

# The improved imagery of the ABI on GOES-R

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NOAA/NESDIS/Satellite Applications and Research  
Advanced Satellite Products Branch (ASPB)

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

CIMSS, Madison, WI

James J. Gurka, Steve Goodman, etc.

GOES-R Program Office

Seventh Annual Symposium on Future Operational Environmental Satellite Systems  
Seattle, WA  
25 January 2011

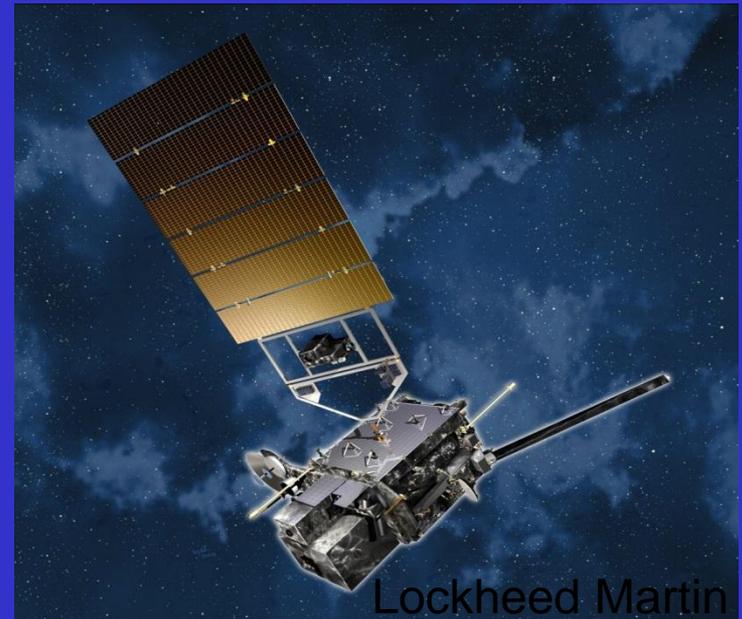


# Also Thanks to...

- 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; Hillger, 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, Jaime Daniels, Walter Wolf, GPO, Jordan Gerth, Chian-Yi Liu, Jason Otkin, Thomas Greenwald, Monica Coakley, GOES-R flight/ground, Bill Smith, ASPB, PG, SSEC data center, CWG, etc.

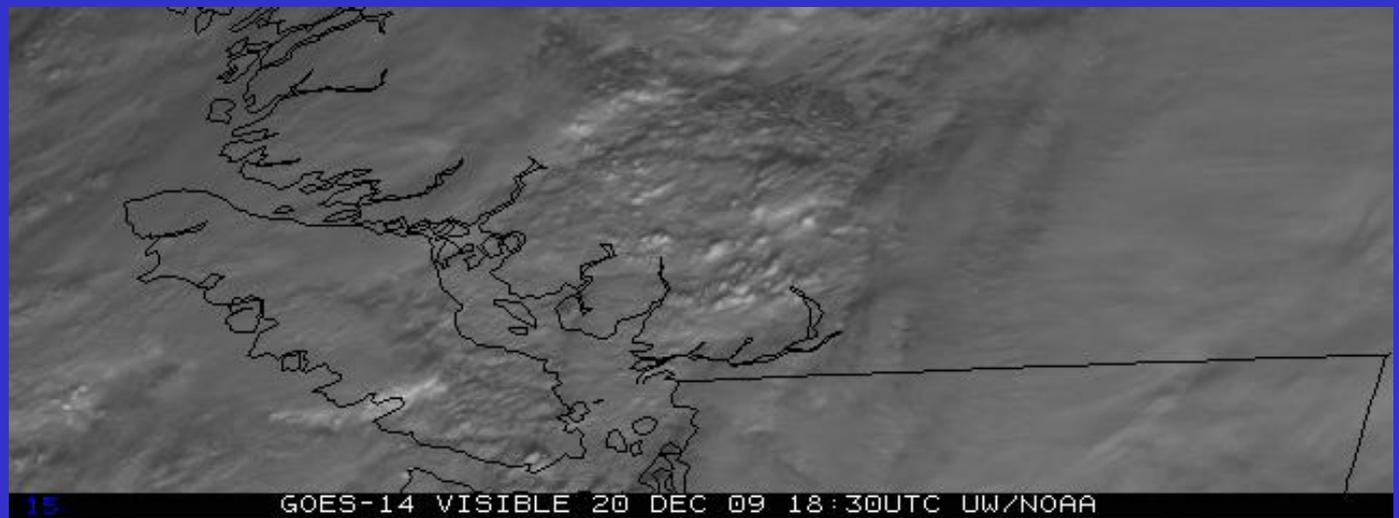
# Overview

- GOES-14/15
  - poster by Hillger and Schmit #640 -- NOAA science test results from the GOES-14 and -15 imager and sounder
- ABI (Advanced Baseline Imager)
  - Temporal
  - Spatial
  - Spectral
  - Imagery
- Summary
  - More information

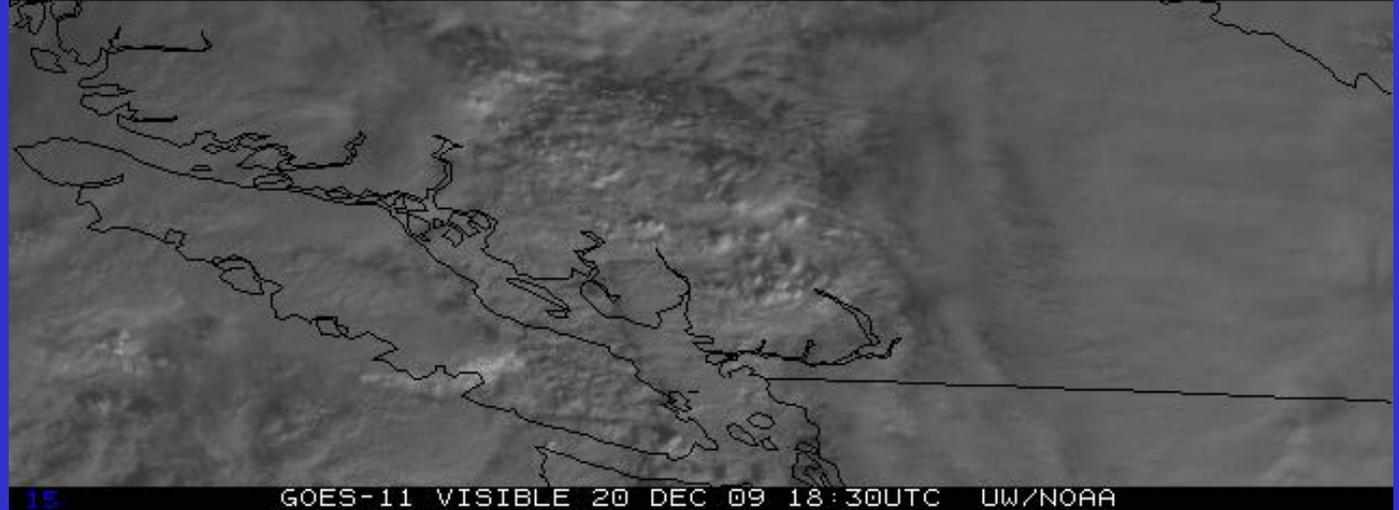


# GOES-14: Special “1-min” imagery

GOES-14

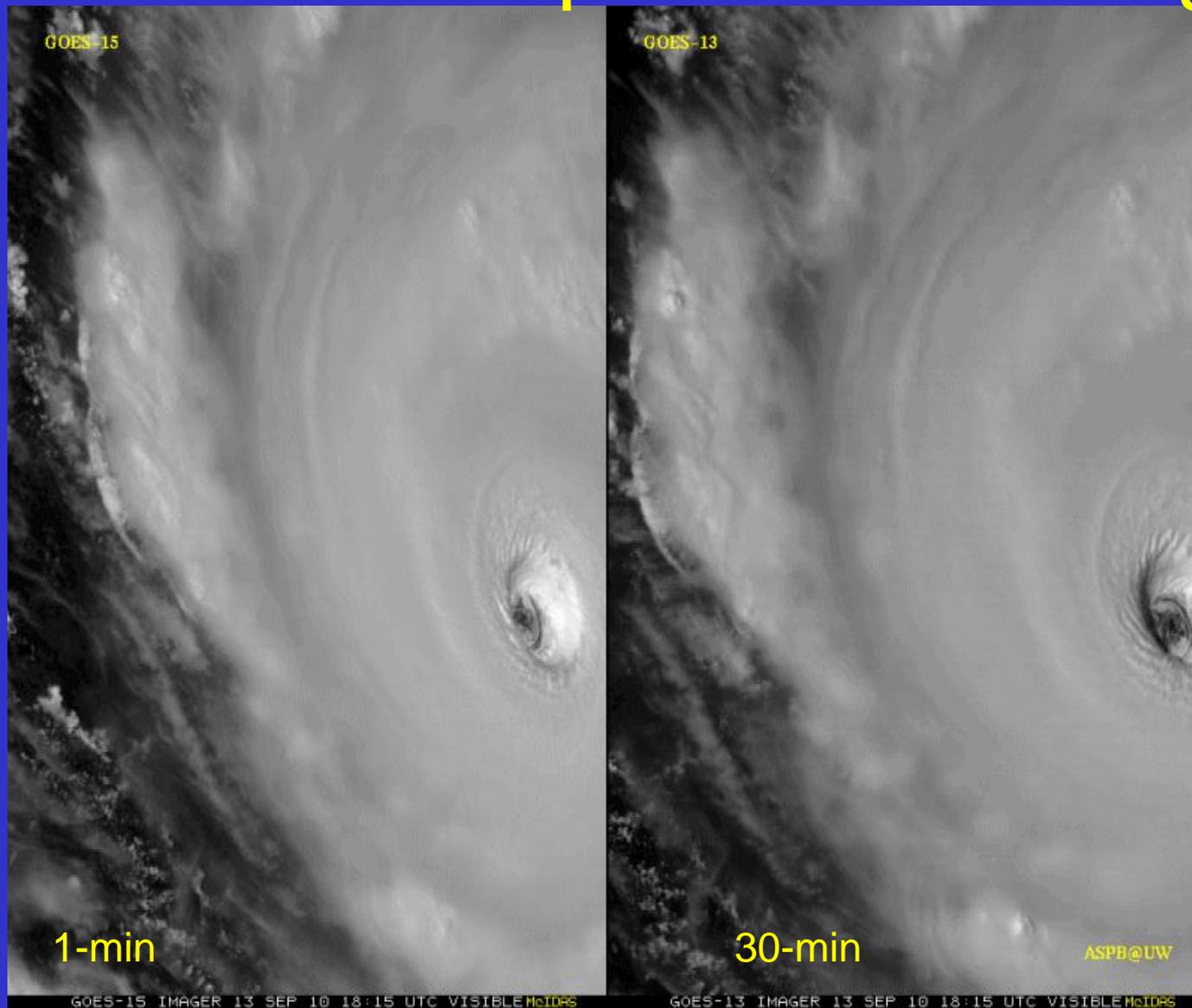


GOES-11



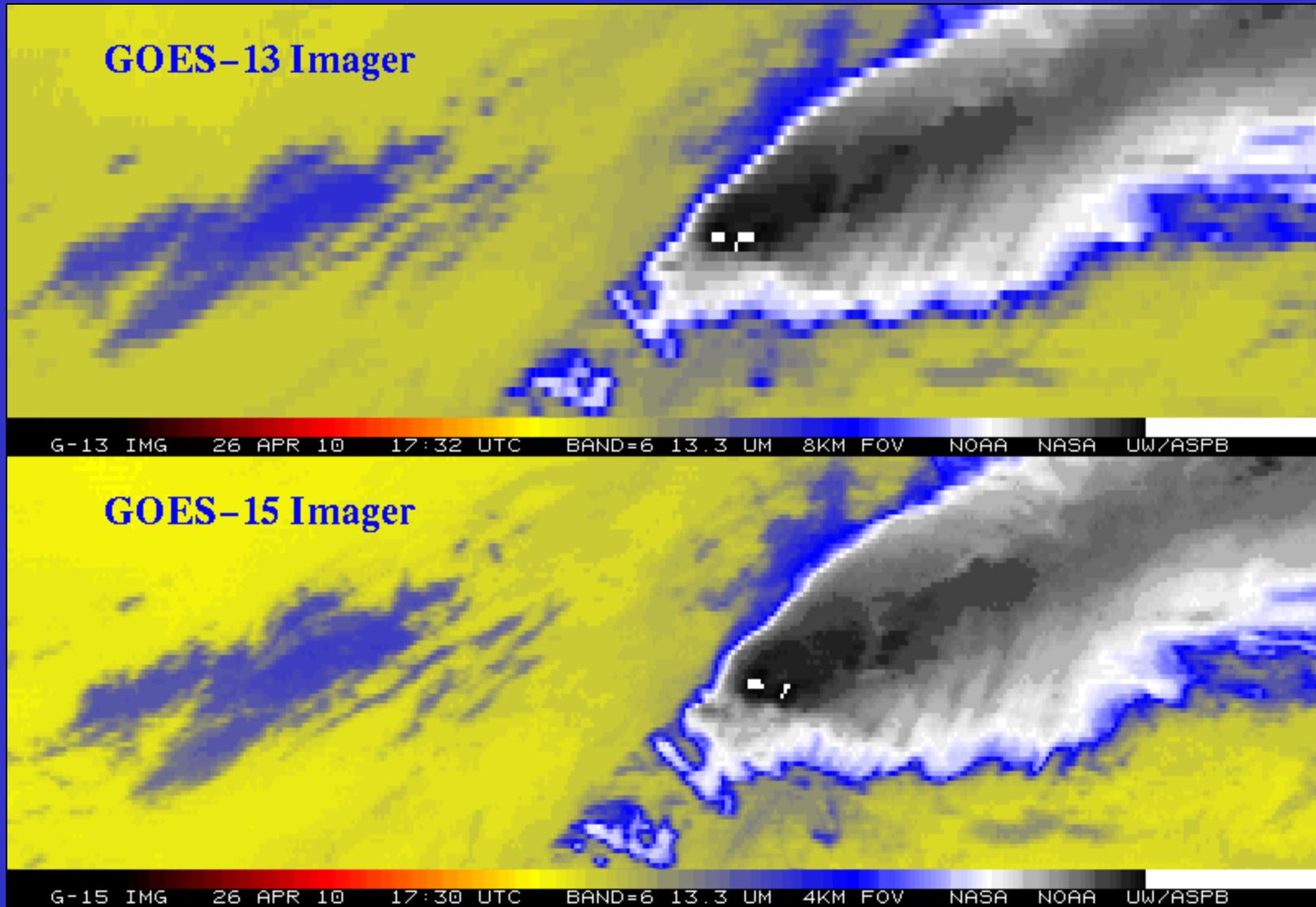
“See changes as they happen – routinely available from the ABI”

