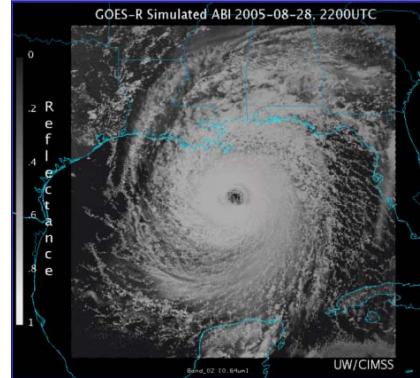
J. Oktin et al., CIMSS

AWG Proxy ABI Simulations of Hurricane Katrina



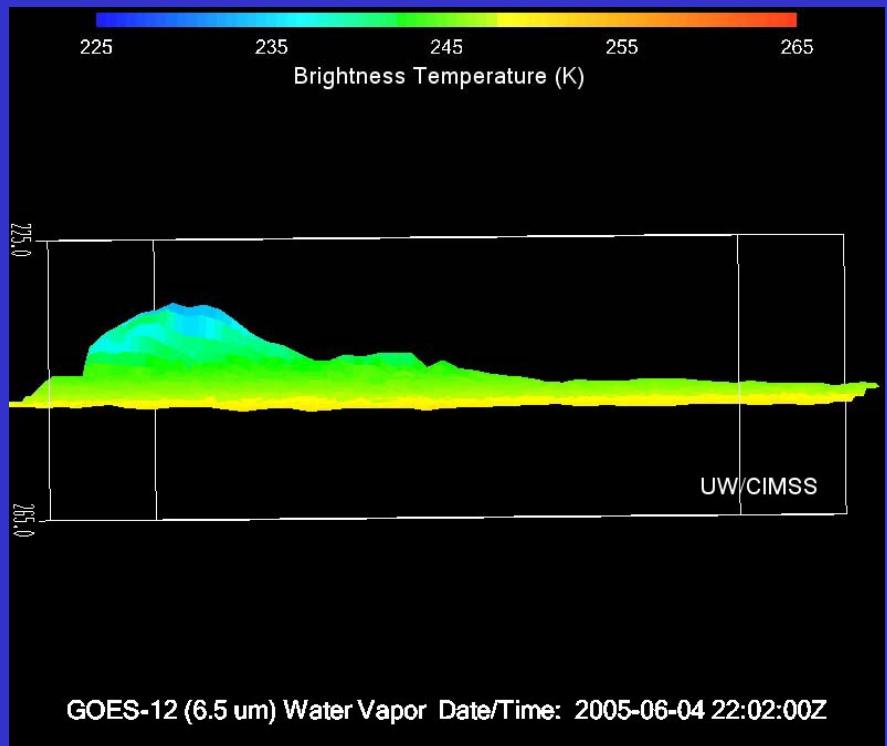
NOAA/NESDIS STAR and GOES-R Imagery Team

