# NASA MSFC GOES-R Series Receiving Station

## Earth Science Branch

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JACOBS
ESSSA Group

# Historical Perspective

NASA Marshall Space Flight Center (MSFC) has been utilizing GOES data since the early 1980's

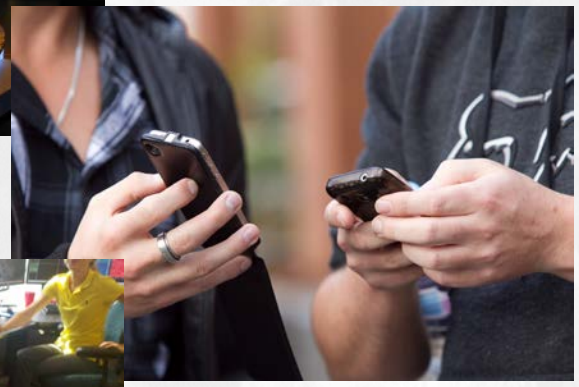
- Launch support for manned spaceflight missions
- Algorithm and product development supporting NASA science
- Real-time data ingest since 1996
  - Provide a consistent and reliable source of real-time data and products for the broader community of interest
  - Data and product transition to the operational weather community to monitor current environmental conditions and improve short-term weather forecasts (SPoRT)

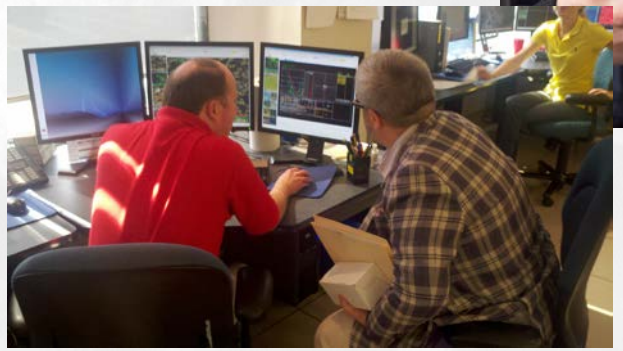
GOES-East/West GVAR

# End Users

- NASA
  - Internal research, algorithm development
  - Field Campaigns
- Other U.S. Government Agencies
  - NOAA
  - FAA
  - USCG
  - USDA
  - DoD
- Commercial
  - Insurance
  - Private weather concerns
- Academia
- Weather-attentive public







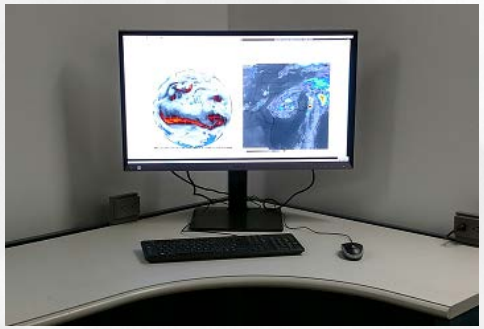
# Receiving Station

## TELESPACE CAPELLA-GR from Enterprise Electronics Corporation (EEC)

- Hardware:
  - Dish: ASC Signal 6.5-m reflector
  - Positioning: ASC Signal motor control system
  - Feed: Quorum GRB
  - Demodulator/Receiver: Quorum GRB-200
  - Dehydrator
  - Linux workstations
    - Acquisition
    - Data processing
    - Visualization
- Software:
  - GEOSat
  - CSPP (v.0.4.4)
  - AIT
  - PROTEUS (visualization)
- Located at MSFC

Acquisition and Data Processing

NASA MSFC receiving station at Activities Building (4316)



Visualization

# Data Processing

- Ingest and process all data from all 6 instruments
  - ABI - Level 1b
  - GLM - Level 2:  events, groups, flashes
  - Space weather instruments - Level 1b data from EXIS, MAG, SEISS, and SUVI
- Temporary local data storage (~ 10 days)
- Real-time transfer of all data to NSSTC via 10 Gbps connection for additional product generation and dissemination
- McIDAS-X used to convert ABI L1b netCDF4 to Area

National Space Science and Technology Center

# System Health Monitoring and Status

Separation distance between NSSTC and receiving station make monitoring challenging

- Created software suite to monitor station health
  - Real-time and historical monitoring of critical system parameters
  - Signal strength, SNR, temperatures, humidity, pressure, etc.
- Ingest and product status systems send email alerts when data outages are detected

## GOES-16 GRB SUVI

Updated: Fri Jun 23 15:41:11 UTC 2017

| | | | | | |
|---|---|---|---|---|---|
| SUVI L1b Fe093 Age: 8 minutes | SUVI L1b Fe131 Age: 7 minutes | SUVI L1b Fe171 Age: 9 minutes | SUVI L1b Fe195 Age: 7 minutes | SUVI L1b Fe284 Age: 9 minutes | SUVI L1b He303 Age: 7 minutes |

