

Preparing for the Advanced Baseline Imager on the GOES-R series

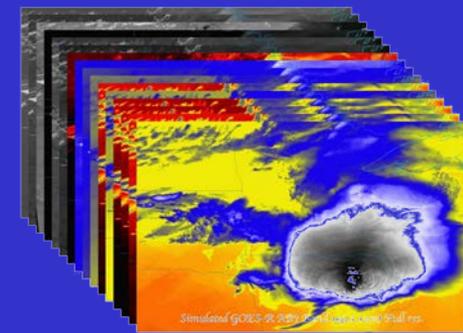
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NOAA/NESDIS/Satellite Applications and Research

Advanced Satellite Products Branch (ASPB)

Madison, WI

Mathew M. Gunshor, Kaba Bah, James J. Gurka, Jason Otkin



*Future Satellite Symposium
Austin, TX*

8 January 2013



UW-Madison

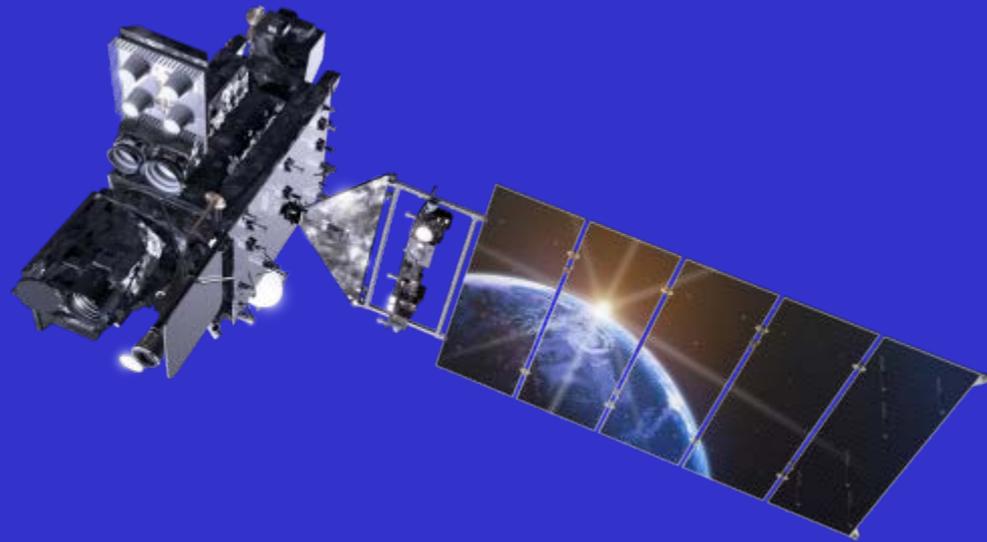
Thanks to...

- Scott Lindstrom, Scott Bachmeier, Joleen Feltz, William Straka, Jun Li, Scott Bachmeier, Steve Ackerman, Bob Aune, Don Hillger, Paul Menzel, Steve Ackerman, Tony Schreiner, Justin Sieglaff, Jim Jung, Elaine Prins, Brad Pierce, Wayne Feltz, Jean Phillips, Gary Wade, Don Hillger, Jinlong Li, Jing Zheng, Allen Huang, Bob Rabin, the SSEC data center, Mike Pavolonis, Jaime Daniels, ASPB, STAR, NESDIS, NSSL, MUG, Kevin Ludlum, GOES operators, GOES shift supervisors, Mark DeMaria, and many others!
- GOES-R Program Office (Steve Goodman, etc.), NASA, ITT Industries, other industry partners, etc.
- You.



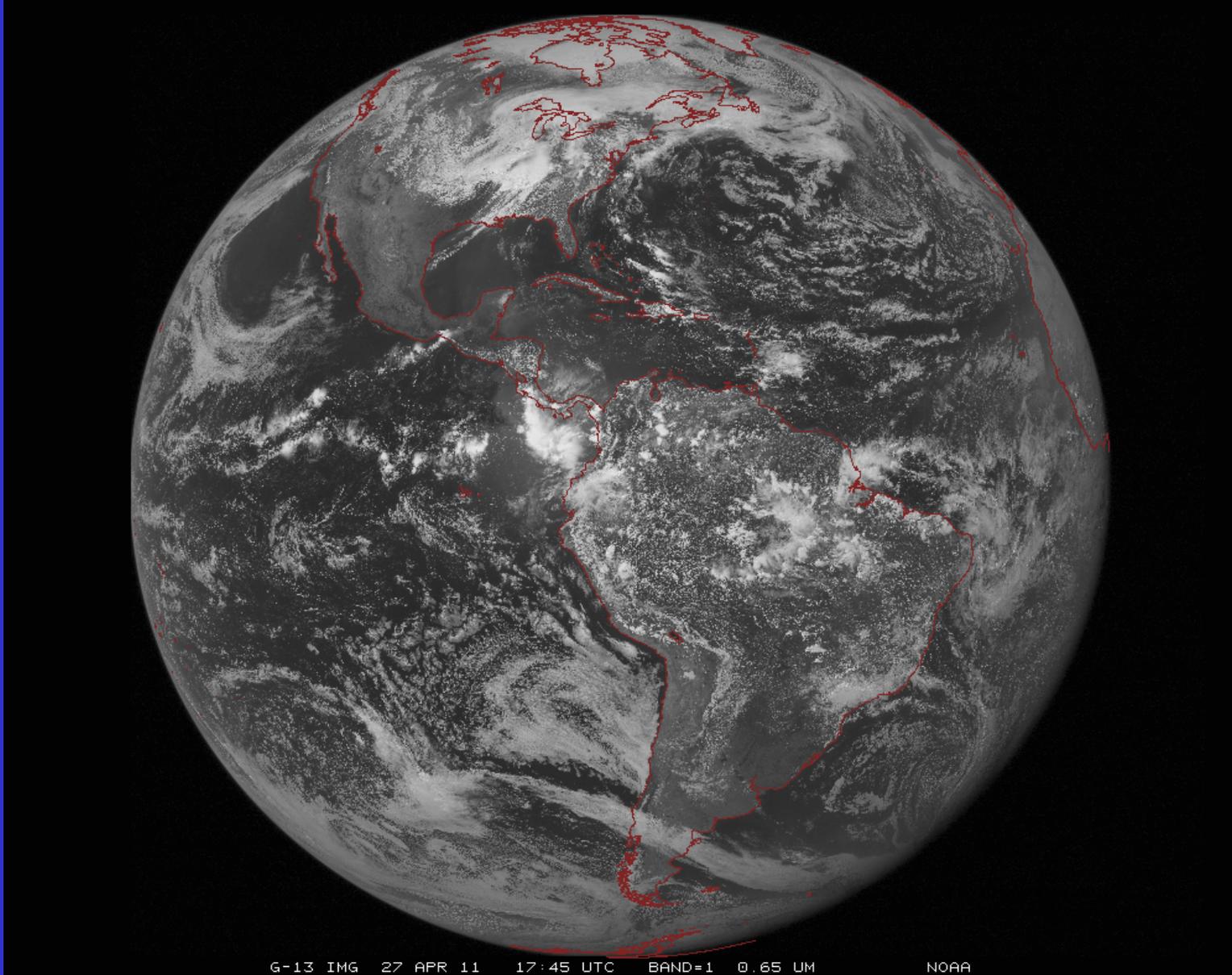
Outline

- ABI (Advanced Baseline Imager)
 - Temporal
 - Spatial
 - Spectral
- Products
- Summary
 - More information
 - Questions



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

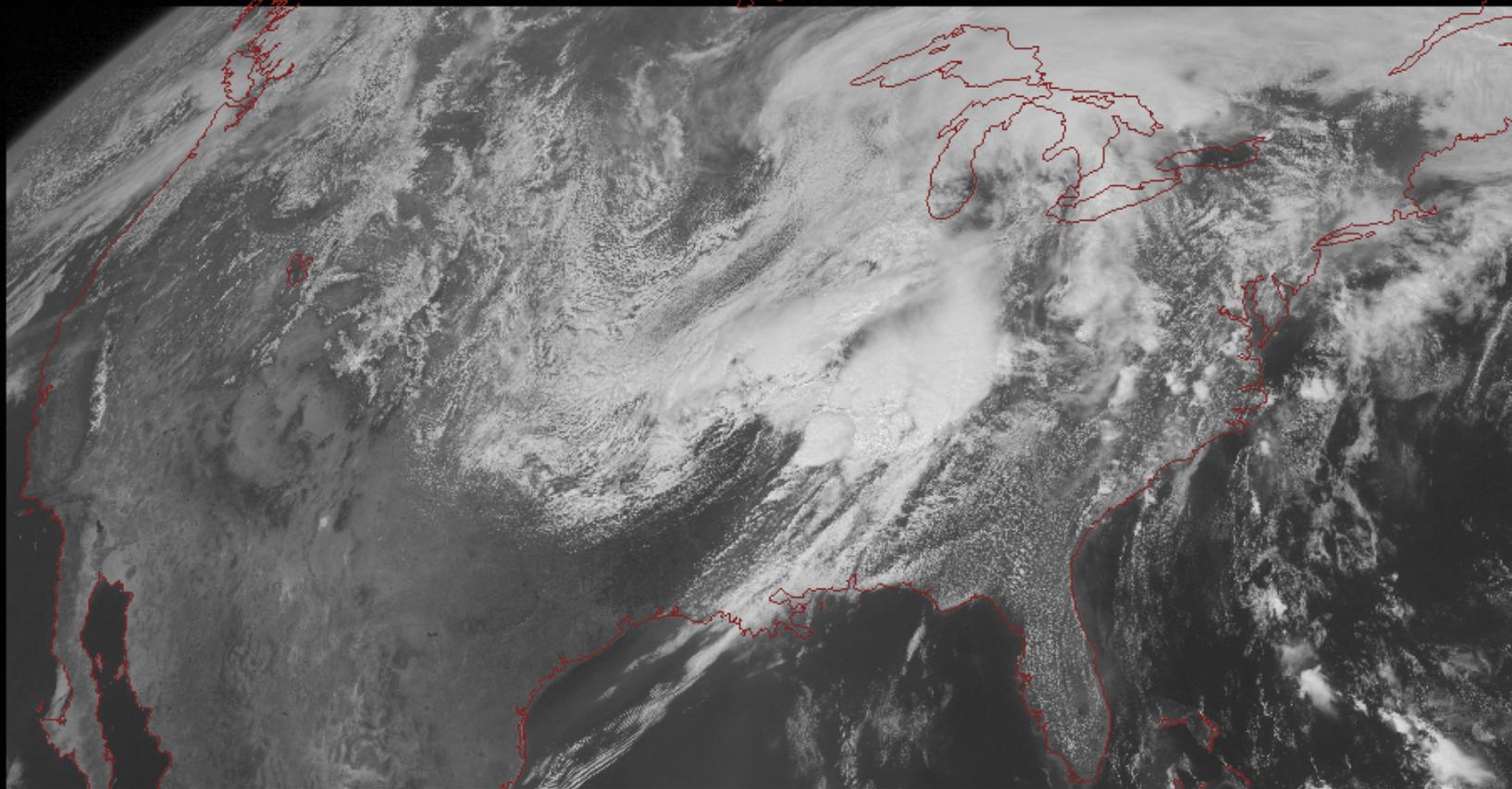
Anticipated scan mode for the ABI:

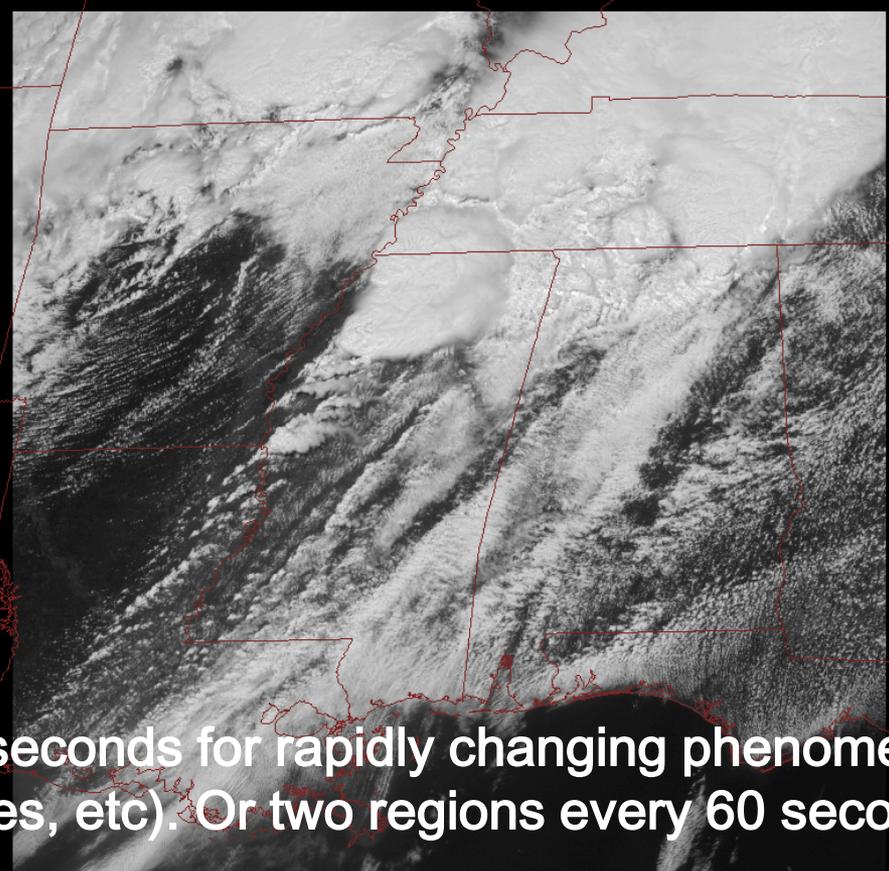
- Full disk images every 15 minutes + 5 min CONUS images + mesoscale.



G-13 IMG 27 APR 11 17:45 UTC BAND=1 0.65 UM NOAA

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.





