Operational Uses of Bands on the GOES-R Advanced Baseline Imager (ABI)

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Topics:

- Introduction to GOES-R & ABI
- ABI individual bands
- Use of band differences
- ABI derived products
- Conclusions

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Introduction to GOES-R ABI

- **GOES-R**
  - Geostationary, at 137W West, Operational by 2017
- **ABI**
  - 16 channel imaging radiometer that covers the visible, near-Infra-red (IR) and IR Spectral regions.
- **Spatial Resolution**
  - IR = 2km
  - Near-IR = 1km
  - 0.64um =0.5 km
- **Temporal Resolution (flex scan mode, [1hr])**
  - CONUS = 12
  - Full disk = 4
  - Mesoscale (1000km x1000km) =120
- **Spectral Resolution**
  - ABI= 16 bands

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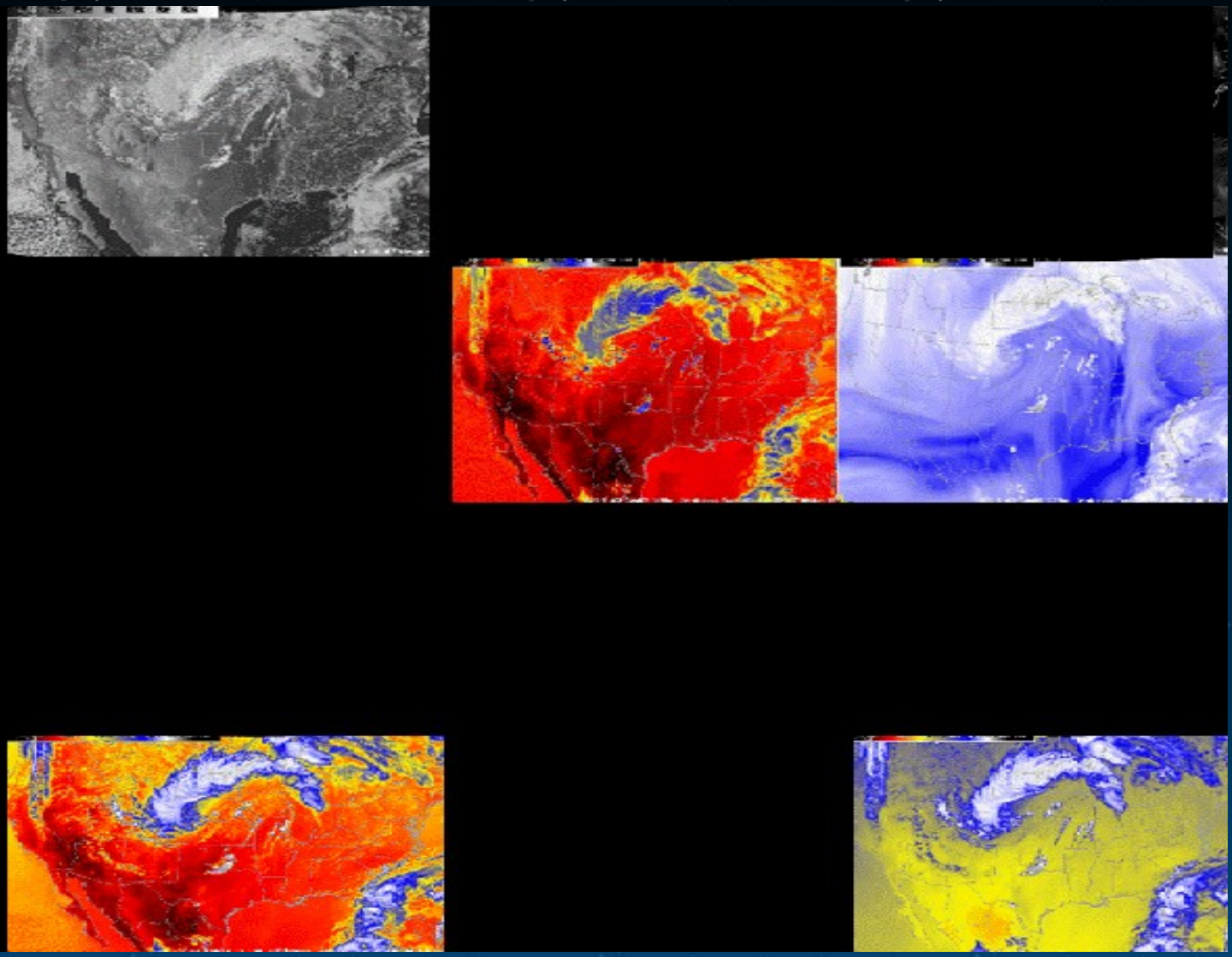
Spectral Resolution
Current GOES vs GOES-R



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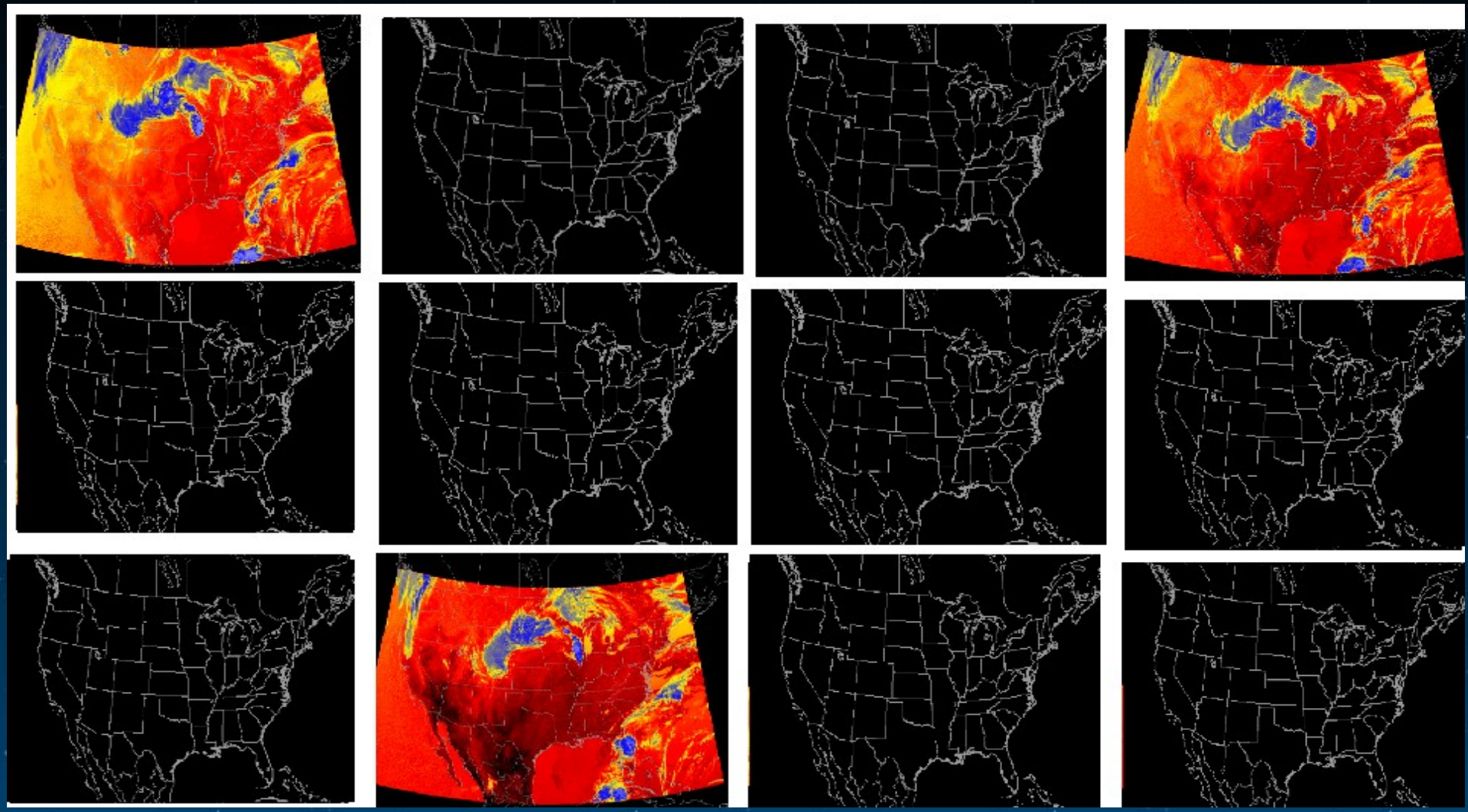
Temporal Resolution
Current GOES vs GOES-R (1hr)