## GOES-16 GRB ABI RGB

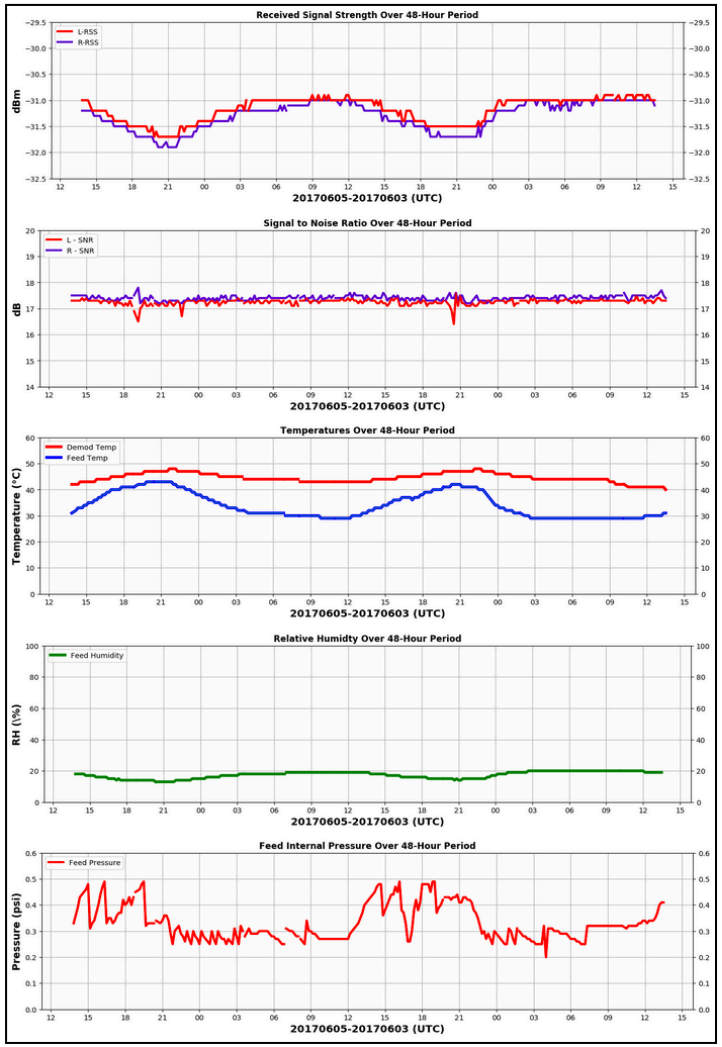
Updated: Fri Jun 23 15:40:19 UTC 2017

| | | | | | |
|---|---|---|---|---|---|
| CONUS Air Mass - Area Age: 8 minutes | CONUS Ash - Area Age: 8 minutes | CONUS Day Convection - Area Age: 8 minutes | CONUS Day Land Cloud - Area Age: 8 minutes | CONUS Day Land Cloud Fires - Area Age: 8 minutes | CONUS Day Ocean Cloud Convection - Area Age: 8 minutes |
| CONUS Day Snow Fog - Area Age: 8 minutes | CONUS Daytime Microphysics - Area Age: 8 minutes | CONUS Dust - Area Age: 8 minutes | CONUS Fire Temperature - Area Age: 8 minutes | CONUS Nighttime Microphysics Advanced - Area Age: 8 minutes | CONUS Simple Water Vapor - Area Age: 8 minutes |

https://weather.msfc.nasa.gov/goeshealth/
https://weather.msfc.nasa.gov/sport/ingeststatus/
https://weather.msfc.nasa.gov/sport/productstatus/

## GOES GRB Health Monitor

George C. Marshall Space Flight Center
GOES-16 East Pad




Page updated on : Mon June 05 13:32:02 UTC 2017
Report Date/Time : Mon Jun 05 13:30:01 UTC 2017

**Demodulator**
Temperature : 40.0 °C
Fan : Running
Local Oscillator Lock : Locked

**Left Hand Polarization**
Received Signal Level : -31.0 dBm
Signal to Noise : 17.3 dB
Physical Layer Sync : Locked
Mode : QPSK
Physical Layer Frames Per Second : 266
# of BCH Uncorrectable Frames : 0
AGC Voltage : 0.91 V

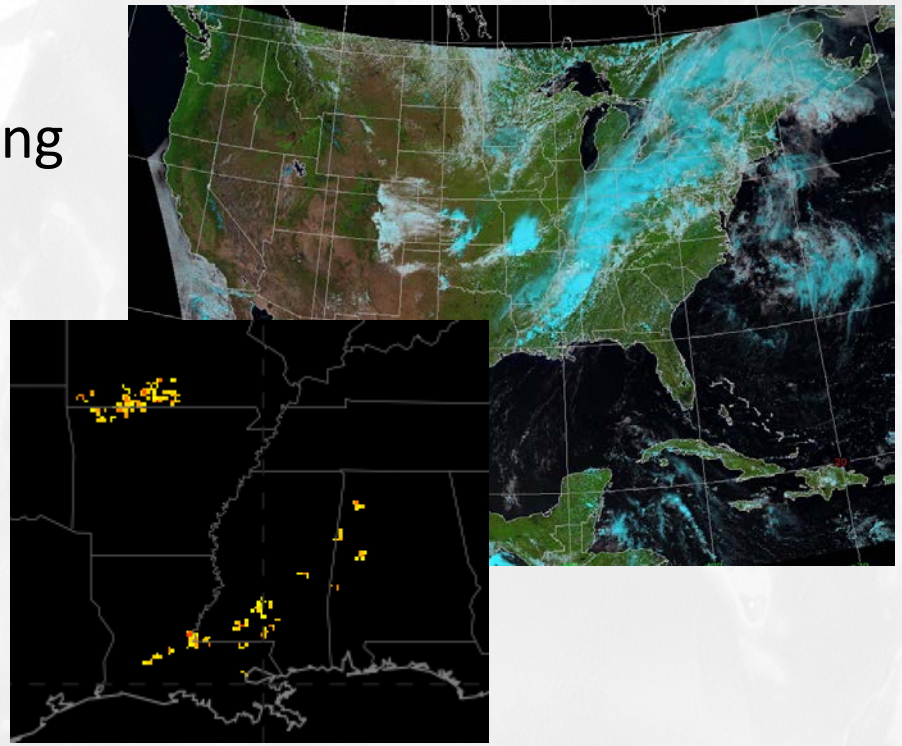
**Right Hand Polarization**
Received Signal Level : -31.1 dBm
Signal to Noise : 17.4 dB
Physical Layer Sync : Locked
Mode : QPSK
Physical Layer Frames Per Second : 267
# of BCH Uncorrectable Frames : 0
AGC Voltage : 0.91 V

**Feed**
Power : ON
Current : 362 mA
Overcurrent : NO
Communications : OK
Voltage : 22.4 V
Local Oscillator Lock : Locked
Temperature : 31.0 °C
Humidity : 19 %
Pressure : .41 PSI
Purge Value : CL

| Variable | 2 Day Mean | 2 Day STDEV | 12 hour Mean | 12 hour STDEV | 3 Hour Mean | 3 Hour STDEV | 1 Hour Mean | 1 Hour STDEV |
|---|---|---|---|---|---|---|---|---|
| Demodulator Temperature (°C) | 44.53 | 1.76 | 43.07 | 1.45 | 40.94 | 0.23 | 40.83 | 0.37 |
| LH Signal Strength (dBm) | -31.18 | 0.23 | -30.98 | 0.05 | -30.94 | 0.05 | -30.97 | 0.05 |
| LH Signal-to-Noise Ratio (dB) | 17.25 | 0.12 | 17.30 | 0.05 | 17.32 | 0.07 | 17.33 | 0.05 |
| RH Signal Strength (dBm) | -31.30 | 0.27 | -31.04 | 0.07 | -31.01 | 0.02 | -31.02 | 0.04 |
| RH Signal-to-Noise Ratio (dB) | 17.40 | 0.09 | 17.44 | 0.08 | 17.48 | 0.08 | 17.53 | 0.09 |
| Feed Temperature (°C) | 34.01 | 4.80 | 29.29 | 0.56 | 29.72 | 0.65 | 30.33 | 0.47 |
| Feed Humidity (%) | 17.35 | 2.17 | 19.80 | 0.40 | 19.50 | 0.50 | 19.00 | 0.00 |
| Feed Pressure (PSI) | 0.33 | 0.07 | 0.31 | 0.04 | 0.35 | 0.03 | 0.38 | 0.03 |