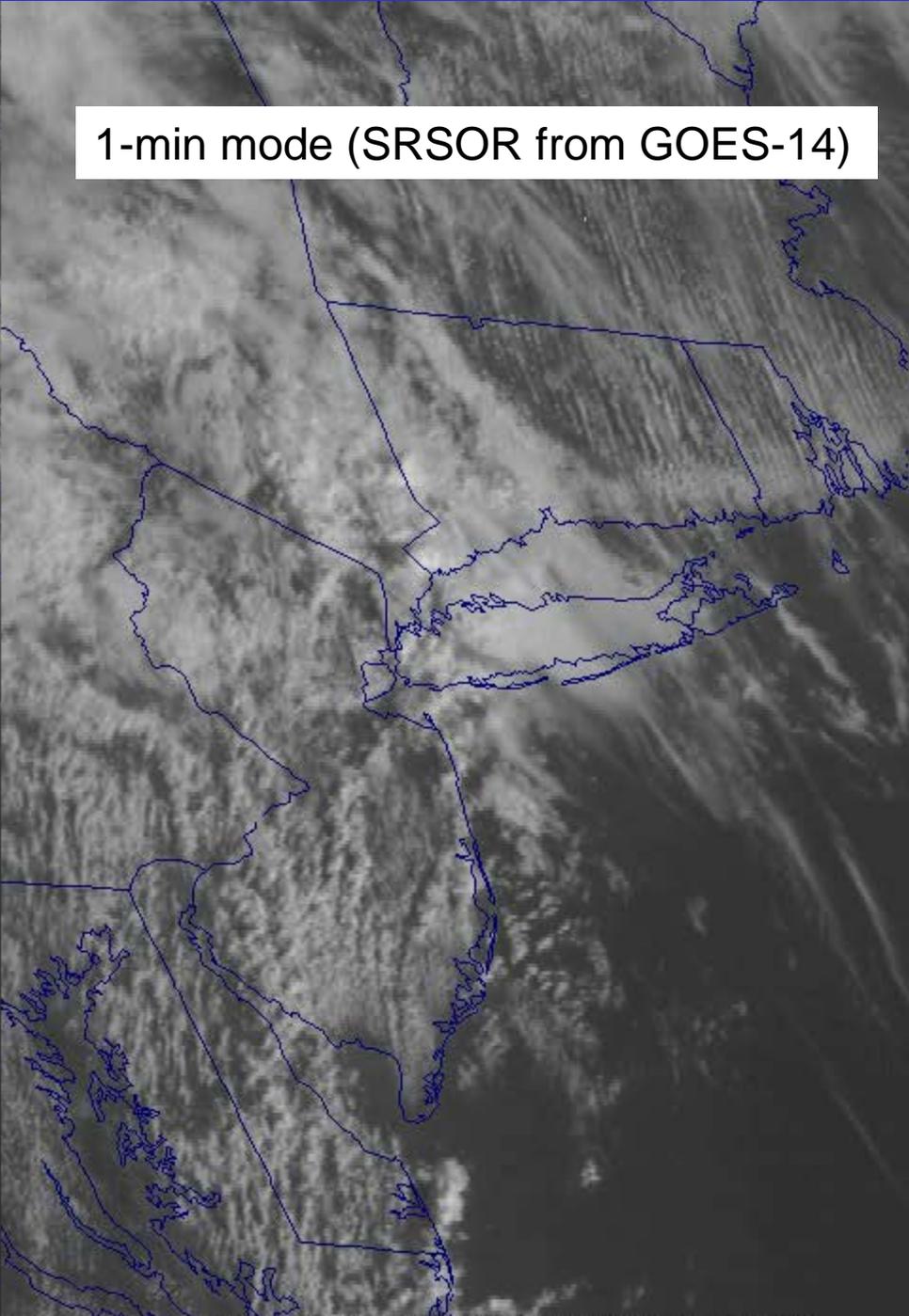
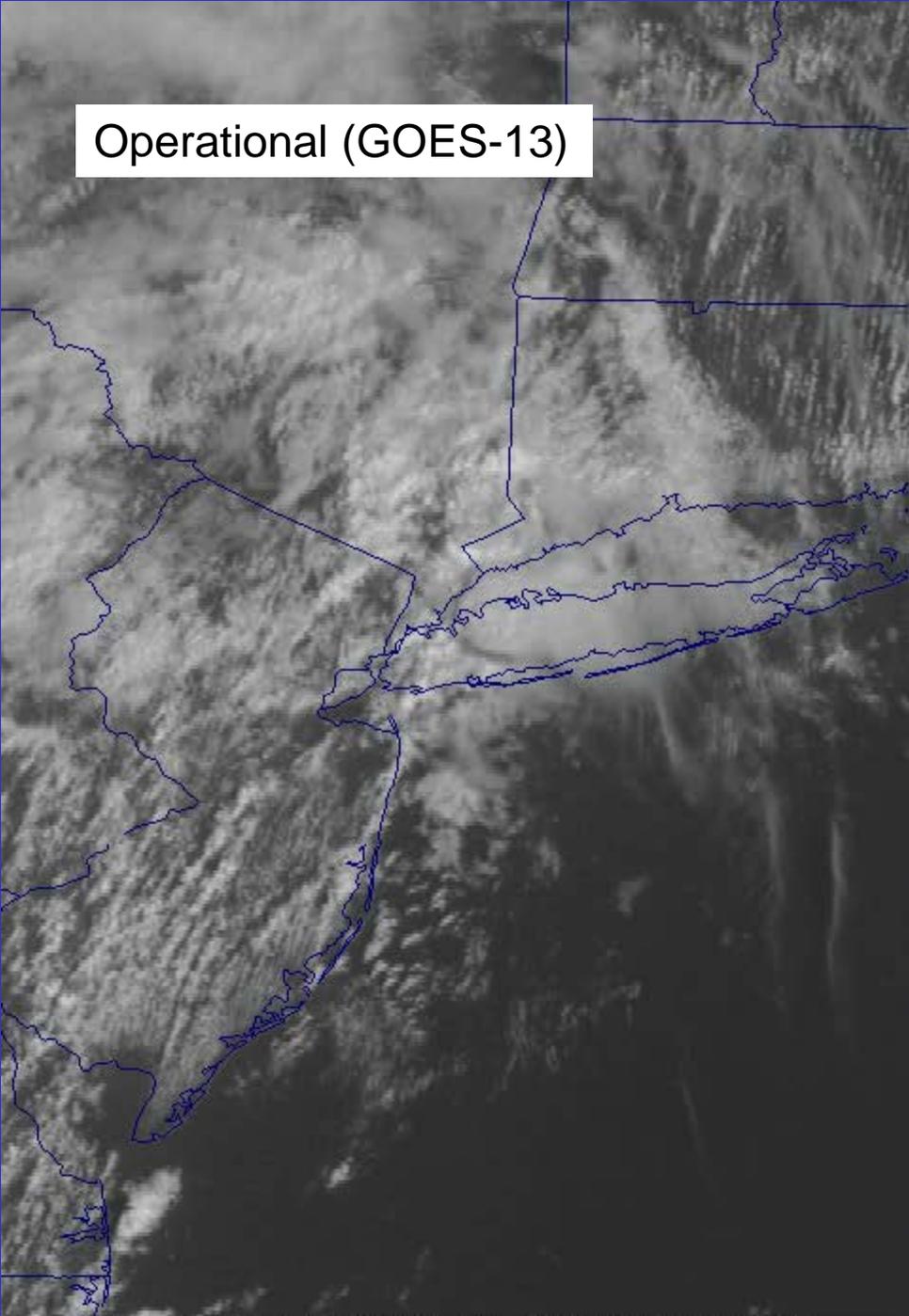
G-13 IMG 27 APR 11 1

Mesoscale images every 30 seconds for rapidly changing phenomena (thunderstorms, hurricanes, fires, etc). Or two regions every 60 seconds.

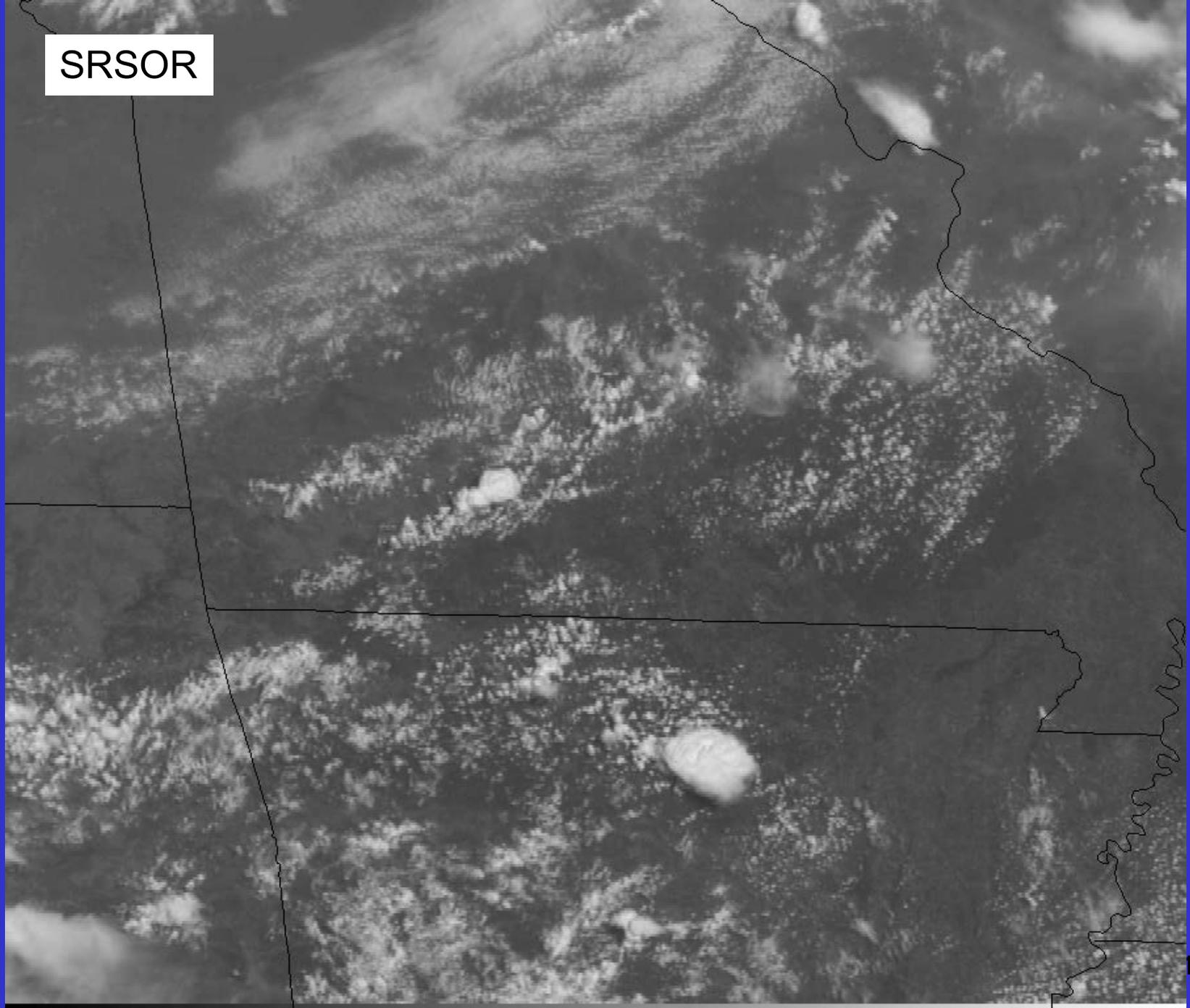
G-13 IMG 27 APR 11 17:45 UTC BAND=1 0.65 UM NOAA

Operational (GOES-13)

1-min mode (SRSOR from GOES-14)

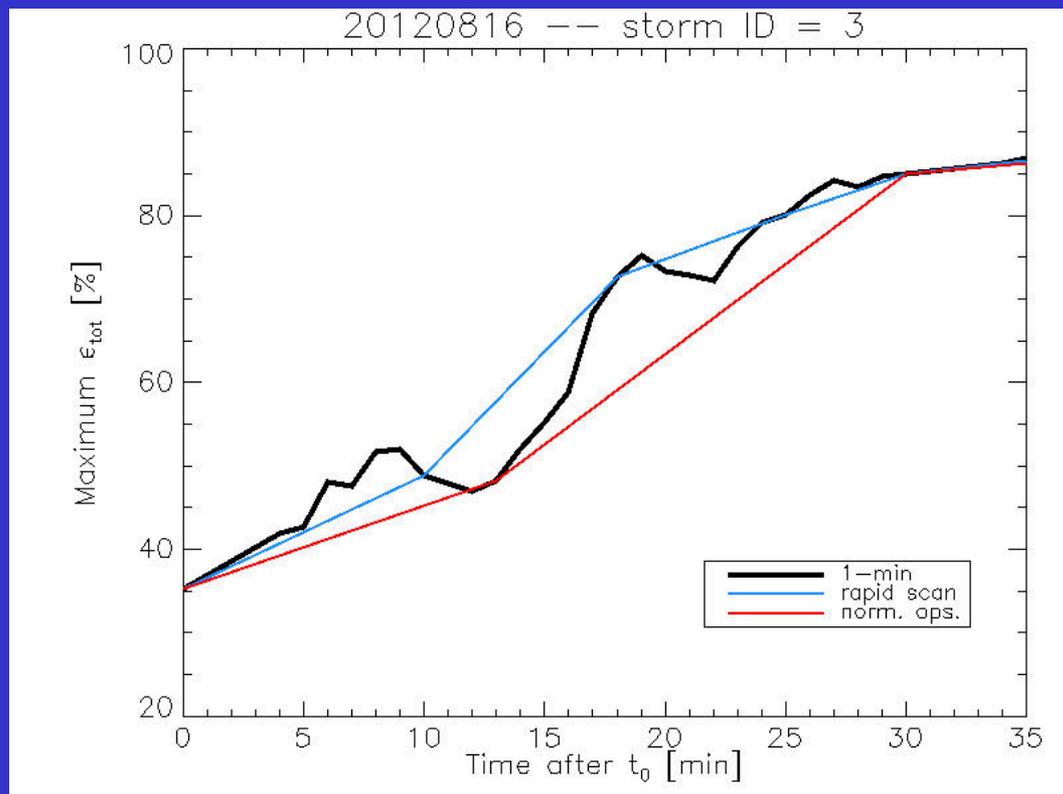
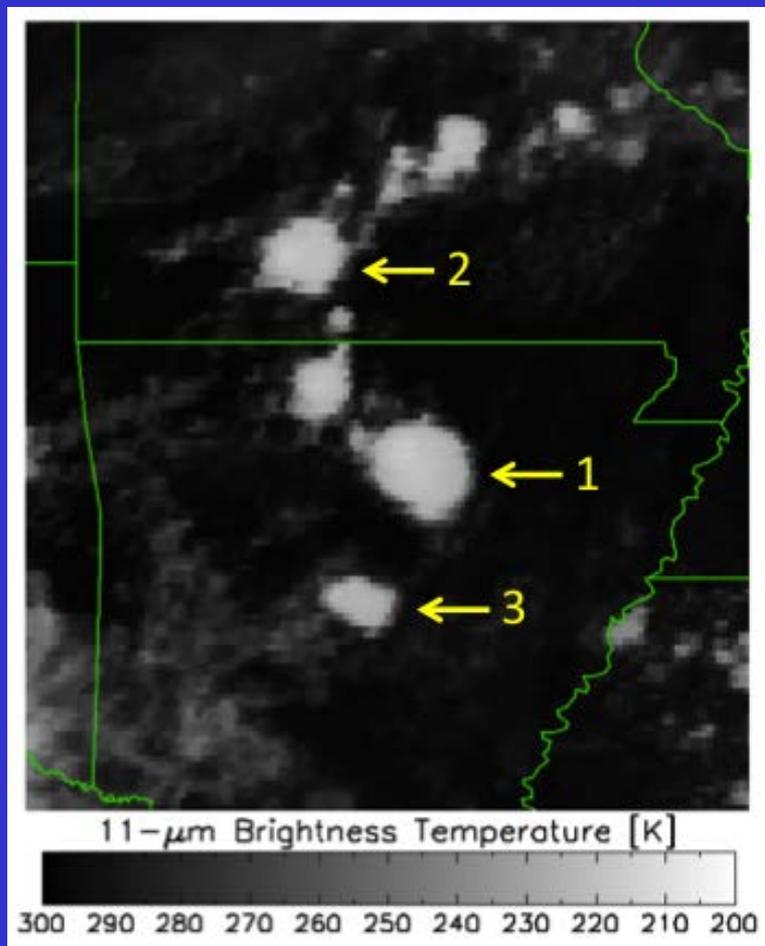


SRSOR



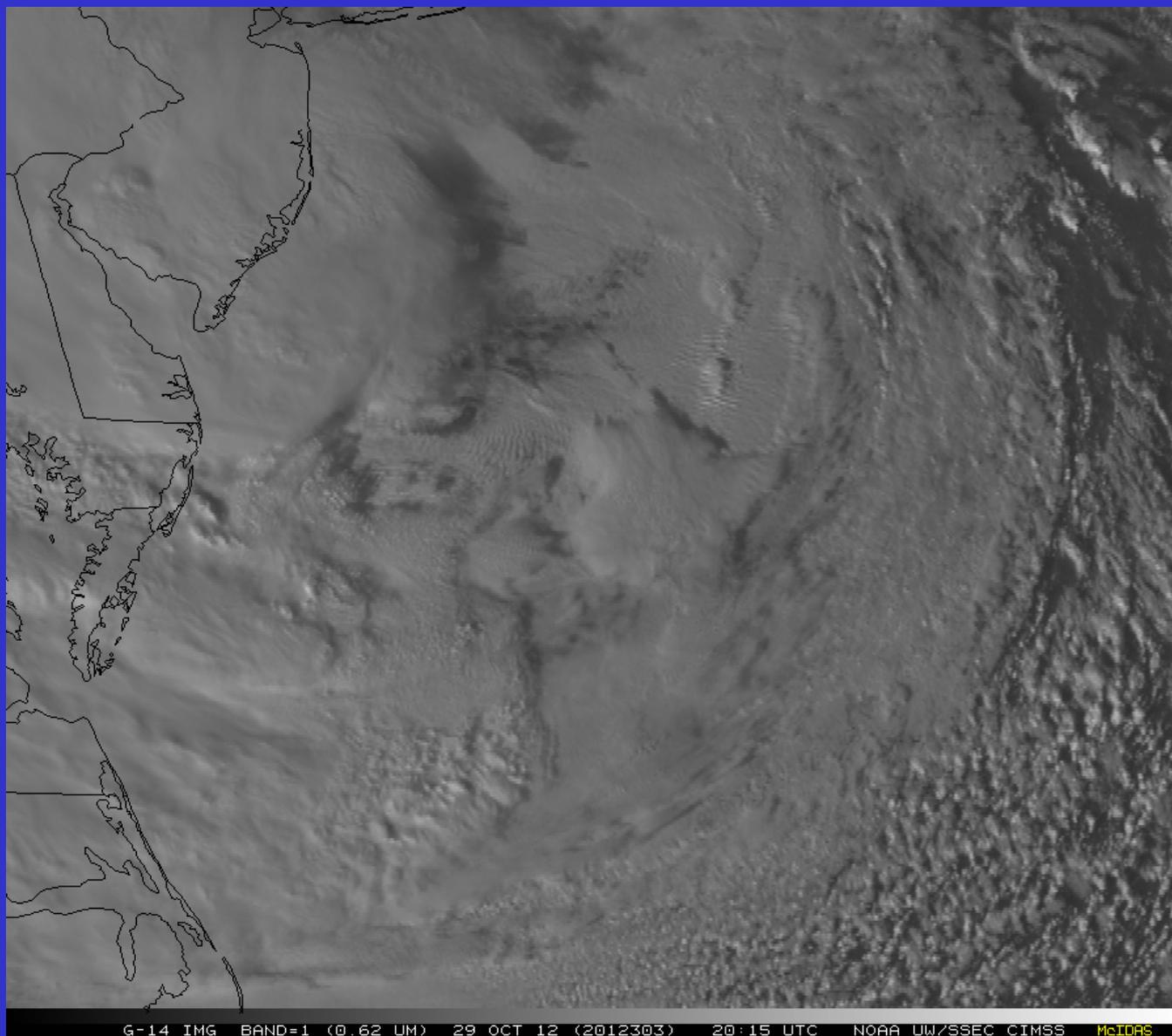
10

Rate of temporal cooling in the longwave infrared band



Cintineo et al., 2013 (CIMSS)

GOES-14 SRSOR of Sandy (Visible)



G-14 IMG BAND=1 (0.62 UM) 29 OCT 12 (2012303) 20:15 UTC NOAA UW/SSEC CIMSS McIDAS

The 1-min interval imagery shows 'what is happening', not 'what has happened'.