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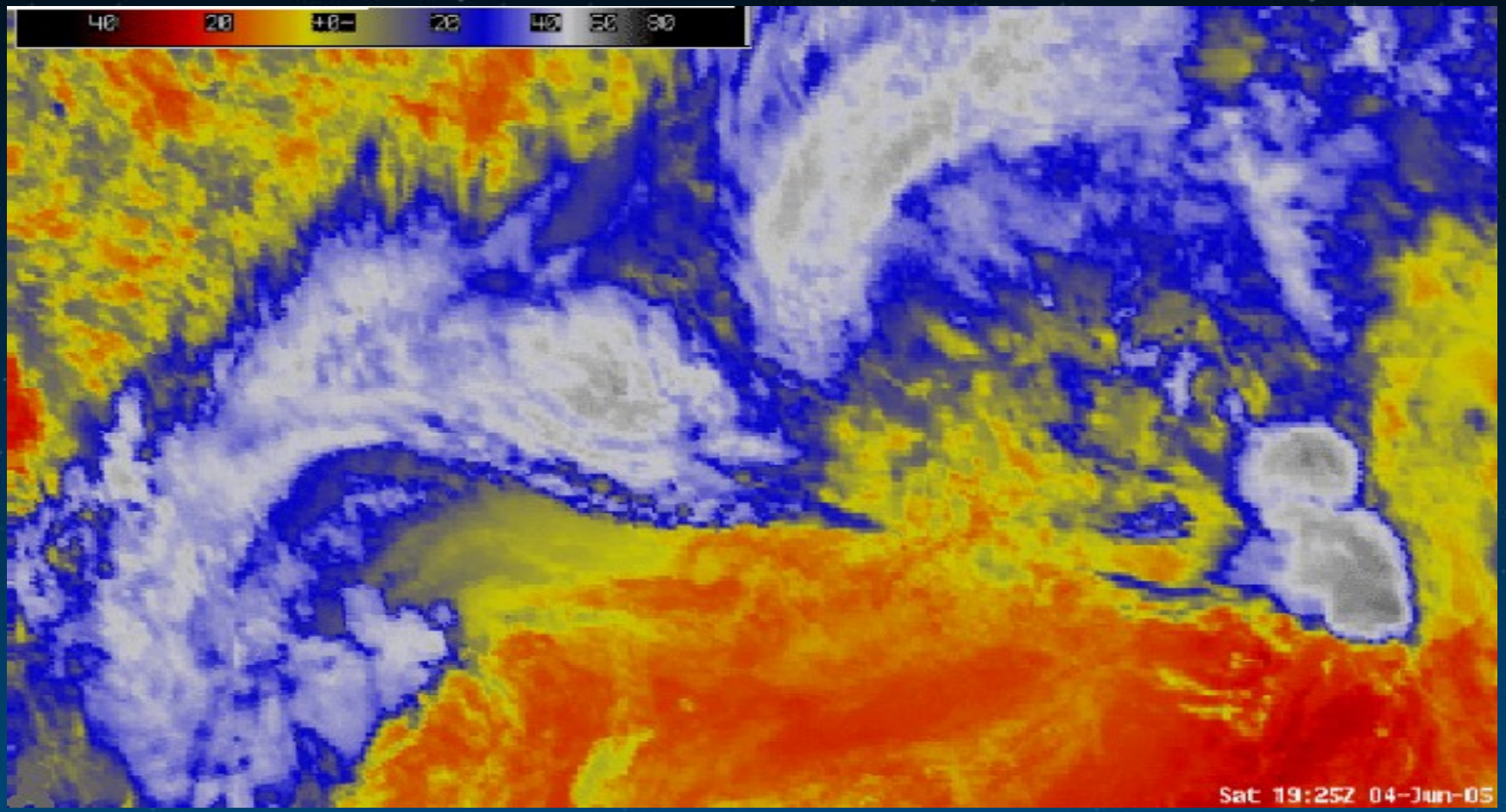
Spatial Resolution
Current GOES vs GOES-R(1hr)

- Better resolved features
- Finer resolution rings associated with rapidly developing convection.
- Current GOES image (REAL), GOES-R image (SIMULATED).



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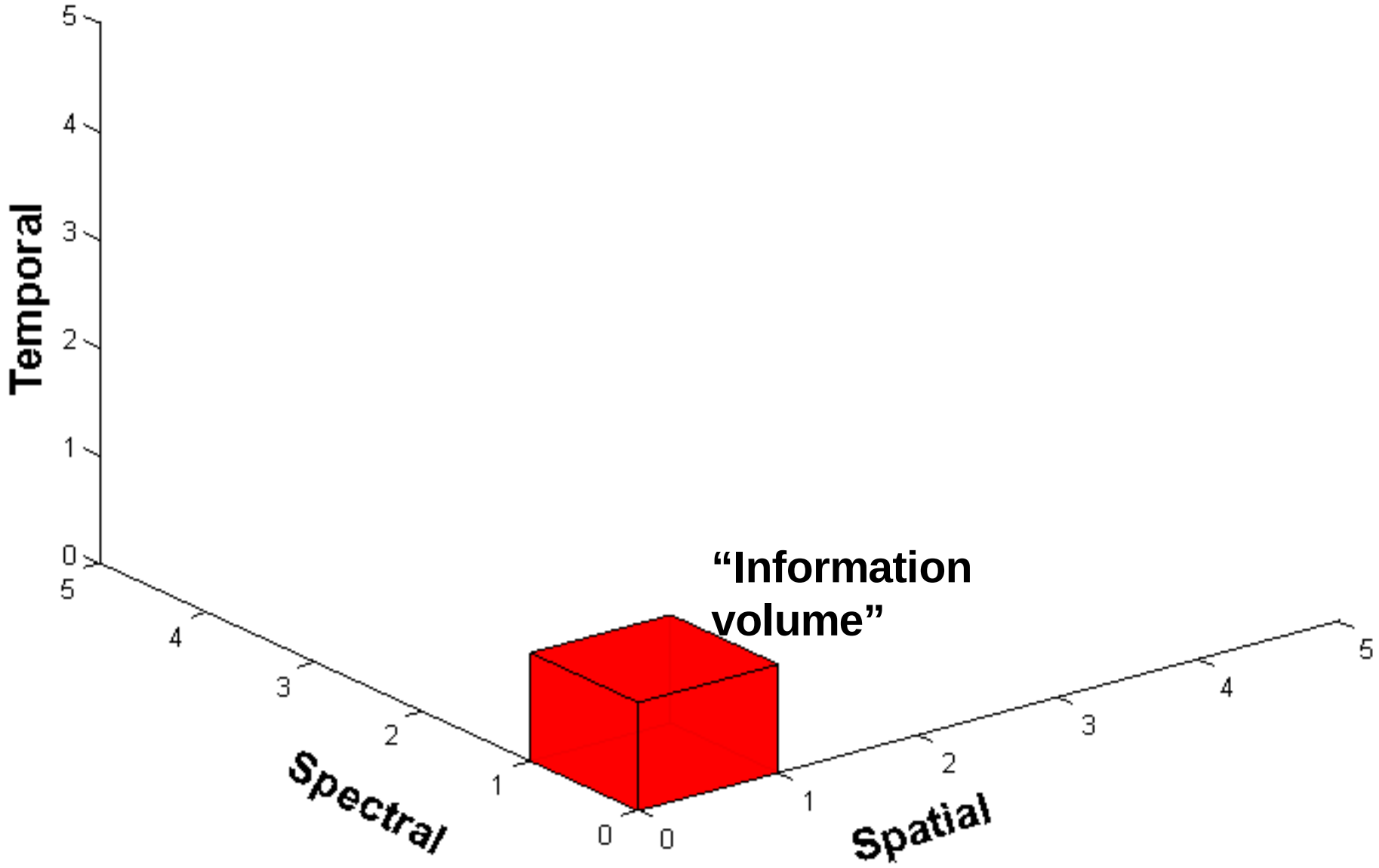
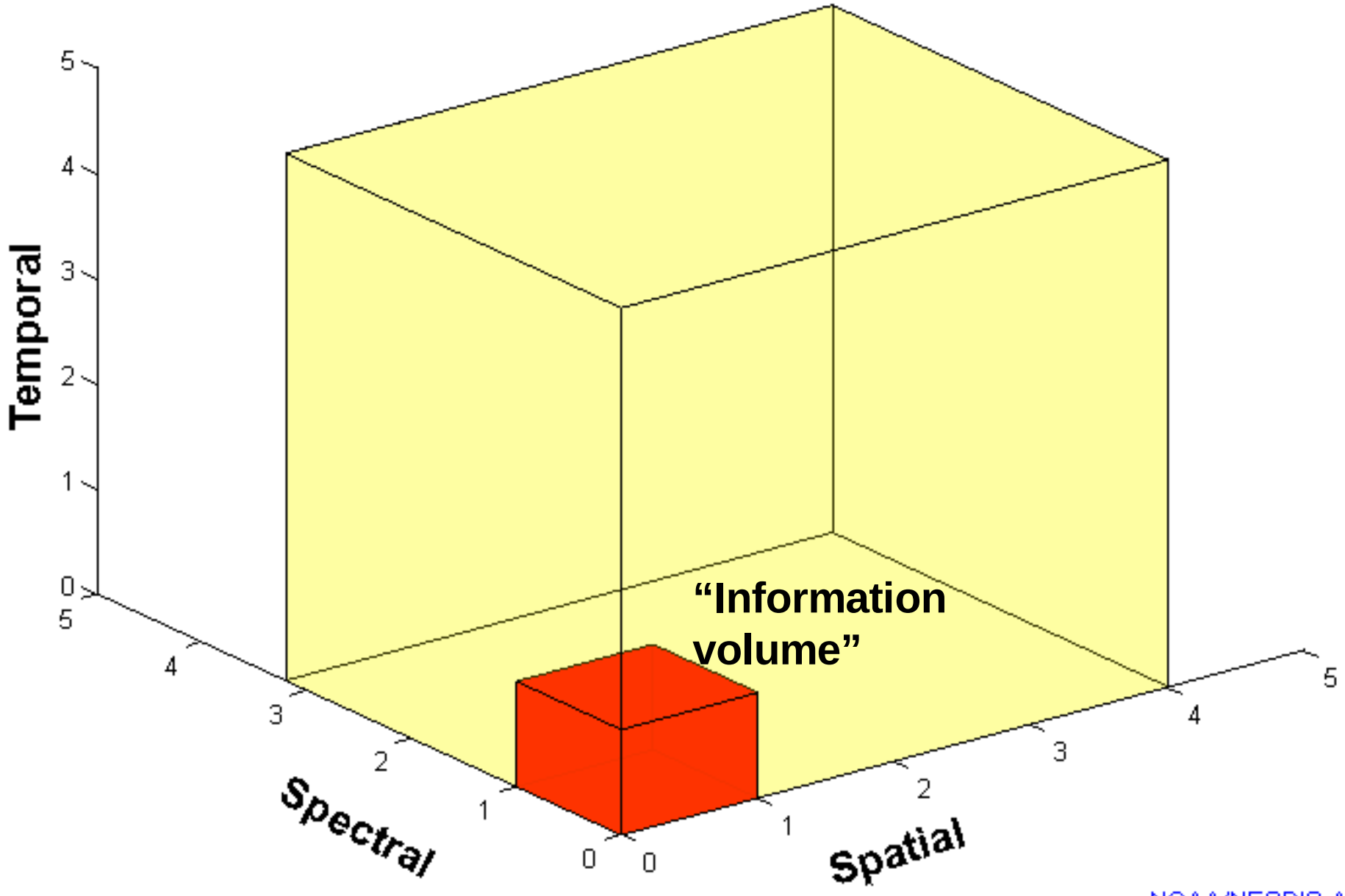
Current attributes: defined to be 1