# GOES-15: Sample “1-min” imagery



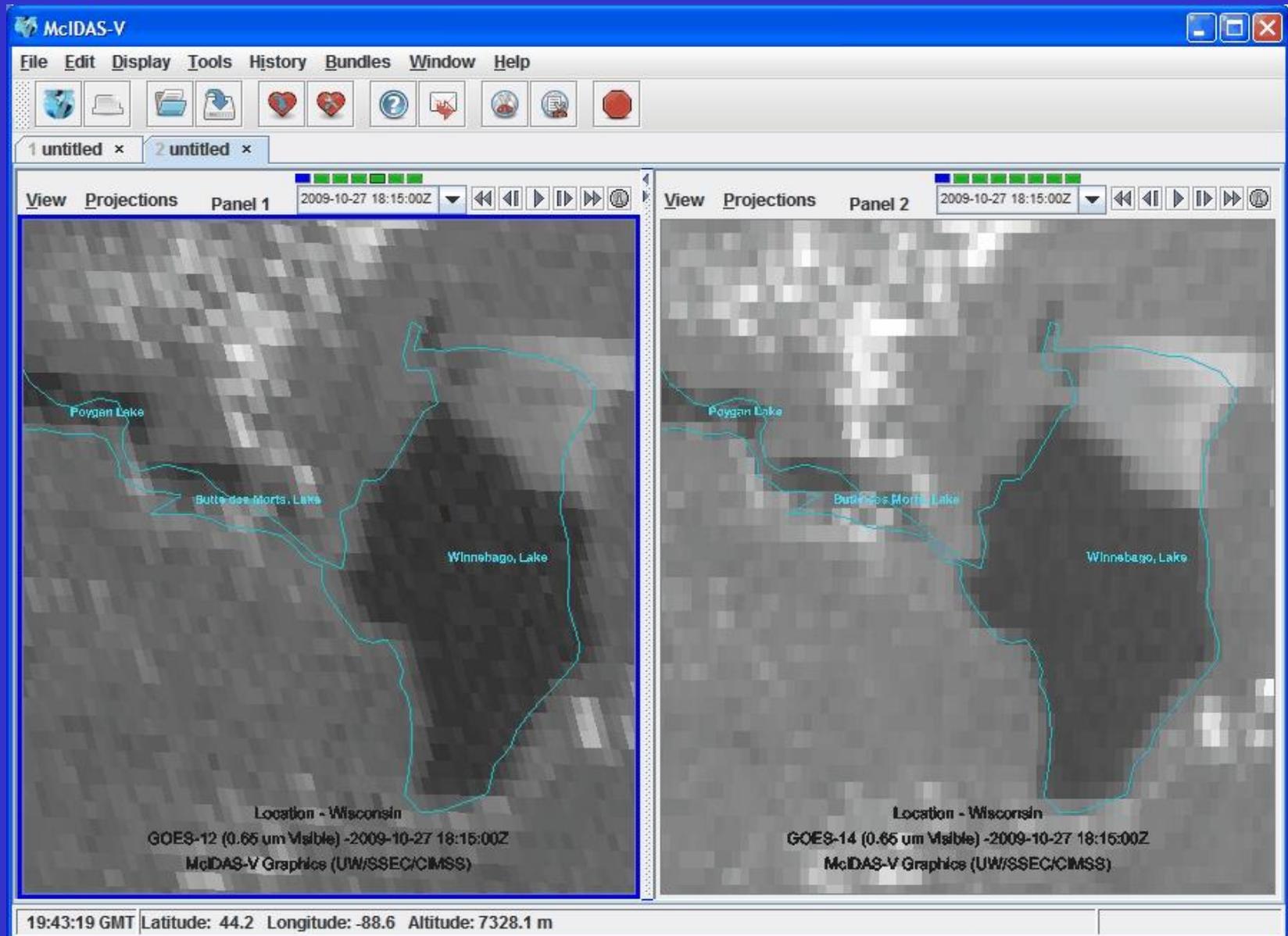
Visible data from the recent NOAA Science Test, lead by Hillger and Schmit

# Improved spatial resolution of GOES-15 Imager band 6



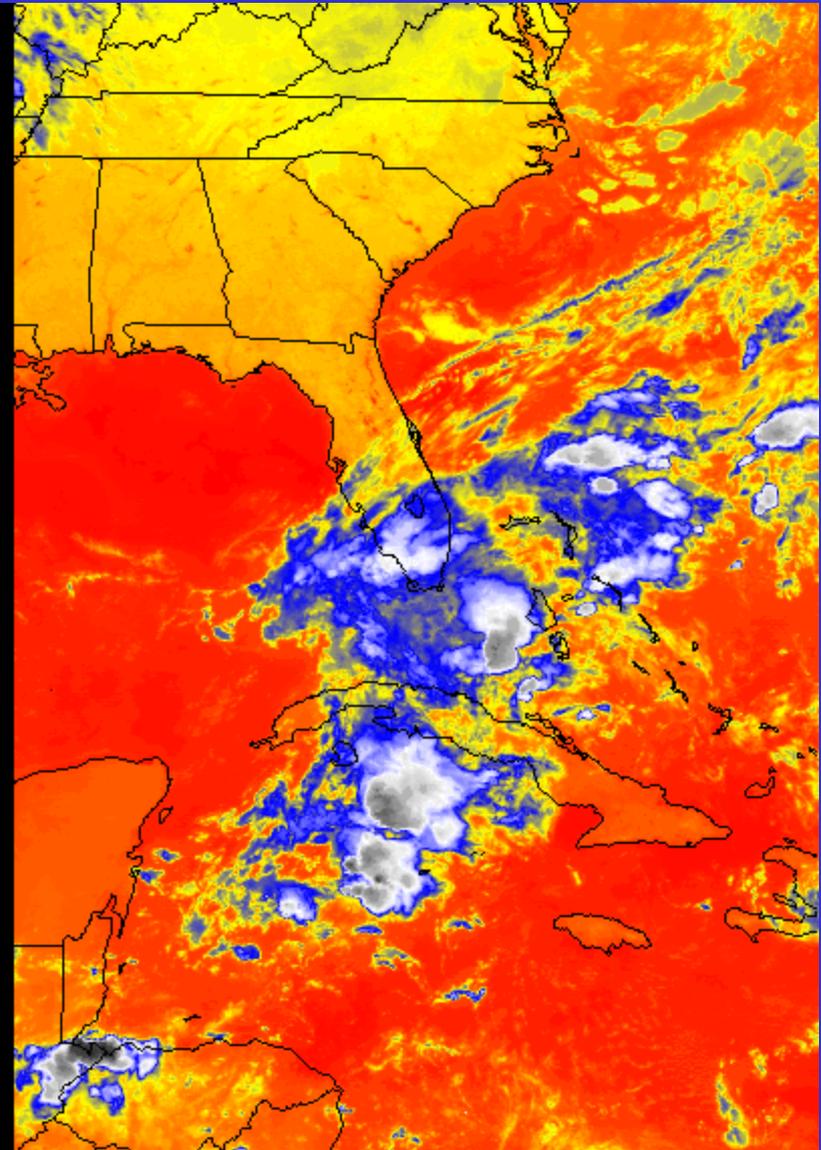
The 13.3  $\mu\text{m}$  band 6 of the GOES-13 (top panel) has an 8 km IGFOV (Instantaneous Geometric Field of View); while the same band on the GOES-15 (lower panel) has a 4 km IGFOV. Note the finer resolution of the cloud edges and the 'cleaner' image.

# Improved INR



# GOES-12/14 (Around eclipse period)

**GOES-12**  
**NO DATA DUE TO ECLIPSE**



GOES-12

GOES-14 1 OCT 09 05:45 UTC BAND=4

**GOES-12**

**GOES-14**

# GOES Outages

## -- approximate hours/year

Satellite Series	KOZ, Eclipse and Stray Light (spring and fall)	Housekeeping, SEM calibration, Maneuvers and Yaw-flip
GOES-8 thru -12	420	211
GOES-13/14/15 (may be reduced)	220	107
GOES-R ABI	~6 - 40	~2 - 6

Hurricane Ivan:



# Overview

- GOES-14/15
- **ABI (Advanced Baseline Imager)**
  - Temporal
  - Spatial
  - Spectral
  - Imagery
- Summary
  - More information

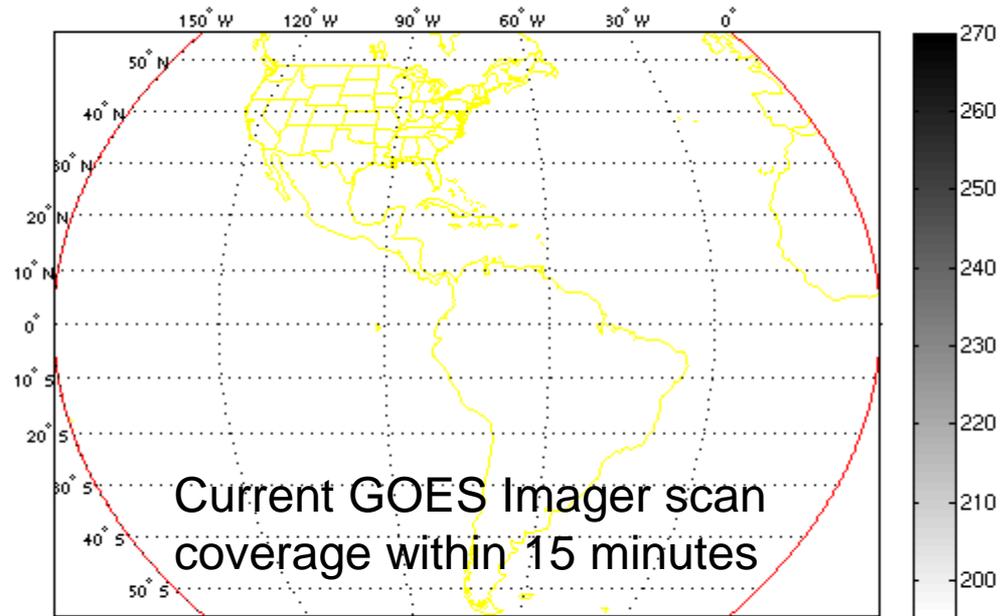


# The Advanced Baseline Imager:

	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

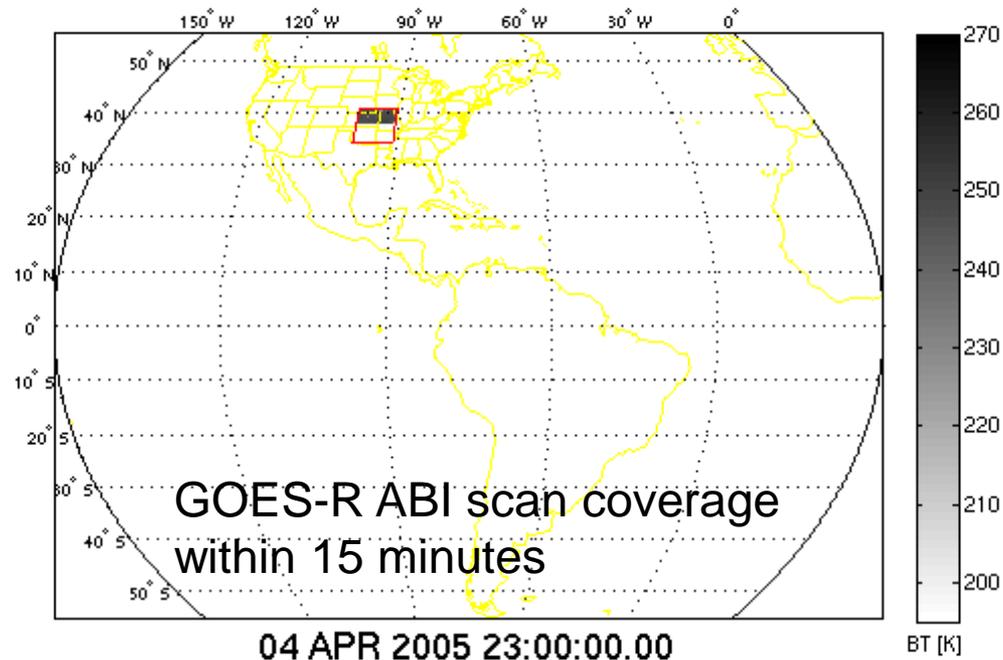
In 15 Minutes  
Current GOES  
Imager can scan:

- Most (3/5) of a Full Disk Image



In 15 Minutes  
ABI (“Flex Mode”) will scan:

- 30 Mesoscale Images
- 3 CONUS Images
- 1 Full Disk Image



GOES

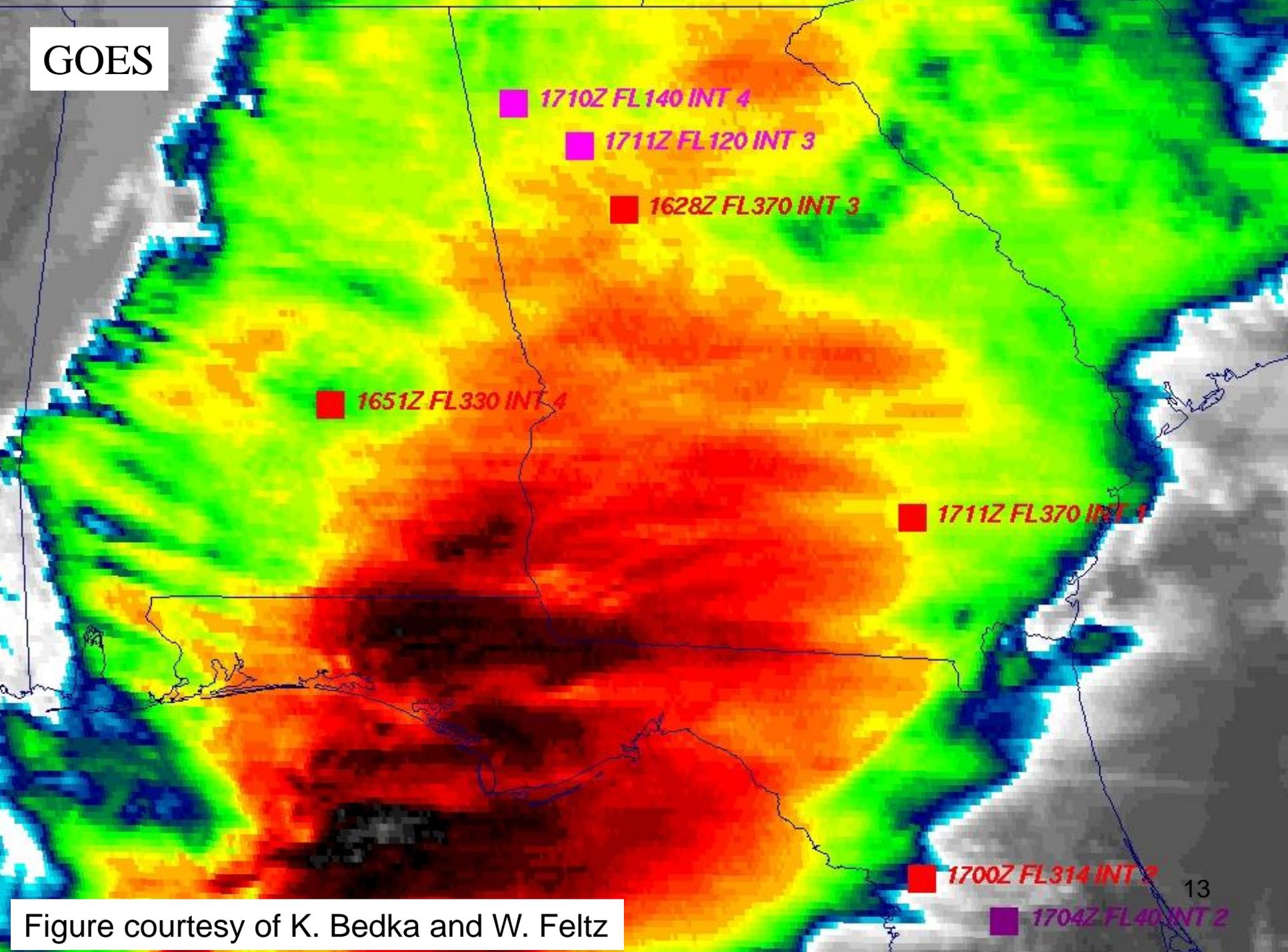


Figure courtesy of K. Bedka and W. Feltz

“ABI”