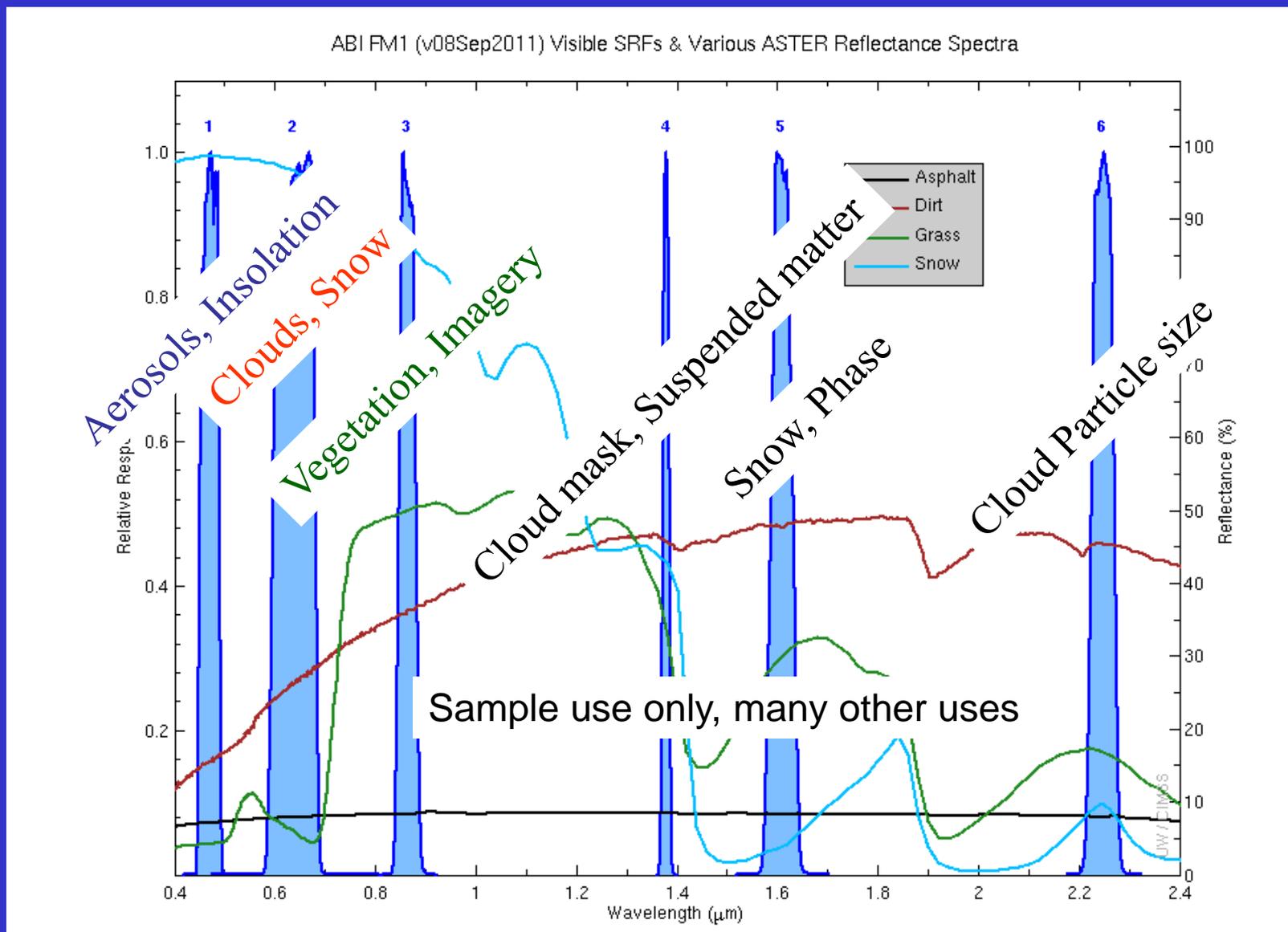
ABI Visible/Near-IR Bands

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, 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 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

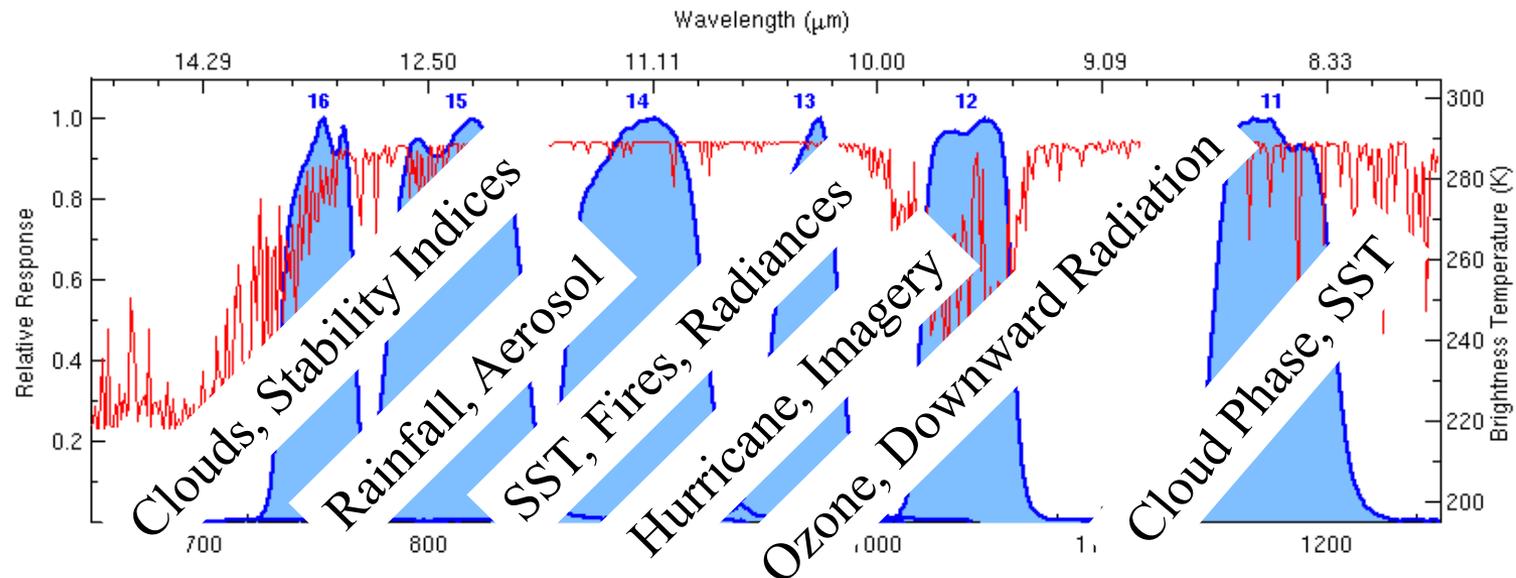
Visible and near-IR channels on the ABI



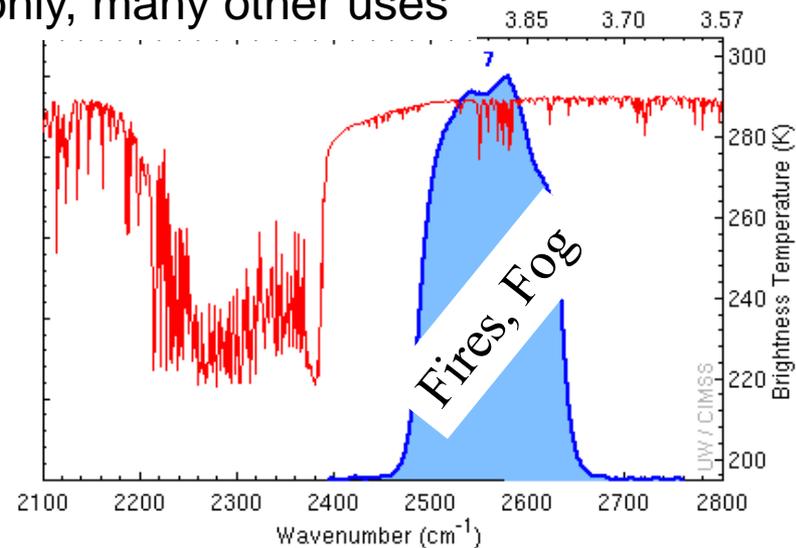
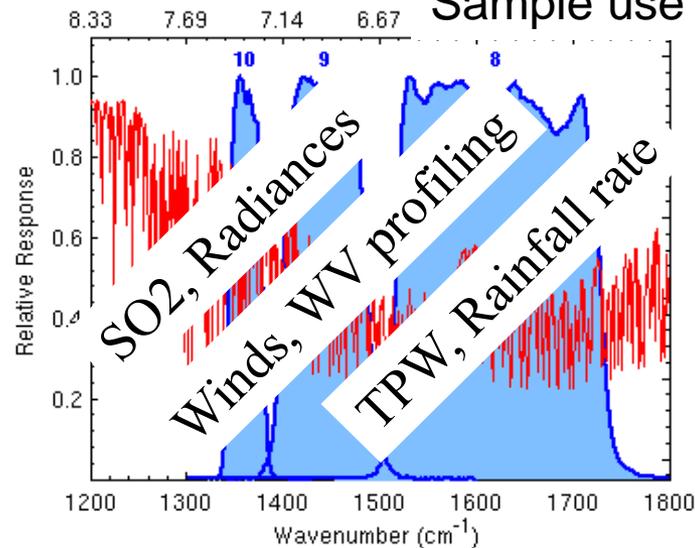
The ABI visible and near-IR bands have many uses.

The IR channels on the ABI

ABI FM1 (v08Sep2011) SRFs & US Std Atms Brightness Temperature Spectrum



Sample use only, many other uses



ABI has many more bands than the current operational GOES imagers.

0

20

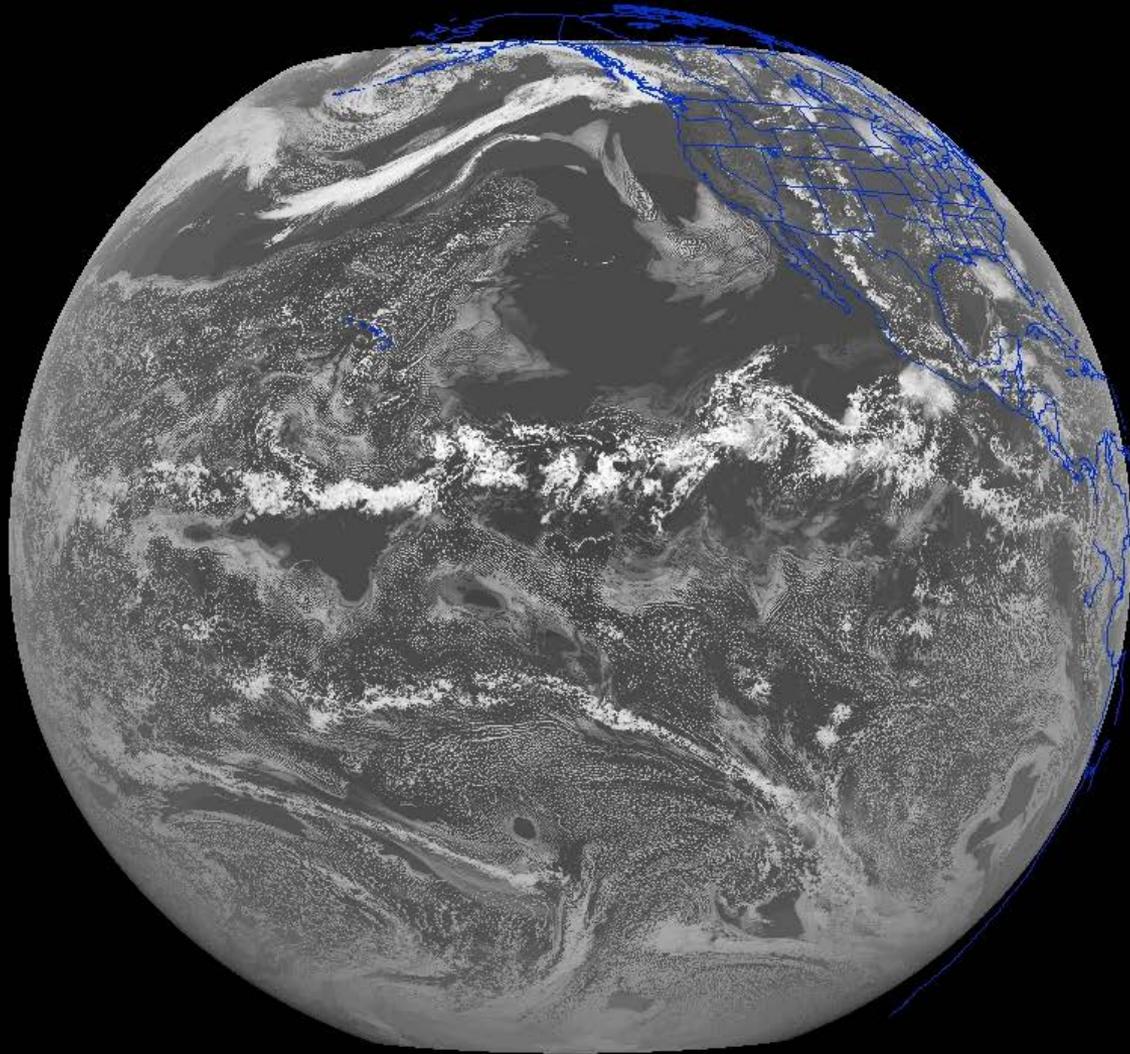
40

60

80

100

(0.47 μm) Raw (Reflectance*100)



Daytime “Blue” band – aerosols, solar insolation, snow cover

ABIS (Band 1): 26 Jun 2008 21:00:00 UTC

0

20

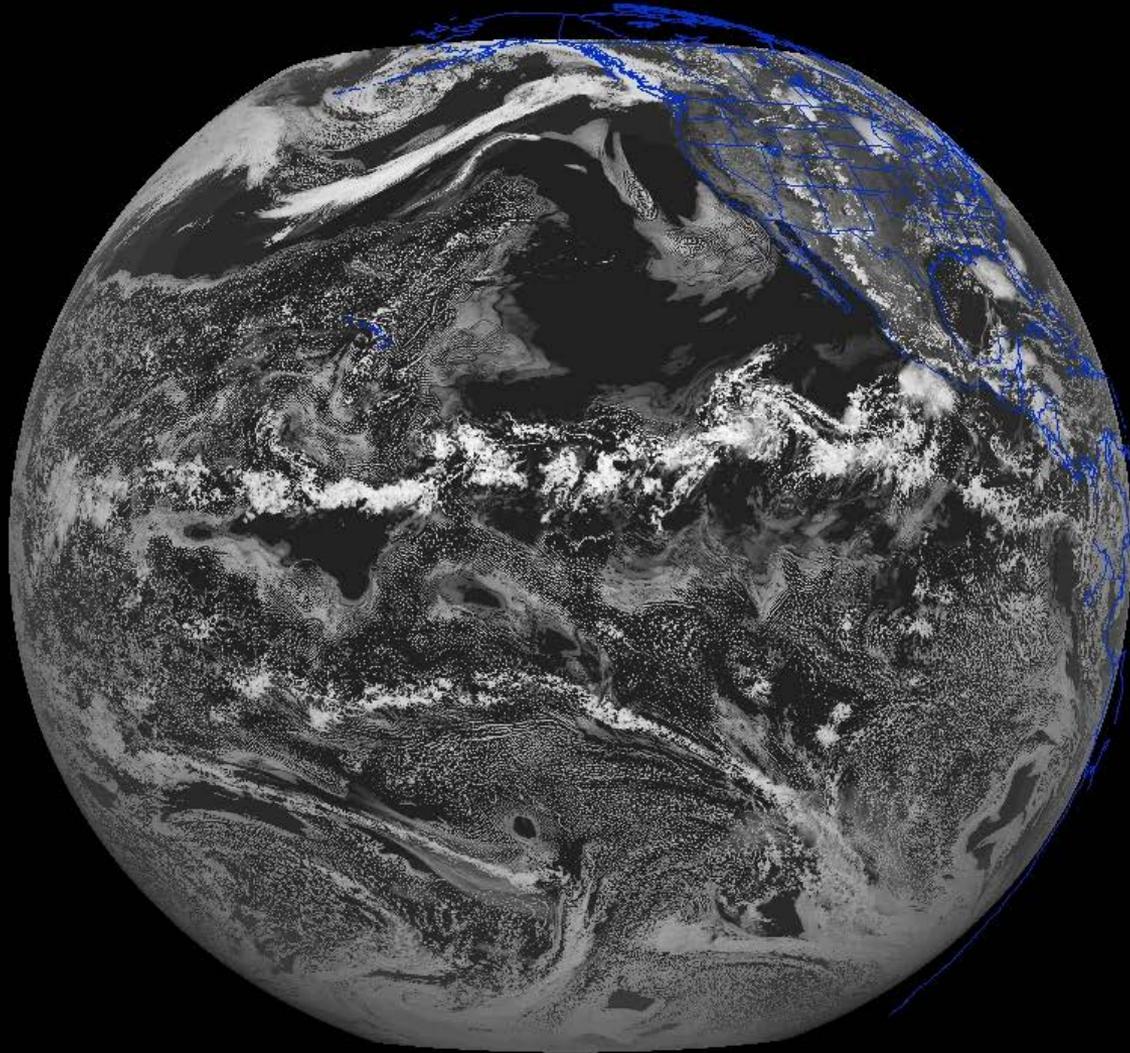
40

60

80

100

(0.64 μm) Raw (Reflectance*100)



Daytime “Red” band – clouds, cloud-mask, optical depth, winds, etc.