Improved attributes with the Future GOES Imagers



NOAA/NESDIS ASPB

Proving Ground efforts

- Work jointly with NWS
  - Prepare for the amplification in data resolution of the GOES-R ABI.
- Use high res. numerical and advance forward model to simulate the ABI bands.
- Compute band differences from simulated ABI bands.
- Derive products from simulations (C.I, CAPE, LI, TPW, SST)
- Display in AWIPS environment (WES)
- Proving ground web page
  - http://cimss.ssec.wisc.edu/goes_r/proving-ground.html

Simulated ABI Individual Bands (2200UTC)

- Band 02 (0.64 um)
- Band 04 (1.37 um)
- Band 08 (6.19 um)
- Band 09 (6.95 um)
- Band 10 (7.34 um)
- Band 13 (10.35 um)
- Band 16 (13.3 um)

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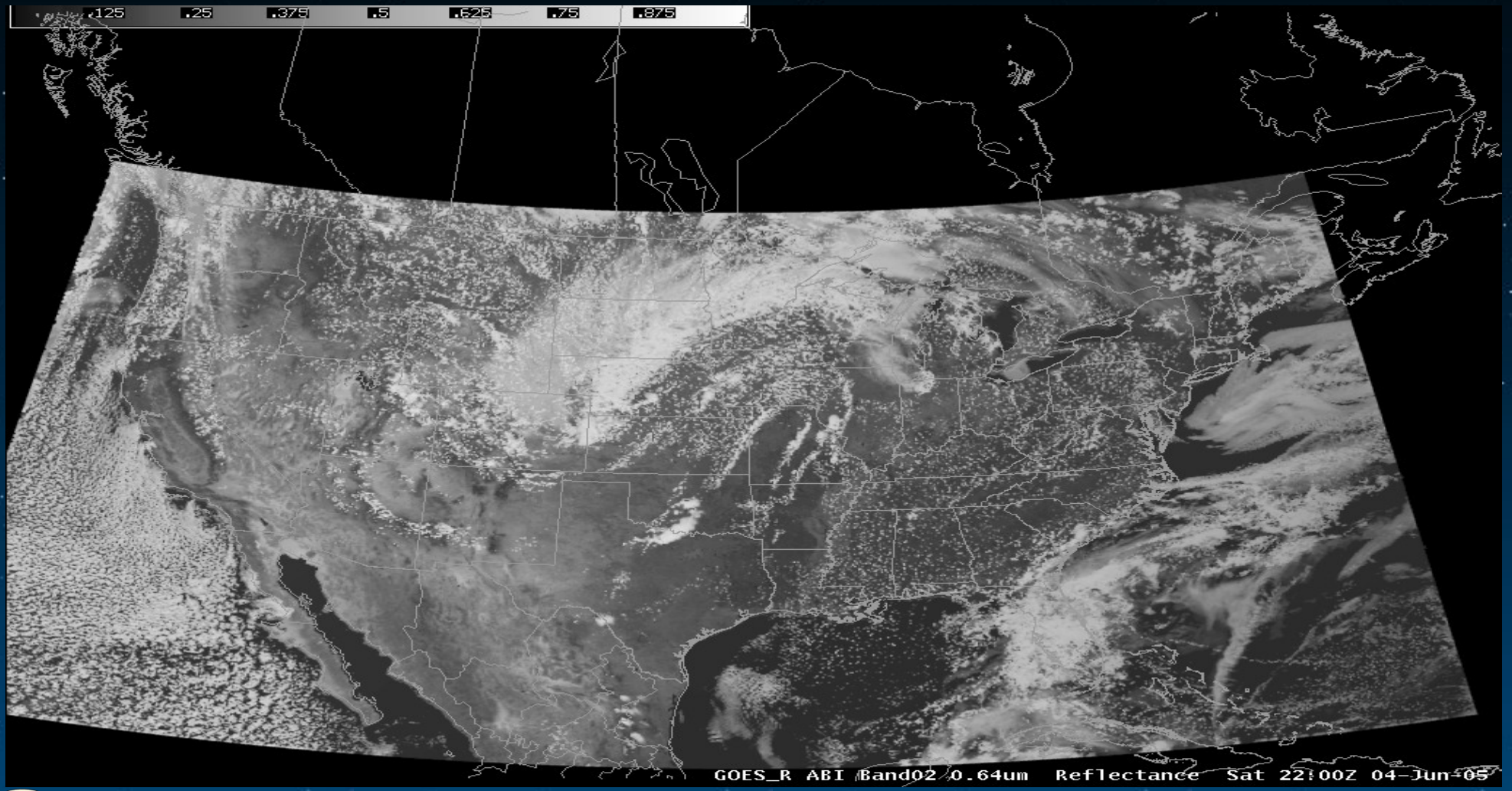
Band 02 (0.64um) (or ‘red’) band

- Similar to current GOES VIS band (0.45um) , improved spatial and temporal resolutions.
- (i) Detection of fog, (ii) Estimation of solar insulation, (III) Daytime snow , (IV) Ice cover, etc



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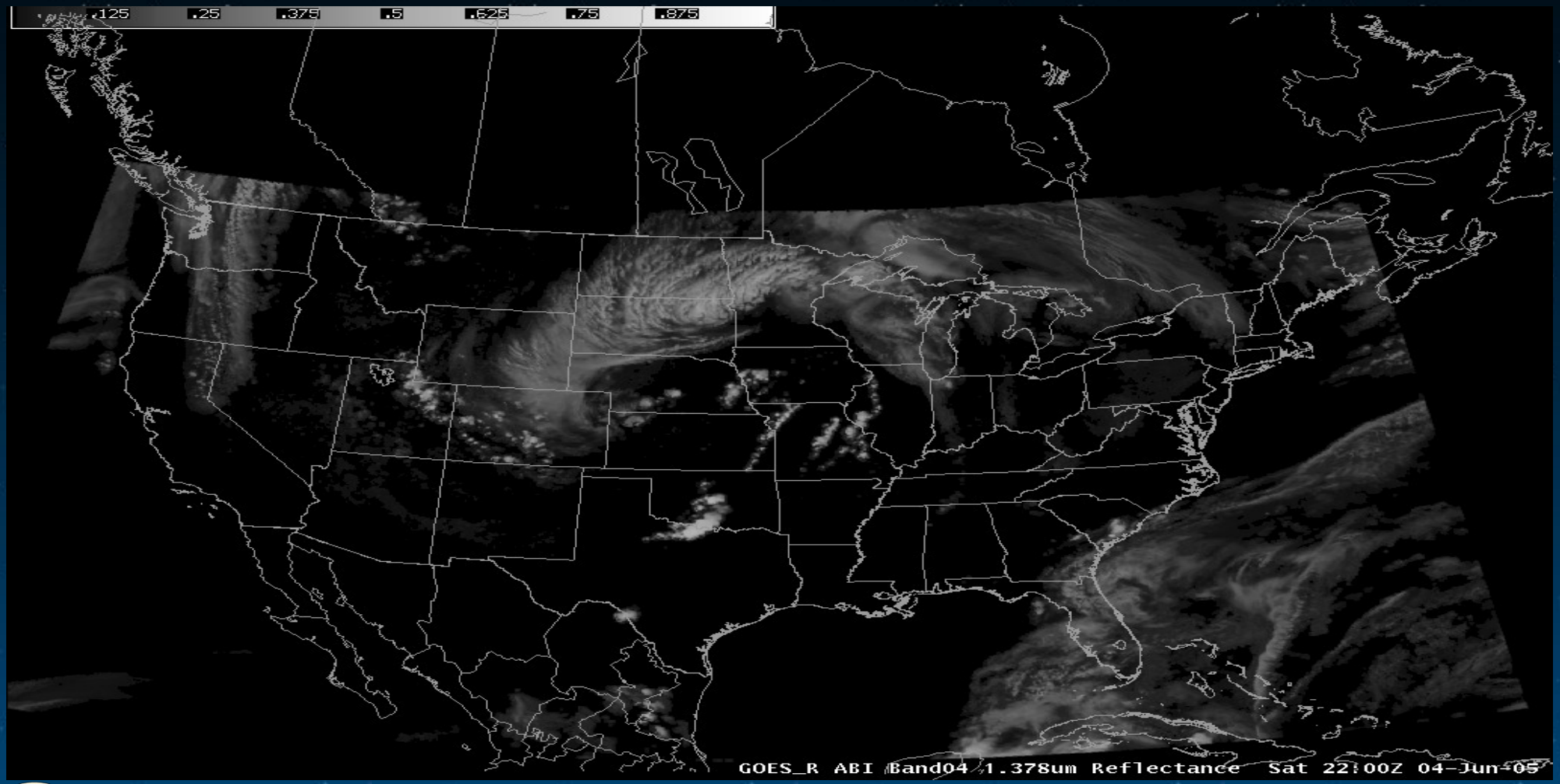
Band 04 (1.37um)(Cirrus Band)

- Heritage inst: MODIS, VIIRS, Centred in a strong water vapor absorption spectral region.
- (I) Detect very thin daytime cirrus clouds (II) Does not sense the lower troposphere.
- (III) Distinguish between low and high clouds, etc



