Future Geostationary Weather Satellites

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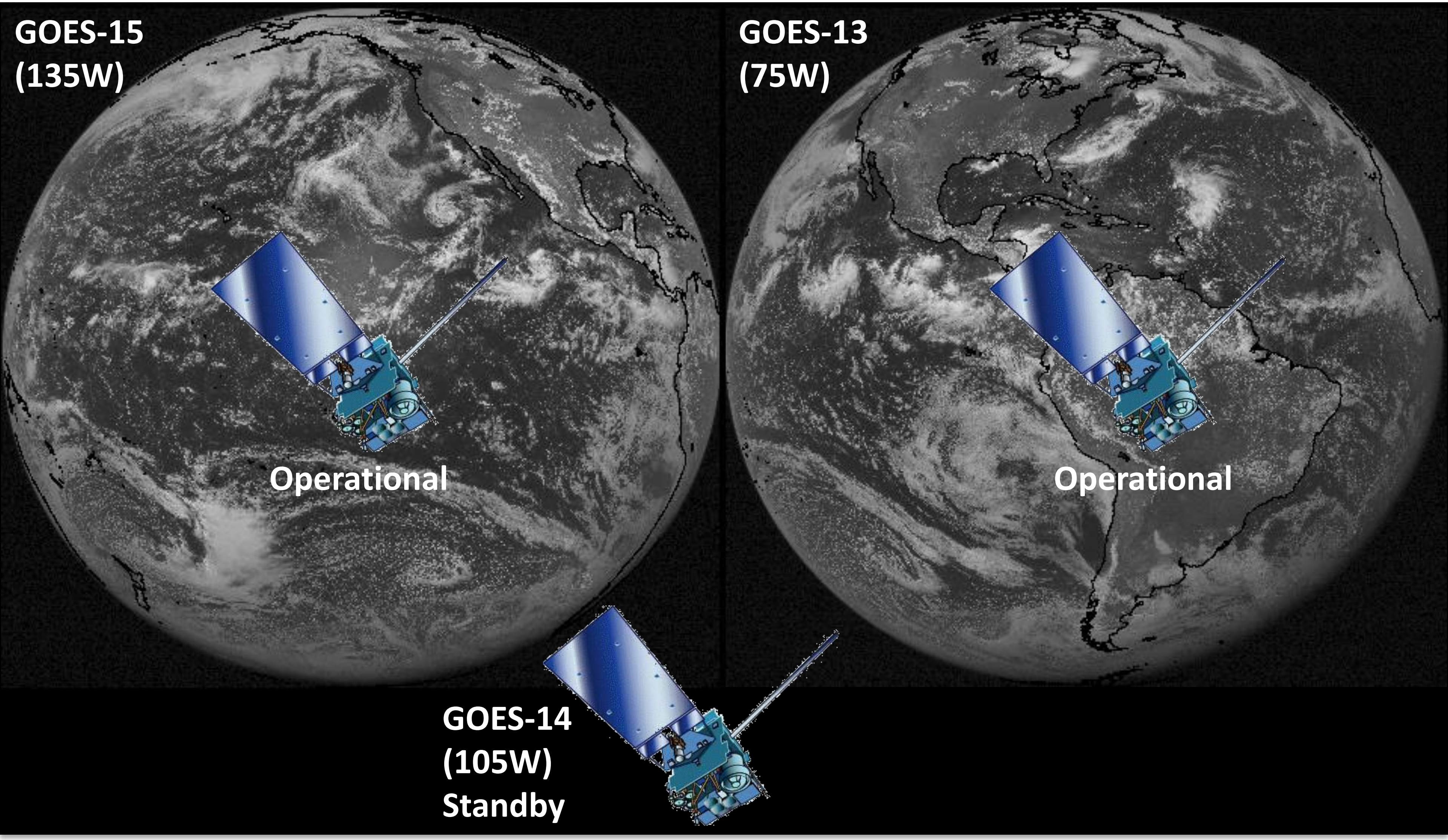
Includes contributions from the community