Corresponding current Imager bands of Hurricane Katrina



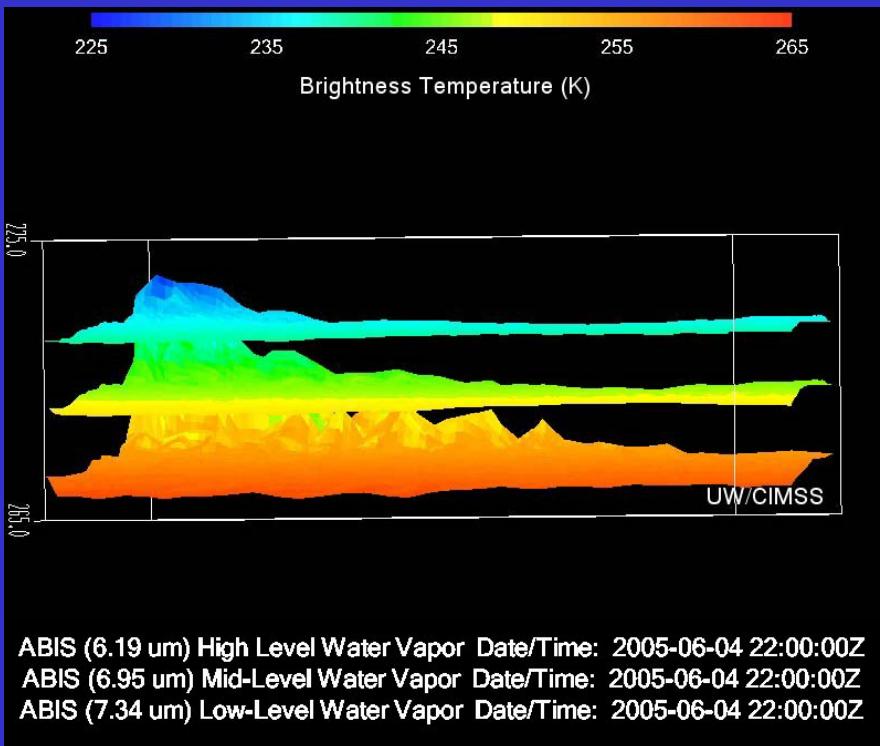


Three ABI water vapor bands



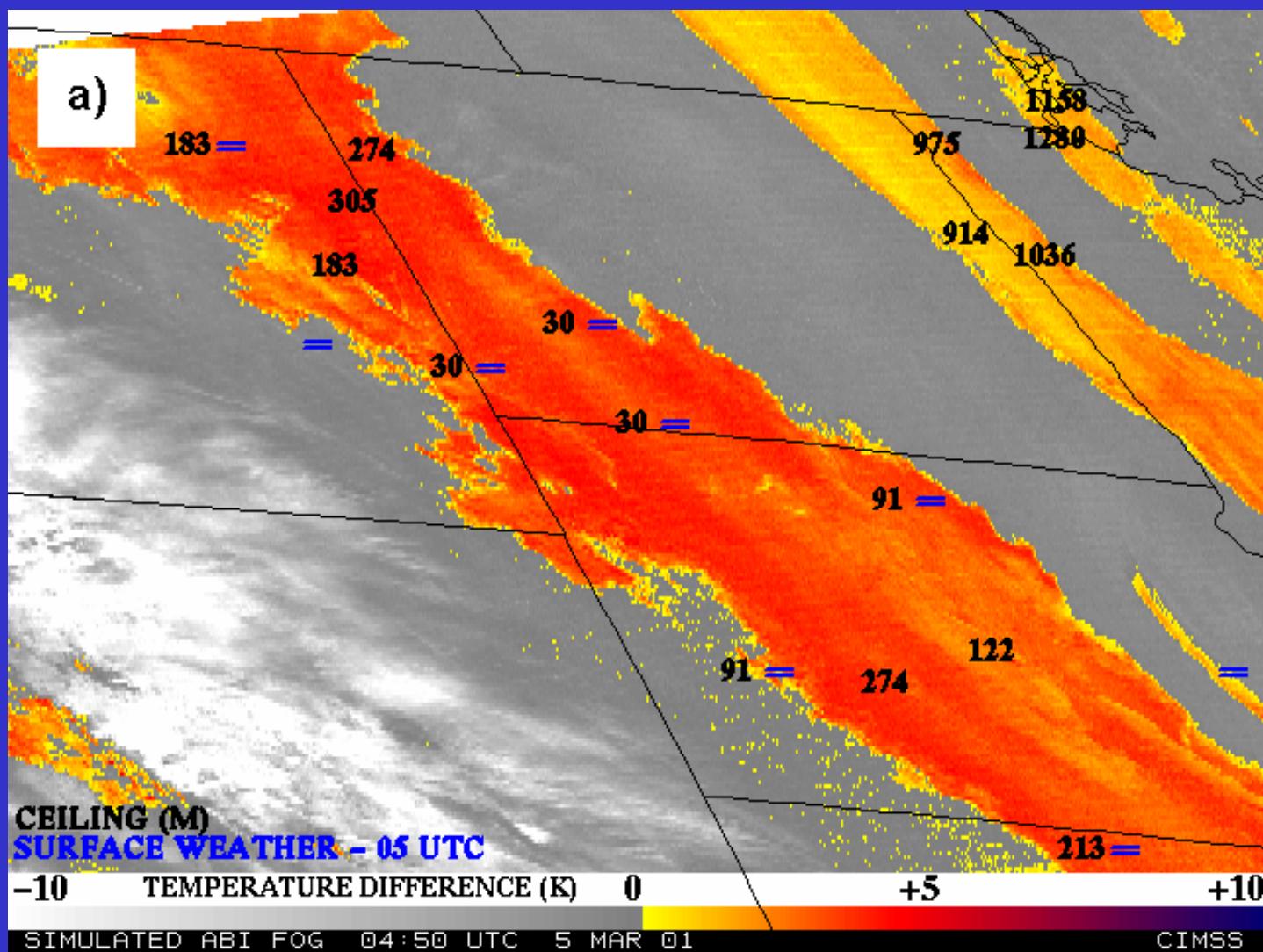