# Data Products

- ABI: Generation of value-added NASA L2 products
  - RGB suite
    - Air Mass
    - Ash
    - Day Convection
    - Day Land Cloud
    - Day Land Cloud Fires
    - Day Ocean Cloud Convection
    - Day Snow Fog
    - Daytime Microphysics
    - Dust
    - Fire Temperature
    - Nighttime Microphysics
    - Simple Water Vapor
    - SO2
- GLM
  - Currently acquiring data via the NESDIS PDA while waiting for GRB dissemination
  - Code written to aggregate data into 2-minute intervals (events, groups, flashes)
- SUVI
  - Imagery from various channels and integration times



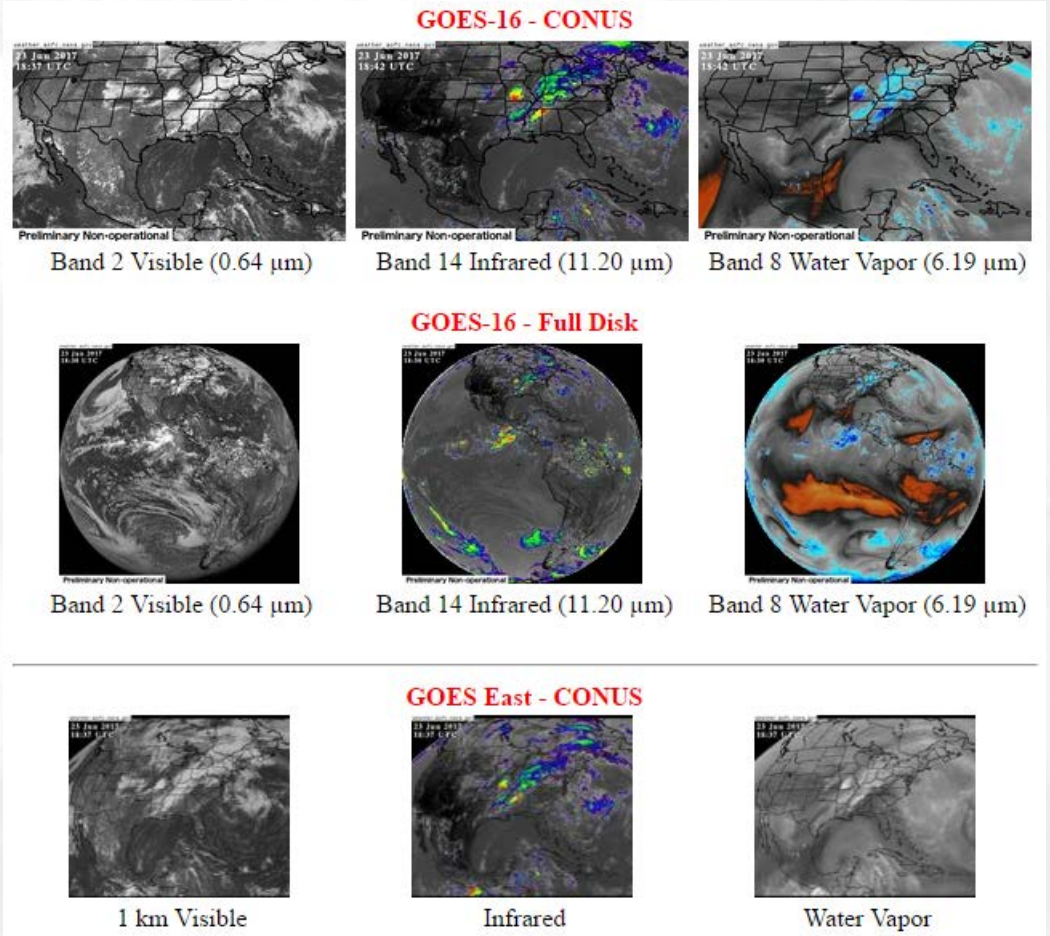
# Data Dissemination

Near real-time access to data and products

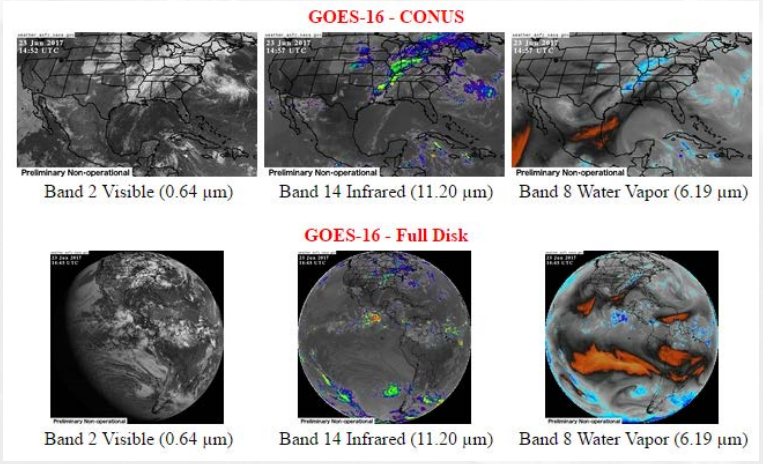
- Web:
  - Classic Viewer and API
  - Quick-Look Images
- Web Map Service (WMS)
- LDM:
  - Timely and efficient transfer of specific data and products to collaborators and partner end users
  - NWS National Centers for use in N-AWIPS and AWIPS II
- SCP/SFTP: ABI feed to other NASA Centers
- FTP: Public access