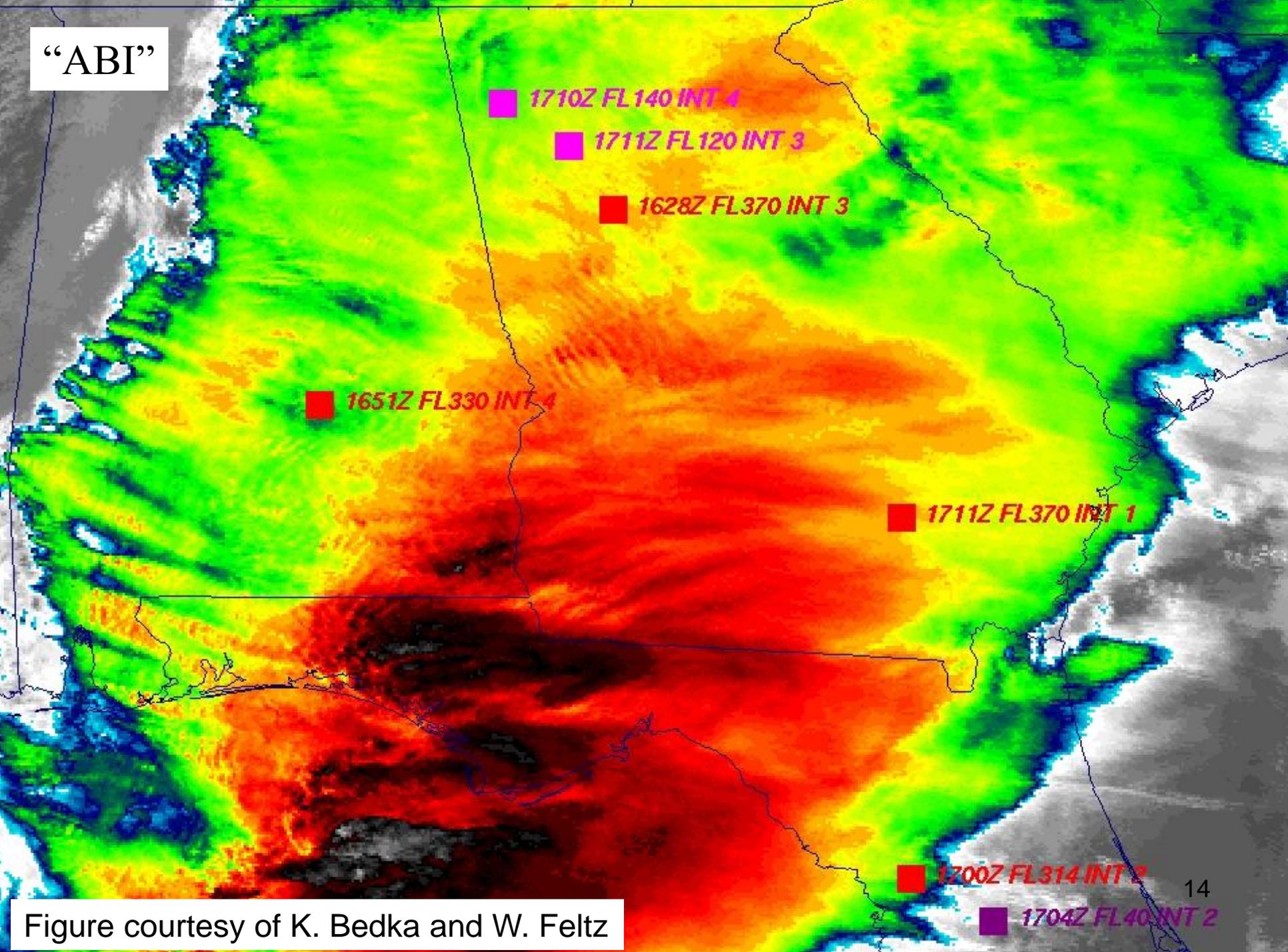


Figure courtesy of K. Bedka and W. Feltz

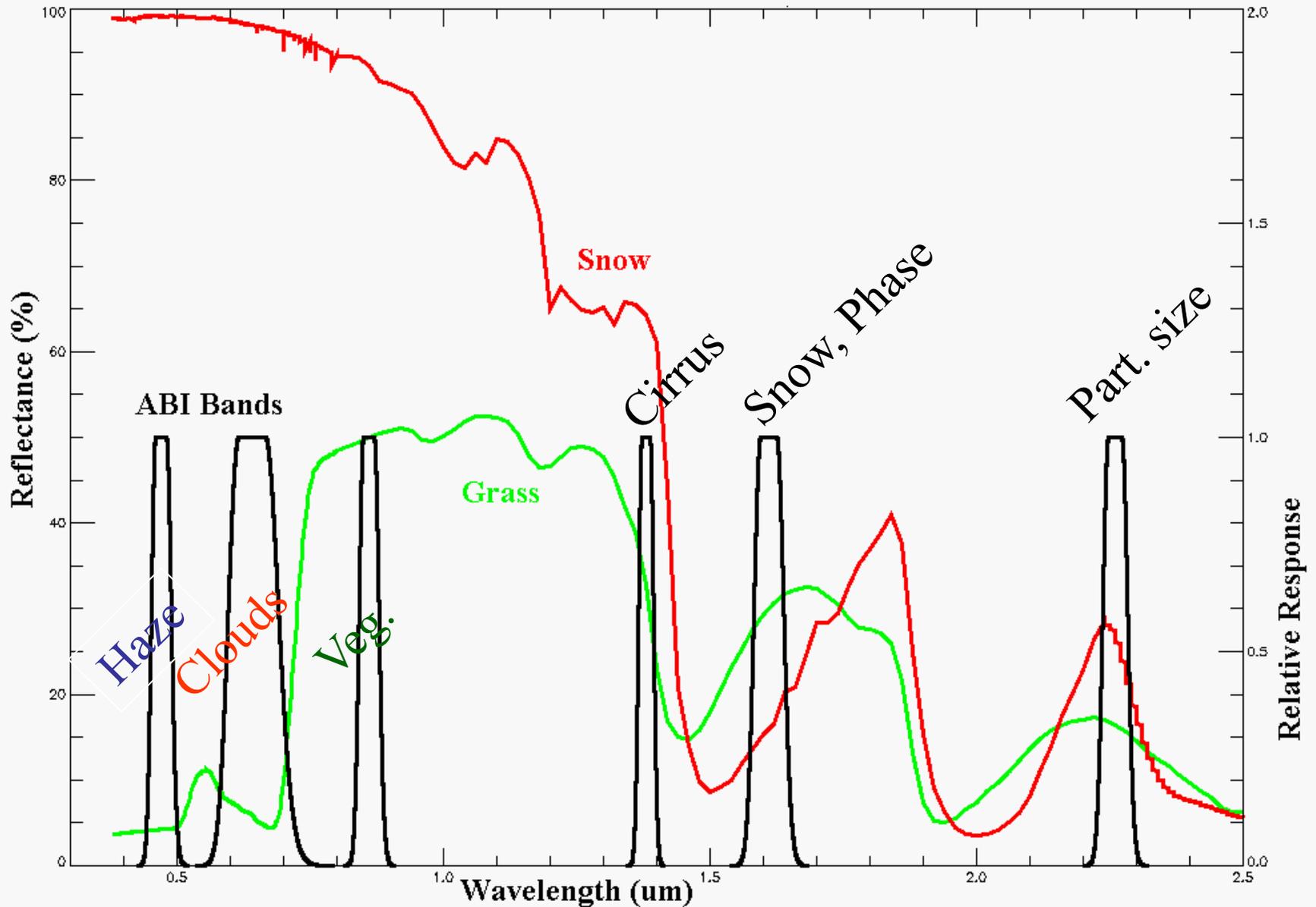
# ABI Visible/Near-IR Bands

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

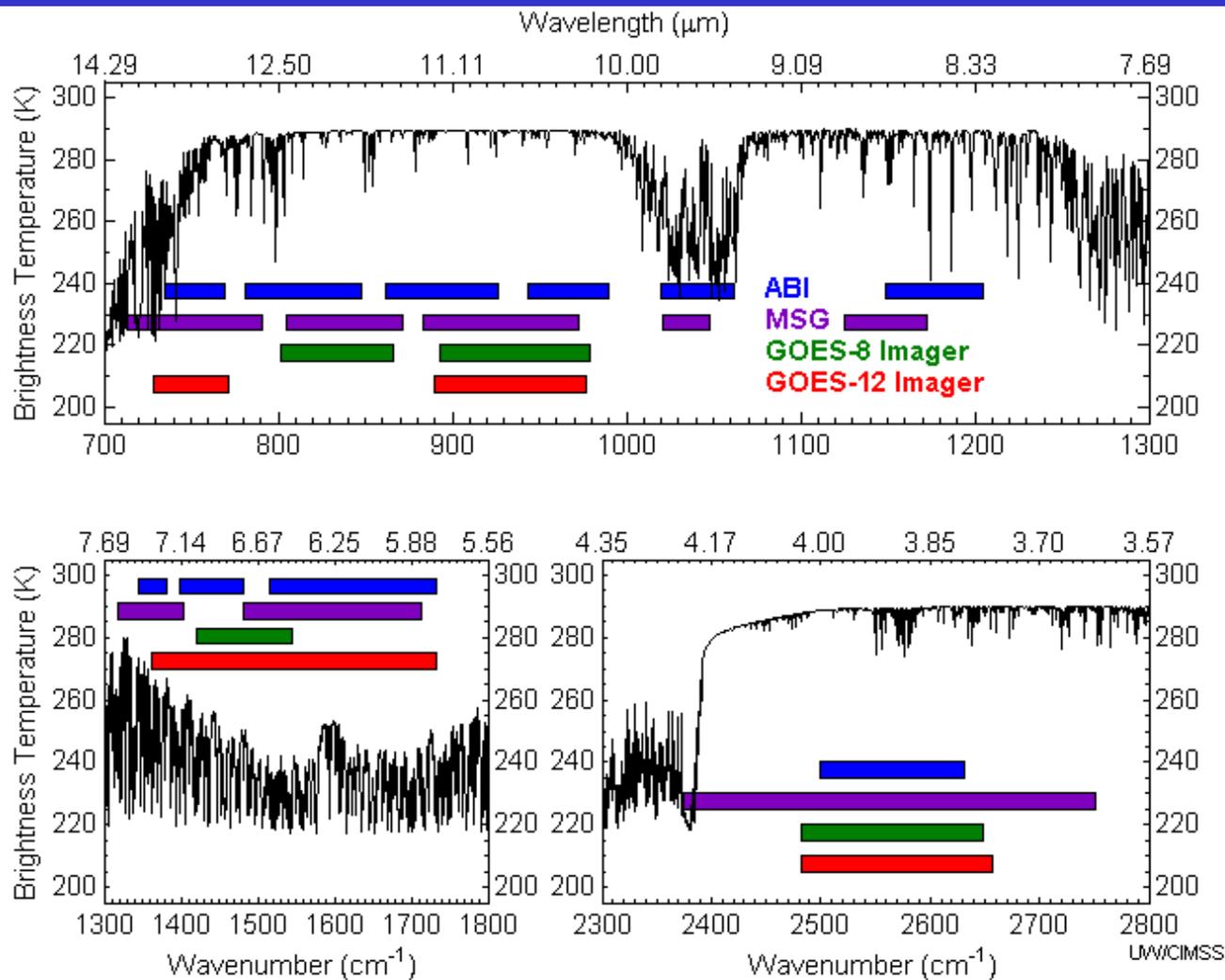
# ABI IR Bands

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

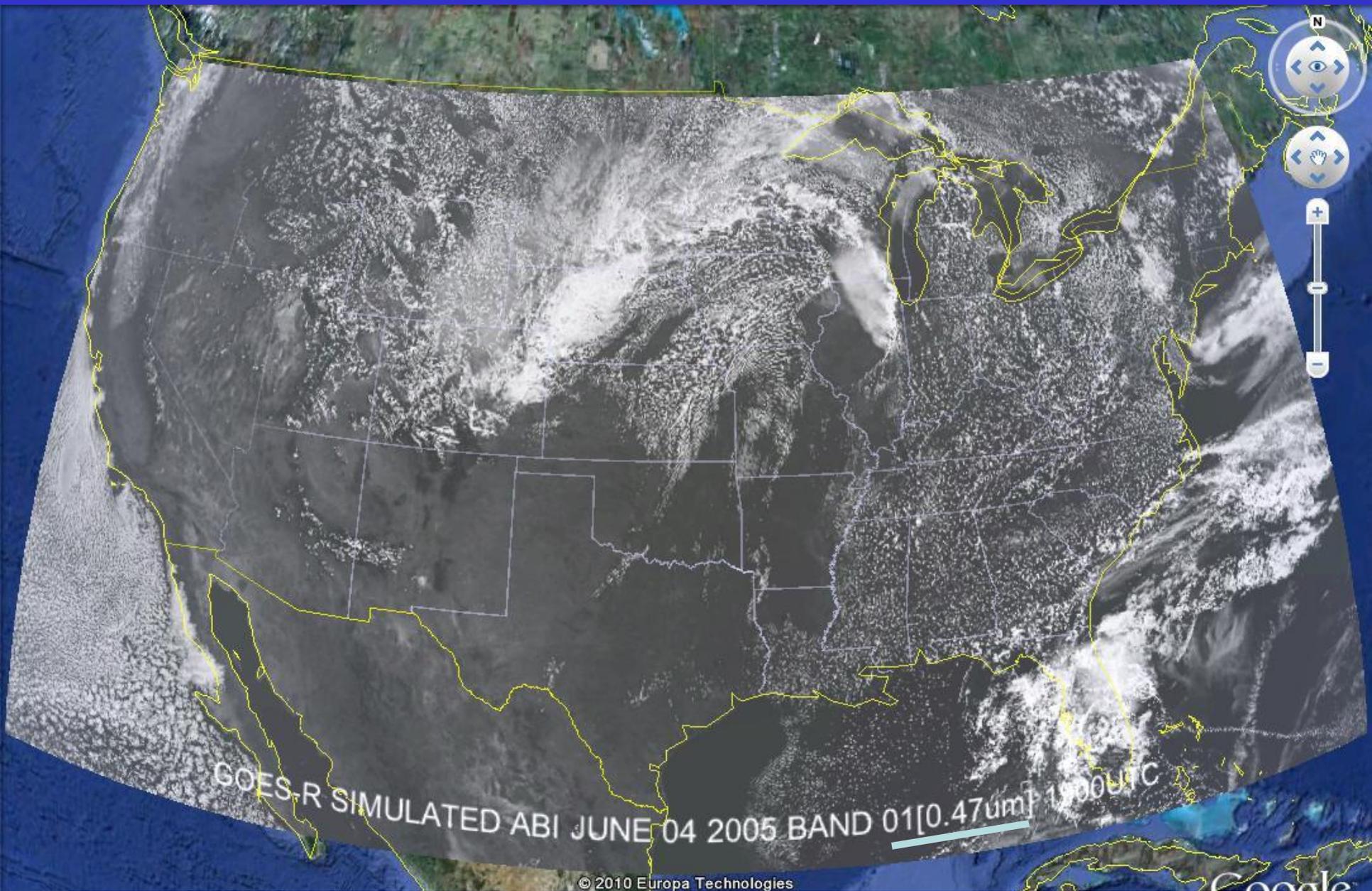


The ABI visible and near-IR bands have many uses.