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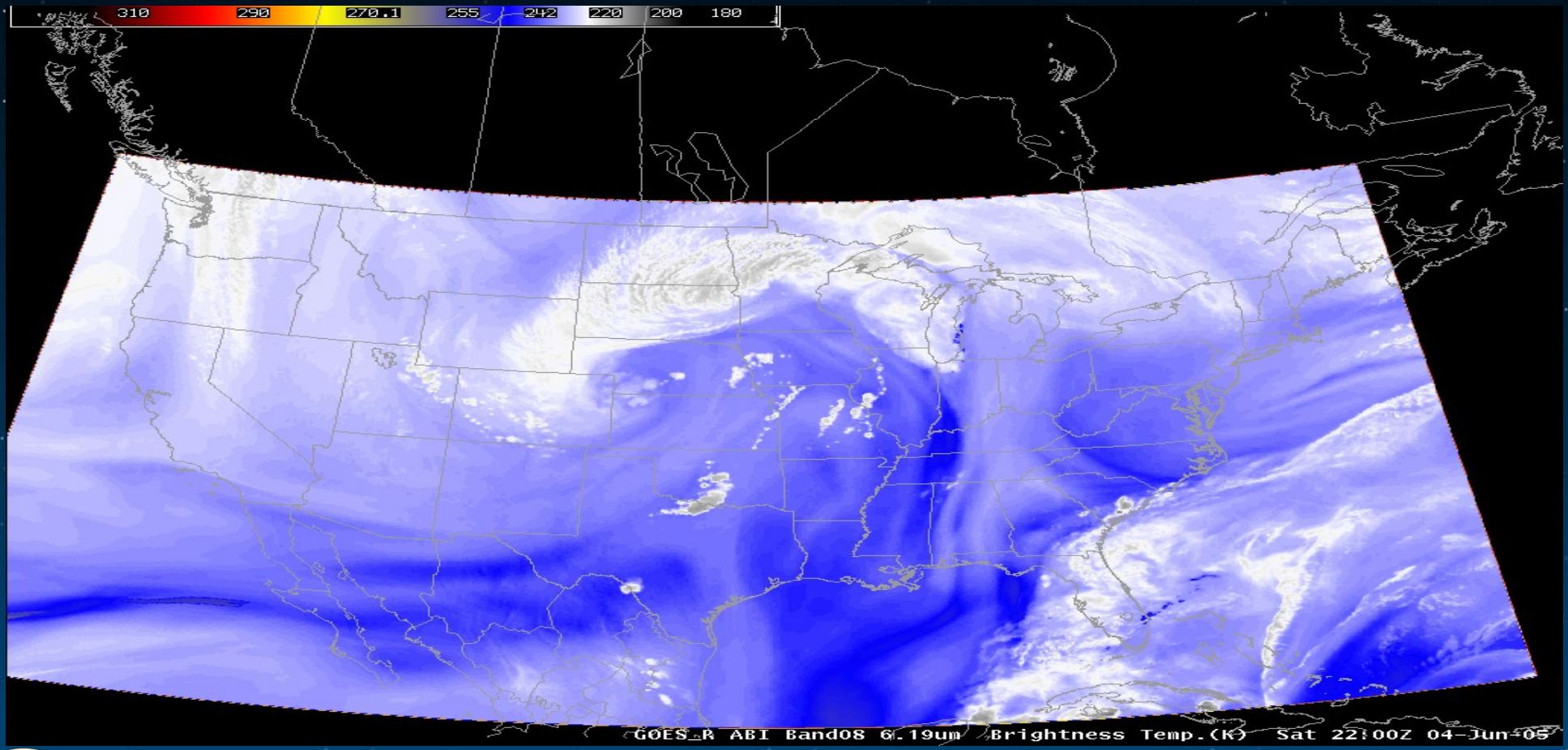
Band 08, 09 & 10 (6.19, 6.95, 7.35um) Water vapor bands

- Similar to current GOES (6.5um) water vapor band.
- (I) Band 08: Upper-level tropospheric water vapor band.
- (II) Band 09: Upper/mid-level tropospheric water vapor band
- (III) Band 10: Lower mid-level water vapor band. IR, etc



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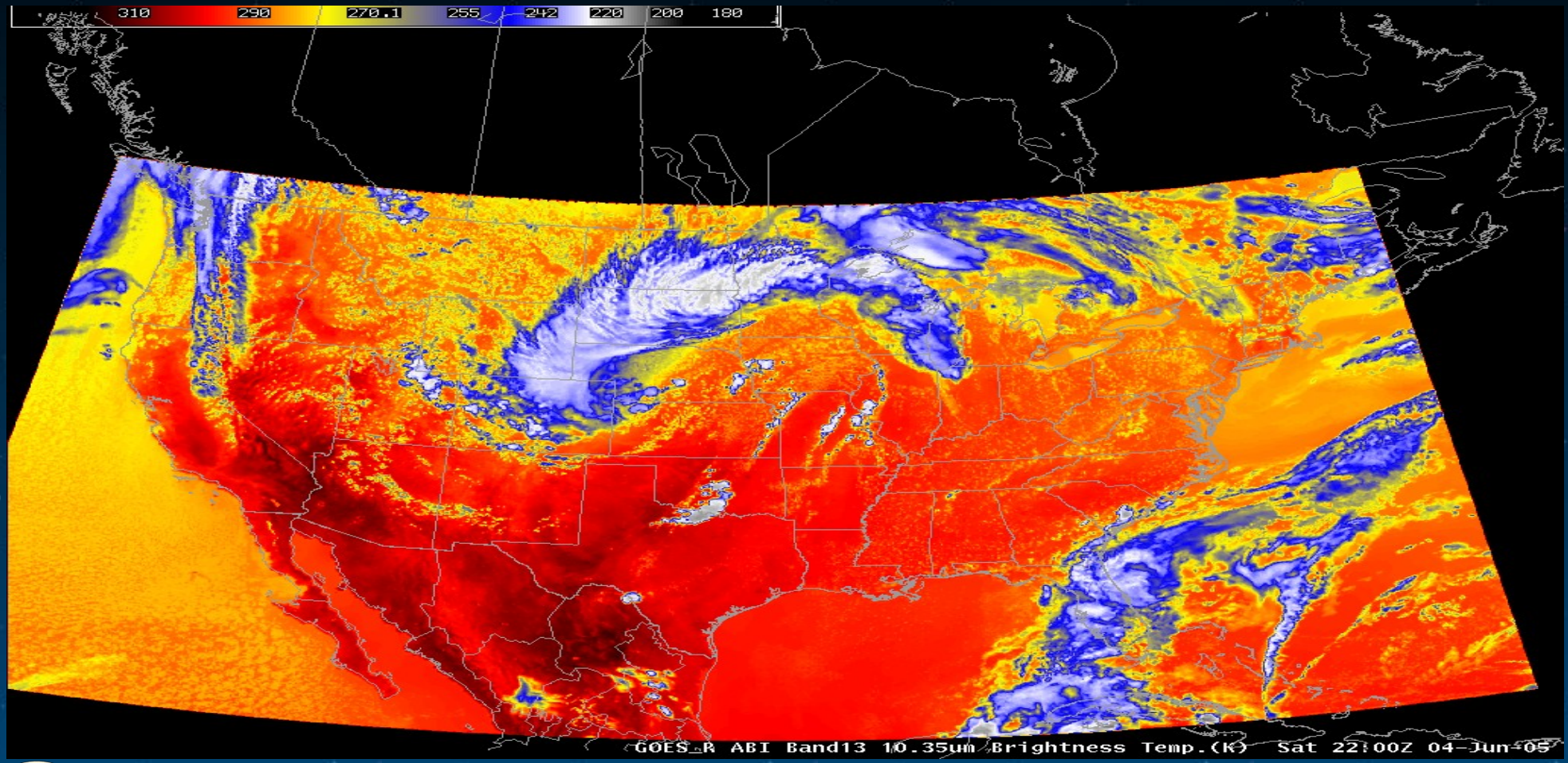
Band 13 (10.35 um) “Clean” IR longwave window

- Heritage inst. MODIS Airborne Simulator (MAS), slightly warmer than the traditional LW window
- Less sensitive to low-level moisture, helps with atmospheric moisture corrections.
- (I) Cloud particle size, (II) Surface properties, etc



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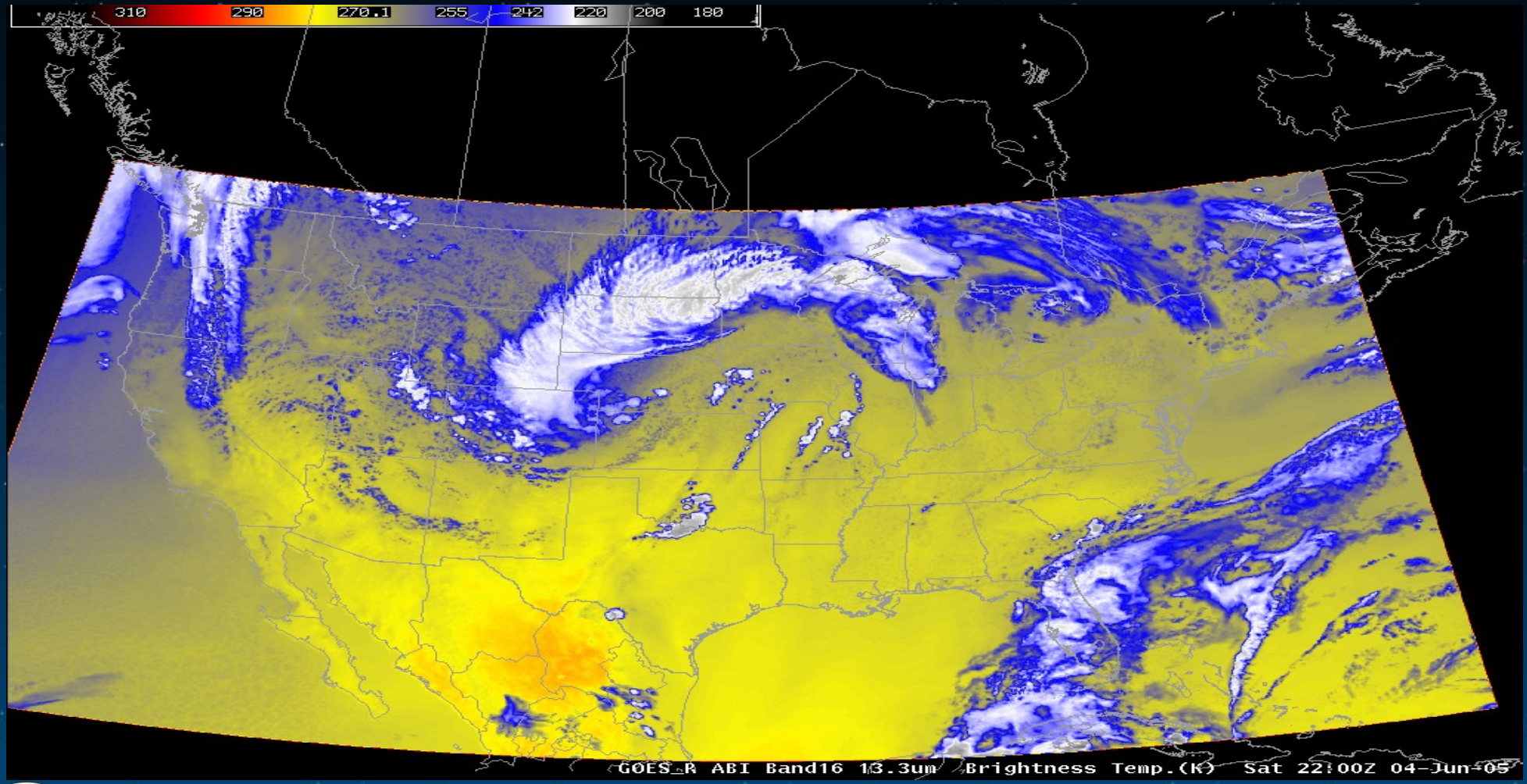
Band 16 (13.3 um) "CO_2" longwave IR band