Current GOES

Images from J. Feltz



Future GOES

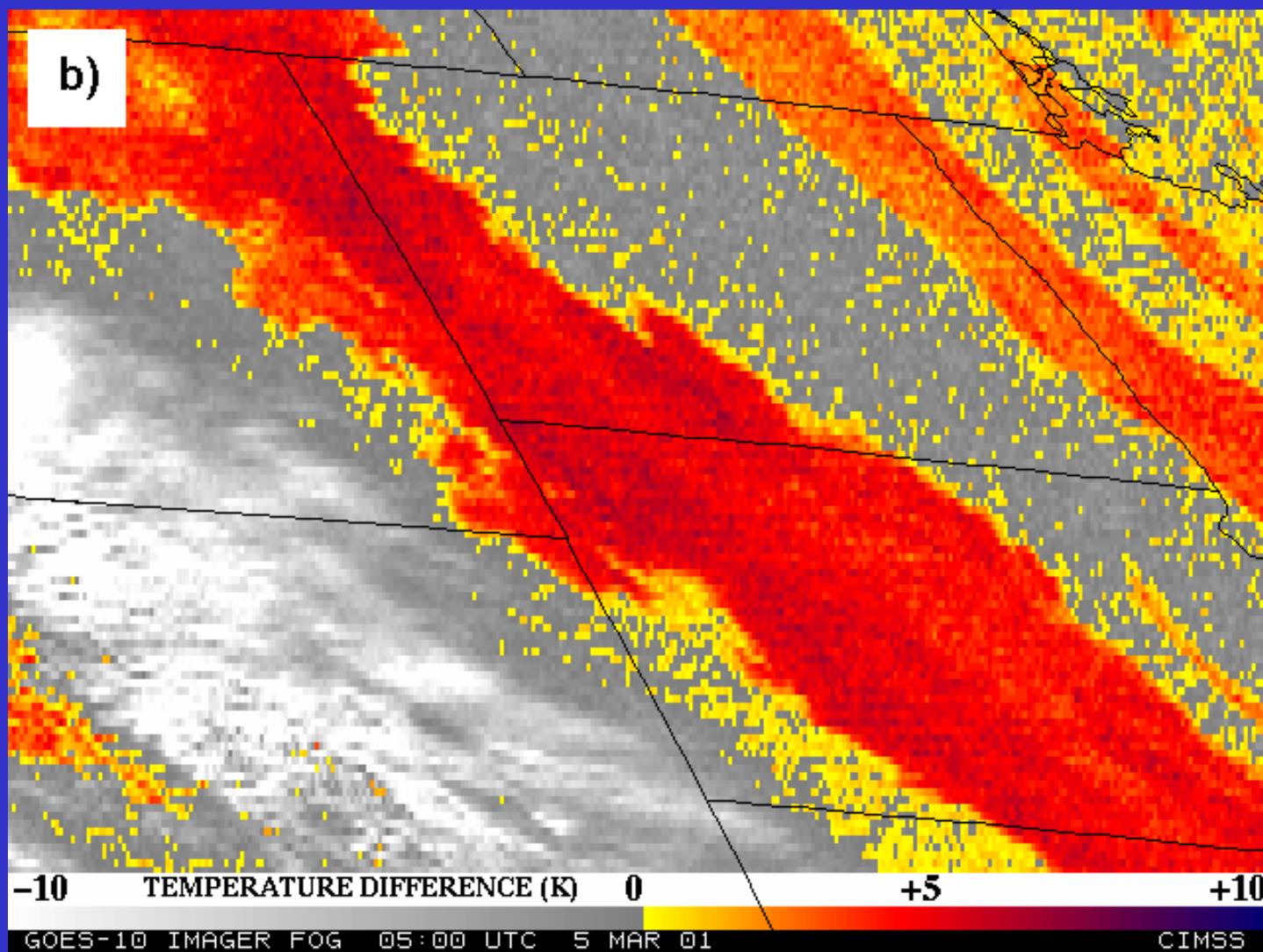
Nocturnal Fog/Stratus Over the Northern Plains