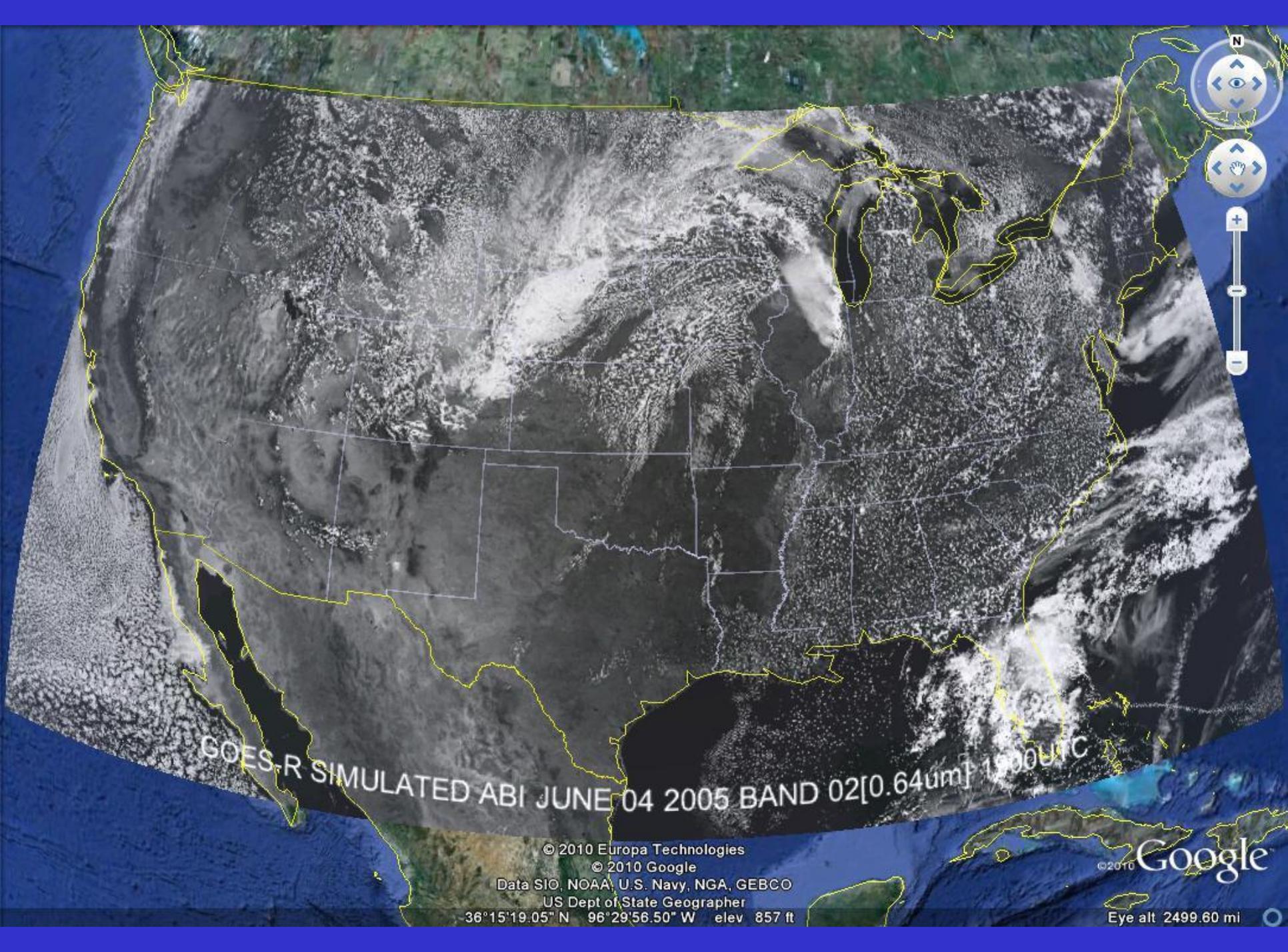
Similarities and differences for the spectral bands on Meteosat Second Generation (MSG), current GOES, and the Advanced Baseline Imager (ABI).

ABI has many more bands than the current operational GOES imagers. 18



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These NWP model simulations were performed on the 'cobalt' supercomputer at the National Center for Supercomputing Applications at the University of Illinois.

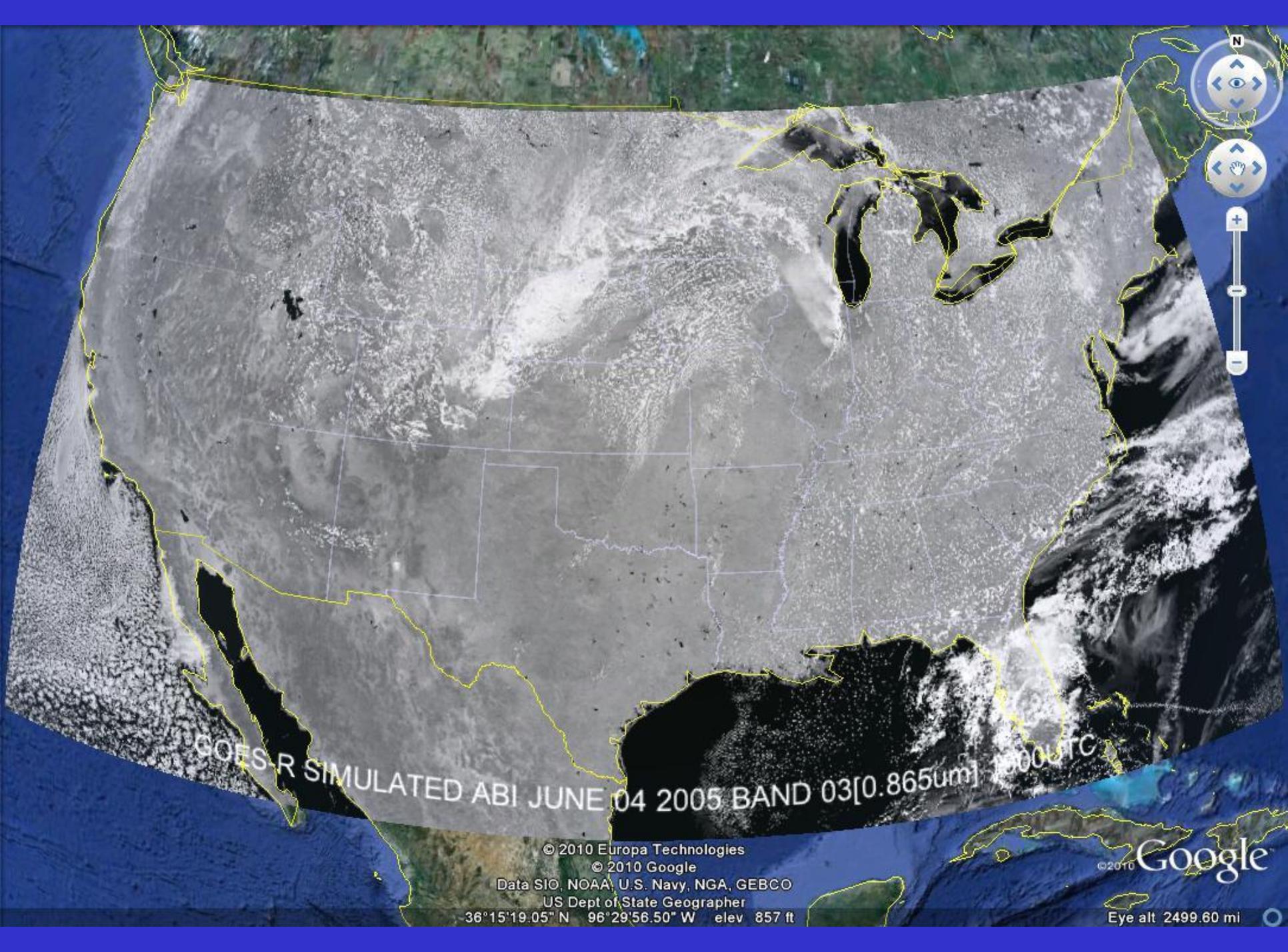


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36°15'19.05" N 96°29'56.50" W elev 857 ft

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Eye alt 2499.60 mi



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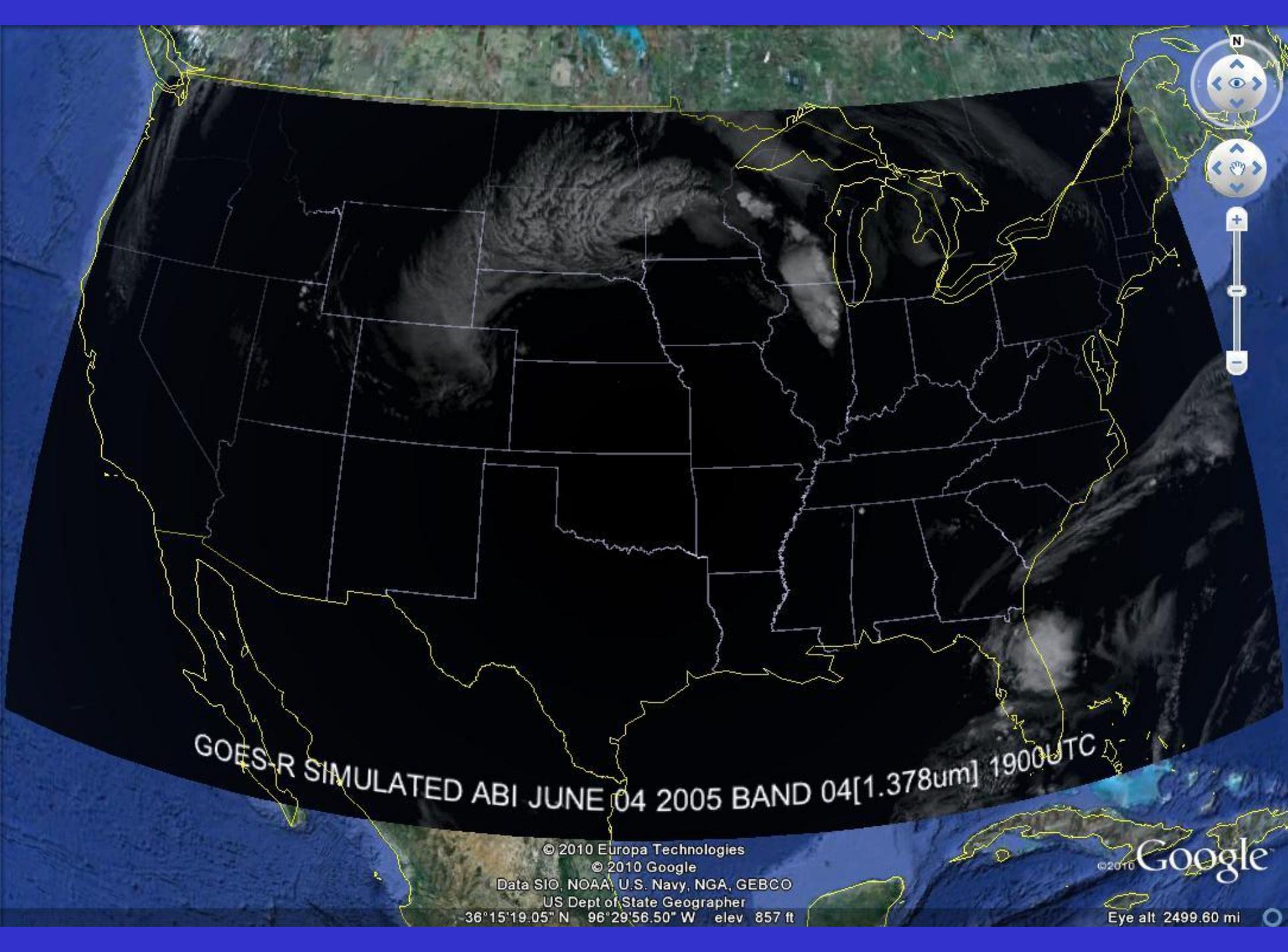
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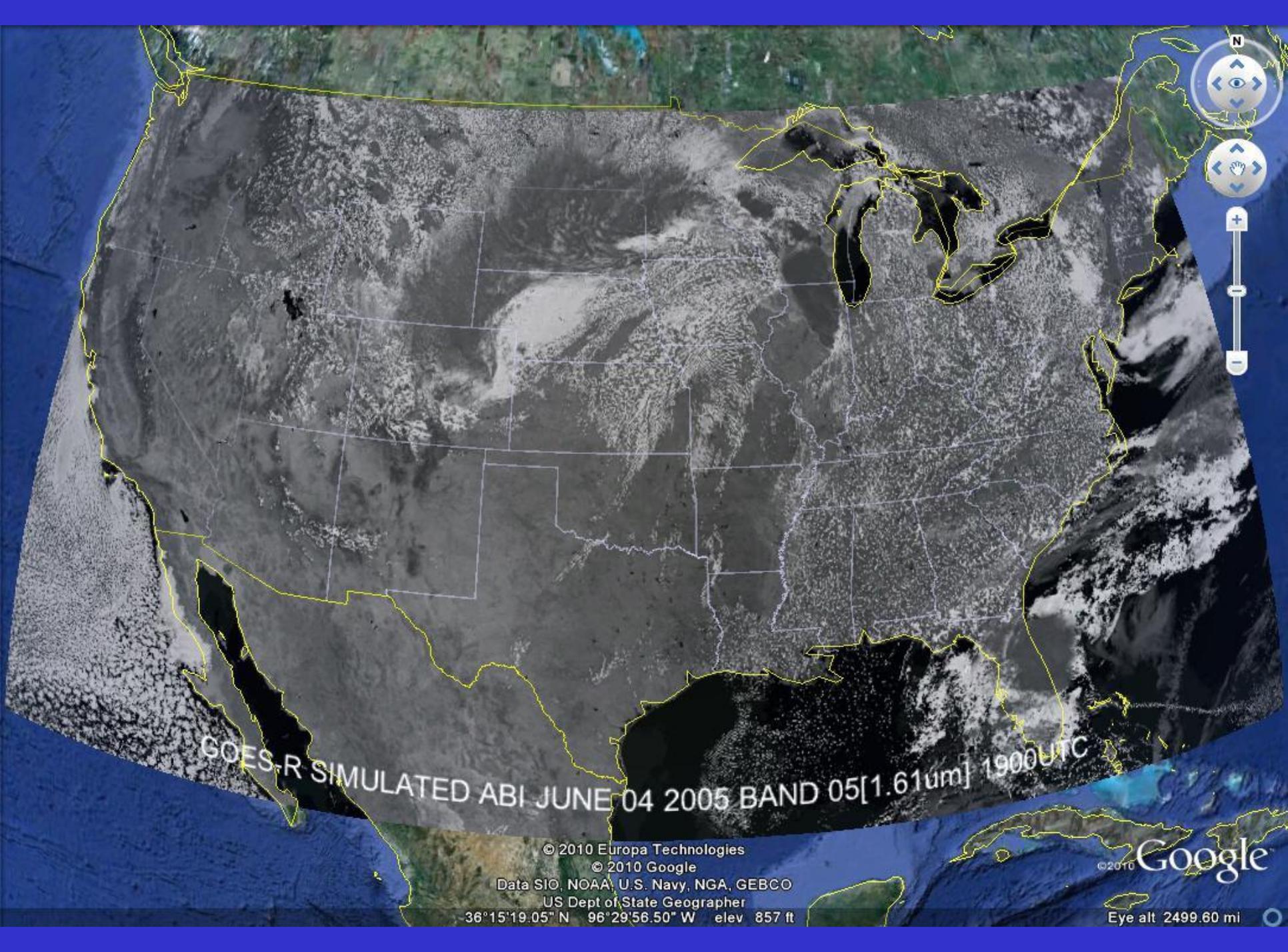


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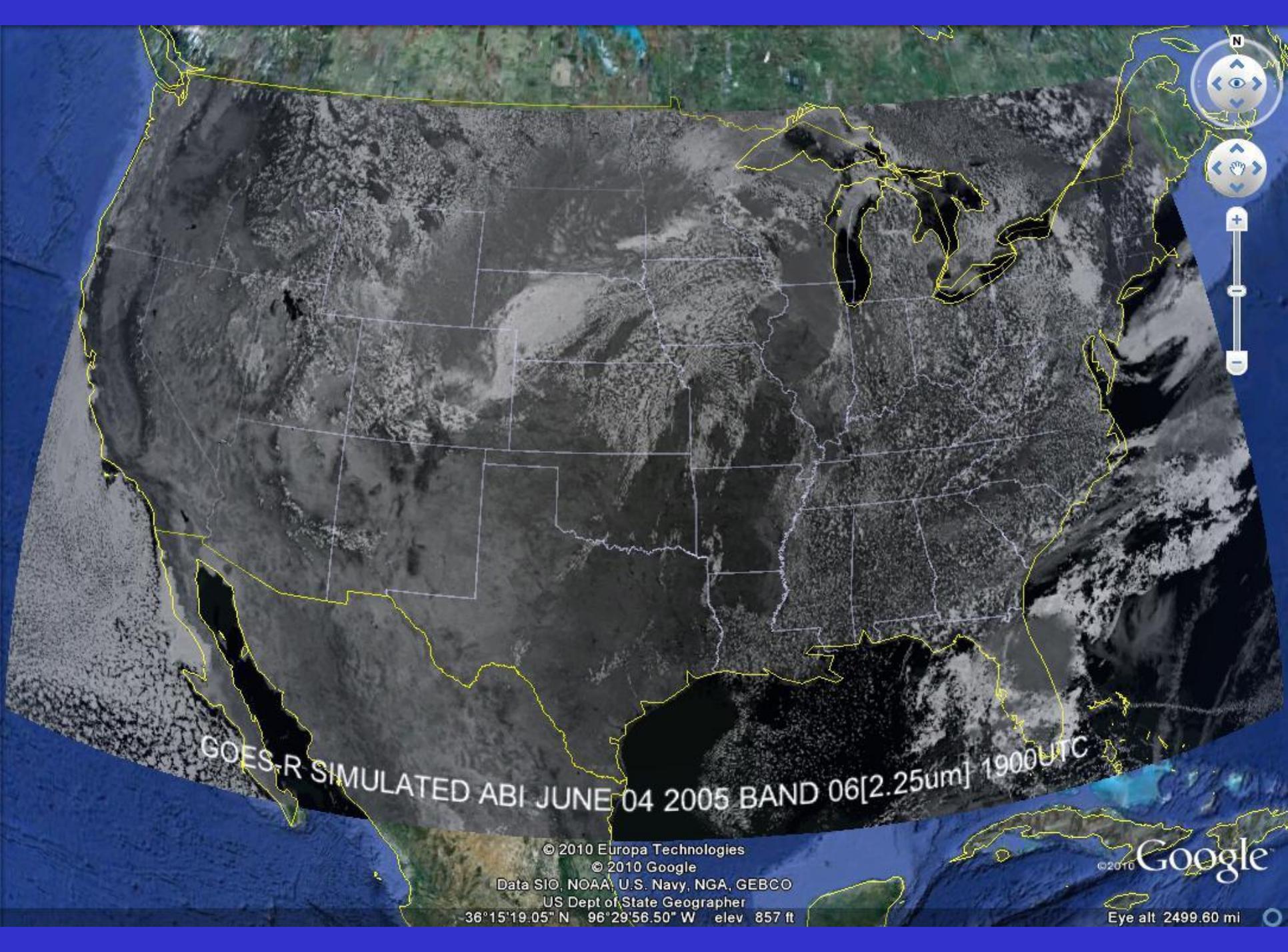