- Similar to current current GOES (13.3um), cooler than all the window bands due to absorption of CO2
- (i) Volcanic ash, (II) Estimation of cloud opacity, (III) Cloud-top height assignments, etc



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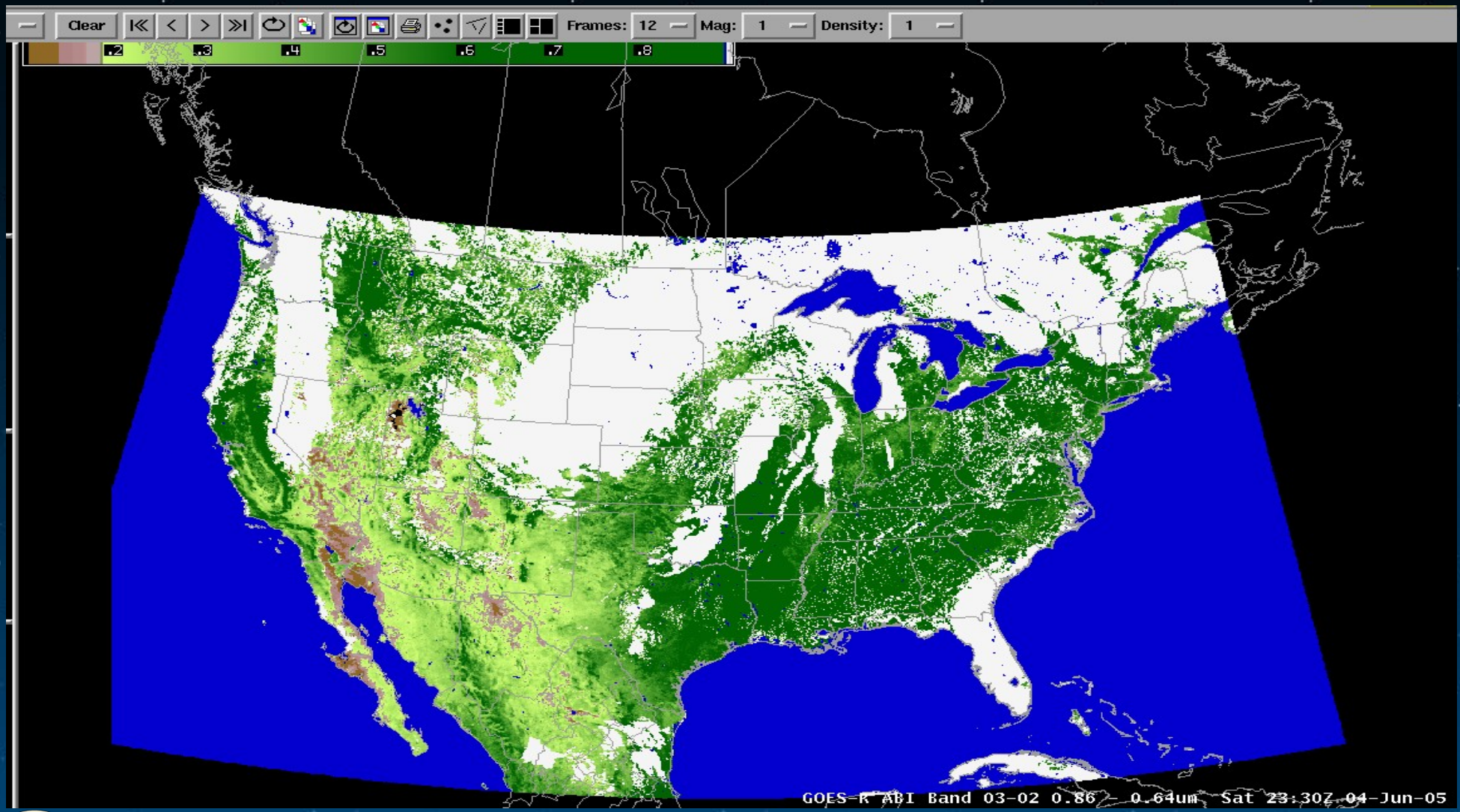
Band Difference (NDVI)

- (Band03 -Band02)/ (Band03 + Band02)



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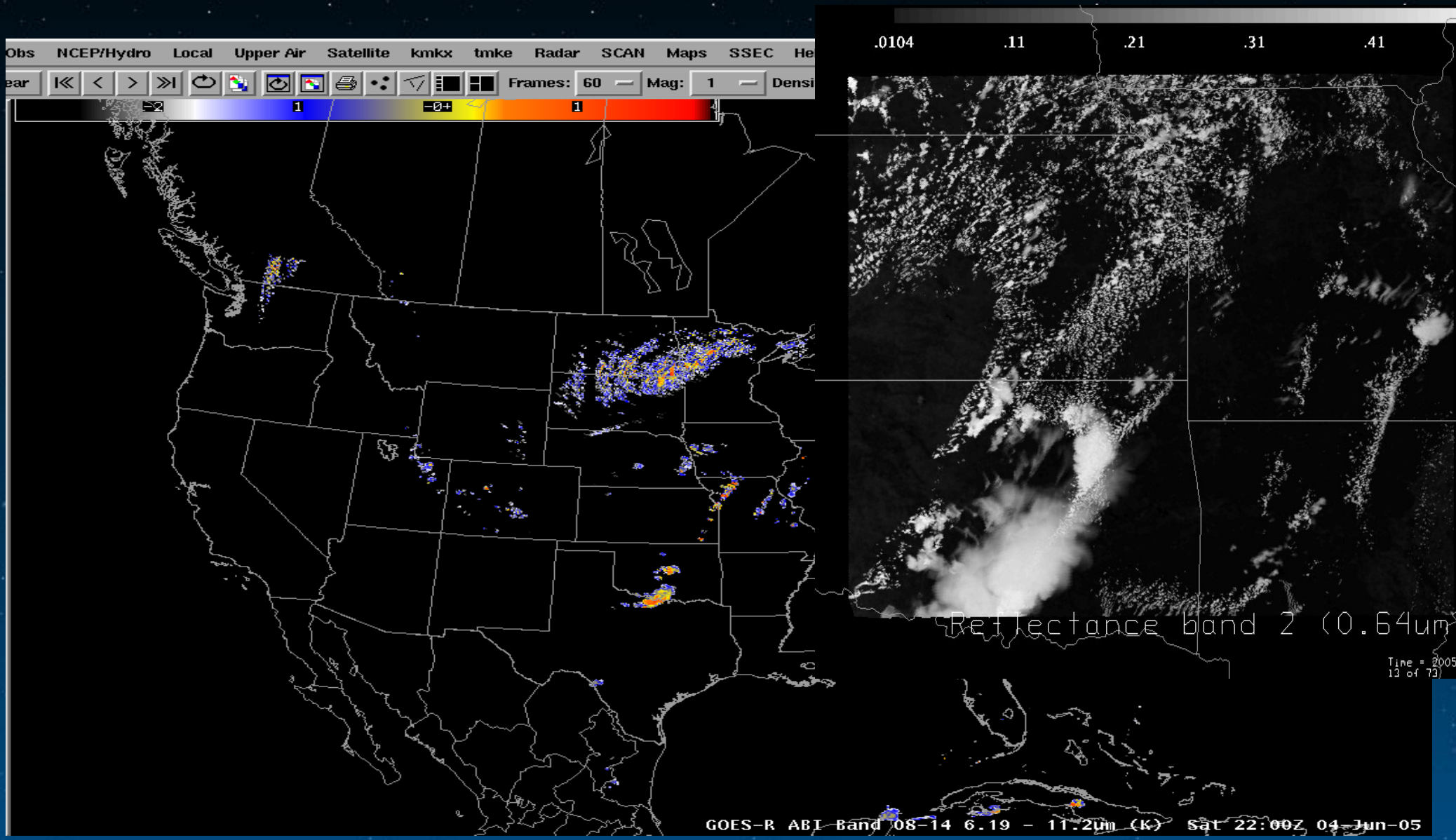
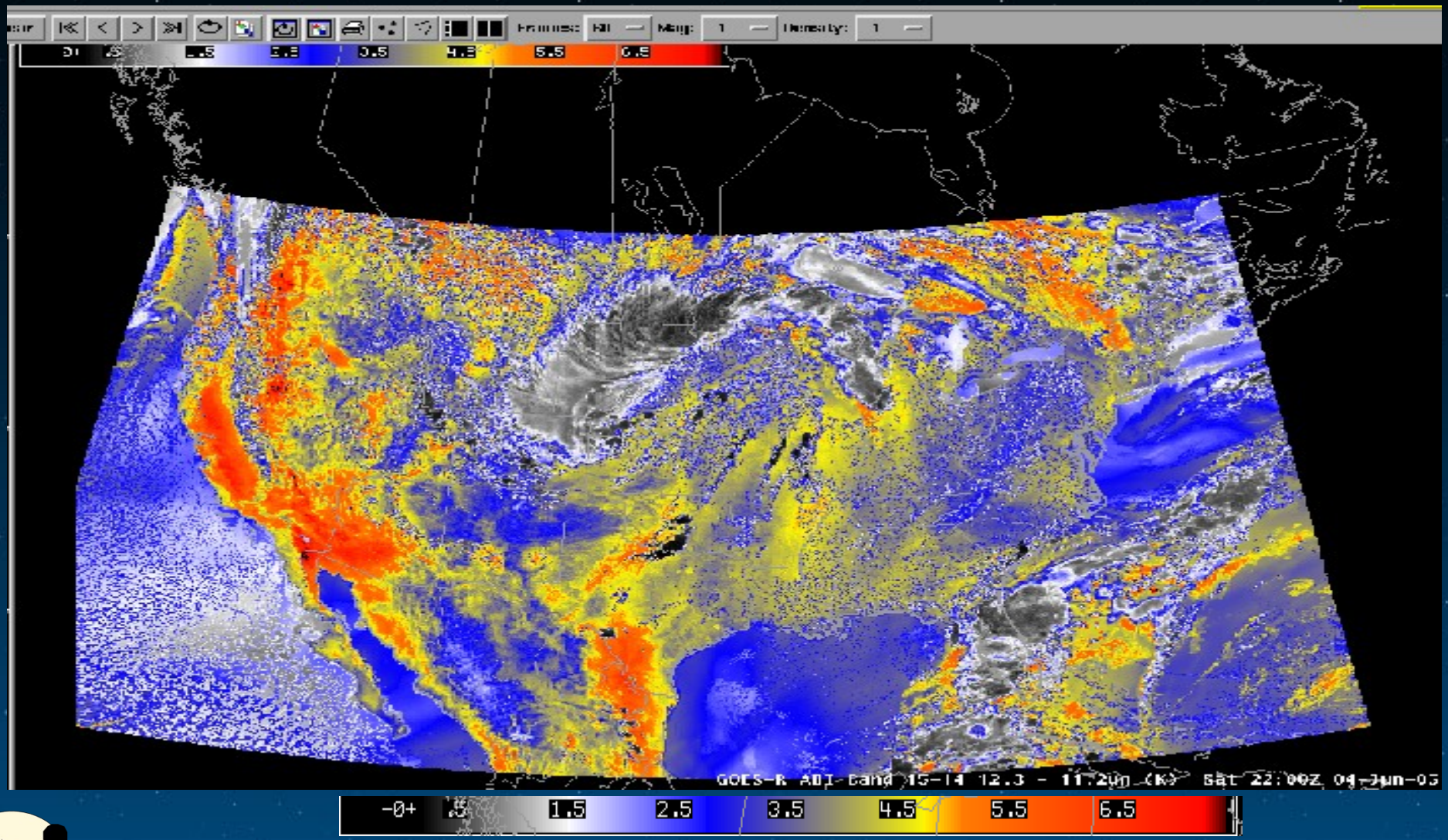
Band 08-14 (6.19um – 11.7 um)