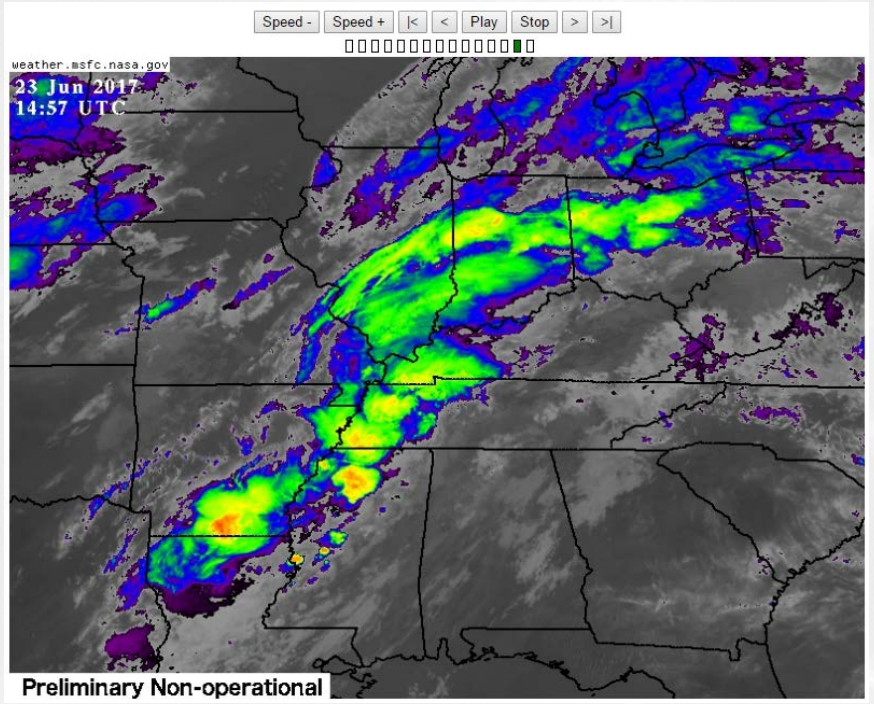
# Classic Viewer

- Developed a web-based interactive interface for viewing GOES imagery in 1997
  - ~500,000 unique visitors/month
  - ~50M hits/month
- Select channels (0.64µm, 6.2µm, 11.2µm)
- Users define area of interest to display
- Animations are very quick to load
- Options:
  - Color palettes
  - Map overlays
  - Quality
  - Resolution
  - Width/height
  - Static or animation



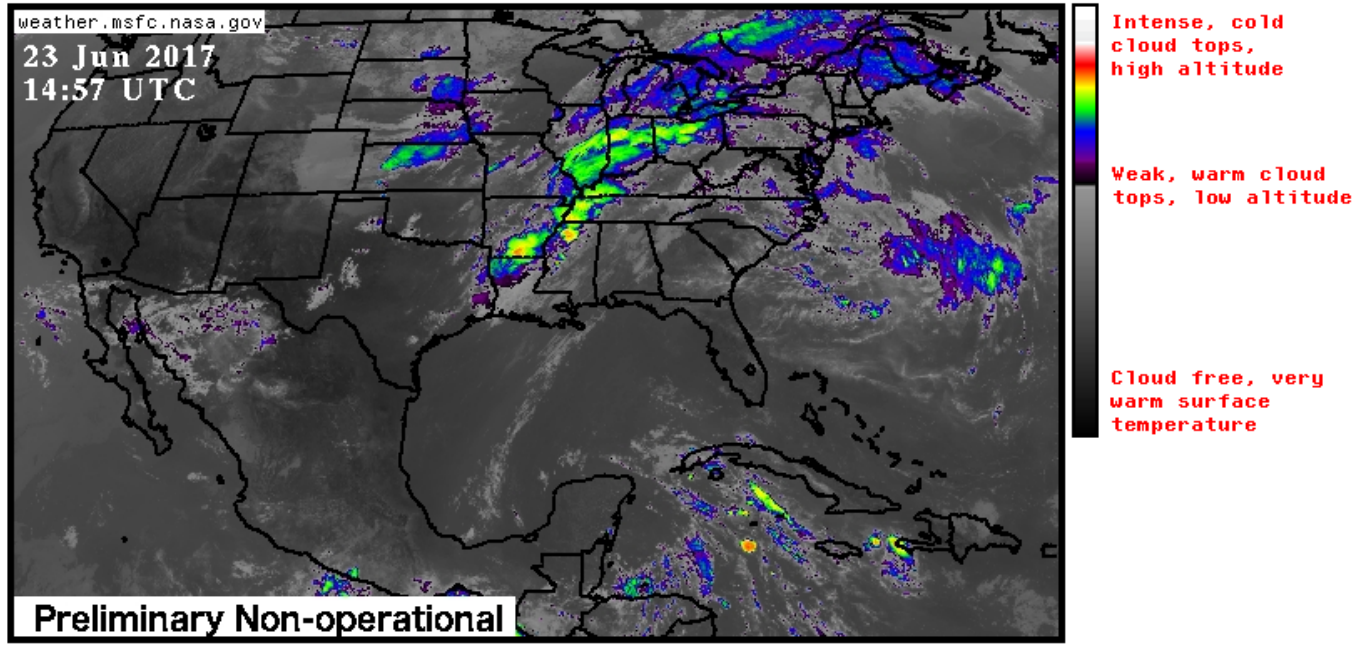
# Classic Viewer




**GOES-16 Wavelength: 11.20 µm Channel: 14 Resolution: 2 km**

Used for: Imagery, sea surface temperature, clouds, rainfall.




Set controls below then click anywhere in the image to zoom.

Show a Single Image or an Animation as a 10 image loop

Output Image (pixels): Width (100-1400): 800 Height (100-1000): 600

Quality: 75% Zoom Factor: High

Map: Standard Map Color: Black

Enhancement: IR2 Display color bar (IR2 only): Yes

Animate image above (choose image loop length above)

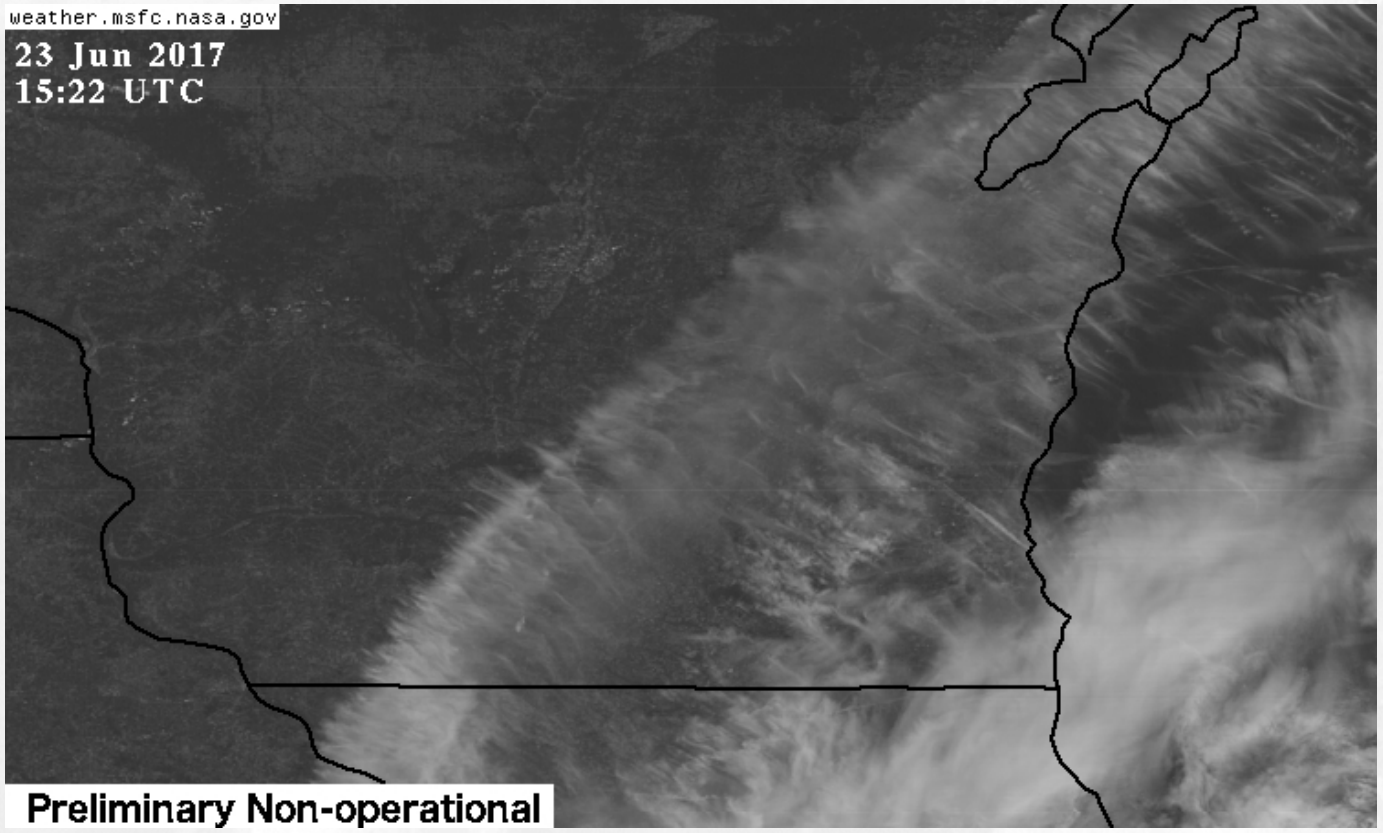
For a historical subsection, **choose a previous slot** from the selection button below (the image above will not change) then click on the image above, or fill in the X, Y form below.