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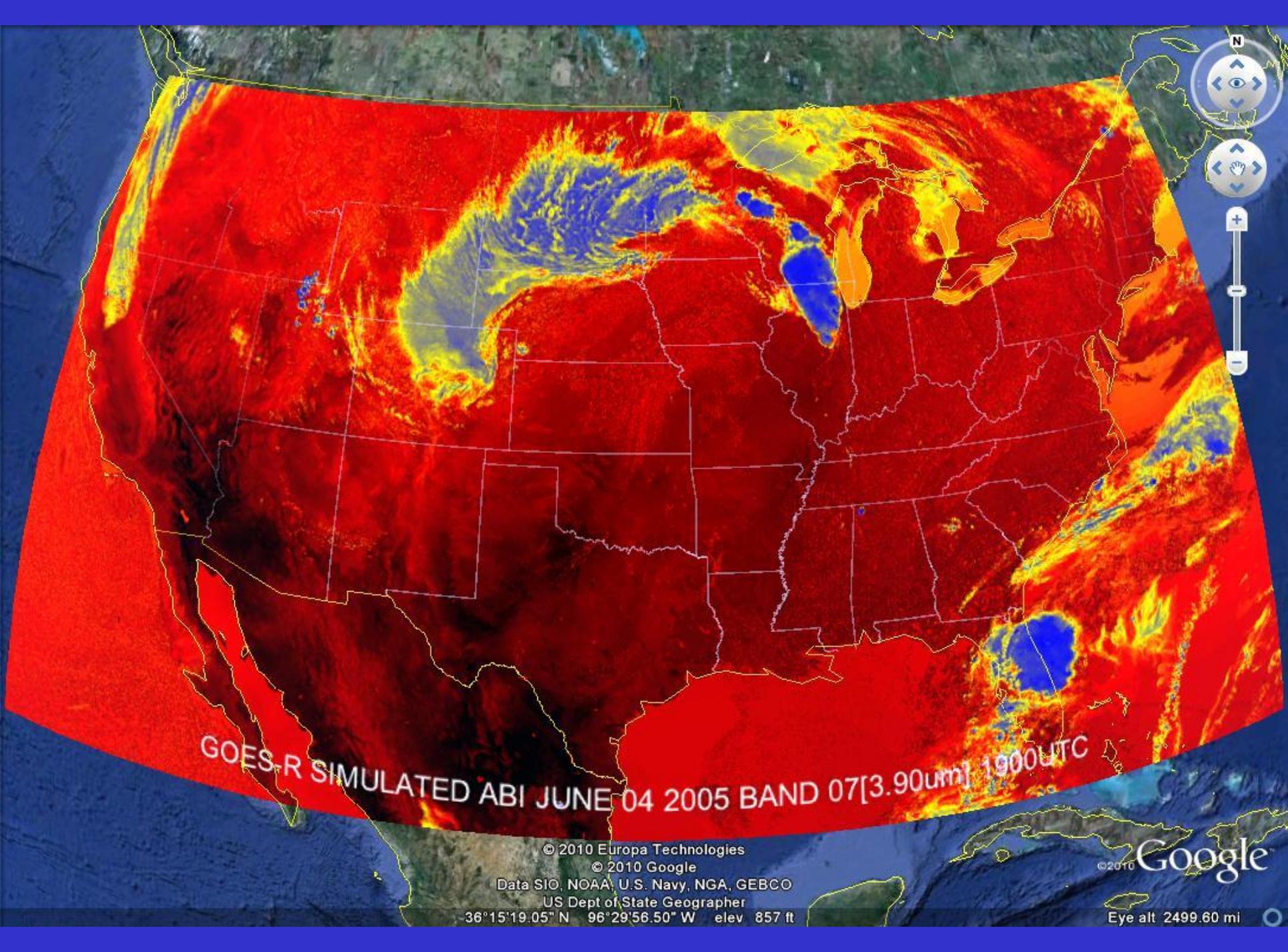


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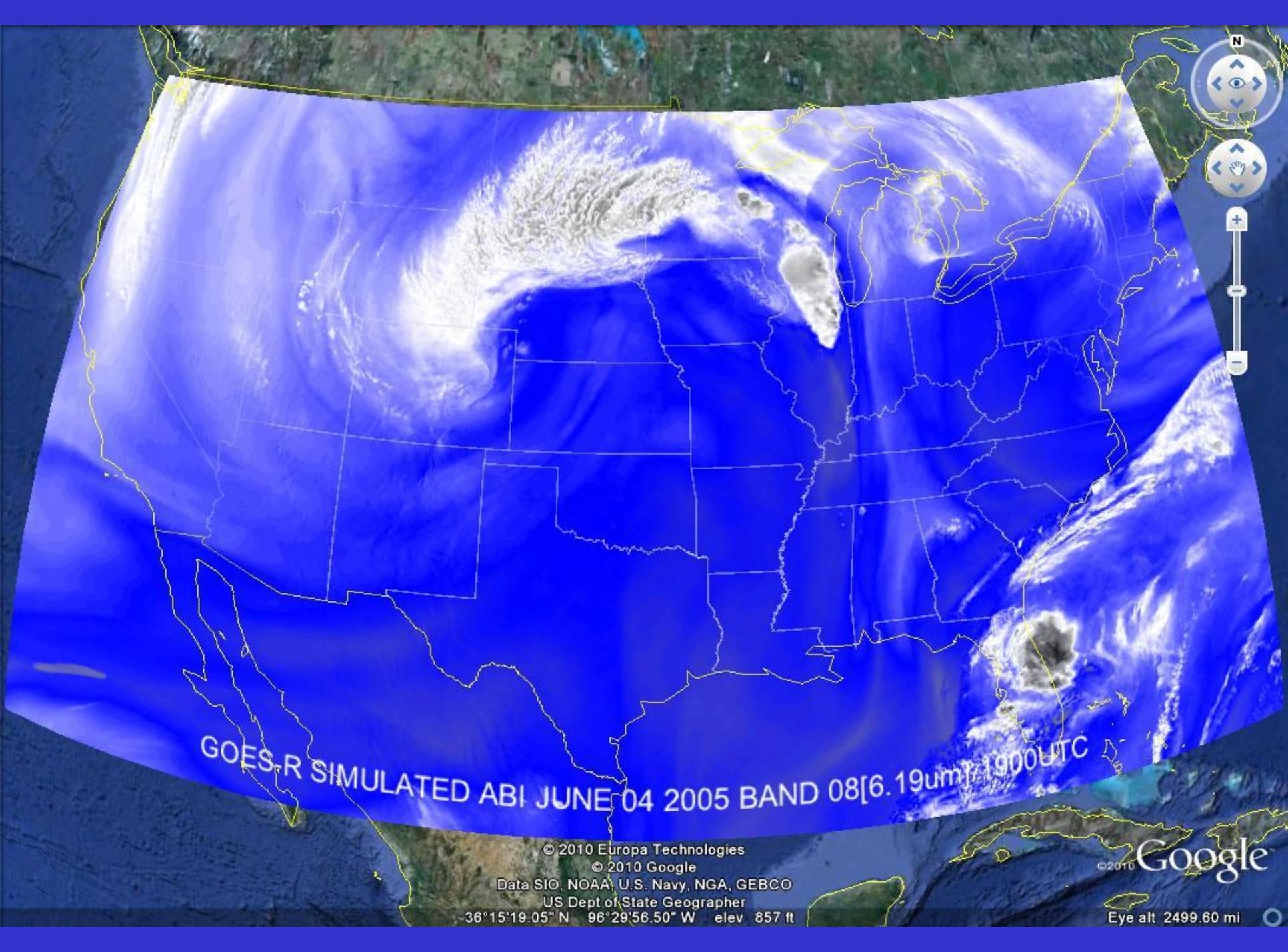


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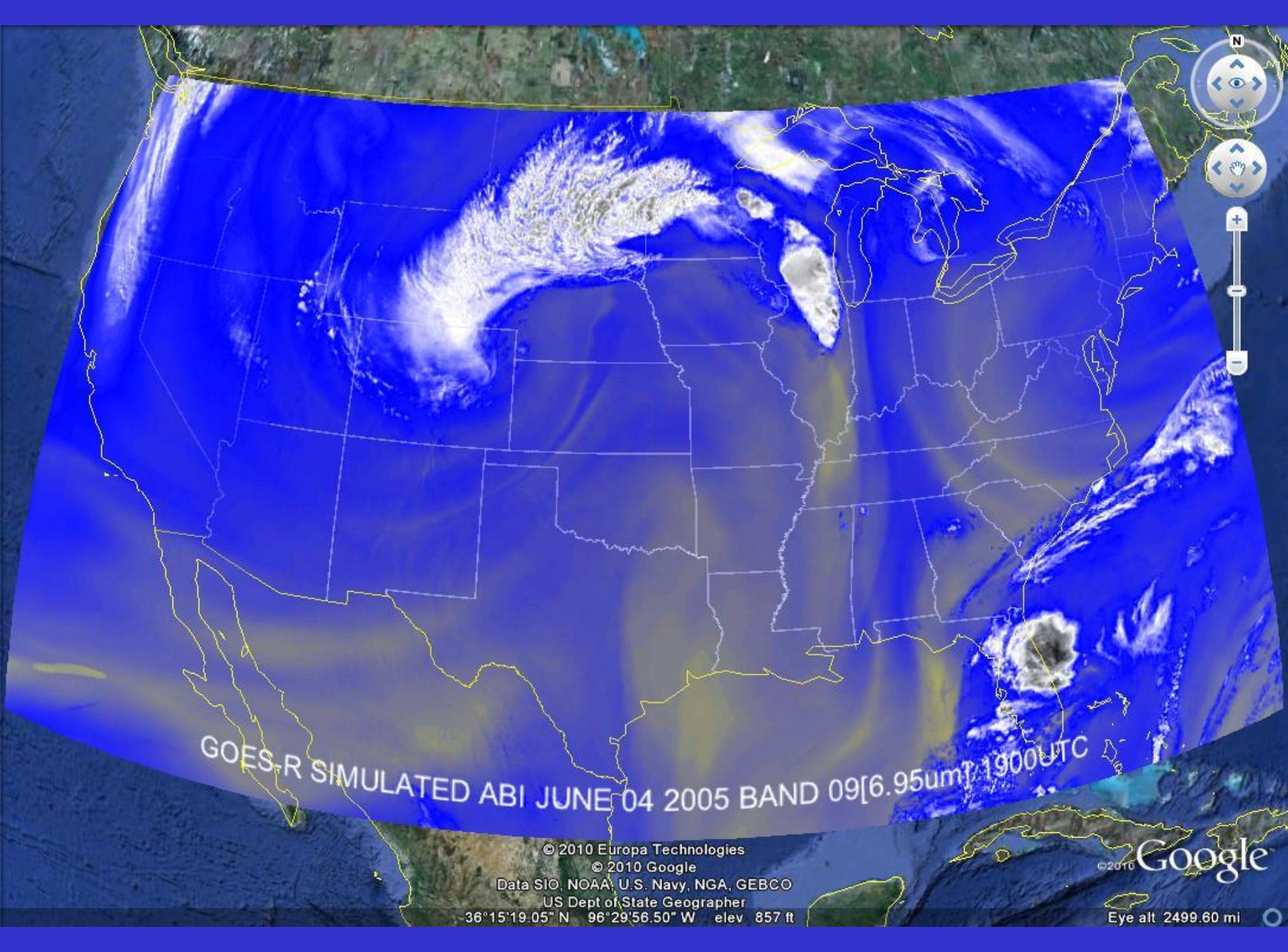
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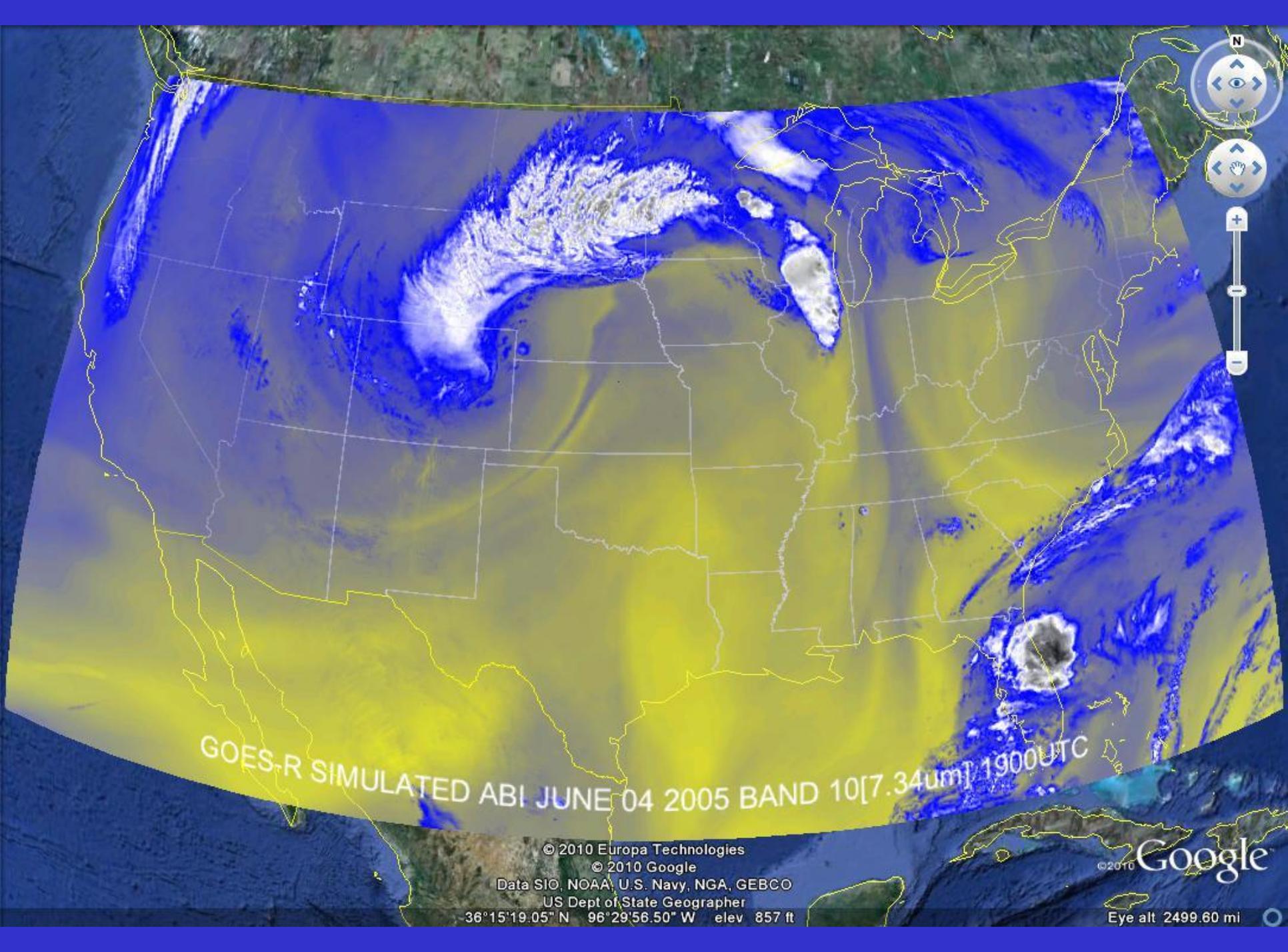