- Potentially over-shooting tops highlighted by the largest differences.
- Low clouds vs High Clouds.



Band 15-14 (13.3um – 12.3um)

- Mid level temperature.



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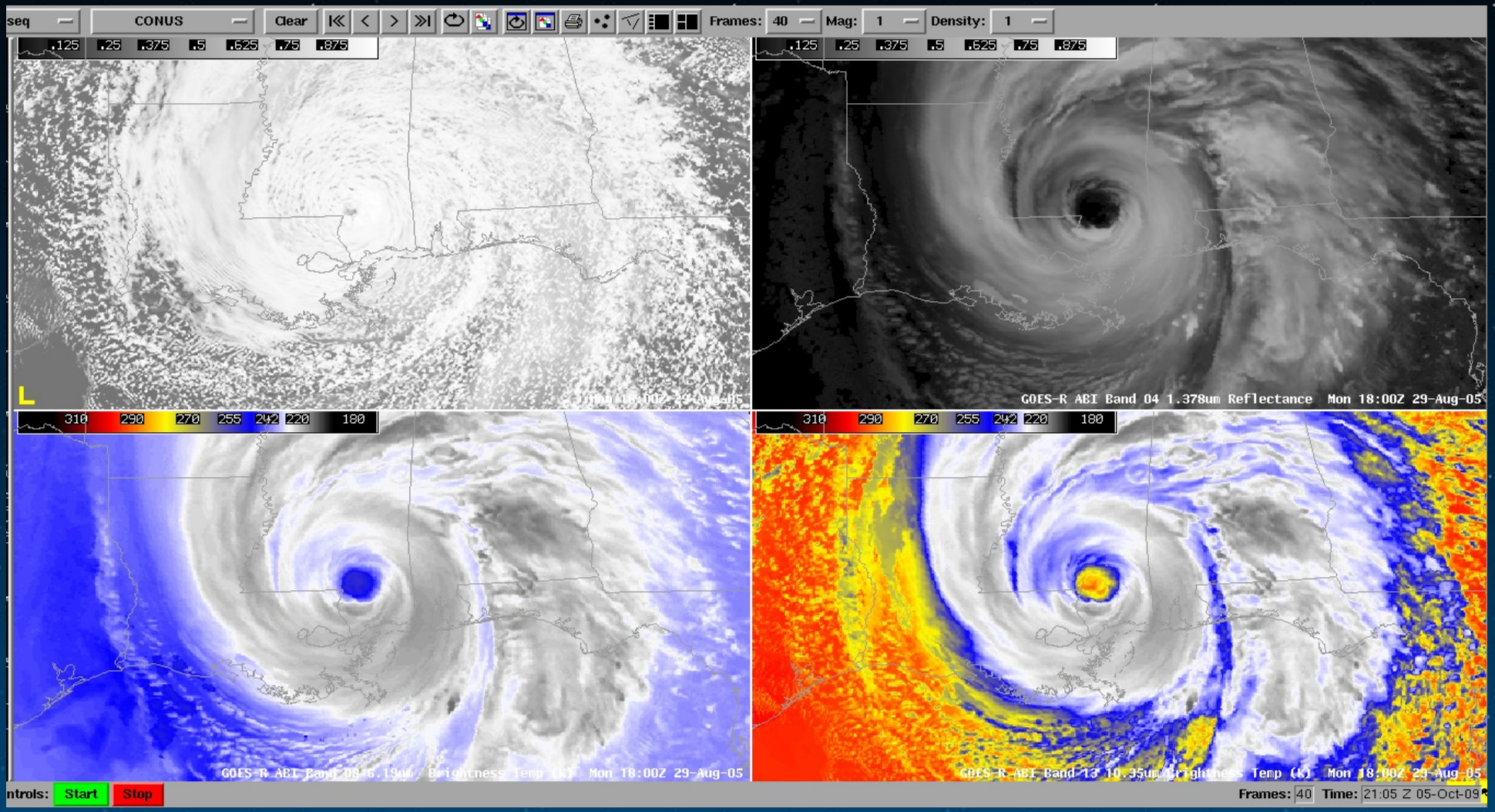
Hurricane Katrina

- Integrated into our WES case for training purposes.
- Can be useful for future ABI hurricane decision support capabilities.



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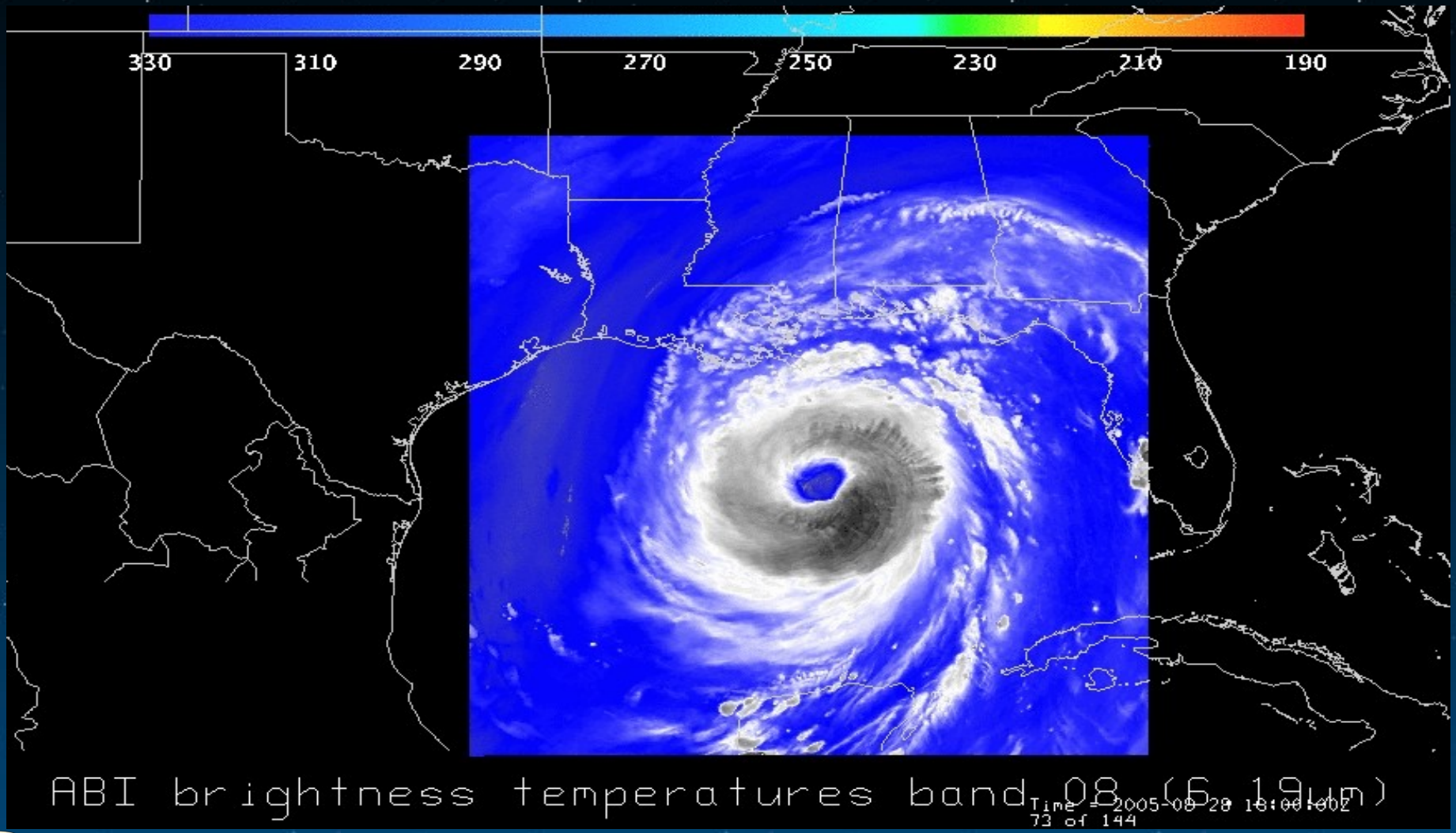
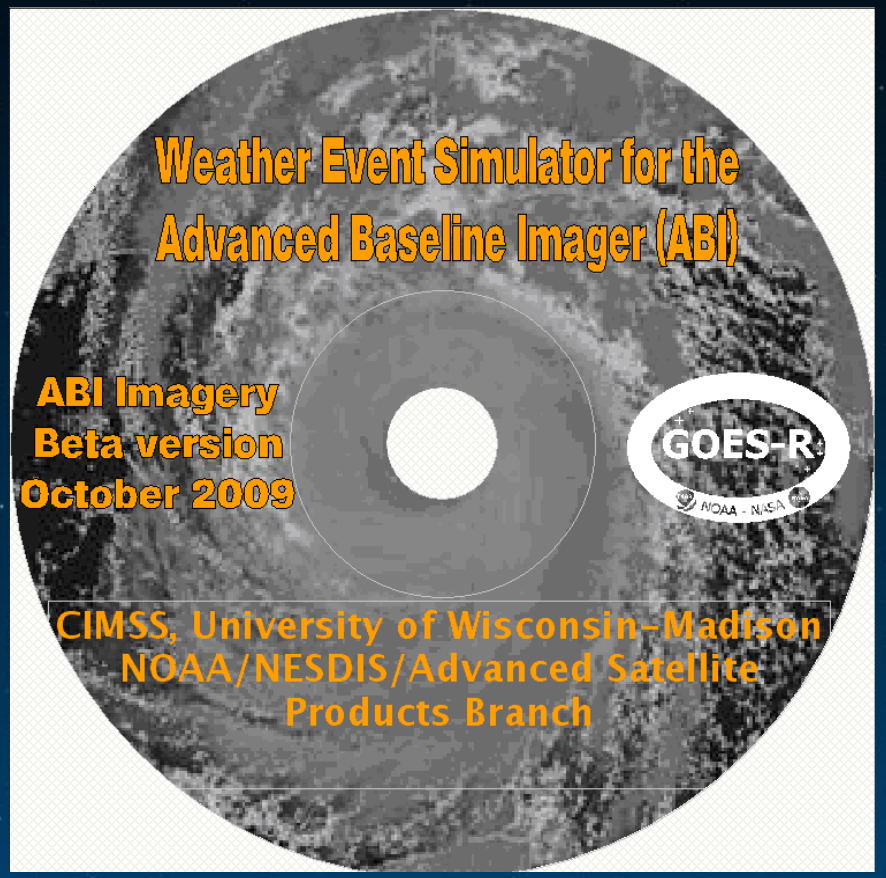