ABIS (Band 2): 26 Jun 2008 21:00:00 UTC

0

20

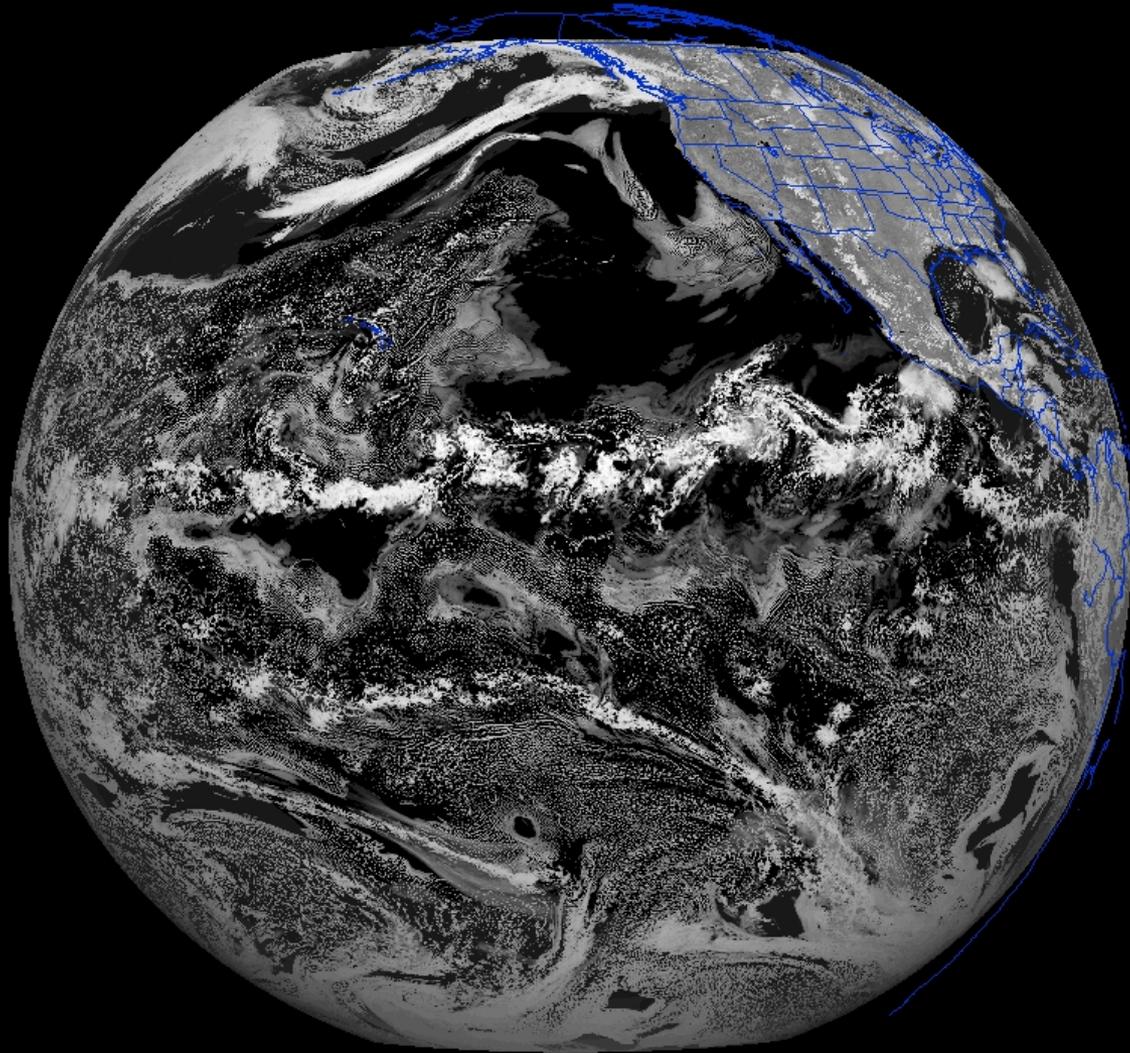
40

60

80

100

(0.87 μm) Raw (Reflectance*100)



Daytime "Veggie" band – NDVI, solar insolation, snow cover

ABIS (Band 3): 26 Jun 2008 21:00:00 UTC

0

20

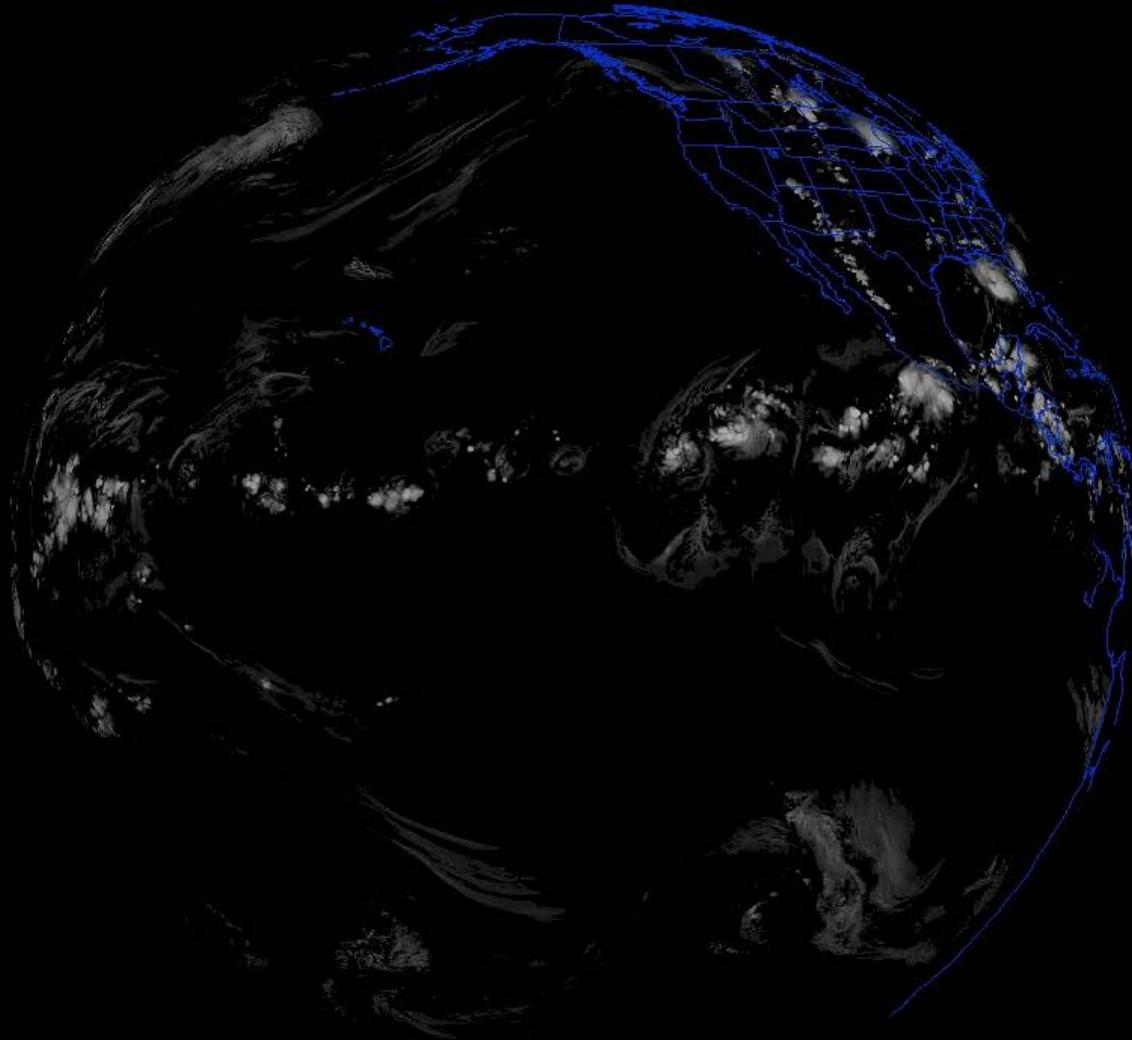
40

60

80

100

(1.38 μm) Raw (Reflectance*100)



1

Daytime "Cirrus" band – cloud mask, aerosol detection

ABIS (Band 4): 26 Jun 2008 21:00:00 UTC

0

20

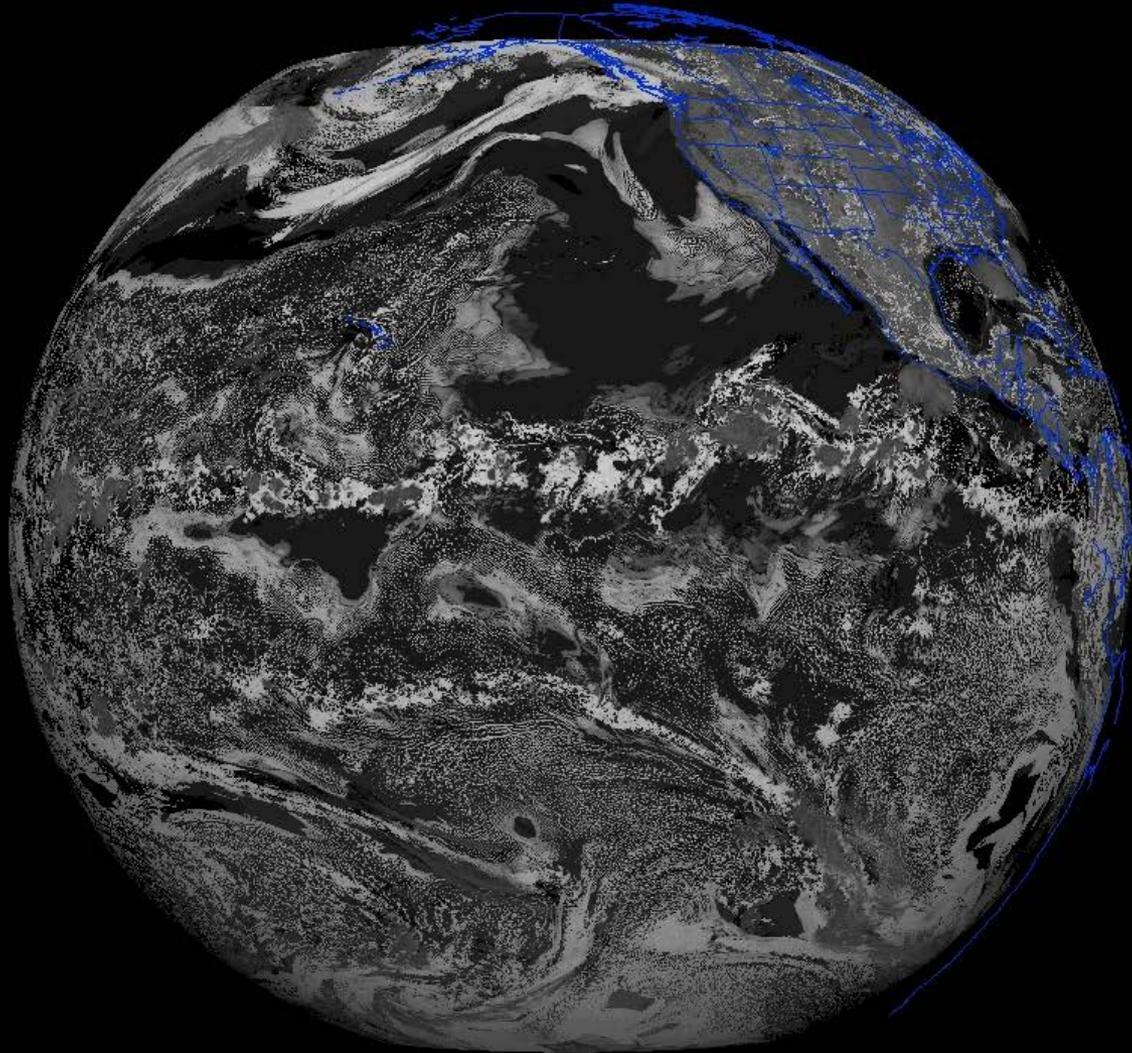
40

60

80

100

(1.61 μm) Raw (Reflectance*100)



Daytime "Snow" band – snow cover, cloud mask, etc.

ABIS (Band 5): 26 Jun 2008 21:00:00 UTC

0

20

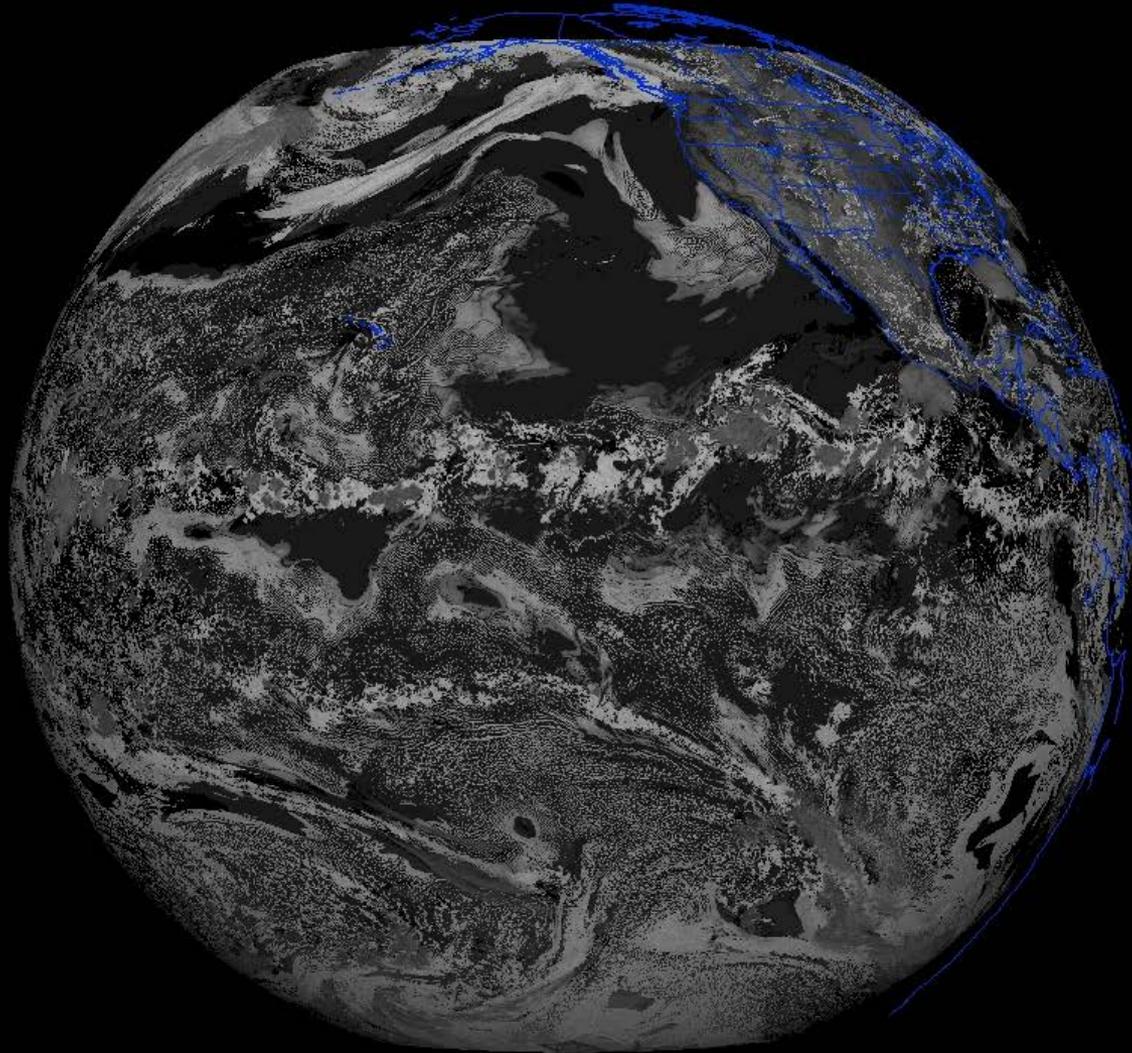
40

60

80

100

(2.25 μm) Raw (Reflectance*100)