Current GOES Constellation



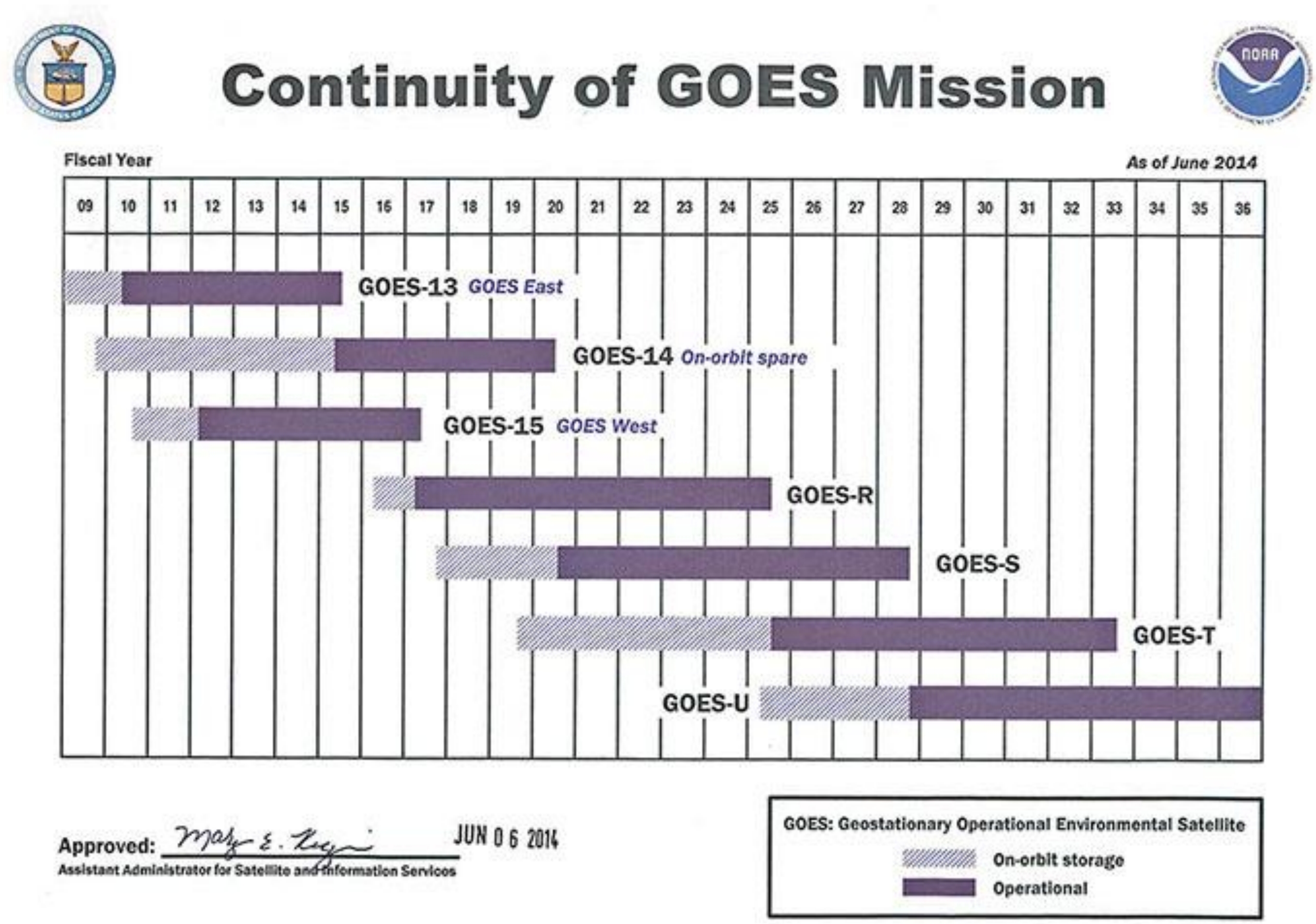
From Current to Future GOES

GOES-R Launches in March 2016

Post-launch test period begins shortly after launch and lasts six months

NOAA is investigating a number of options, including:

- Commissioning phase timeline
- Placement of GOES-R following test period



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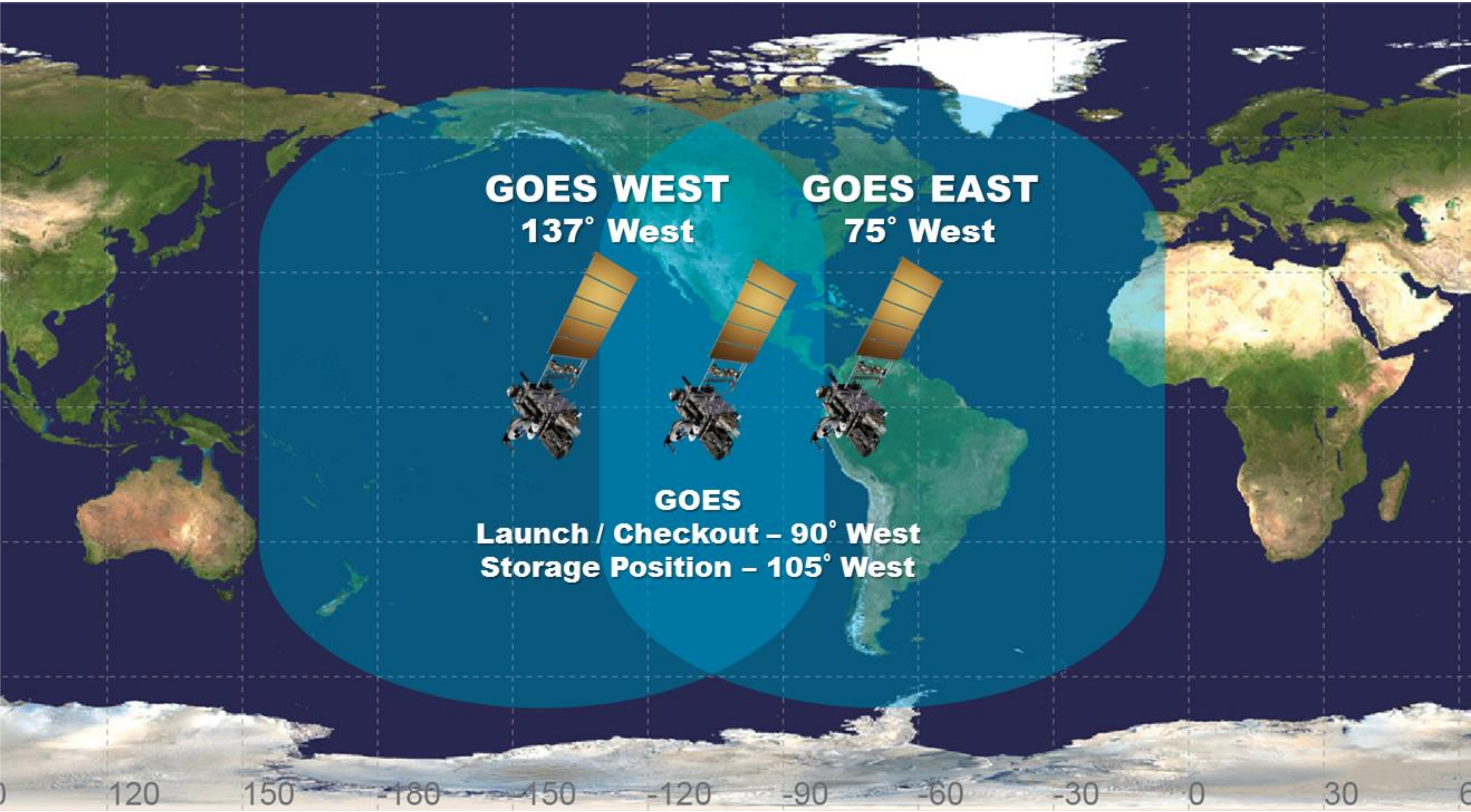
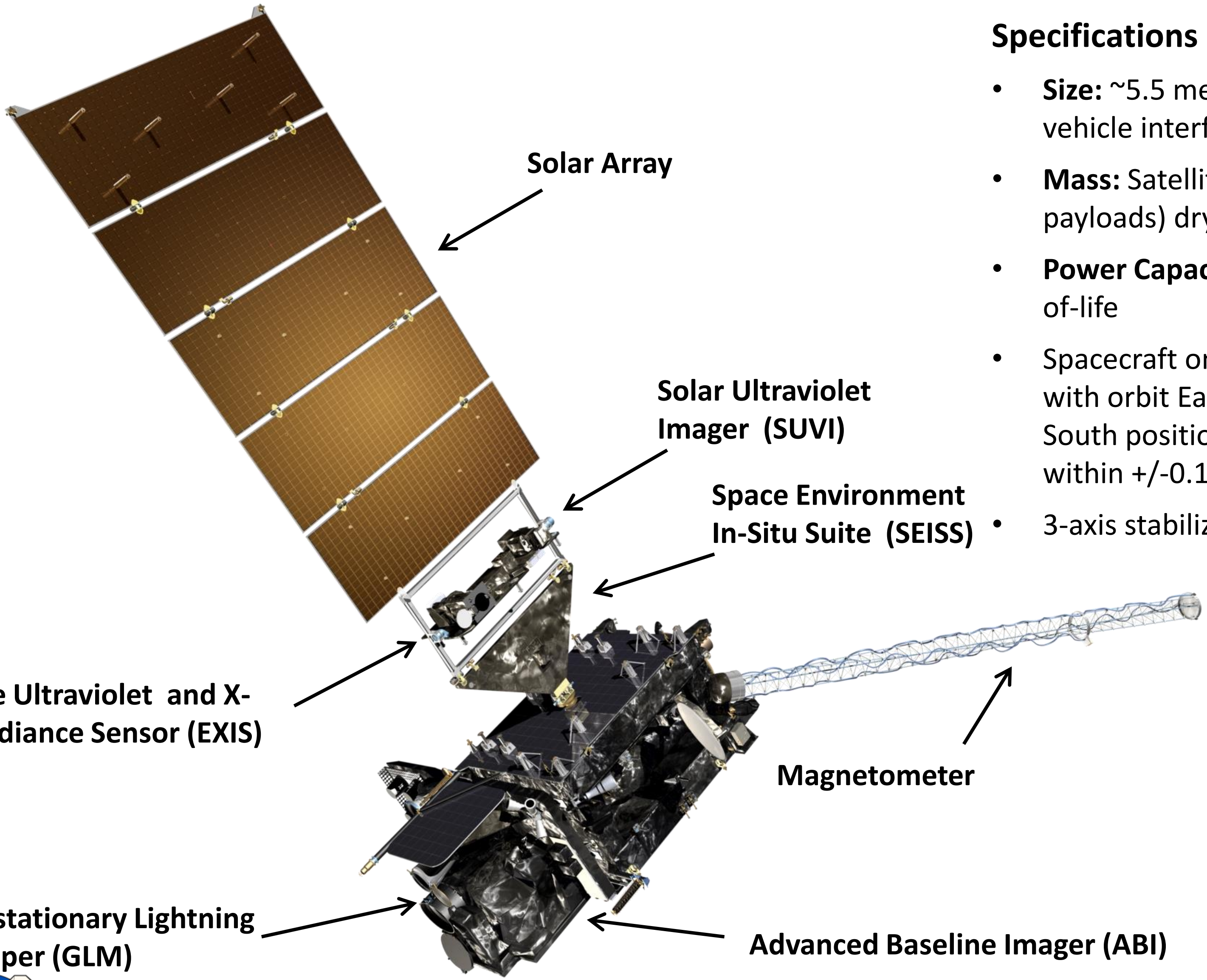
Future GOES-R/S/T Constellation