Previous Image 0

https://weather.msfc.nasa.gov/GOES/

# Classic Viewer API

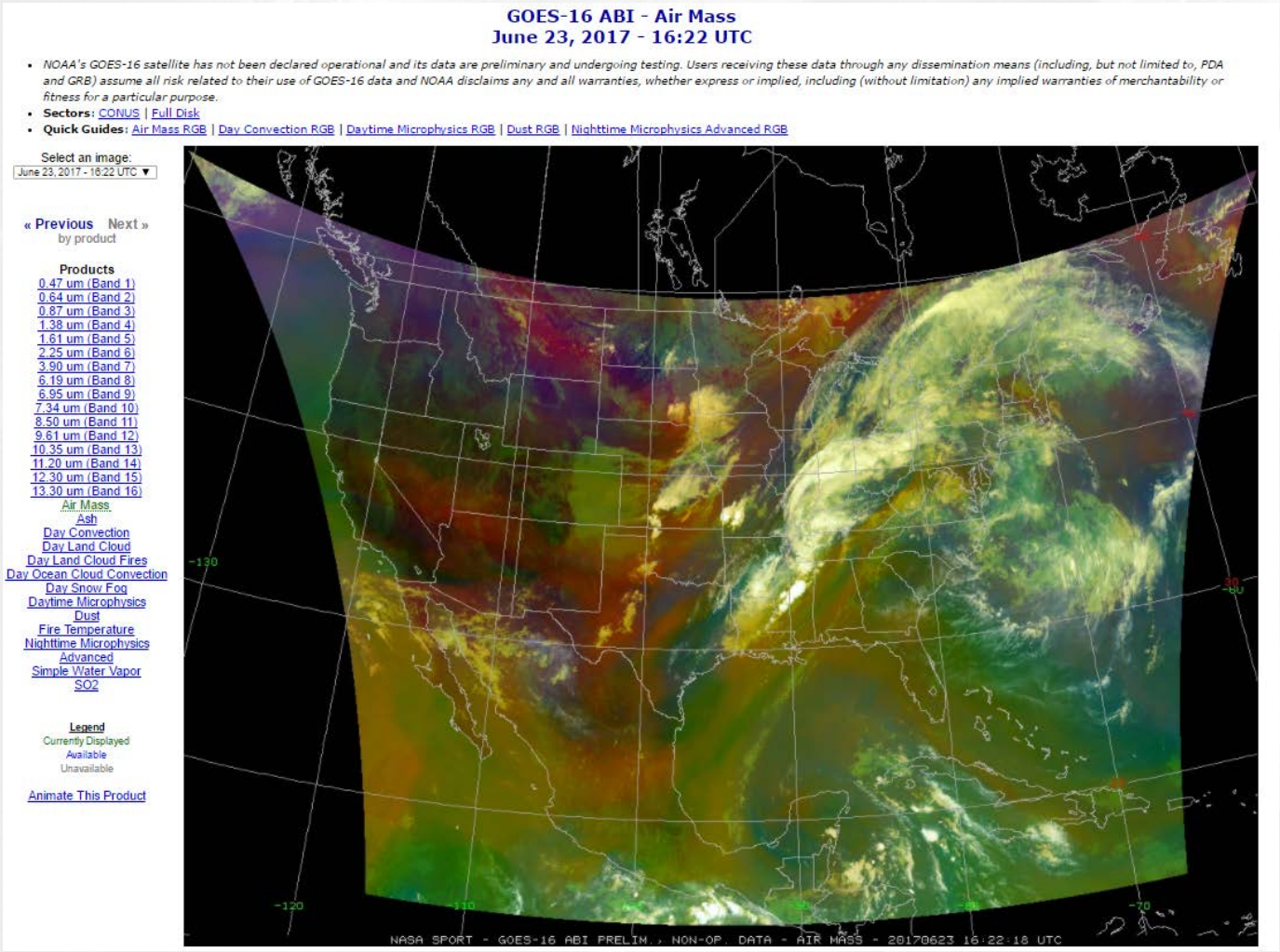
- Based on HTTP GET protocol
- Scriptable
- Easy to integrate real-time imagery into web pages and apps
- Popular with social media users