“ABI” 4 minus 11 μm Difference

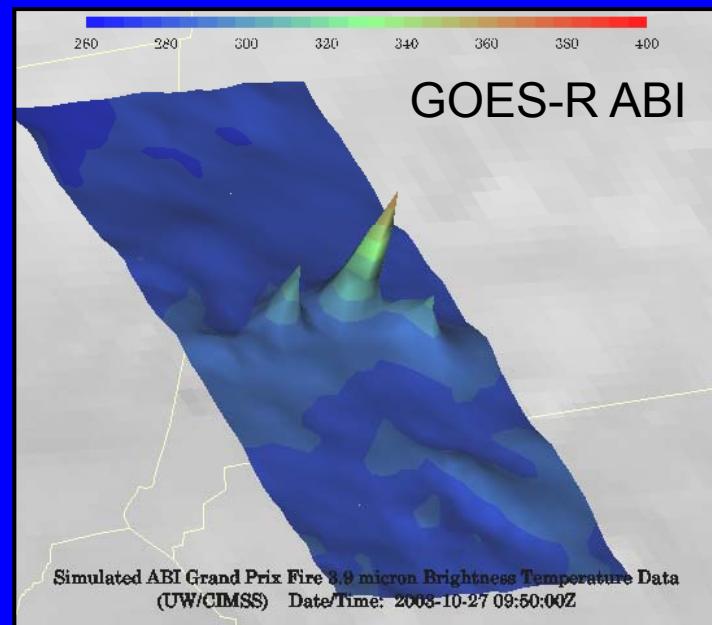
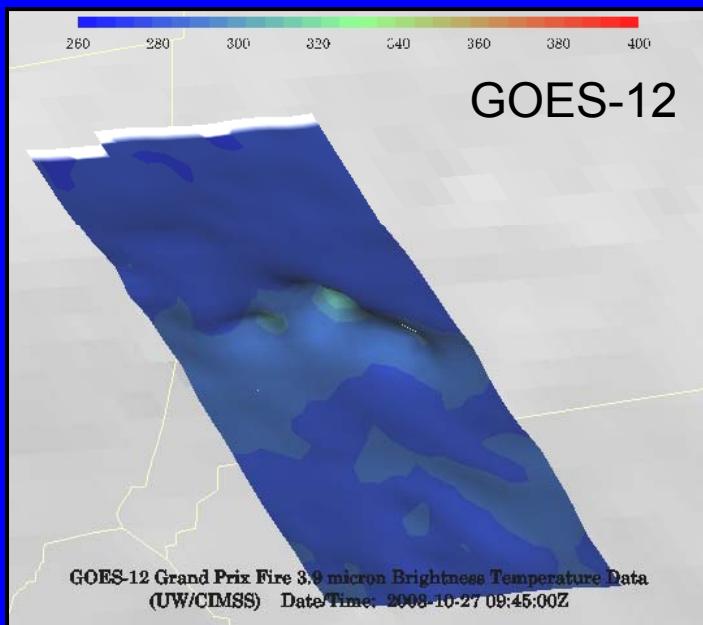
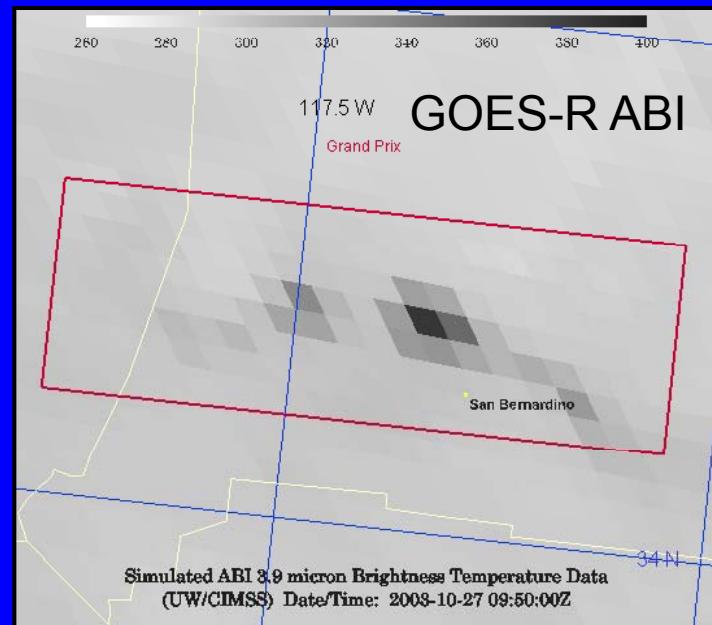
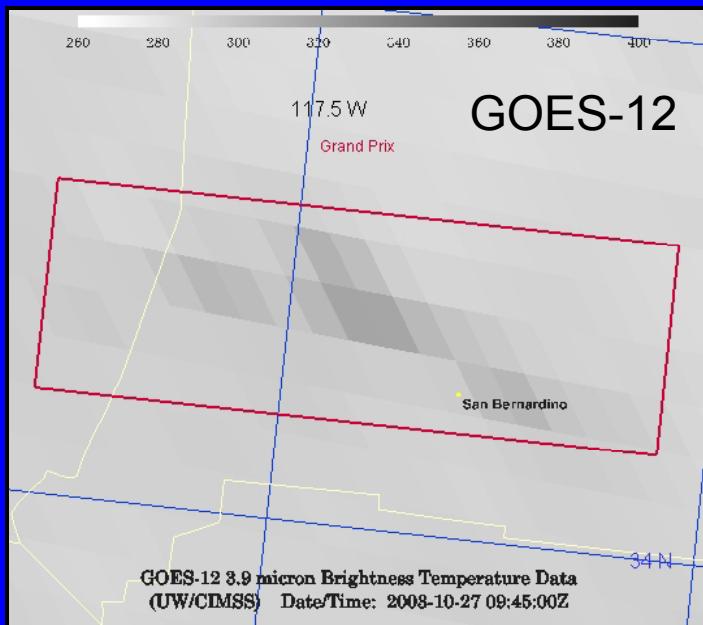
ABI image (from MODIS) shows greater detail in structure of fog.