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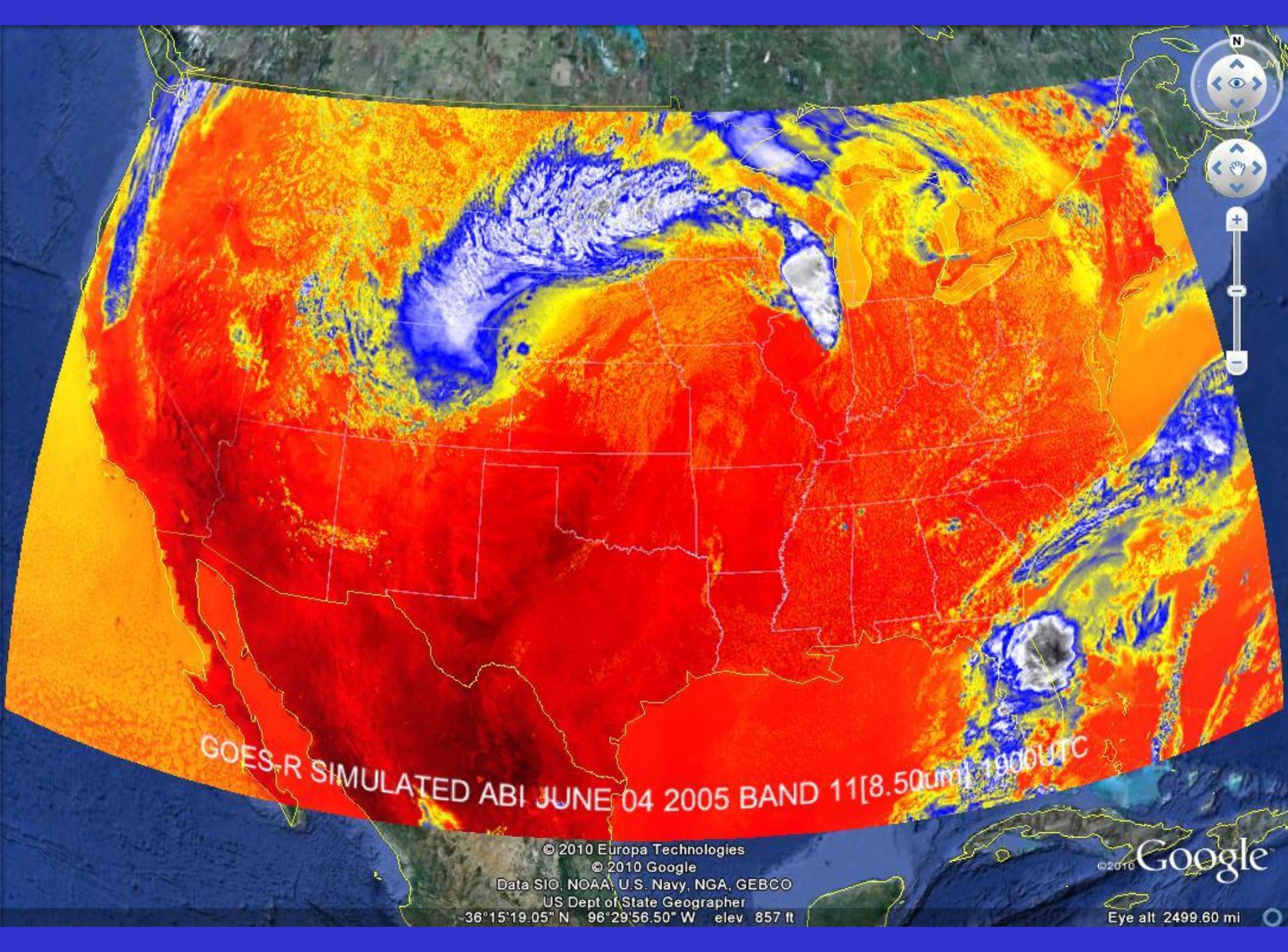
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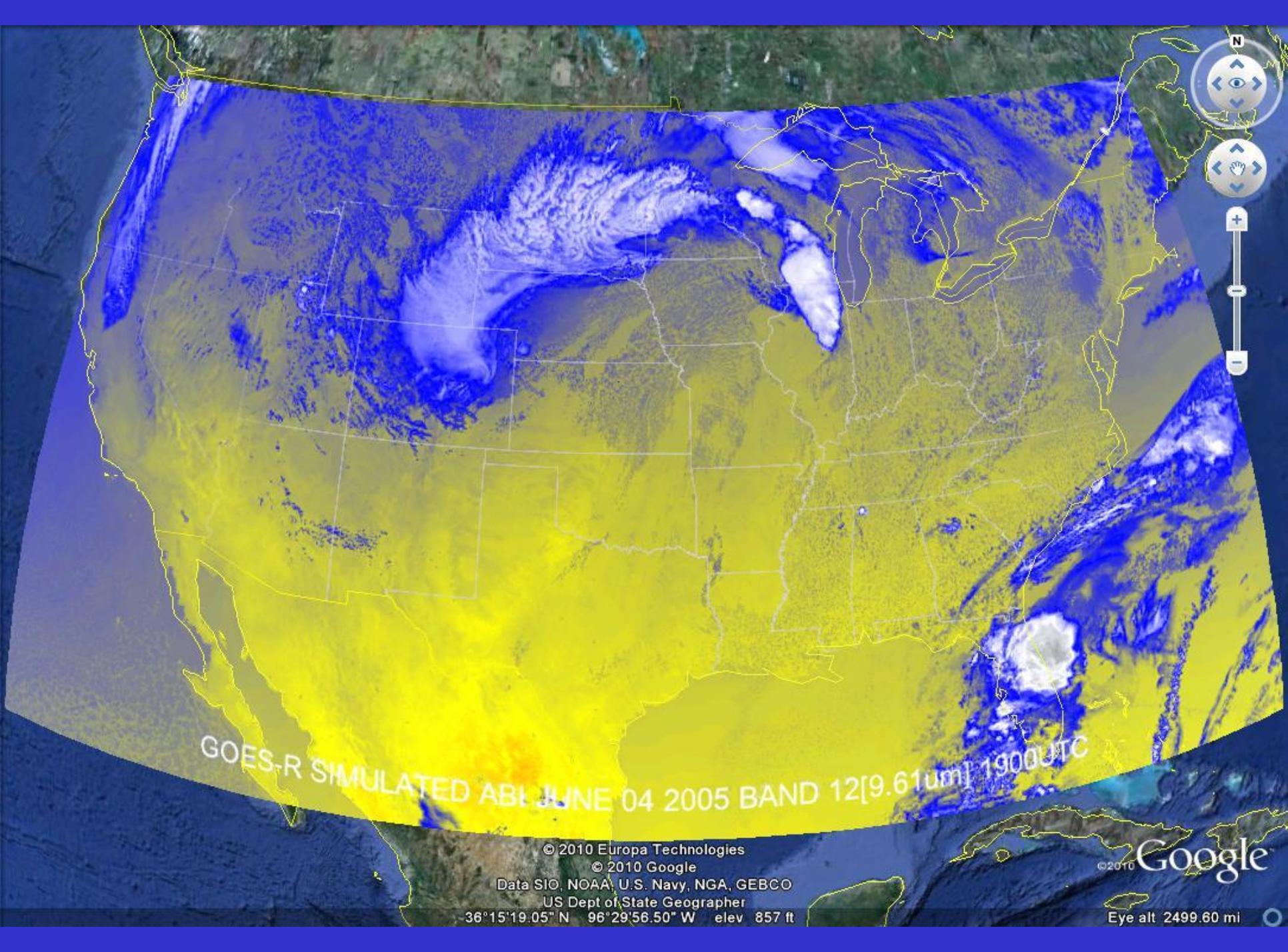
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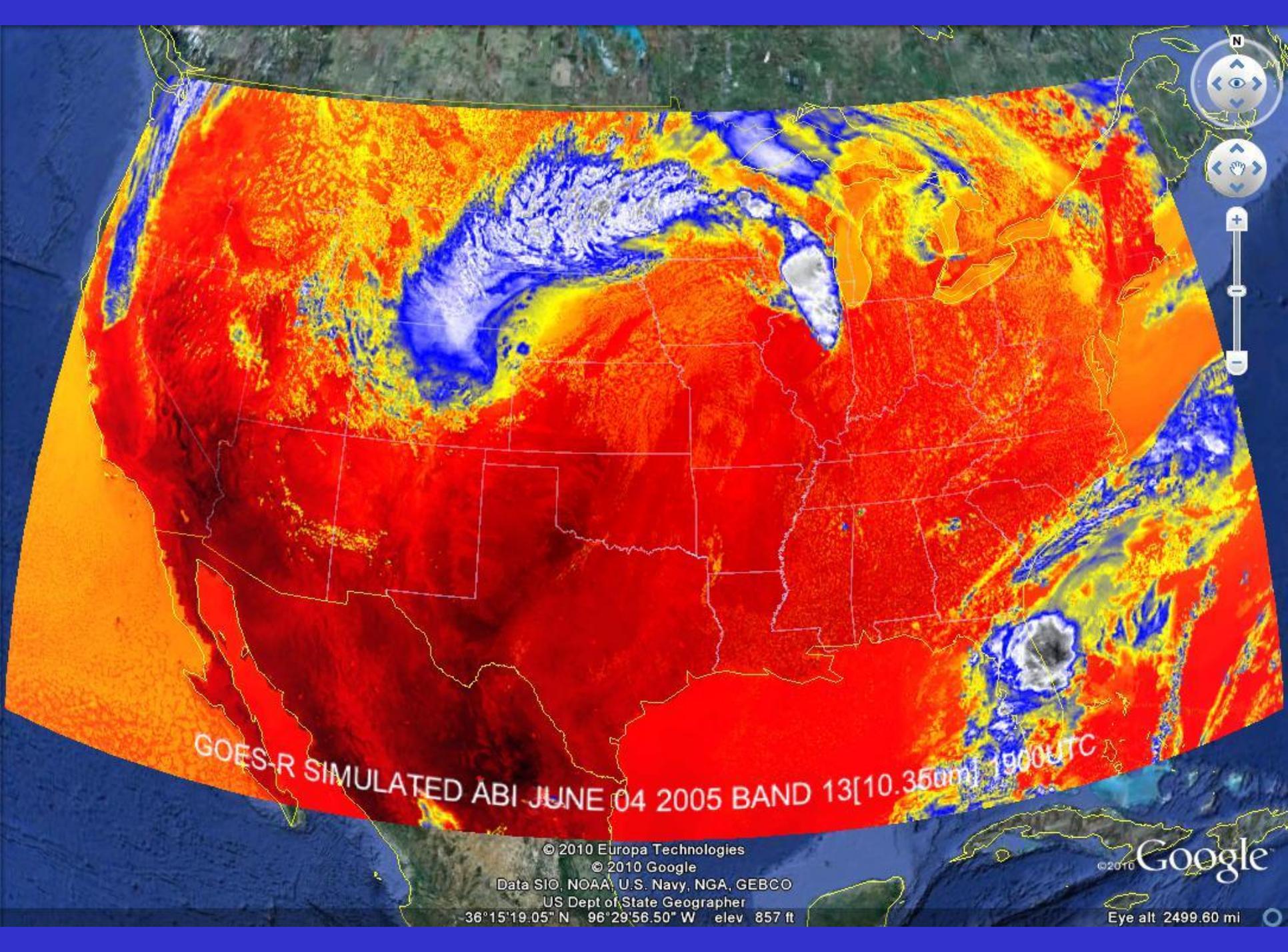