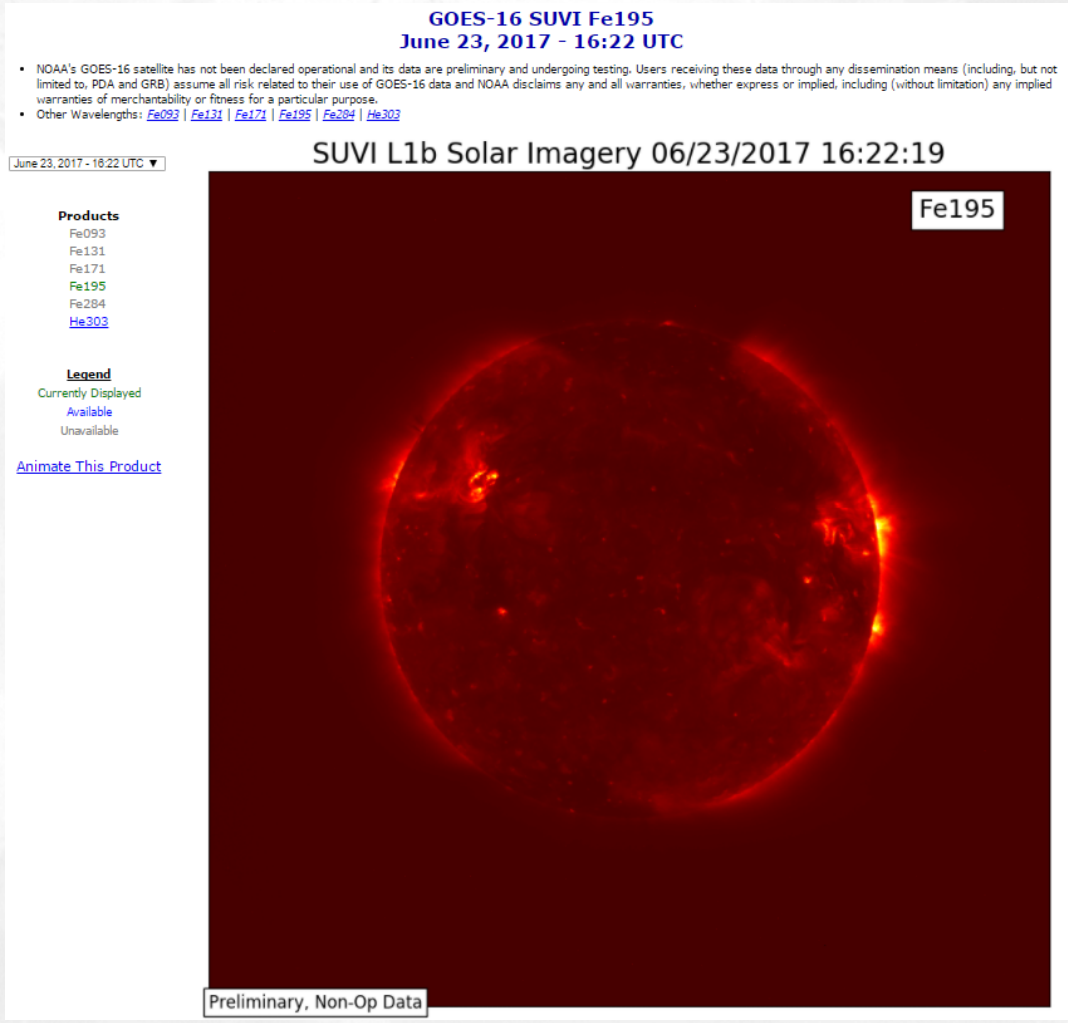



- API Documentation: https://weather.msfc.nasa.gov/goes/abi/wxSatelliteAPI.html
- Example: https://weather.msfc.nasa.gov/cgi-bin/get-abi?satellite=GOESEastconusband02&lat=43.5&lon=-89&zoom=1&width=750&height=450&quality=100

# Quick-Look Images

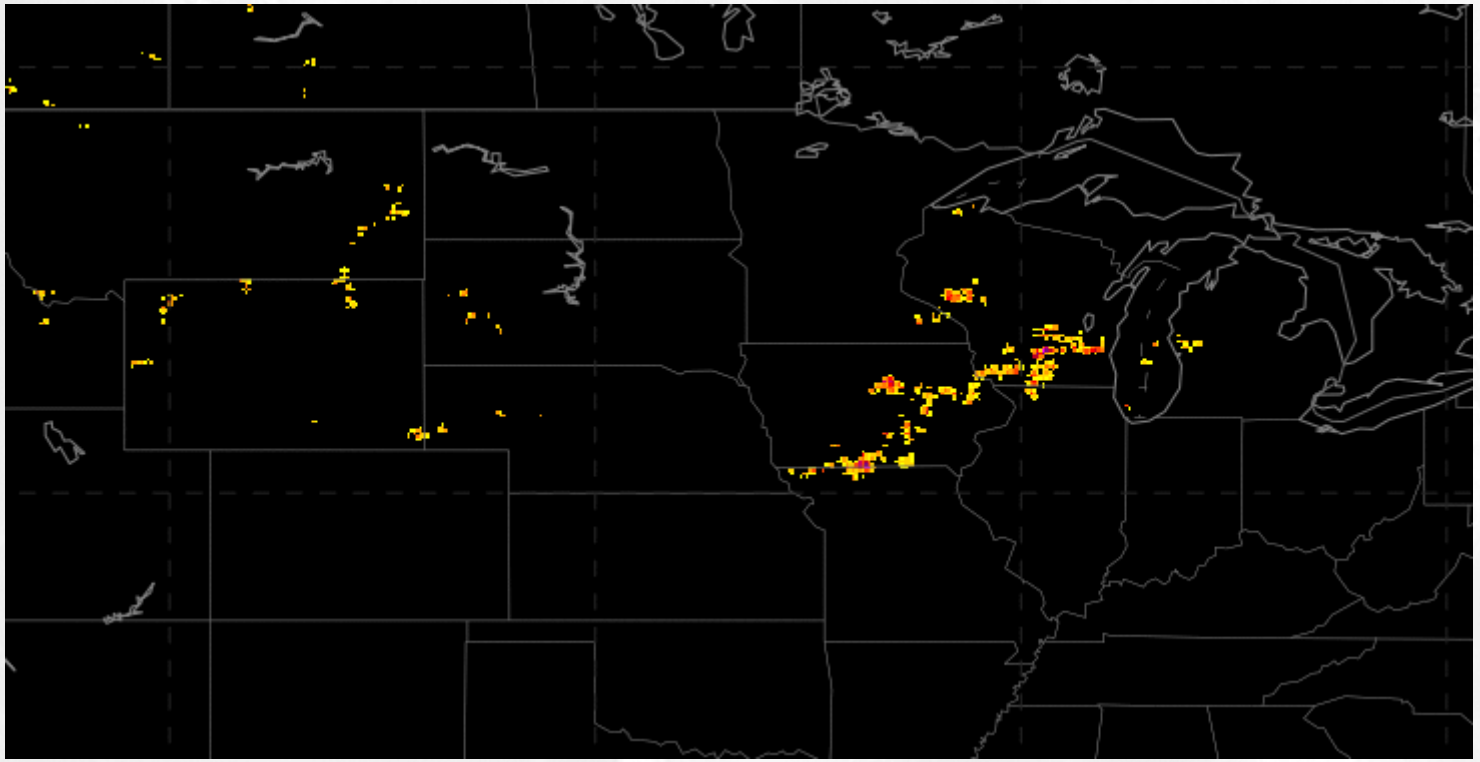
- Used to verify data integrity for all ABI, GLM, and SUVI products
- Supports long animation sequences
- Fixed resolutions