Weather Event Simulator (WES)

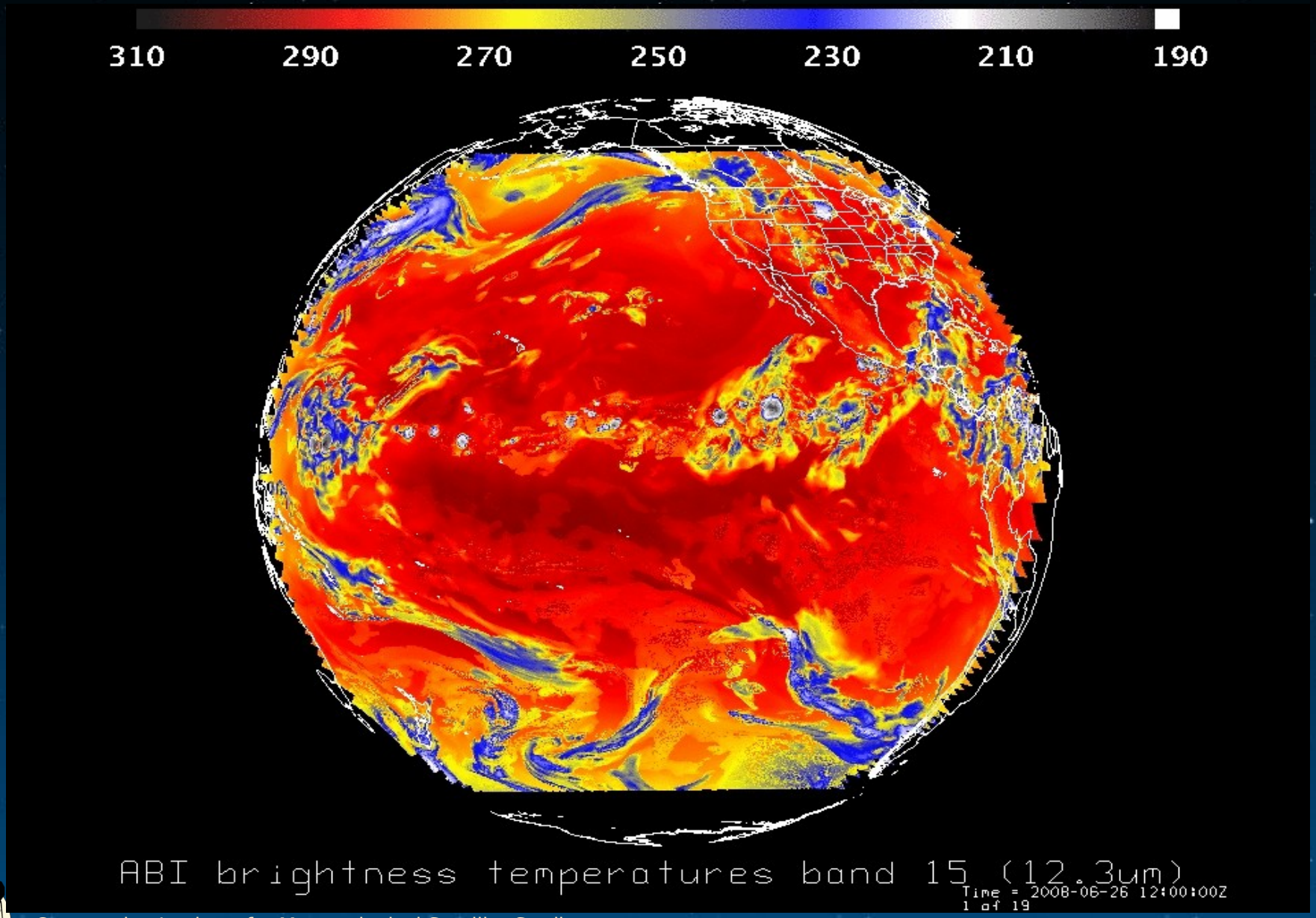
Developed as part of the GOES-R PG concept

- **Content:**
  - WES guide
  - June 05th 2005 case
  - Hurricane Katrina
  - Mesoscale
  - Band differences
  - Introductory videos

- **Beta release**



Other sample data sets
Full disk simulation 2008-06-26



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ABI Derived Products

GOES-R Product Set- 68

GOES-R 34 Baseline Products
Aerosol Detection (incl Smoke & Dust)
Suspended Matter / Optical Depth
Volcanic Ash: Detection & Height
Cloud & Moisture Imagery
Cloud Optical Depth
Cloud Particle Size Distribution
Cloud Top Phase
Cloud Top Height
Cloud Top Pressure
Cloud Top Temperature
Hurricane Intensity
Lightning Detection: Events & Flashes
Rainfall Rate / QPE
Legacy Vertical Moisture Profile
Legacy Vertical Temperature Profile
Derived Stability Indices
Total Precipitable Water
Clear Sky Masks
Radiances
Downward Solar Insolation: Surface
Reflected Solar Insolation: TOA
Derived Motion Winds
Fire / Hot Spot Characterization
Land Surface (Skin) Temperature
Snow Cover
Sea Surface Temperature
Energetic Heavy Ions
Magnetospheric Electrons and Protons: Low Energy
Magnetospheric Electrons and Protons: Medium & High Energy
Solar and Galactic Protons
Geomagnetic Field
Solar Flux: EUV
Solar Flux: X-Ray
Solar Imagery: X-Ray

GOES-R 34 Additional Products (Option 2)
Aerosol Particle Size
Aircraft Icing Threat
Cloud Ice Water Path
Cloud Imagery: Coastal
Cloud Layers / Heights and Thickness
Cloud Liquid Water
Cloud Type
Convective Initiation
Enhanced “V” / Overshooting Top Detection
Low Cloud and Fog
Turbulence
Visibility
Probability of Rainfall
Rainfall Potential
Total Water Content
Absorbed Shortwave Radiation: Surface
Downward Longwave Radiation: Surface
Upward Longwave Radiation: Surface
Upward Longwave Radiation: TOA
Ozone Total
SO2 Detection
Flood/Standing Water
Ice Cover/Landlocked
Snow Depth
Surface Albedo
Surface Emissivity
Vegetation Fraction: Green
Vegetation Index
Currents
Currents: Offshore
Sea & Lake Ice: Age
Sea & Lake Ice: Concentration
Sea & Lake Ice: Extent
Sea & Lake Ice: Motion