Daytime “Cloud-top phase” band – cloud particle size, snow cover

ABIS (Band 6): 26 Jun 2008 21:00:00 UTC

200

220

240

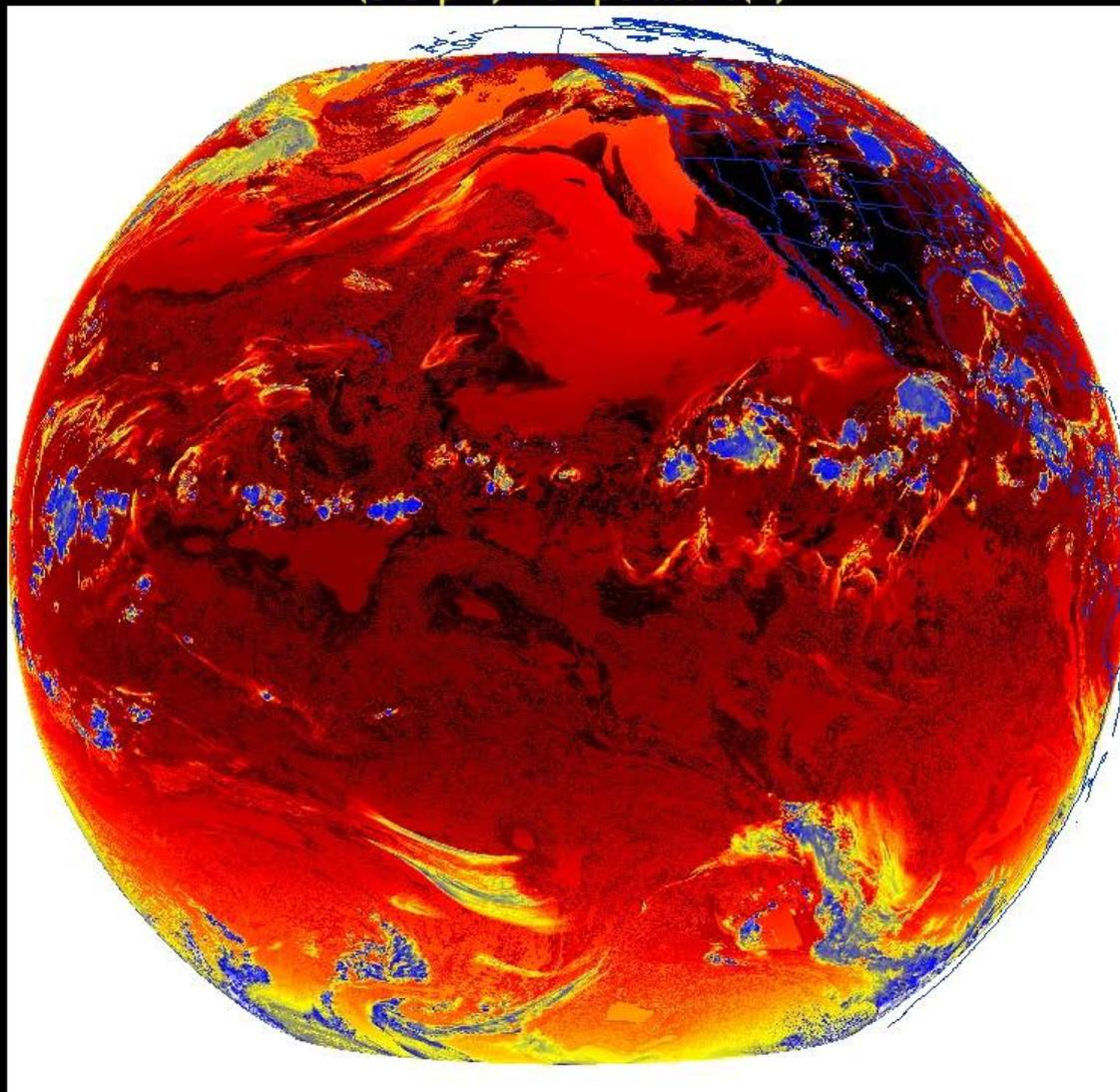
260

280

300

320

(3.9 μm) Temperature(K)



Shortwave IR window band - fog, fires, winds, SST, etc.

ABIS (Band 7): 26 Jun 2008 21:00:00 UTC

200

220

240

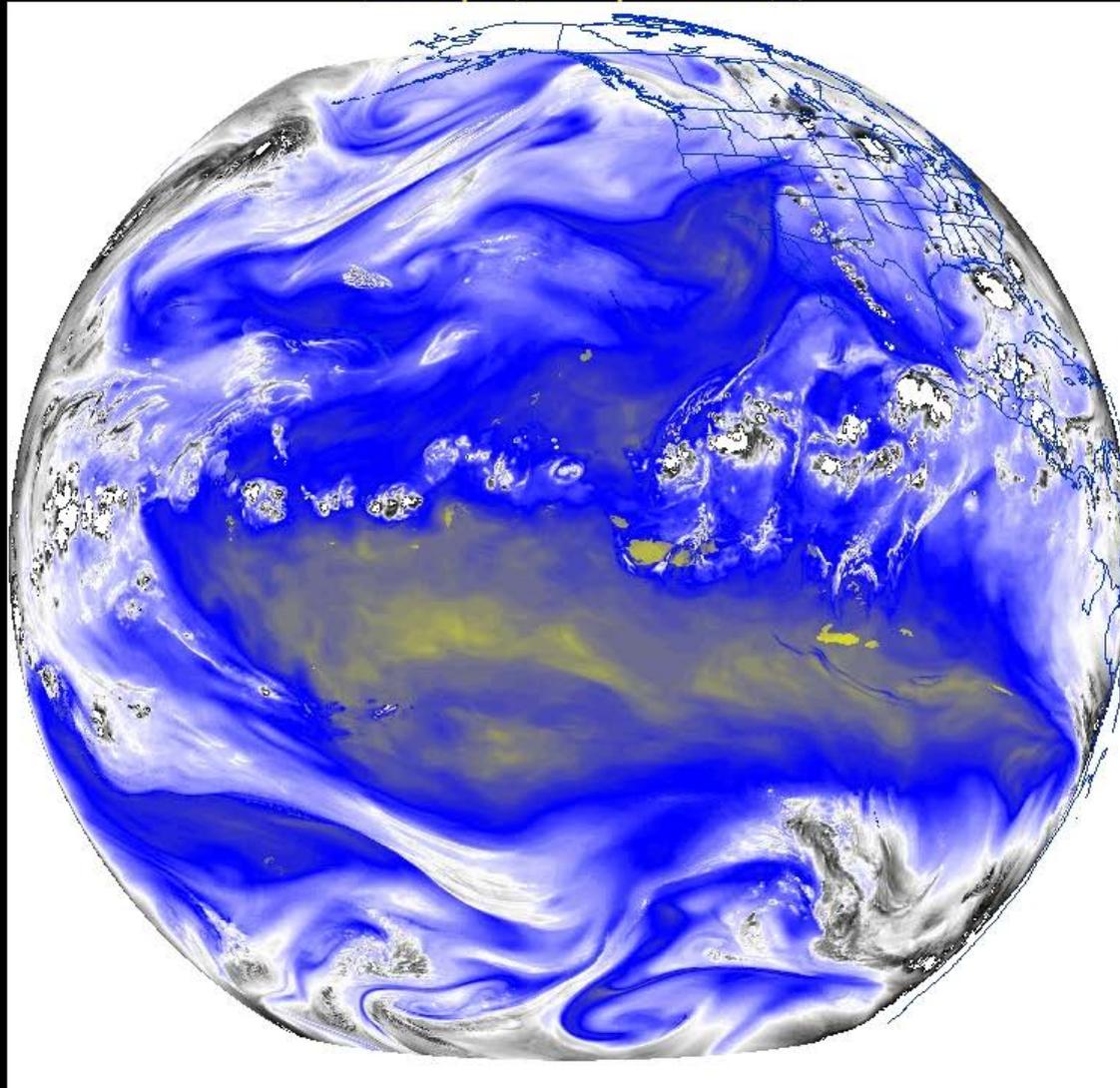
260

280

300

320

(6.19 μm) Temperature(K)



Upper-level tropospheric water vapor band – moisture, flow, winds

ABIS (Band 8): 26 Jun 2008 21:00:00 UTC

200

220

240

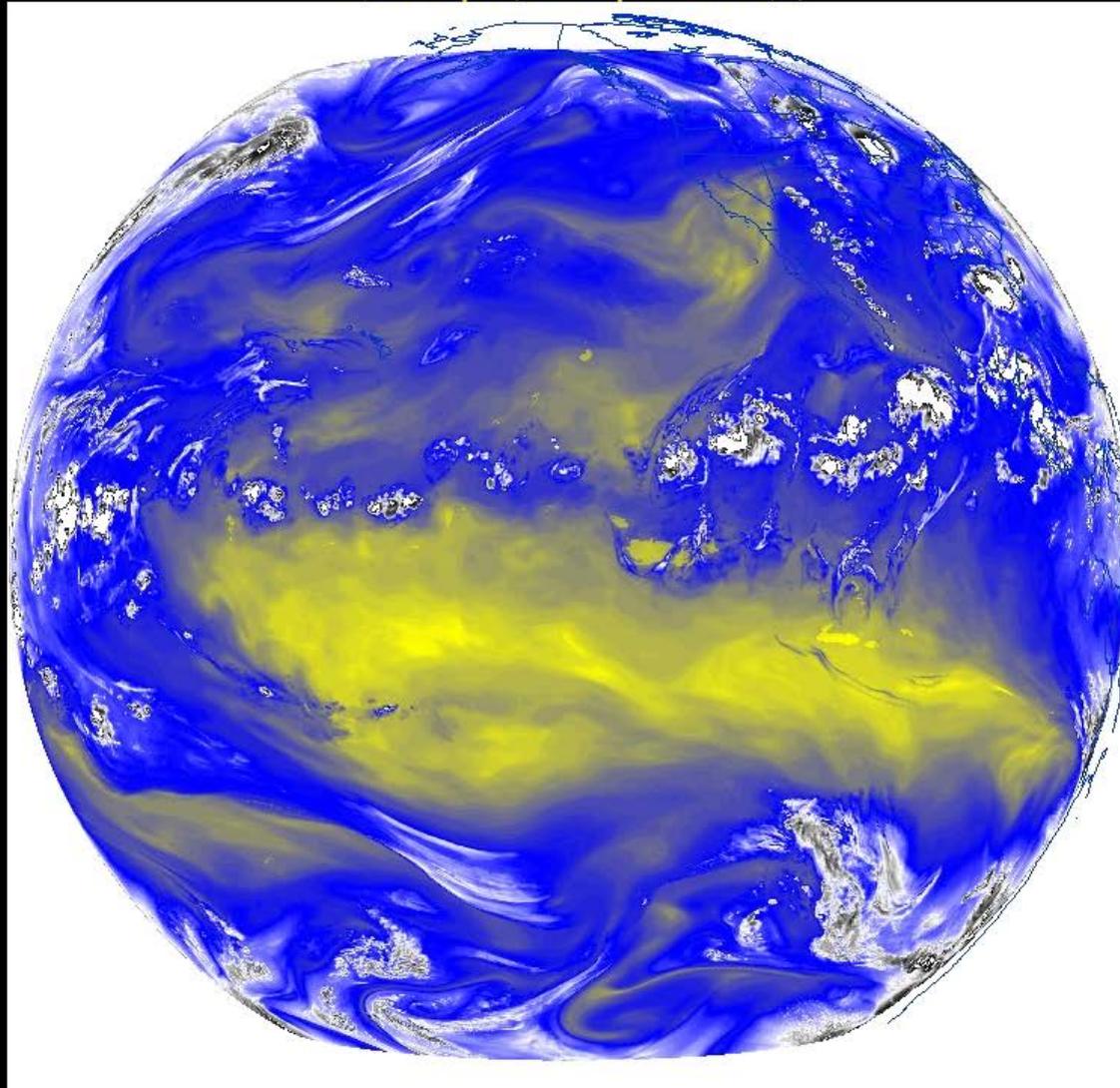
260

280

300

320

(6.95 μm) Temperature(K)



Upper/mid-level tropospheric water vapor band – moisture, flow, winds

ABIS (Band 9): 26 Jun 2008 21:00:00 UTC

200

220

240

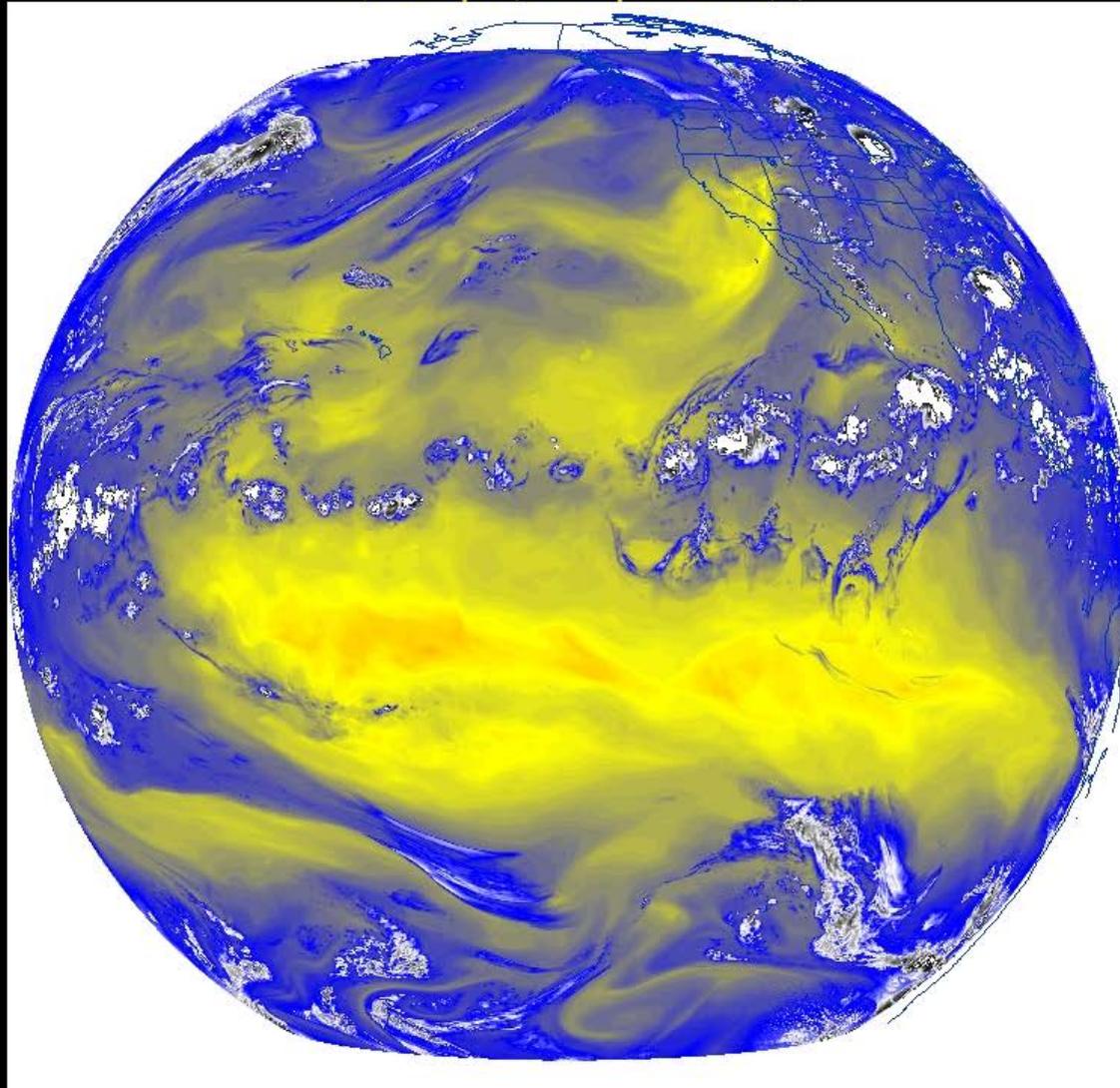
260

280

300

320

(7.34 μm) Temperature(K)