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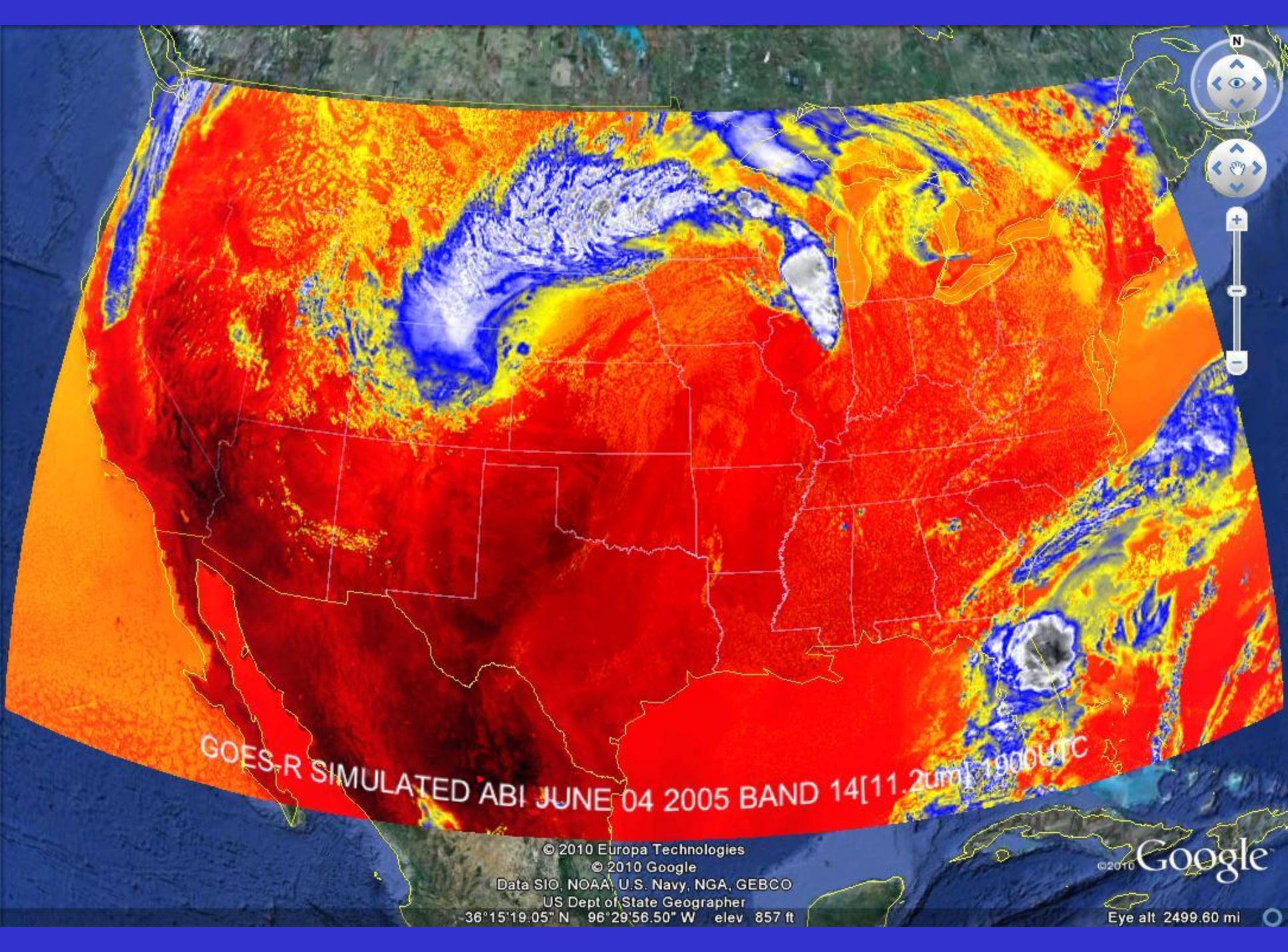
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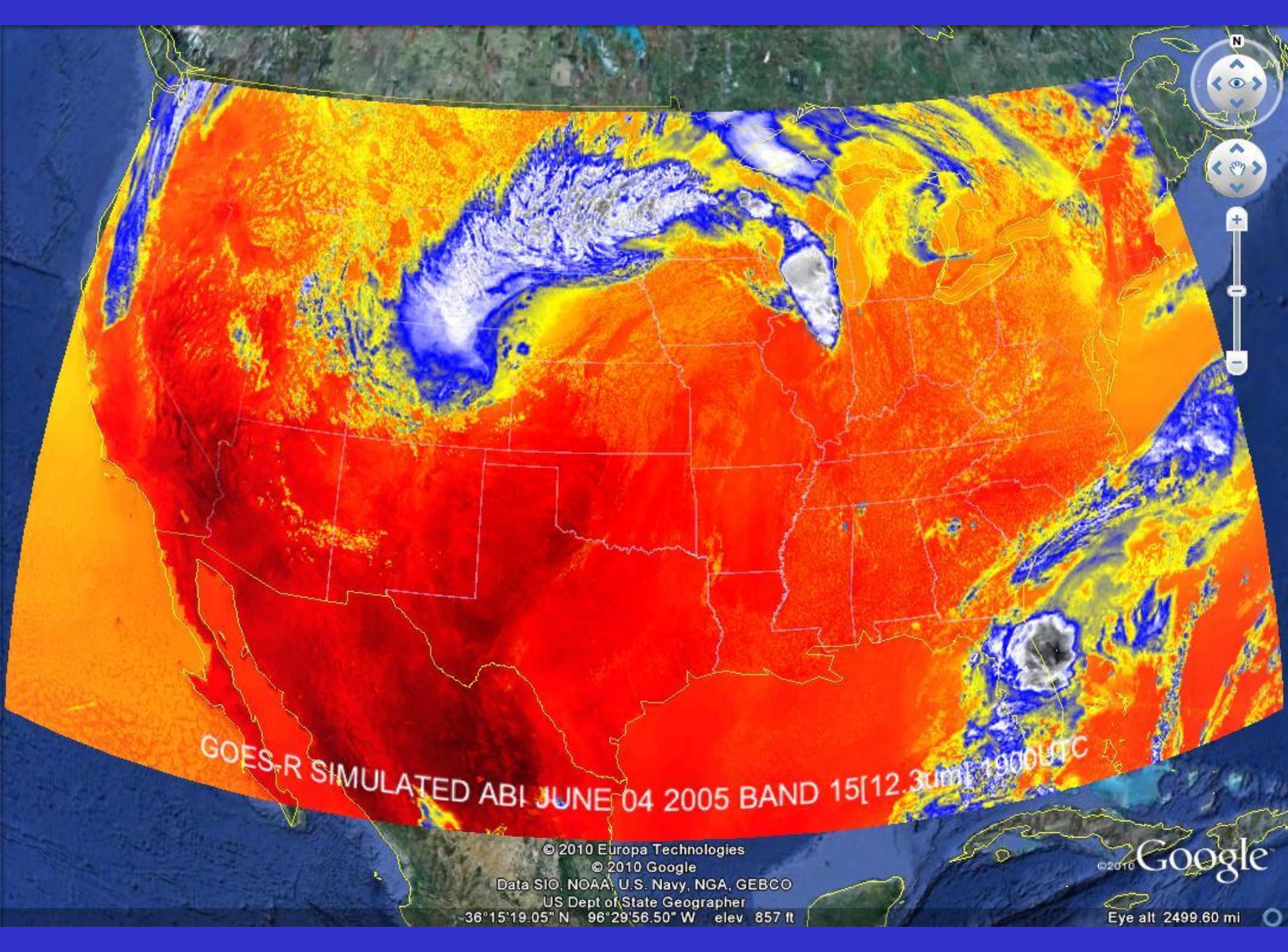
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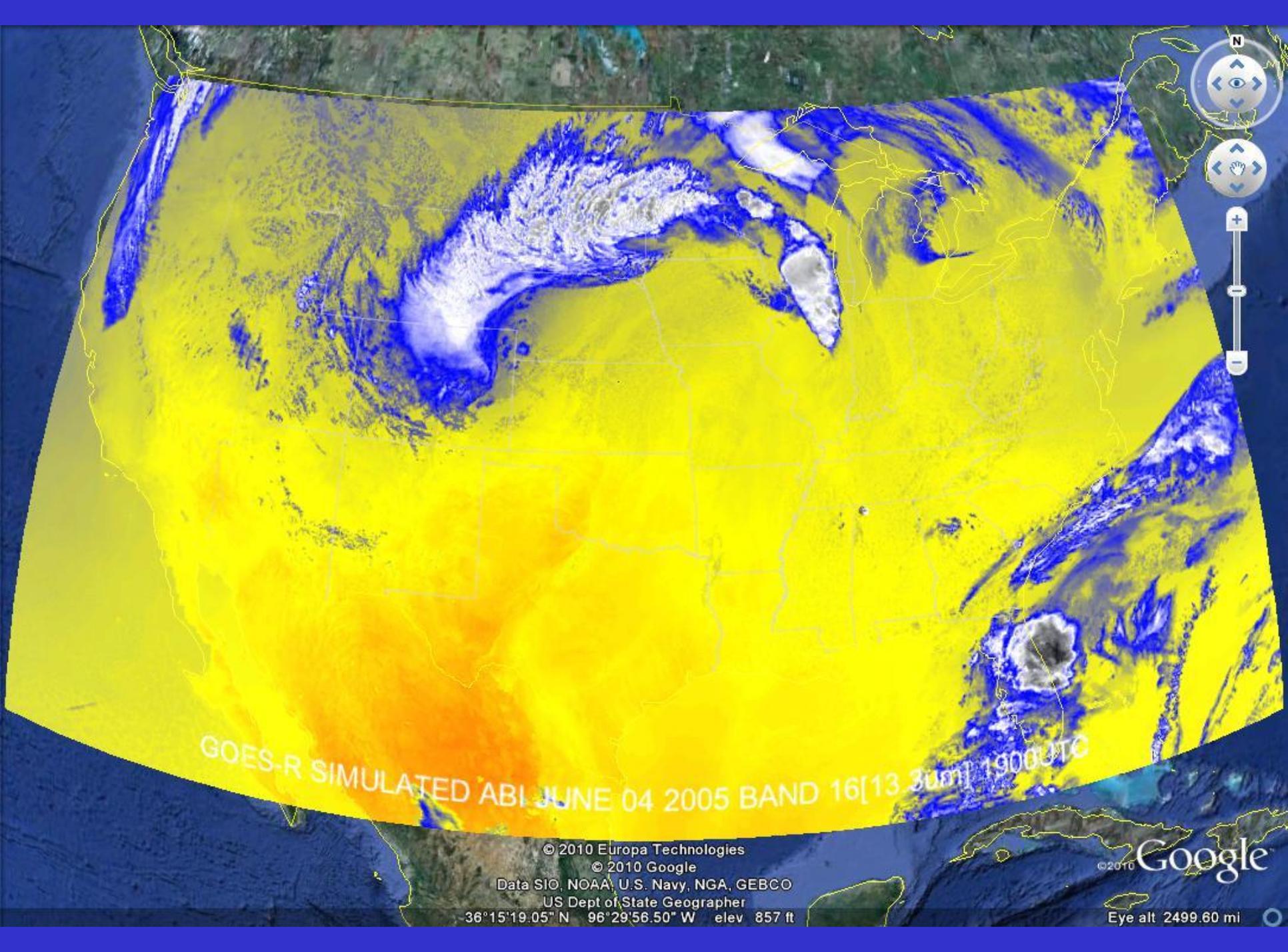


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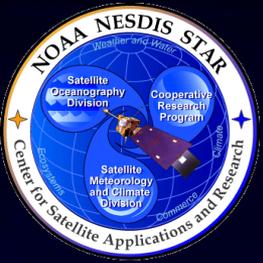


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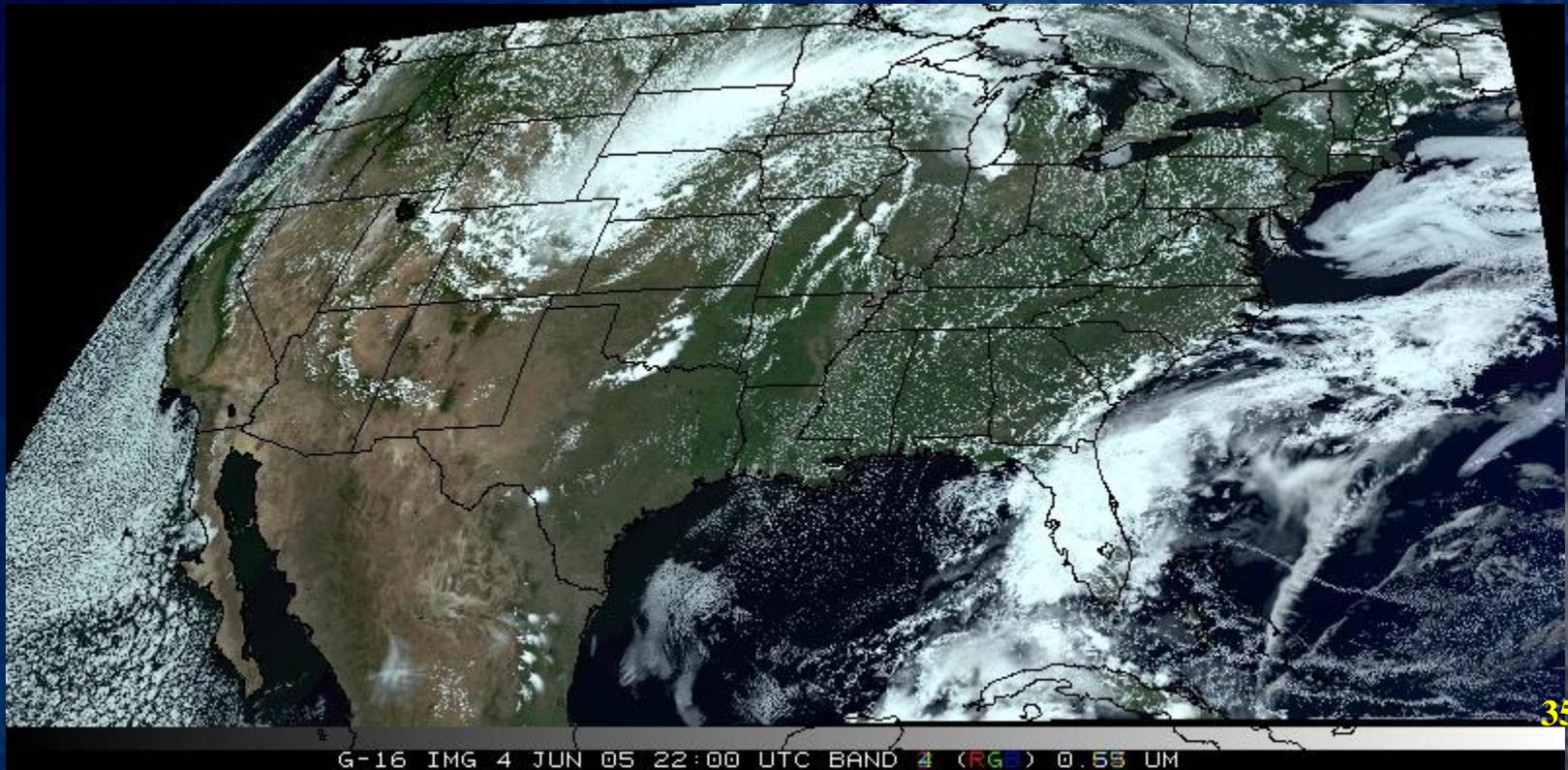
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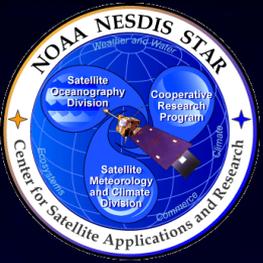
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# Visualization ("decision aid")

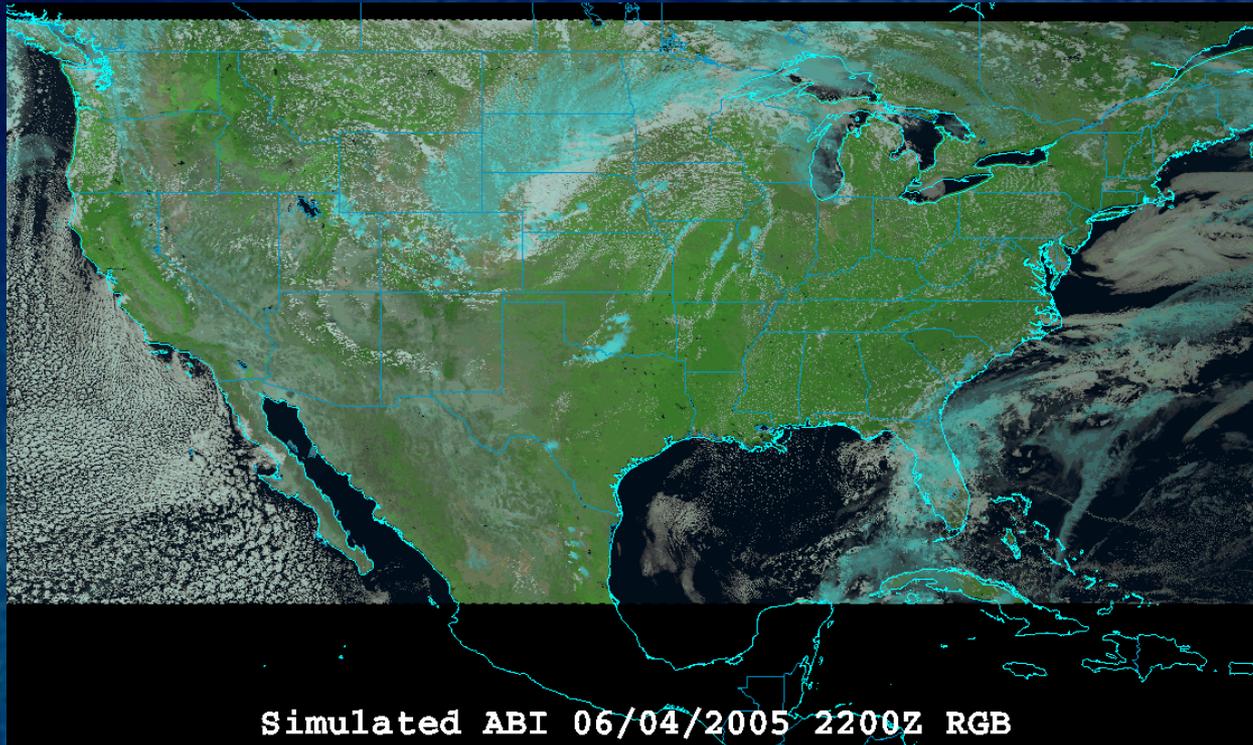
- "True Color" with "synthetic" green from ABI simulated data (from CIMSS); image from Don Hillger, RAMMB.
  - » Poster by Hillger et al (#568) -- GOES-R ABI true-color capability