Nocturnal Fog/Stratus Over the Northern Plains



GOES-10 4 minus 11 μm 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

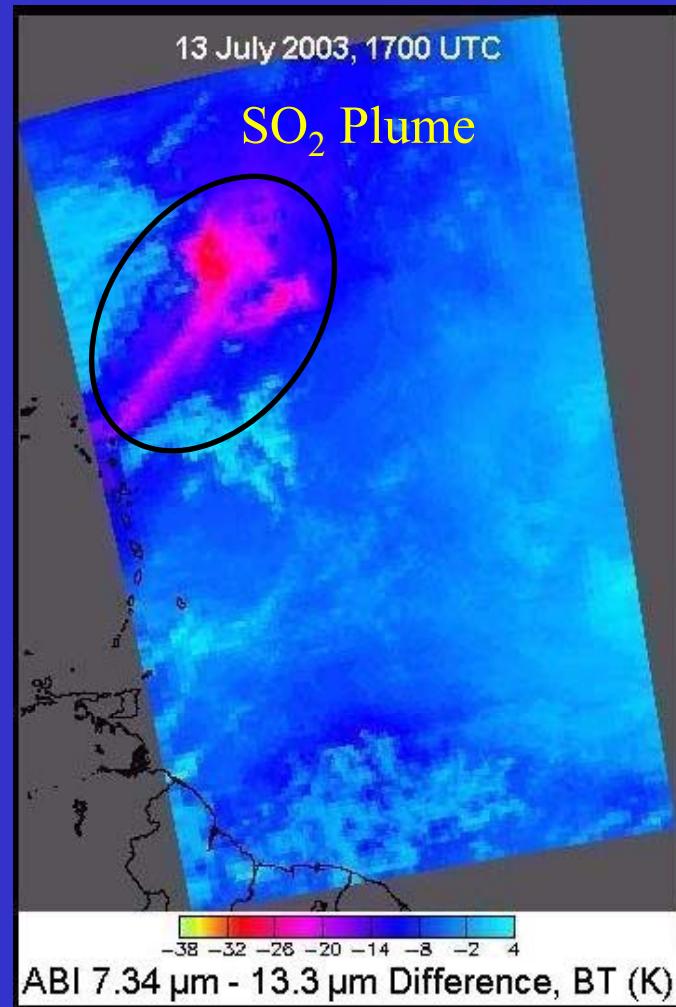


GOES-R ABI will detect SO₂ plumes

Water Vapor Band Difference convolved from AIRS data
sees SO₂ plume from Montserrat Island, West Indies