Lower mid-level tropospheric water vapor band– moisture, flow, winds

ABIS (Band 10): 26 Jun 2008 21:00:00 UTC

200

220

240

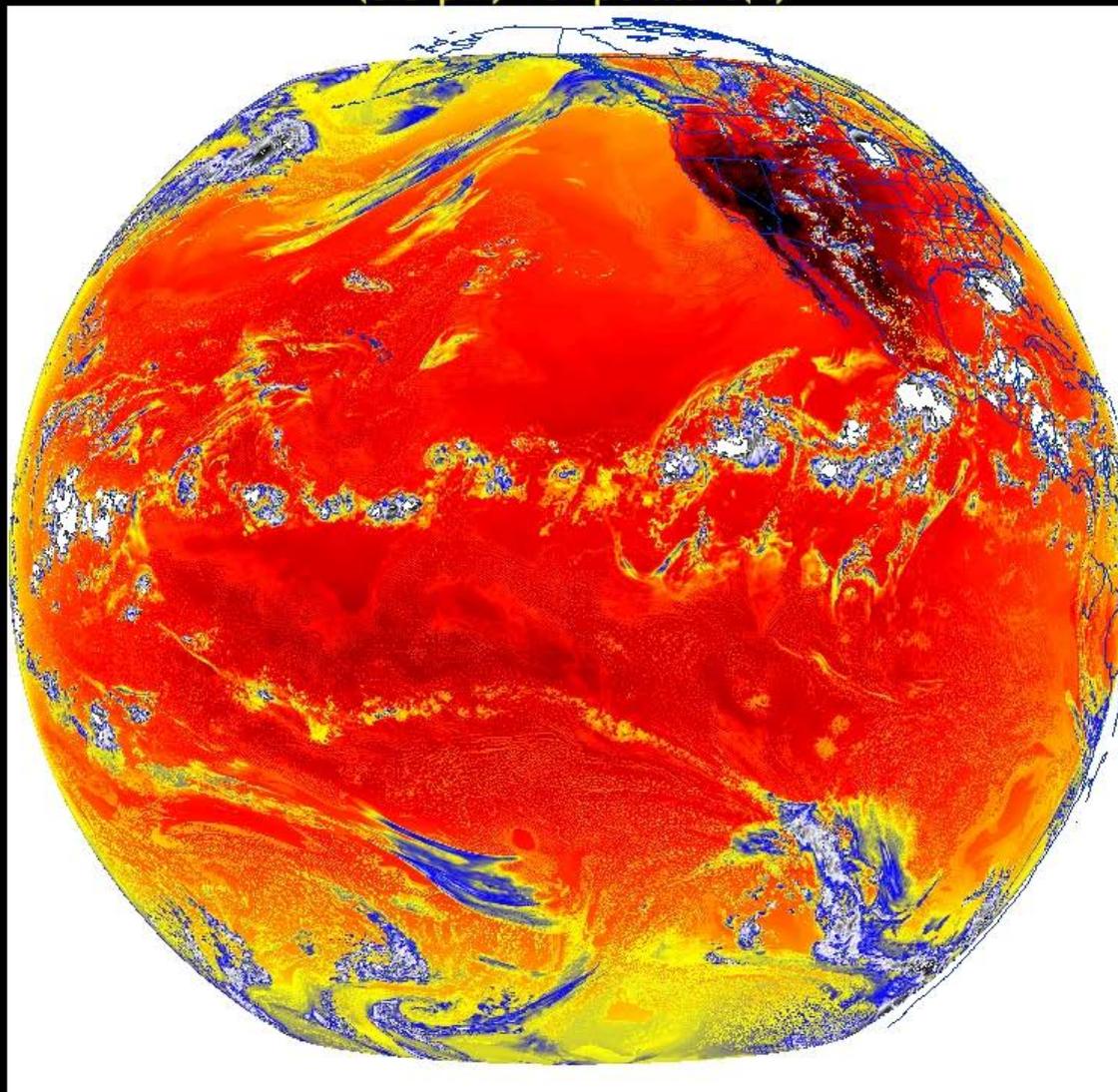
260

280

300

320

(8.5 μm) Temperature(K)



“Cloud-top phase” band – SO_2 , dust, SST, stability indices, etc.

ABIS (Band 11): 26 Jun 2008 21:00:00 UTC

200

220

240

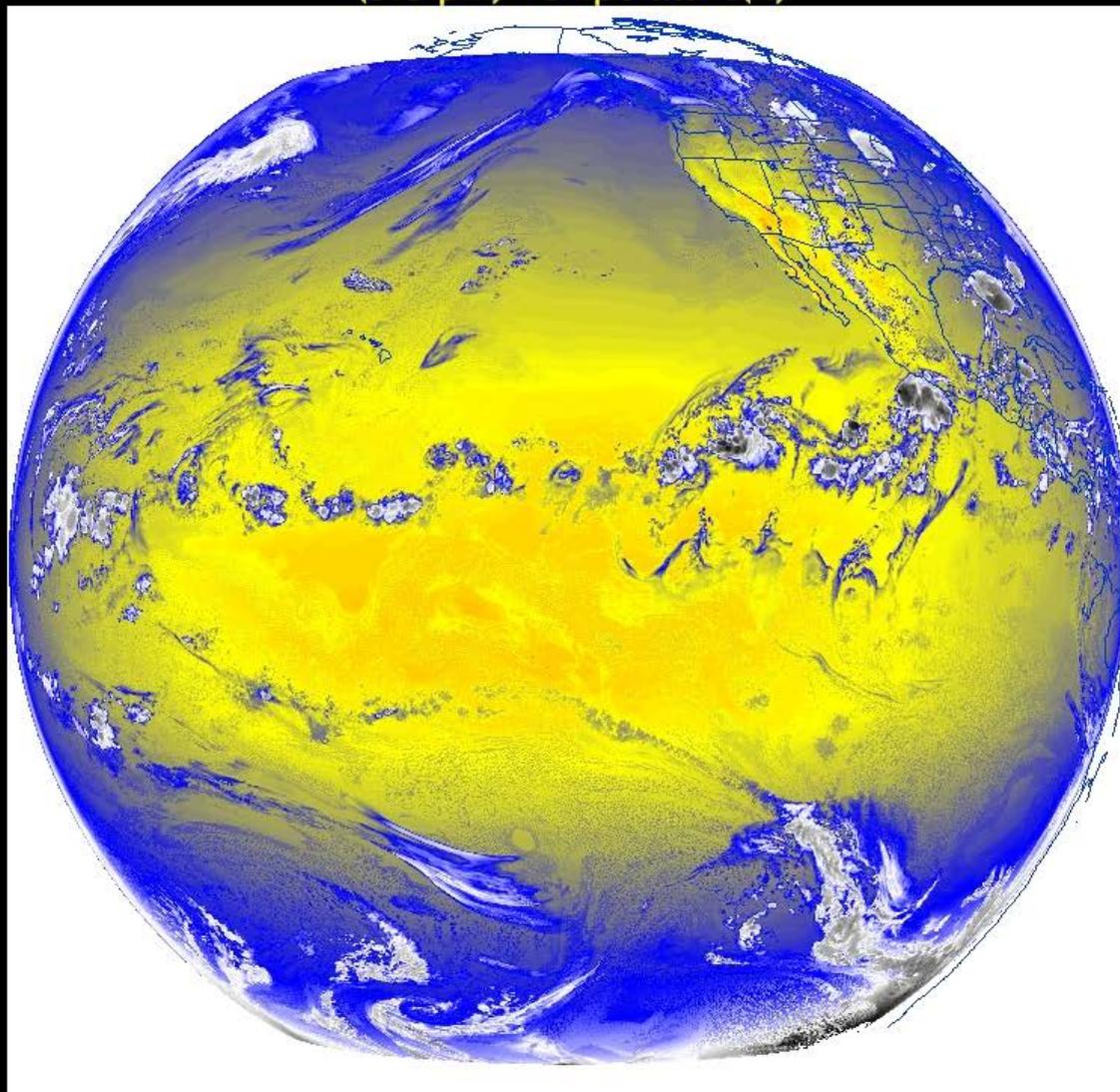
260

280

300

320

(9.6 μm) Temperature(K)



“Ozone” band

ABIS (Band 12): 26 Jun 2008 21:00:00 UTC

200

220

240

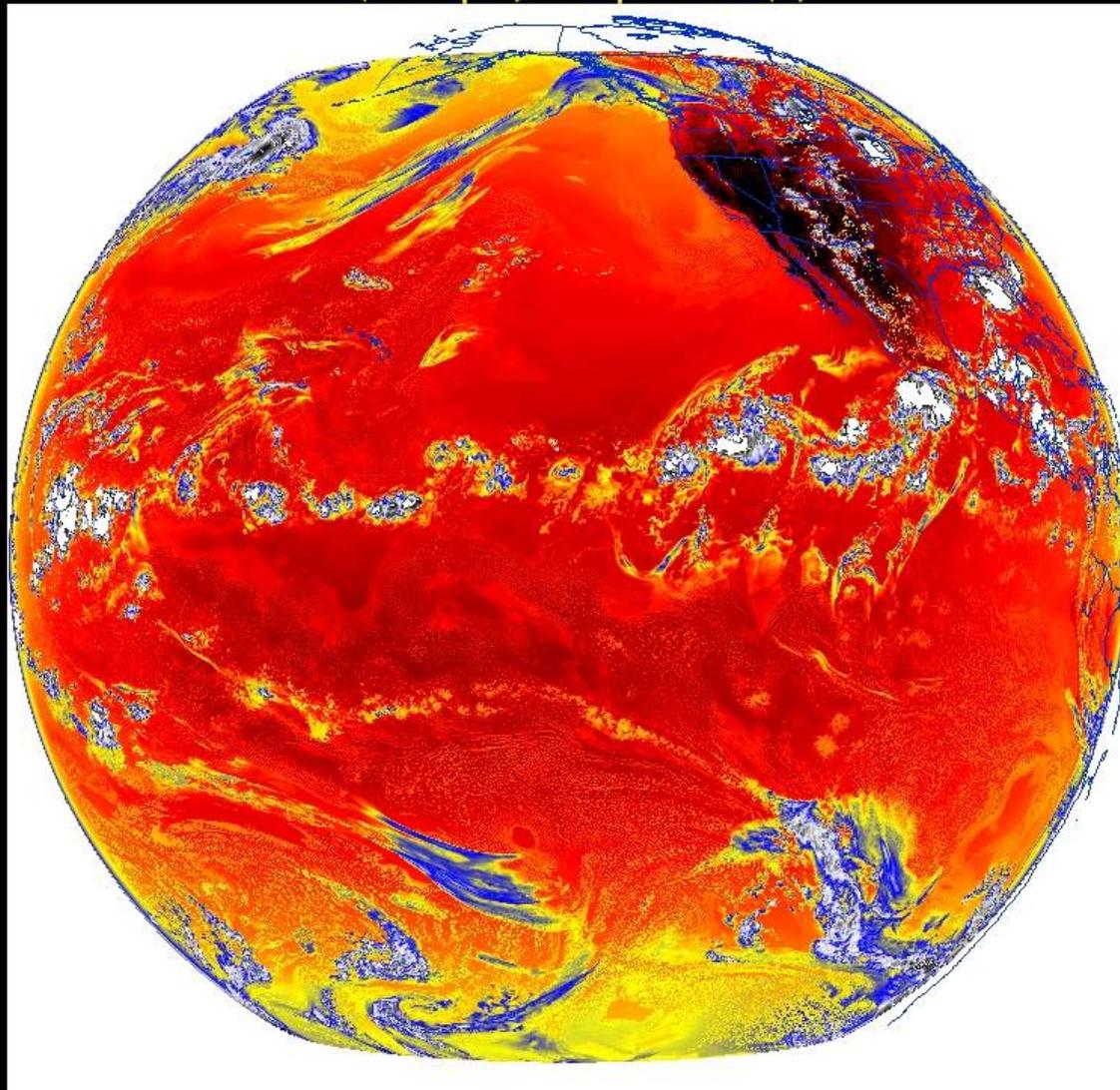
260

280

300

320

(10.4 μm) Temperature(K)



“Clean” IR longwave window band – imagery, TPW, etc.

ABIS (Band 13): 26 Jun 2008 21:00:00 UTC

200

220

240

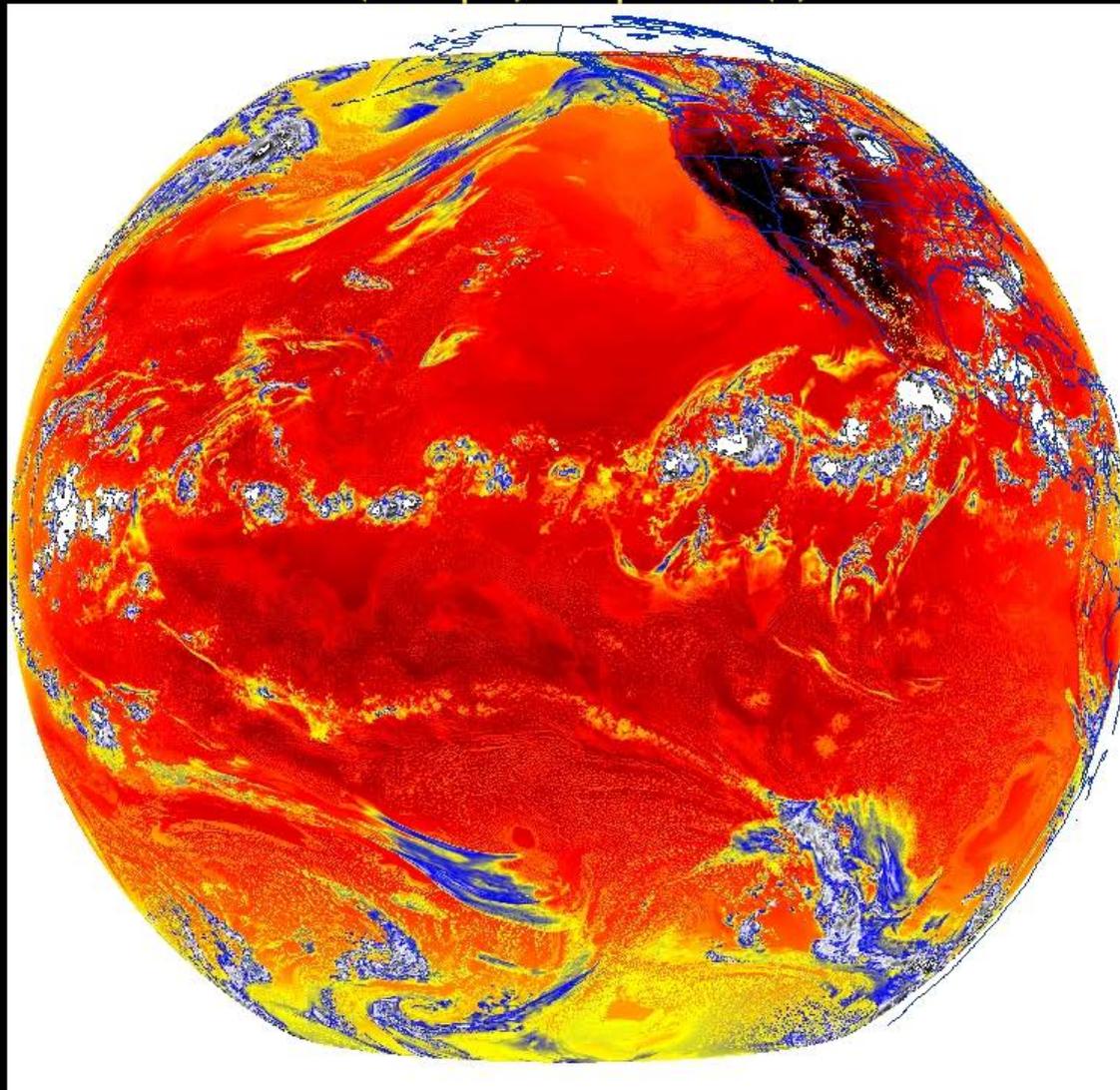
260

280

300

320

(11.2 μm) Temperature(K)



IR longwave window band – many cloud parameters, SST, snow cover

ABIS (Band 14): 26 Jun 2008 21:00:00 UTC

200

220

240

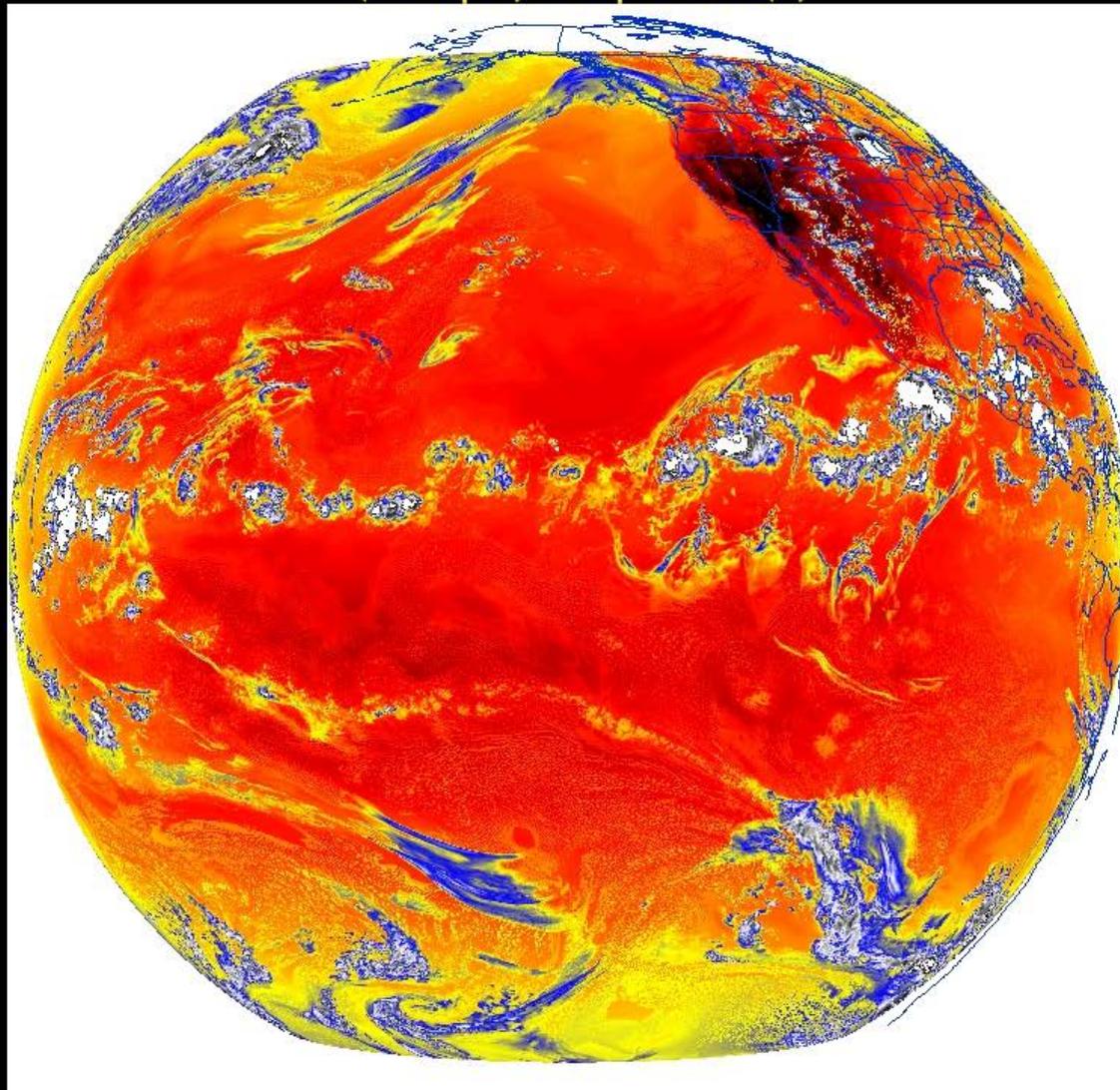
260

280

300

320

(12.3 μm) Temperature(K)