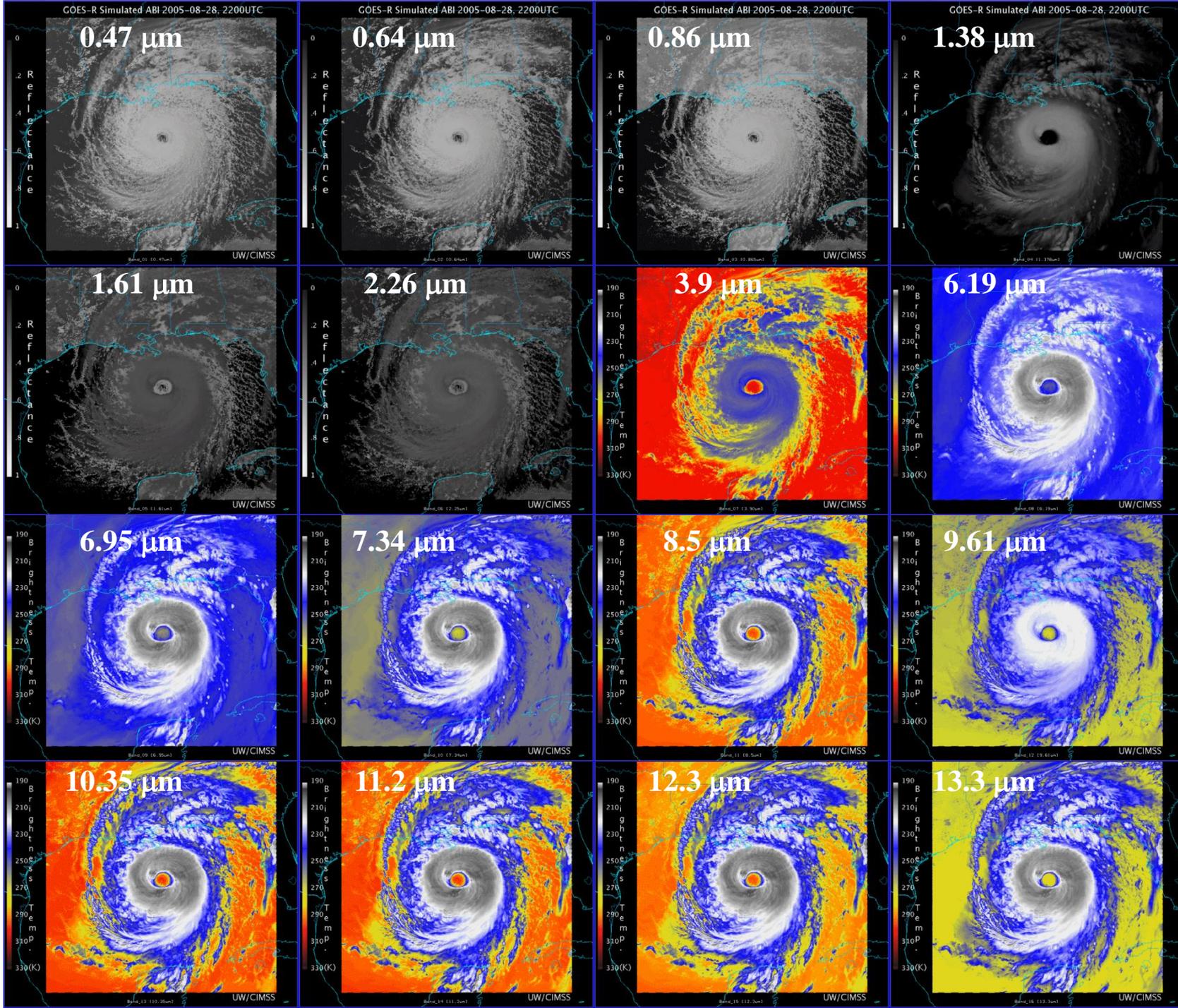


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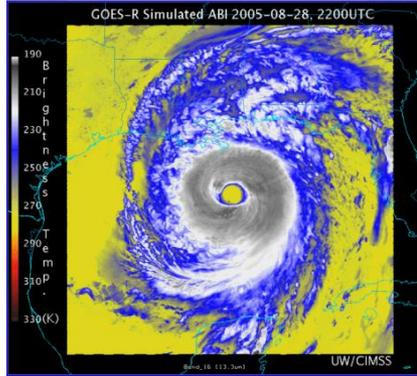
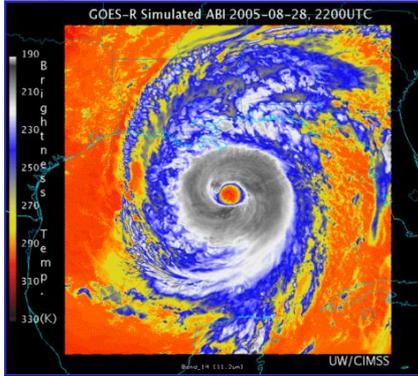
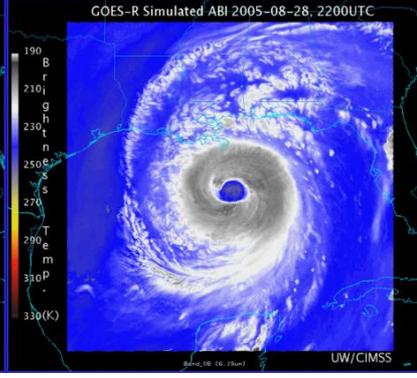
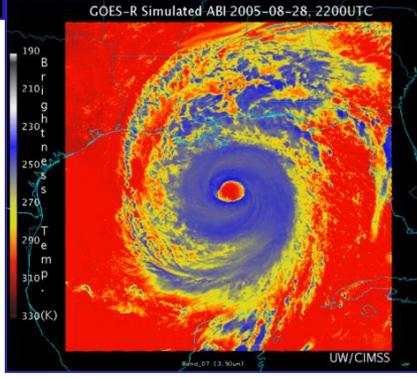
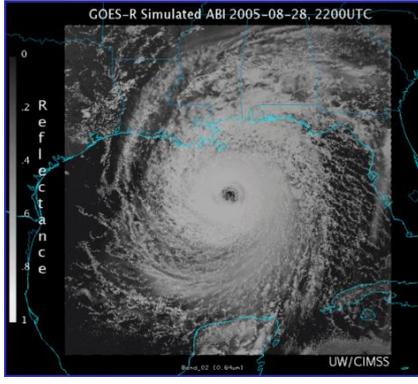
- "RGB Color" (VIS 0.6, VIS 0.8, and NearIR 1.6 um) with ABI simulated data (from CIMSS); image from William Straka, CIMSS and using the EUMETSAT enhancement.
  - » #598 -- McIDAS-V, Visualization and Data Analysis for GOES-R



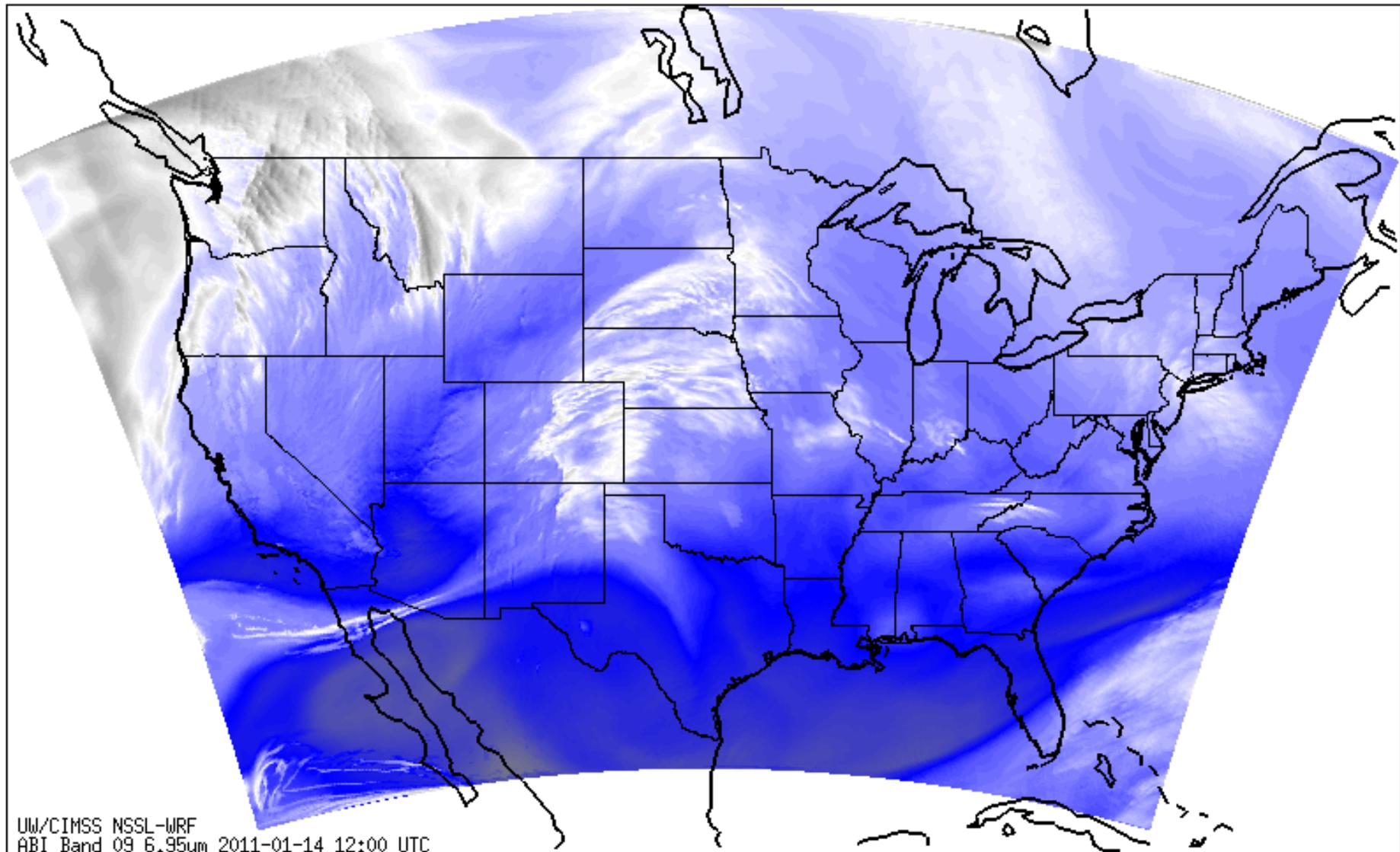
# AWG Proxy ABI Simulations of Hurricane Katrina



# Corresponding current Imager bands of Hurricane Katrina



# Simulated ABI band

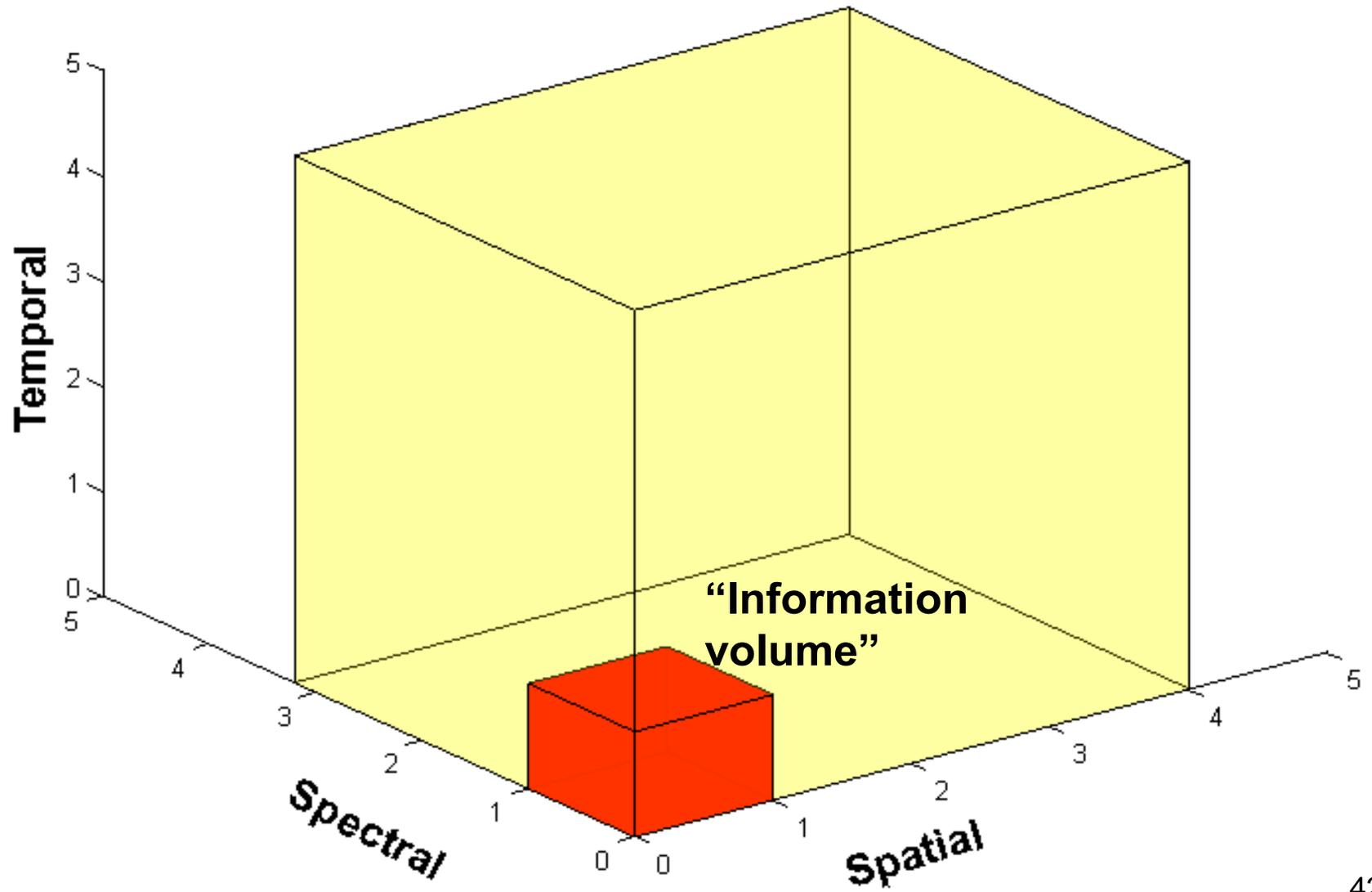


# Overview

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- ABI (Advanced Baseline Imager)
  - Temporal
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  - Imagery
- **Summary**
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# Improved attributes with the Future GOES Imagers



# GOES-R “Earth-viewing” Product Summary

Advanced Baseline Imager (ABI)

- Clouds and Moisture Imagery (KPP)
- Clear Sky Mask
- Cloud Top Pressure and Height
- Cloud Top Phase
- Cloud Top Temperature
- Cloud Particle Size Distribution
- Cloud Optical Path
- Temperature and Moisture Profiles
- Total Precipitable Water
- Stability Parameters (Lifted Index)
- Aerosol Detection
- Aerosols Optical Depth
- Derived Motion Winds
- Hurricane Intensity
- Fire/Hot Spot Characterization
- Land and Sea Surface Temperature
- Volcanic Ash
- Rainfall Rate
- Snow Cover
- Downward Solar Insolation: Surface
- Reflected Solar Insolation: TOA

GLM

- Lightning Detection

- Cloud Layer/Heights
- Cloud Ice Water Path
- Cloud Liquid Water
- Cloud Type
- Convective Initiation
- Turbulence
- Low Cloud and Fog
- Enhanced “V”/Overshooting Top
- Aircraft Icing Threat
- SO<sub>2</sub> Detections (Volcanoes)
- Visibility
- Upward Longwave Radiation (TOA)
- Downward Longwave Radiation (SFC)
- Upward Longwave Radiation (SFC)
- Total Ozone
- Aerosol Particle Size
- Surface Emissivity
- Surface Albedo
- Vegetation Index
- Vegetation Fraction
- Flood Standing Water
- Rainfall probability and potential
- Snow Depth
- Ice Cover
- Sea & Lake Ice Concentration, Age, Extent, Motion
- Ocean Currents, Currents: Offshore



# Google Earth

- Sample ABI simulated data are available in google earth format:
  - <http://cimss.ssec.wisc.edu/goes/abi/loops/links.html>
  - Poster #582 -- Preparation for use of GOES-R Advanced Baseline Imager (ABI)



# Summary

- The ABI on GOES-R will improve over the current instrument in many aspects (spectral, spatial, and temporal on orders of 3, 4 and 5, respectively), plus improved image navigation and registration and radiometer performance.
- These improvements will greatly assist a host of applications and new products.
- 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.