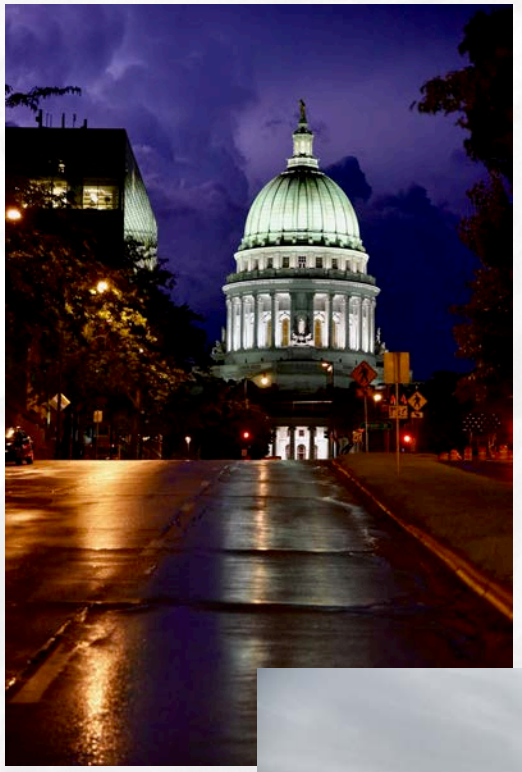




https://weather.msfc.nasa.gov/cgi-bin/sportPublishData.pl?dataset=goes16abiconus

# Quick-Look Images



GLM 2-Minute Group Density
28 June 2017 2341Z – 29 June 2017 0424Z

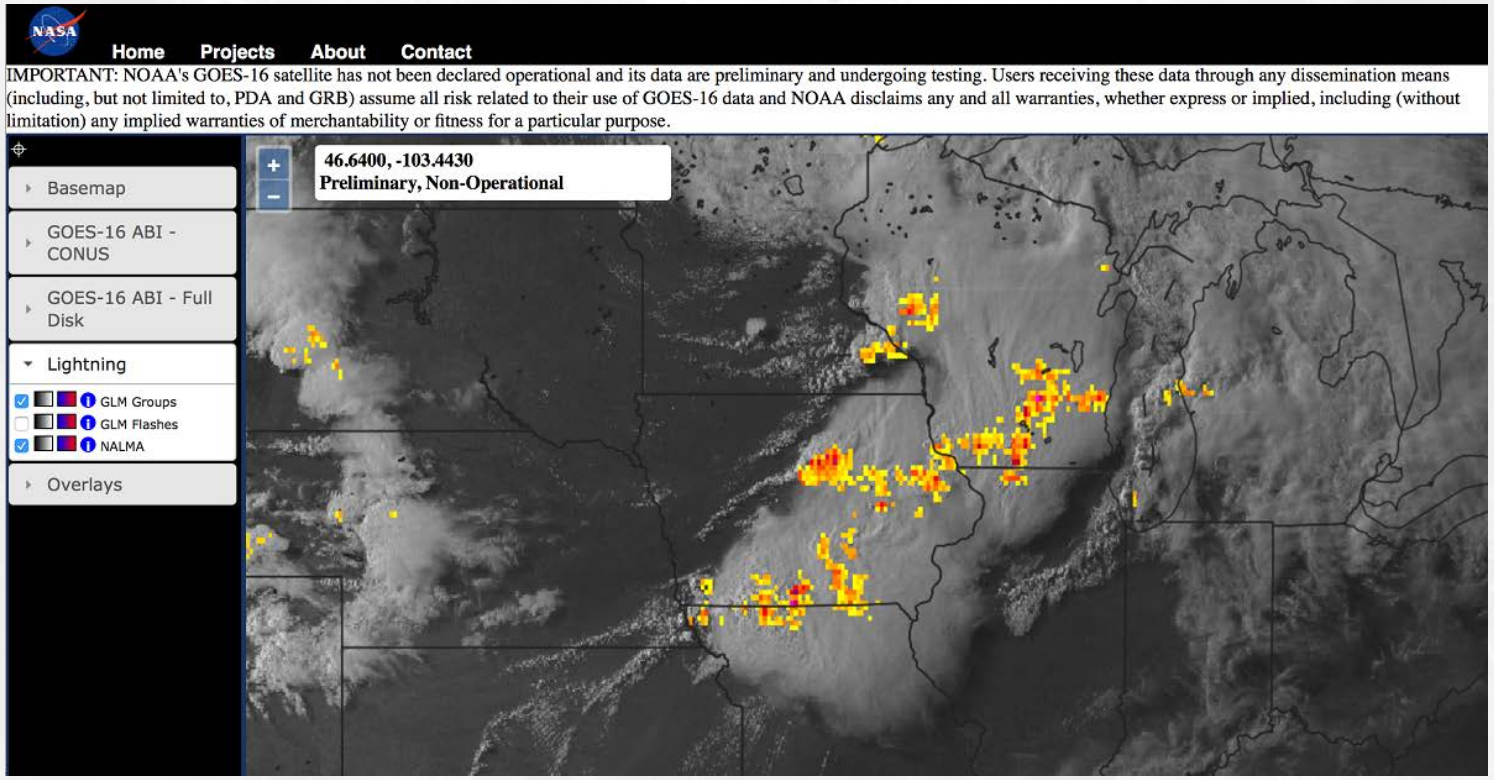



28 June 2017

# Web Map Service

Interactive GIS-based Layered Visualization and Data Access

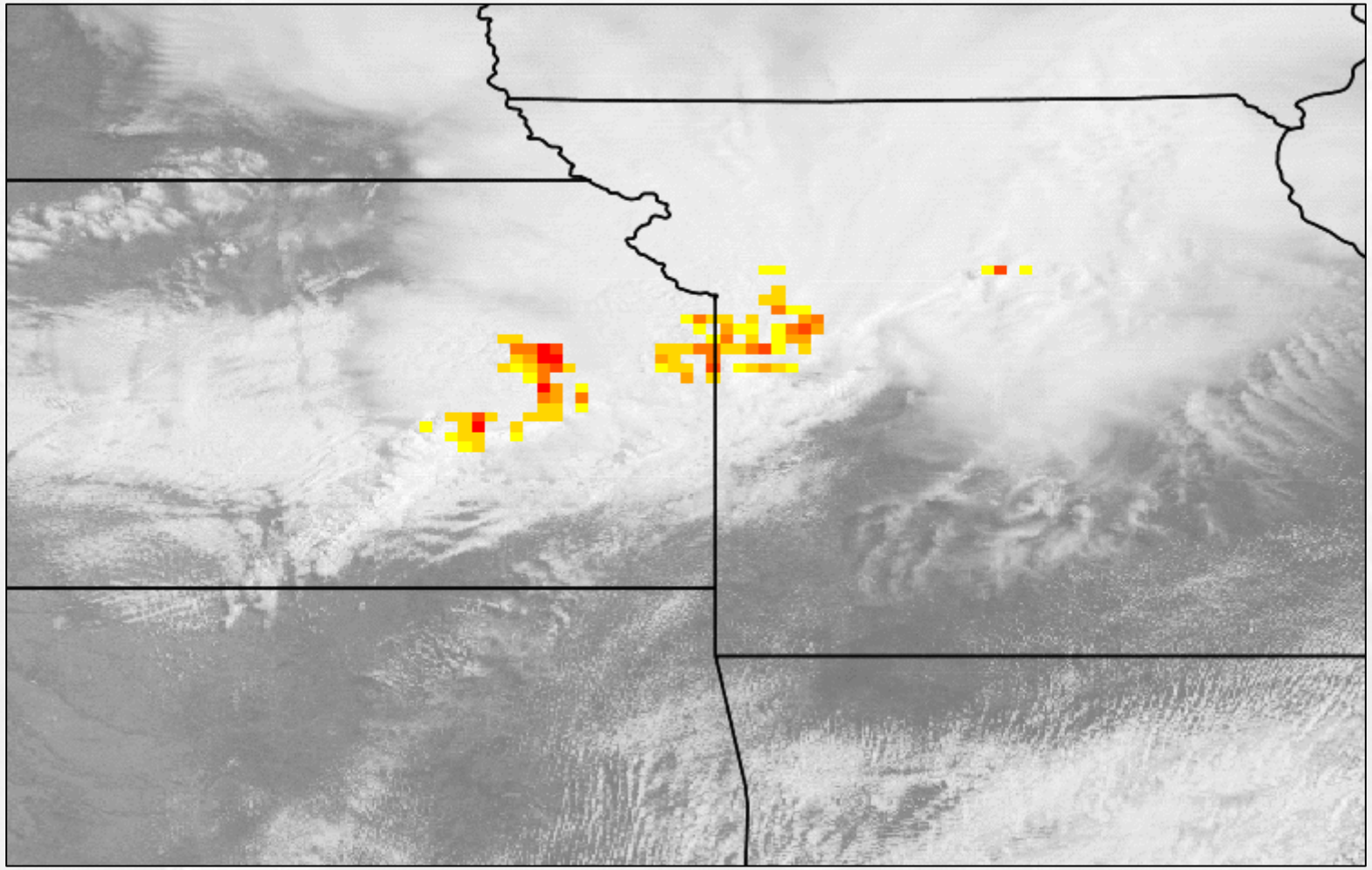
- Current viewer is based upon OpenLayers
- Transitioning from open source GeoServer WMS to Esri Enterprise Server
- Ability to more easily share layers with other GIS users




GLM 2-Minute Groups Overlaid on ABI 0.64µm in GIS Framework (28 June 2017)

https://weather.msfc.nasa.gov/viewer/viewer.html?config=GOES

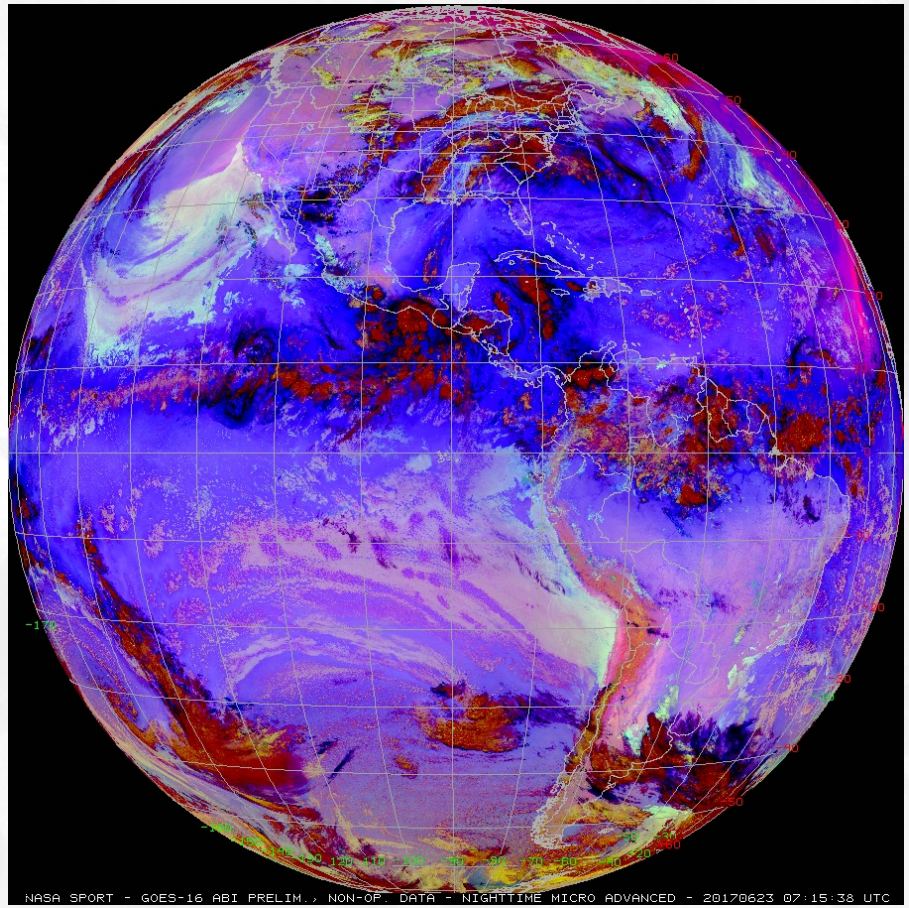
# Web Map Service



GLM 2-Minute Group Density Overlaid on ABI 0.64µm
29 June 2017 1530Z – 1630Z

# Future

- Visualization and dissemination of real-time data
  - ABI
    - Addition of mesoscale sectors and unique NASA products
  - GLM
    - Implement display in classic viewer
  - Space weather instruments
    - SUVI: Create quick-look displays
    - EXIS, MAG, and SEISS: Visualize temporal changes as graphical plots
  - WMS
    - Animation
    - Migration to Esri ecosystem
- Integrate NASA unique value-added products as part of the GOES L2 processing within CSPP
- Acquire a second GOES-R series receiving station for ocean-to-ocean CONUS coverage – replicate visualization and dissemination capabilities



# Contact Info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