“Dirty” IR longwave window band – many cloud parameters, TPW

ABIS (Band 15): 26 Jun 2008 21:00:00 UTC

200

220

240

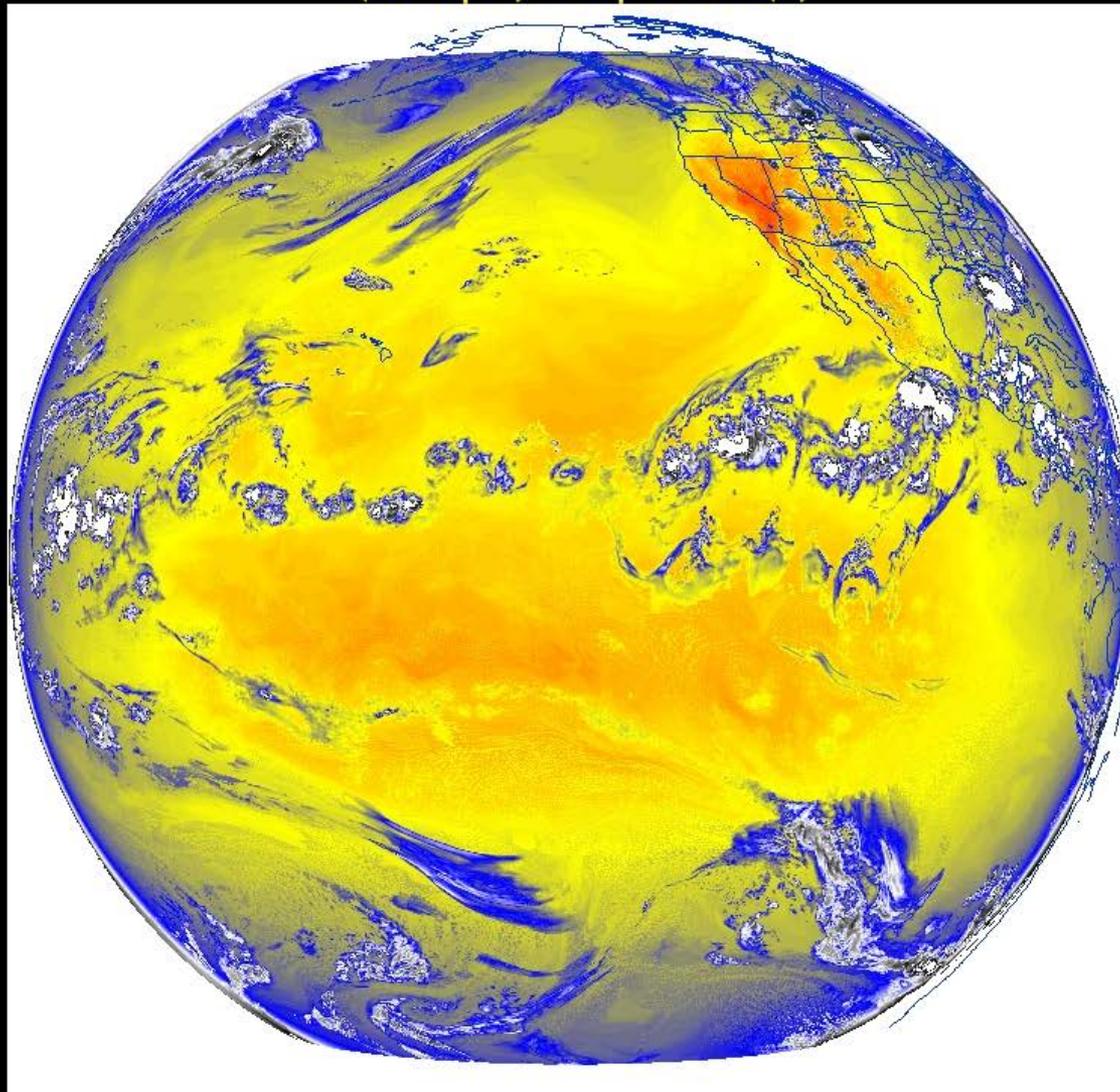
260

280

300

320

(13.3 μm) Temperature(K)



“CO2” longwave IR band – cloud height/pressure, stability indices

ABIS (Band 16): 26 Jun 2008 21:00:00 UTC

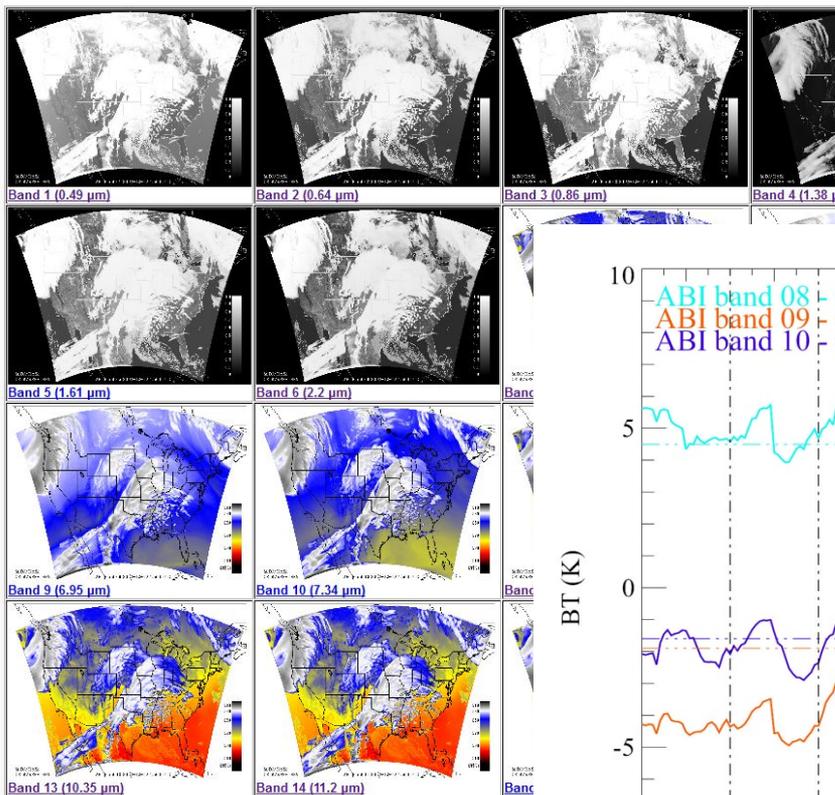
Near Realtime WRF Chem ABI runs

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

GOES-R Activities at CIMSS / SSEC
» Home » Proving Ground

GOES-R Proving Ground UW/CIMSS WRF Chem Simulated ABI Bands 1-16

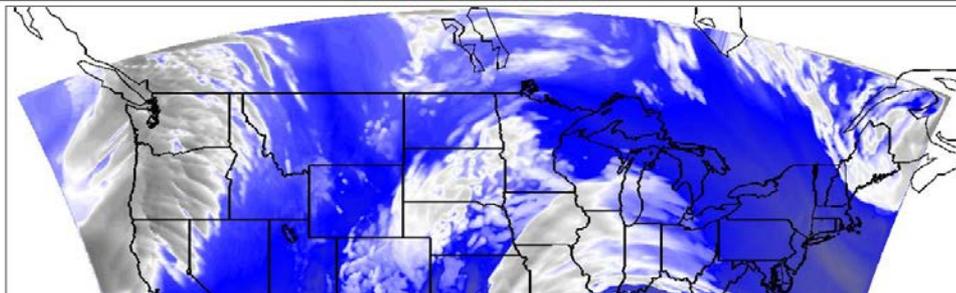
Click on band for time loop.



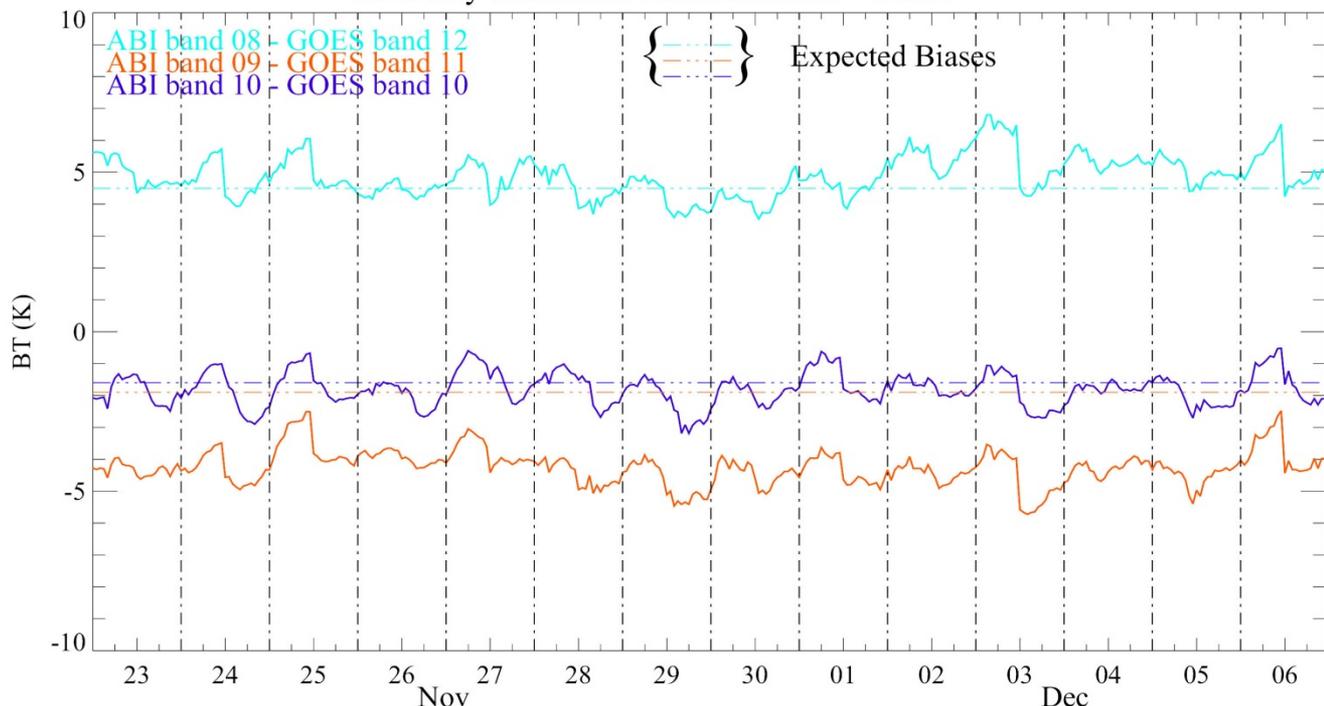
GOES-R Activities at CIMSS / SSEC
» Home » UW/CIMSS WRF Chem ABI Realtime

ABI Band 10 (7.34 μm) - Mid-Level Water Vapor

Start Set Animation Speed Rock Zoom

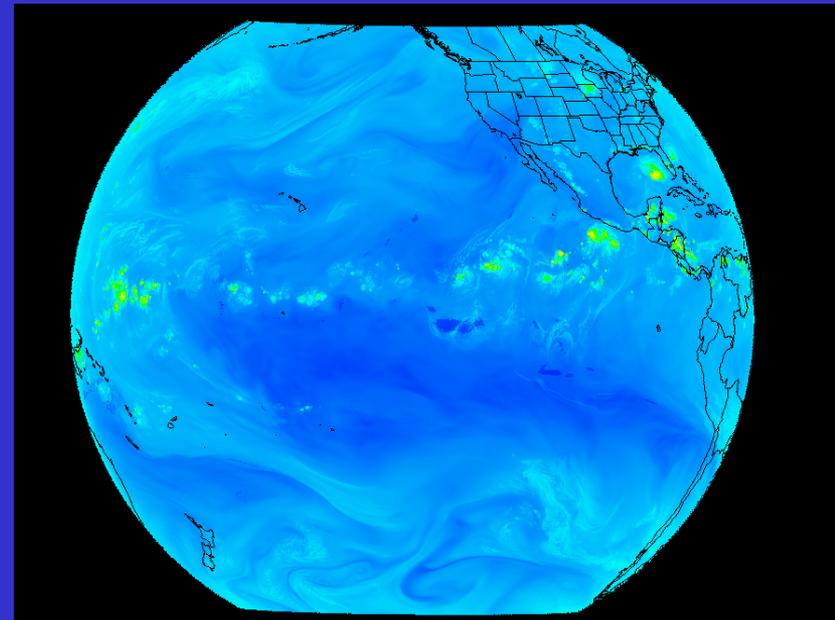


Clear Sky Difference Simulated ABI - GOES



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GOES-R ABI Products



Baseline Products

Advanced Baseline Imager (ABI)

Aerosol Detection (Including Smoke and Dust)
Aerosol Optical Depth (AOD)
Clear Sky Masks
Cloud and Moisture Imagery
Cloud Optical Depth
Cloud Particle Size Distribution
Cloud Top Height
Cloud Top Phase
Cloud Top Pressure
Cloud Top Temperature
Derived Motion Winds
Derived Stability Indices
Downward Shortwave Radiation: Surface
Fire/Hot Spot Characterization
Hurricane Intensity Estimation
Land Surface Temperature (Skin)
Legacy Vertical Moisture Profile
Legacy Vertical Temperature Profile
Radiances
Rainfall Rate/QPE
Reflected Shortwave Radiation: TOA
Sea Surface Temperature (Skin)
Snow Cover
Total Precipitable Water
Volcanic Ash: Detection and Height