Current GOES Imager
No skill in monitoring

Current GOES Imager can not
detect SO₂

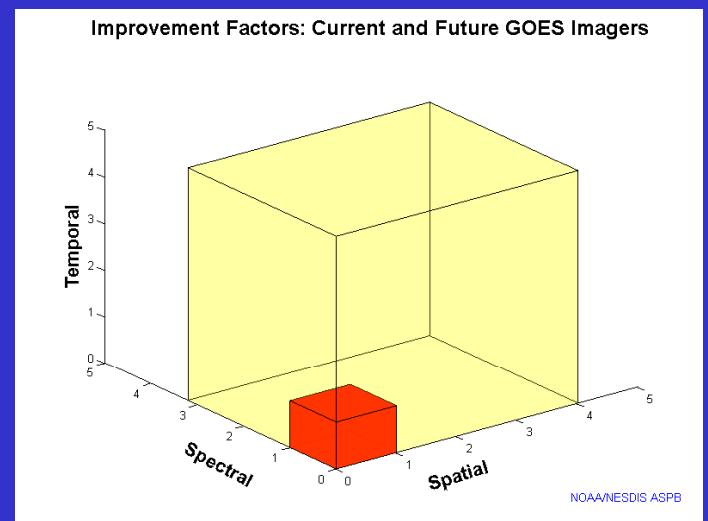


ABI 7.34 μm – 13.3 μm

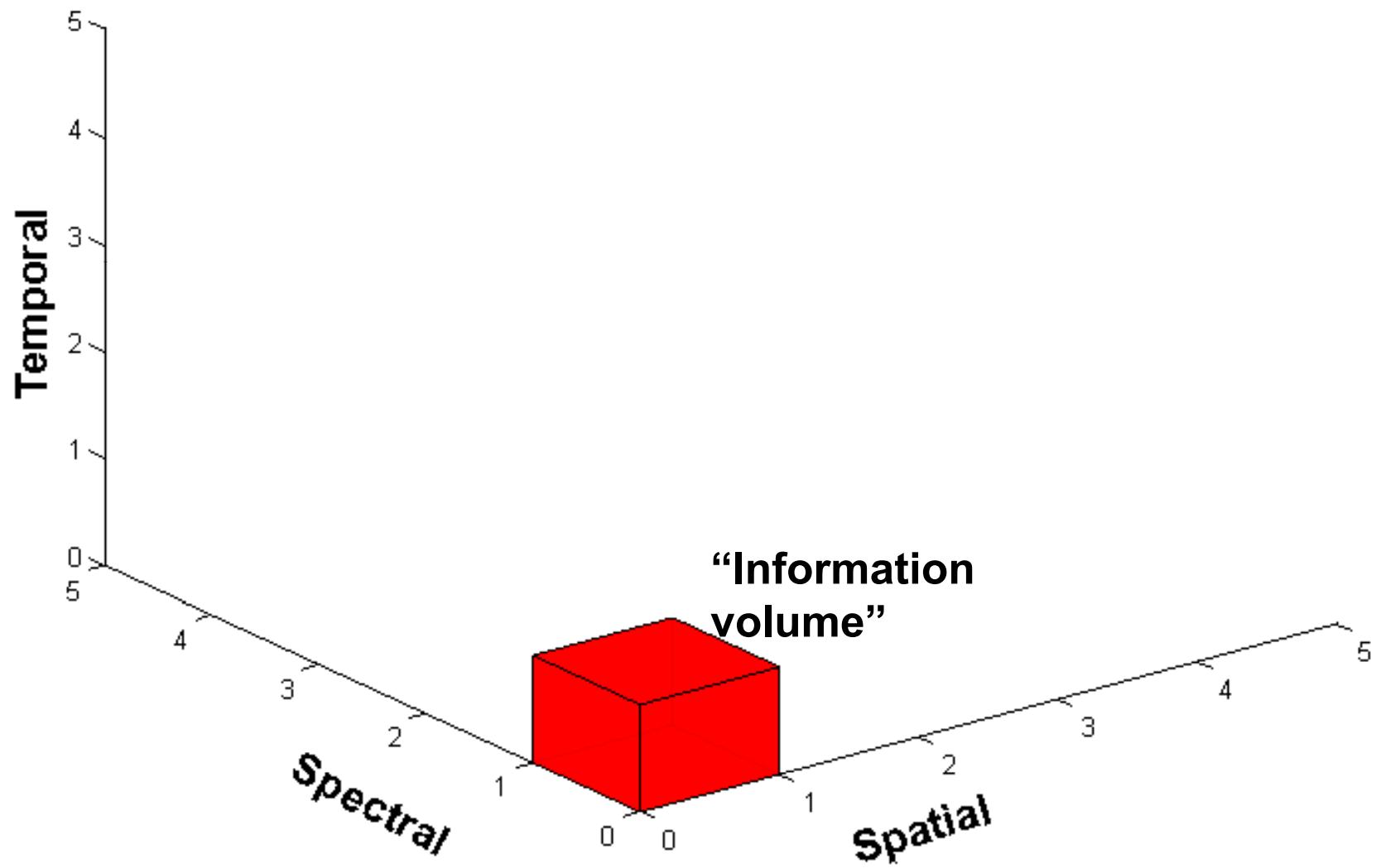
Figure courtesy of Kris Karnauskas

Overview

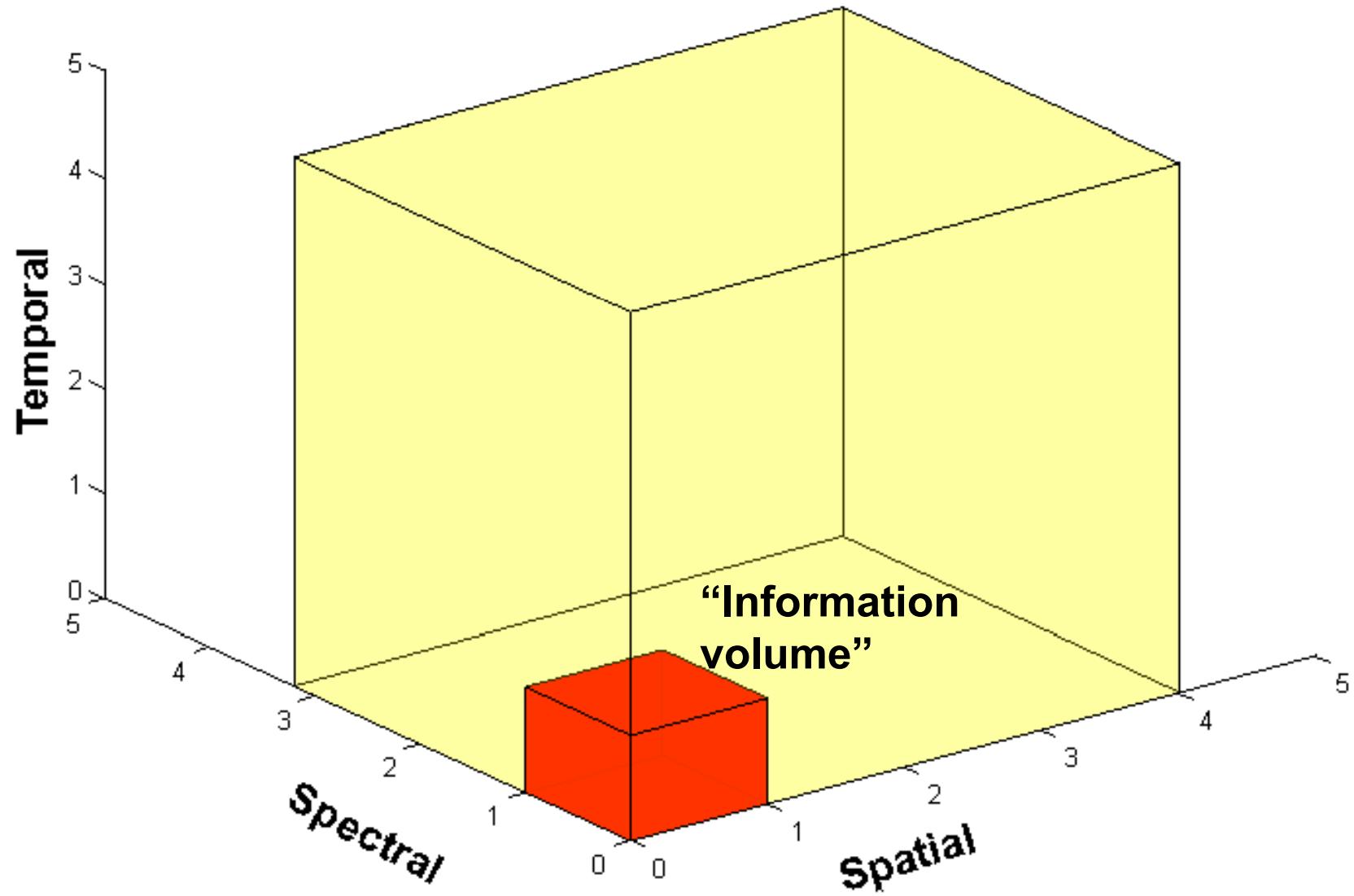
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Current attributes: defined to be 1



Improved attributes with the Future GOES Imagers



Approximate spectral and spatial resolutions of US GOES Imagers

\sim Band Center (μm)	GOES-6/7	GOES-8/11	GOES-12/N	GOES-O/P	GOES-R+
0.47	Yellow box	Yellow box	Yellow box	Yellow box	Pink box
0.64	Pink box with small green square	Pink box with small green square	Pink box with small green square	Pink box with small green square	Pink box
0.86	Yellow box	Yellow box	Yellow box	Yellow box	Pink box
1.6	<i>Box size represents detector size</i>				
1.38	Yellow box	Yellow box	Yellow box	Yellow box	Pink box with small green square
2.2	Yellow box	Yellow box	Yellow box	Yellow box	Pink box
3.9	Yellow box with dotted outline	Pink box with green square	Pink box with green square	Pink box with green square	Pink box
6.2	Yellow box with dotted outline	Blue box with number 8	Yellow box	Yellow box	Pink box
6.5/6.7/7	Purple box with text "14km"	Pink box	Blue box with number 8	Pink box with number 4	Pink box
7.3	Yellow box with dotted outline	Blue box with text "MSI mode"	Yellow box	Yellow box	Pink box
8.5	Yellow box with dotted outline	Yellow box	Yellow box	Yellow box	Pink box
9.7	Yellow box	Yellow box	Yellow box	Yellow box	Pink box
10.35	Blue box	Yellow box	Yellow box	Yellow box	Pink box
11.2	Pink box	Blue box	Pink box	Pink box	Pink box
12.3	Yellow box with dotted outline	Pink box	Blue box	Yellow box	Pink box
13.3	Purple box	Yellow box	Blue box	Pink box	Pink box



More information

GOES-R:

- <http://www.goes-r.gov>
- <http://www.meted.ucar.edu/index.htm>
- 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/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 Thomas J. Schmit, Michael E. Goodman, W. Rex Potts, James J. Green, and A. Scott Baucus

The ABI will begin its career as the U.S. environmental satellite system's most spectral, broad-spectrum, and highest spatial resolution thermal imager.