ABI	SUVI	EXIS
GLM	SEISS	Magnetometer

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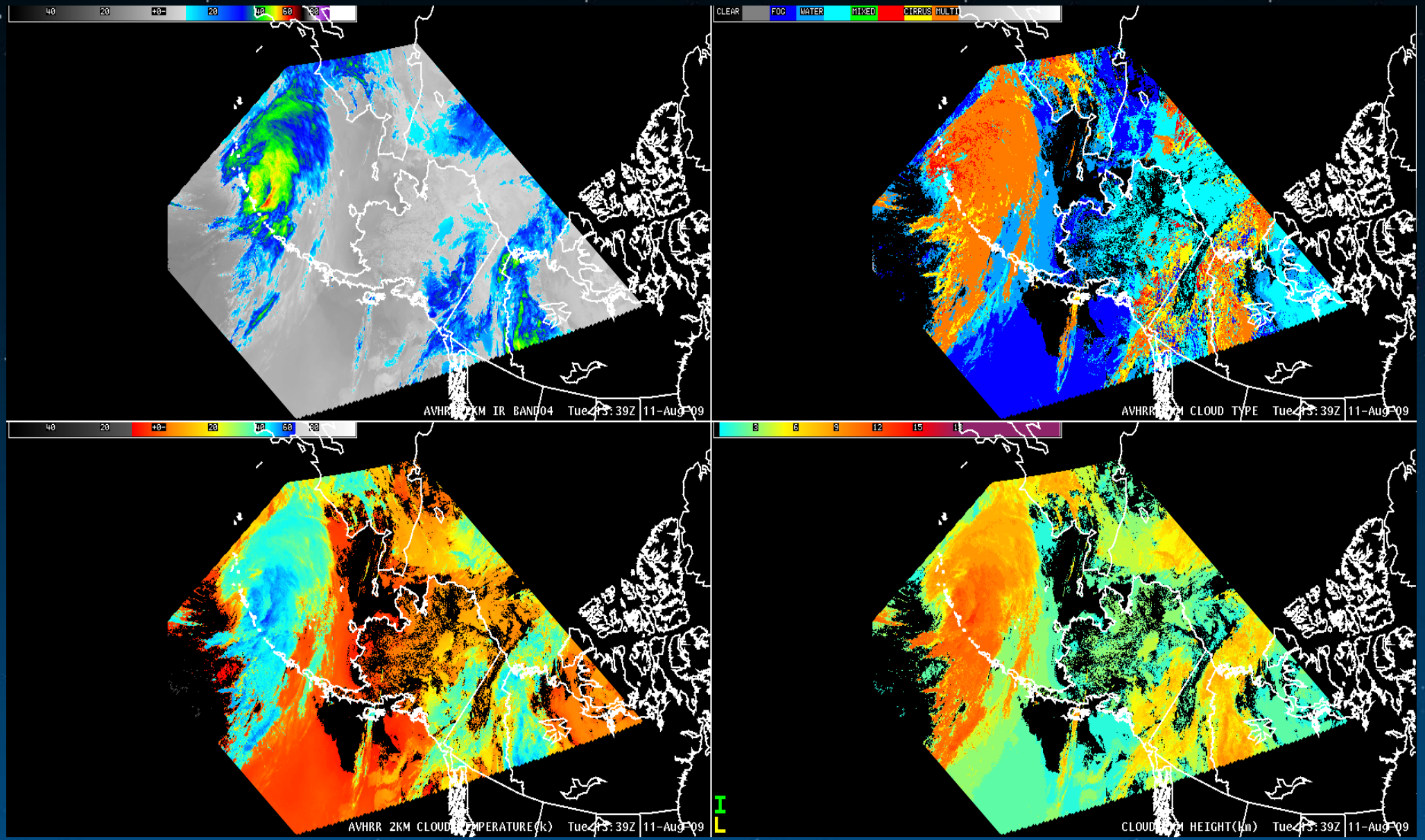
Derived Products.
AVHRR 1km, in AWIPS



Conclusions

- **Though GOES-R ABI is not schedule for operation until 2017, as a result of this PG effort, NWS personnel can access lots of useful products already:**

AVAILABLE IN AWIPS (SSEC)

AVHRR (1KM res.)

- Sea Surface Temperature
- Cloud Type
- Cloud Top Temperature
- Cloud Top Height
- Cloud Optical Depth
- Cloud Particle Effective Radius

GOES 12 SECTOR

- Convective Initiation- Instantaneous
- Cloud Top Cooling- Instantaneous
- Convective Initiation- Accumulated
- Cloud Top Cooling- Accumulated

Coming Soon.

AIRS DPI

- Convective Available Potential Energy (CAPE)
- Lifted Index (LI)
- Perceptible Water Sfc-900MB (PW1)
- Perceptible Water 900-700MB (PW2)
- Perceptible Water 700-300MB (PW3)

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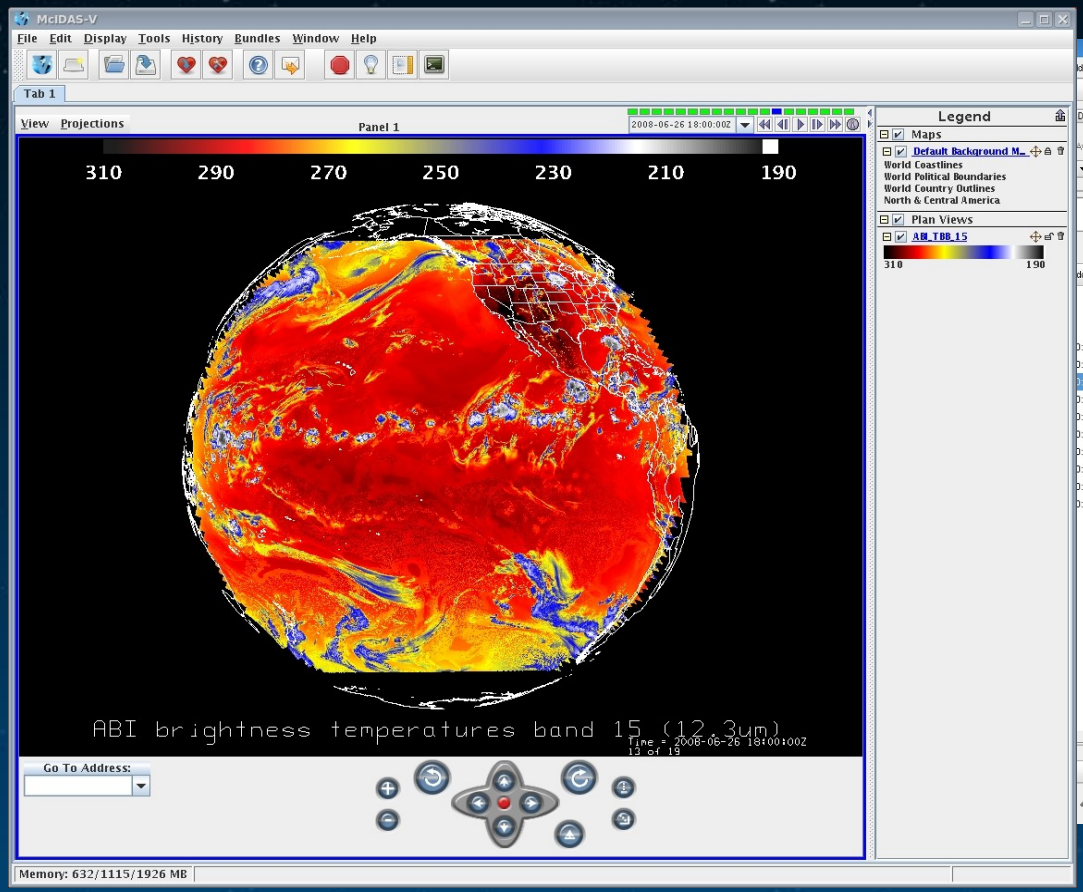
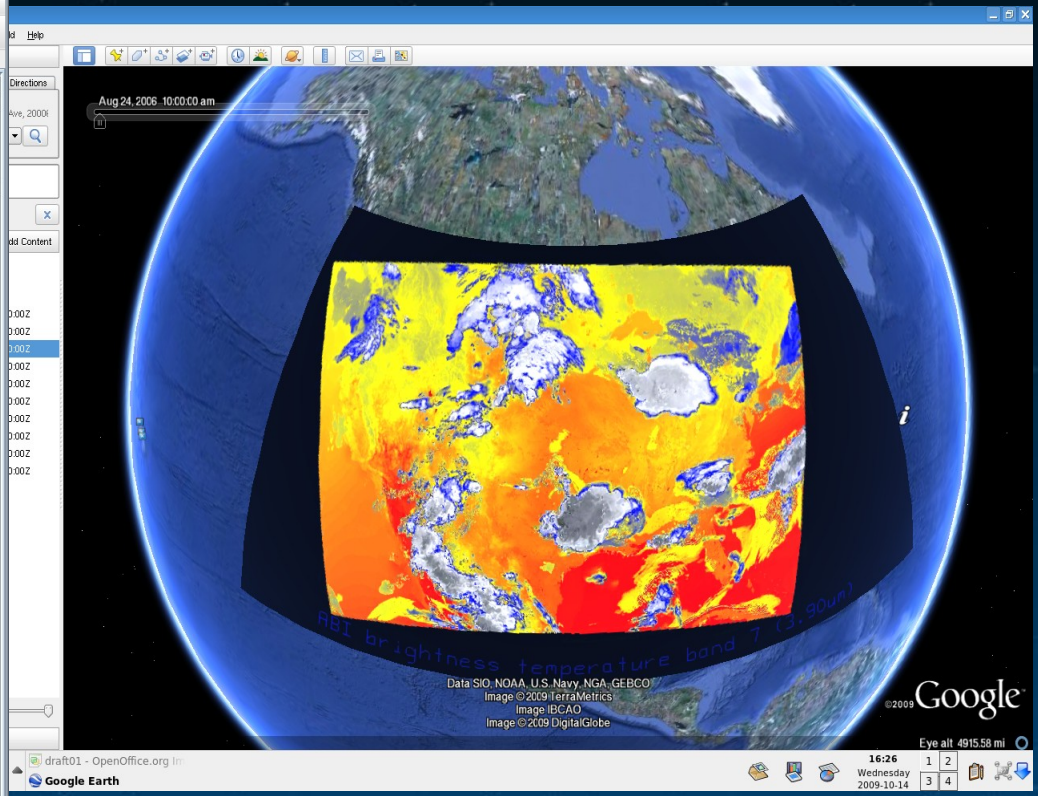
Conclusions

Alternative Ways to work with this data, Non WES users.

- **McIDAS-V**
- **Google Earth**





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Thank You.

- Jason Otkin
- Jordan Gerth
- Justin Sieglaff
- Tim Schmit
- Andy, Mike, William (AVHRR Team)

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