Future Capabilities

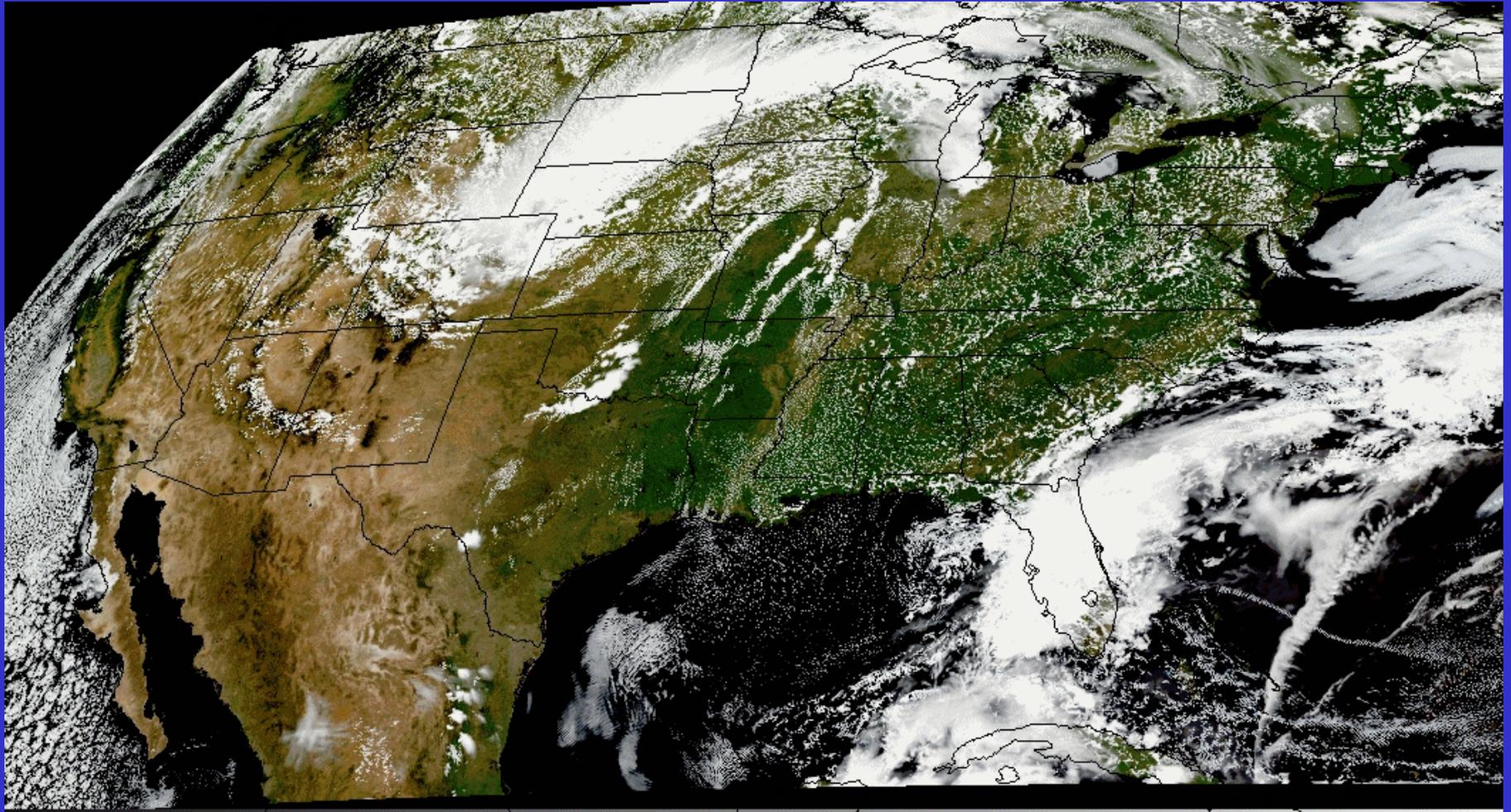
Advanced Baseline Imager (ABI)

Absorbed Shortwave Radiation: Surface
Aerosol Particle Size
Aircraft Icing Threat
Cloud Ice Water Path
Cloud Layers/Heights
Cloud Liquid Water
Cloud Type
Convective Initiation
Currents
Currents: Offshore
Downward Longwave Radiation: Surface
Enhanced "V"/Overshooting Top Detection
Flood/Standing Water
Ice Cover
Low Cloud and Fog
Ozone Total
Probability of Rainfall
Rainfall Potential
Sea and Lake Ice: Age
Sea and Lake Ice: Concentration
Sea and Lake Ice: Motion
Snow Depth (Over Plains)
SO₂ Detection
Surface Albedo
Surface Emissivity
Tropopause Folding Turbulence Prediction
Upward Longwave Radiation: Surface
Upward Longwave Radiation: TOA
Vegetation Fraction: Green
Vegetation Index
Visibility

Three Groups of Users

- Direct use of radiances/imagery
 - Numerical models
 - Forecasters
 - Broadcasters
 - General public/private sector/Internet
- Direct use of satellite products
 - Numerical models
 - Forecasters
 - Blended products, etc.
 - General public/private sector/Internet
- Use of services which use data/products
 - **Basically everyone!**

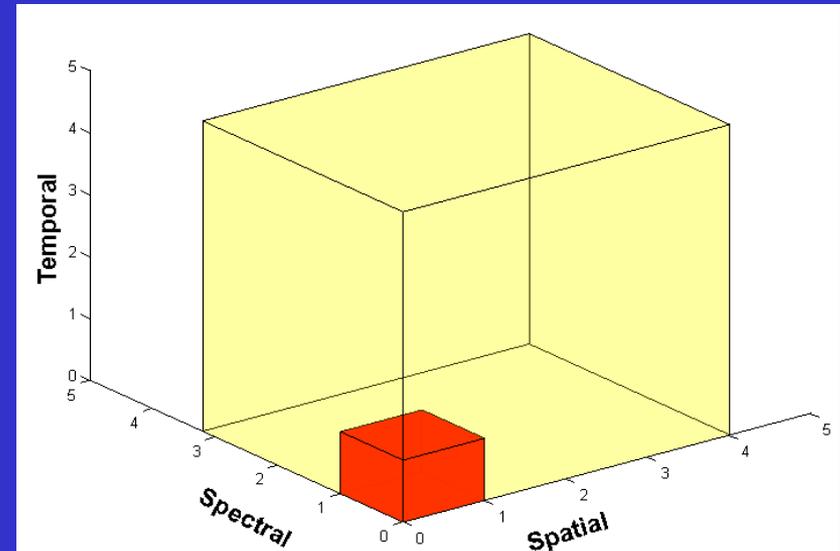
Pseudo-Natural Color



“True Color” with “synthetic” green band from ABI simulated data (from CIMSS); image from Don Hillger, RAMMB.

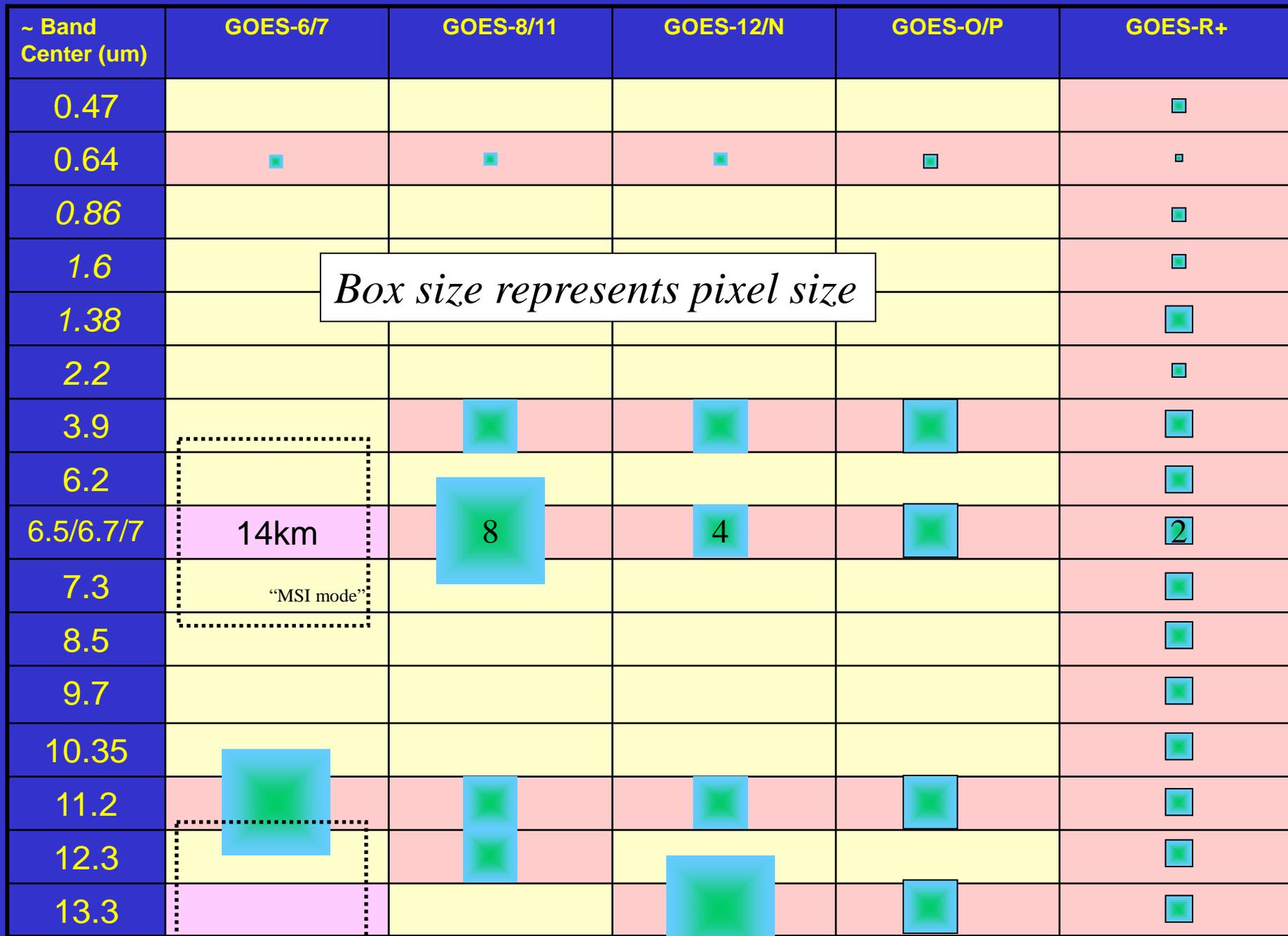
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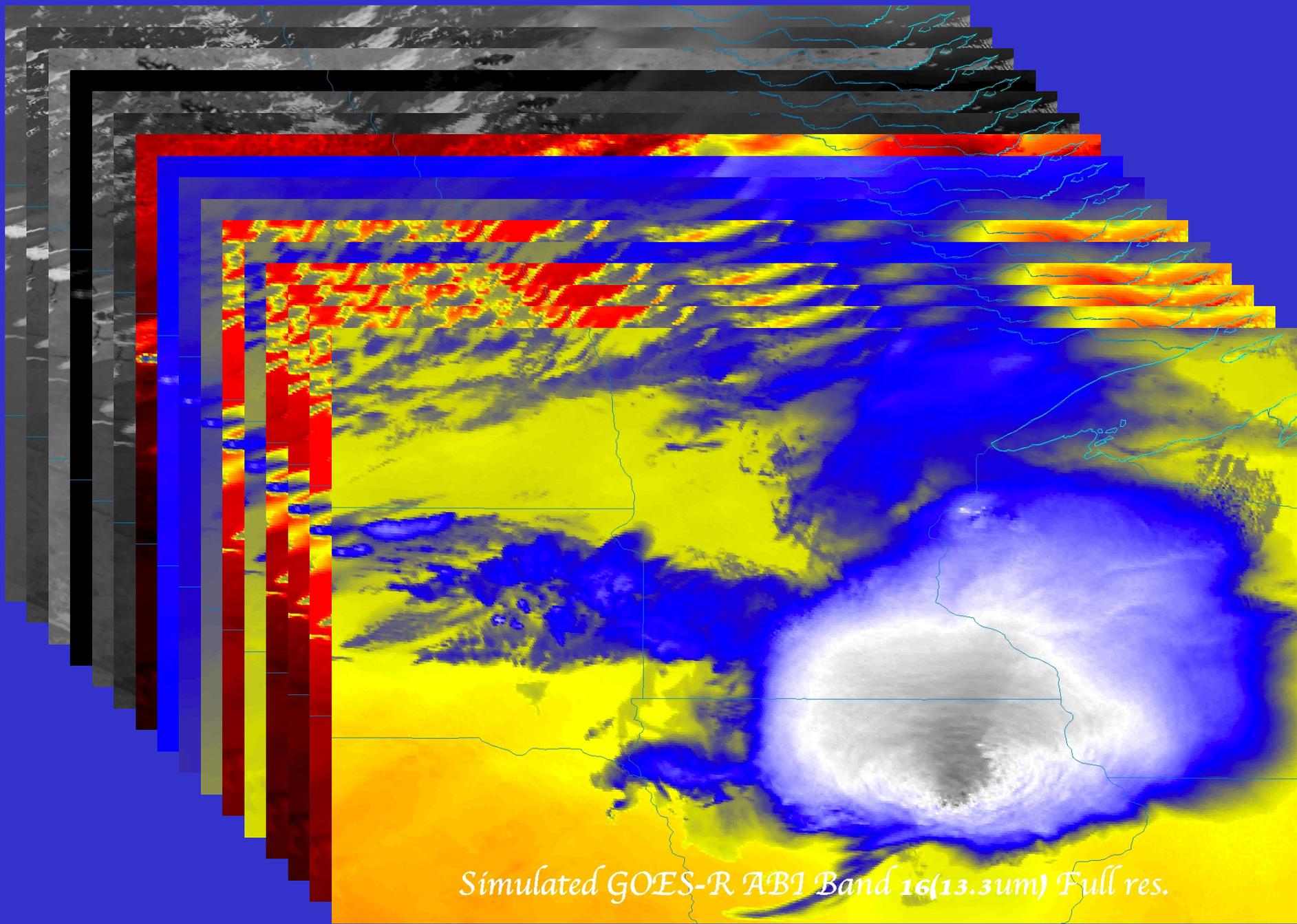
Approximate spectral and spatial resolutions of US GOES Imagers



Summary

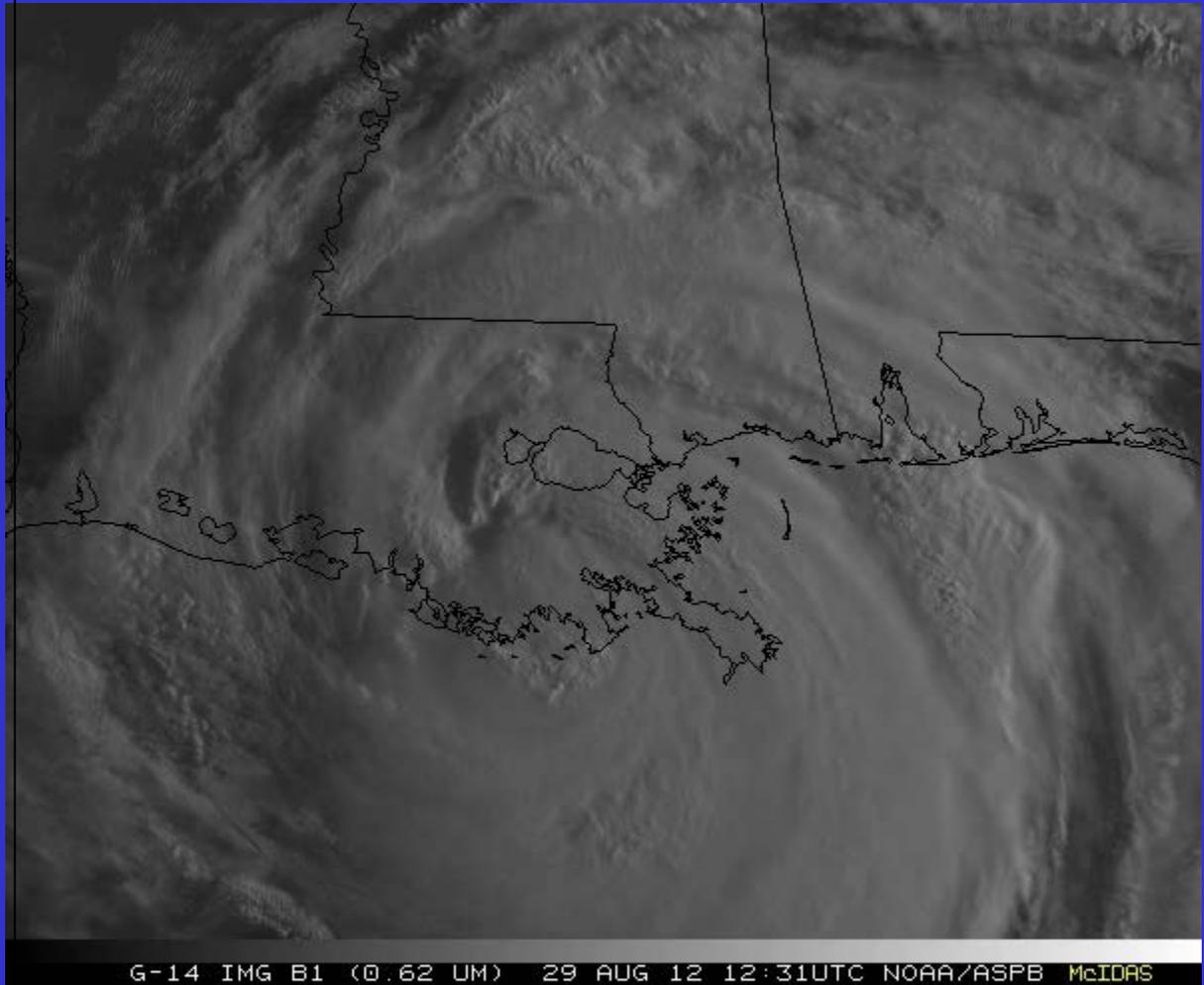
1. The GOES-R ABI provides mission continuity
2. Two times the image navigation quality
3. Three times the number of imaging bands
4. Four times the spatial resolutions
5. Five times the coverage rate





GOES-14 in Special Rapid Scan mode

- SRSOR (Super Rapid Scan Operations for GOES-R) from GOES-14 imager while it was out of storage.
- Worked with OSPO to define schedules
- Deciding on daily location for scanning between mid-August and end of October
- Posting many animations
- http://cimss.ssec.wisc.edu/goes/srsor/GOES-14_SRSOR.html
- Many phenomena were observed: convection, hurricanes, fires, smoke, etc.,
- Data to many groups HPC, OPC, AWC, SPC, etc.



Animation from GOES-14 Imager visible at 1-min time resolution.

SRSOR provided unique information and offers a glimpse into the possibilities that will be provided at even higher resolutions by the ABI on GOES-R.