The Advanced Baseline Imager (ABI) is being developed as the future imager on the National Polar-orbiting Operational Environmental Satellite System (NOSES), which is currently known as the GOES-R series (Schmit et al. 2004). With GOES-R (Clarke and Delbridge 2004), the ABI will be the third generation of geostationary environmental imagers, and will extend the capabilities of previous imagers, and will solve many specific needs. Unlike previous imagers, the ABI will have a much larger field of view, and will have a much higher resolution.

The ABI design will be expected to approximately double the spectral range of the current GOES-13 imager, and spatial resolution will be approximately 2 km at 4% visible wavelengths (hereinafter referred to as 4% visible).

At the time of launch, they are expected to be the most advanced environmental imagers ever built. They will have a multi-spectral capability, three basic modes of operation, and a much larger field of view than the current GOES-13 imager. The ABI will use the full disk (355° plus continental United States) and will have a resolution of 2 km at 4% visible wavelengths every 5 h. The second mode is to be the continental United States, and the third mode is to be the polar orbiting mode.

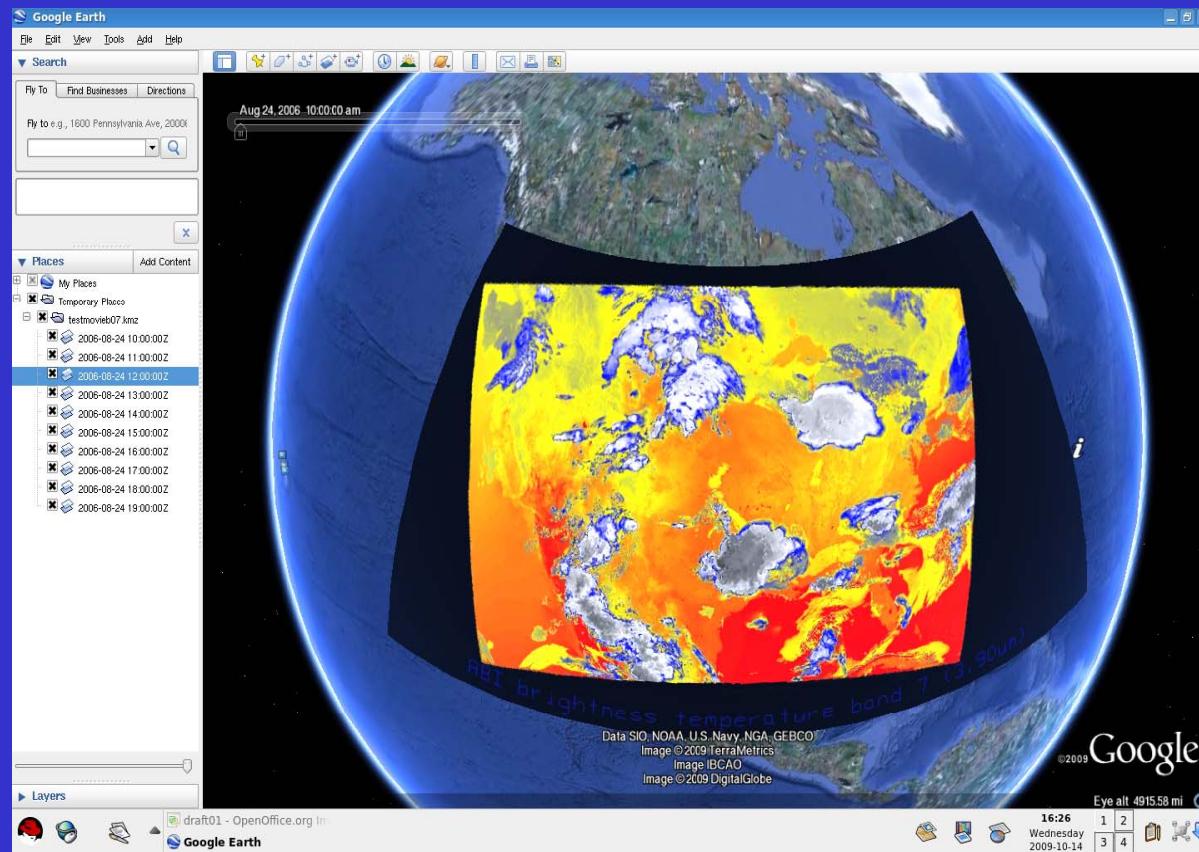
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Google Earth

- 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



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.