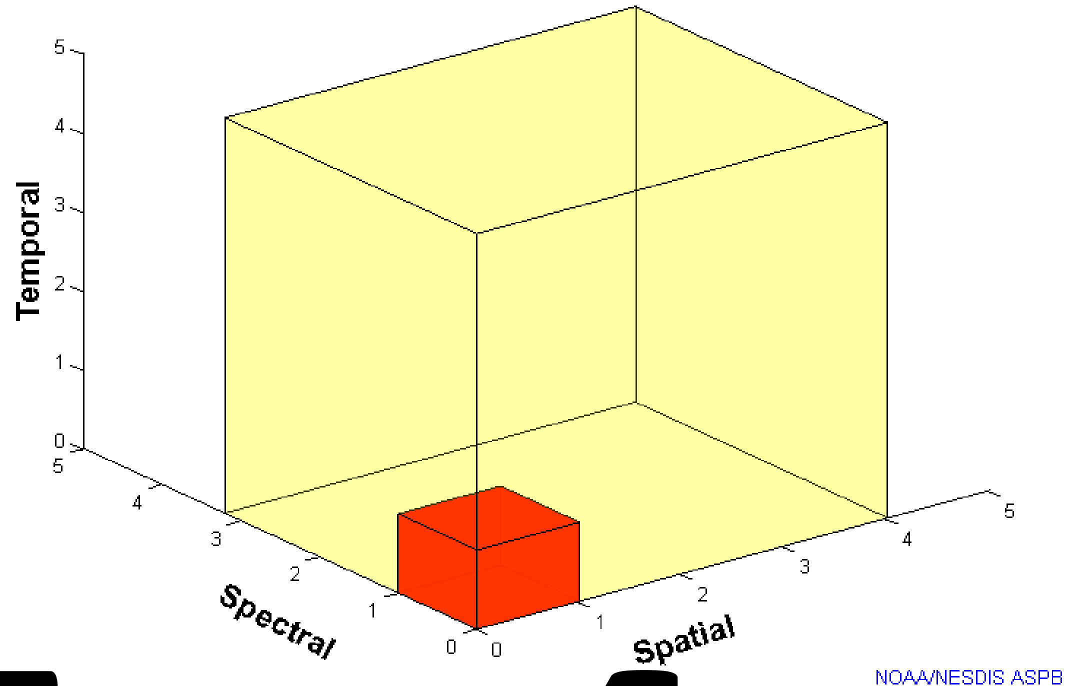
GOES-R Series Spacecraft



Specifications

- **Size:** ~5.5 meters (from launch vehicle interface to top of ABI)
- **Mass:** Satellite (spacecraft and payloads) dry mass <2800kg
- **Power Capacity:** >4000W at end-of-life
- Spacecraft on-orbit life of 15 years with orbit East-West and North-South position maintained to within +/-0.1 degree
- 3-axis stabilized

Advanced Baseline Imager



5X Faster scanning (5-minute full disk vs. 25-minute)

4X Improved spatial resolution (2 km IR vs. 4 km)

3X More spectral bands (16 on ABI vs. 5)

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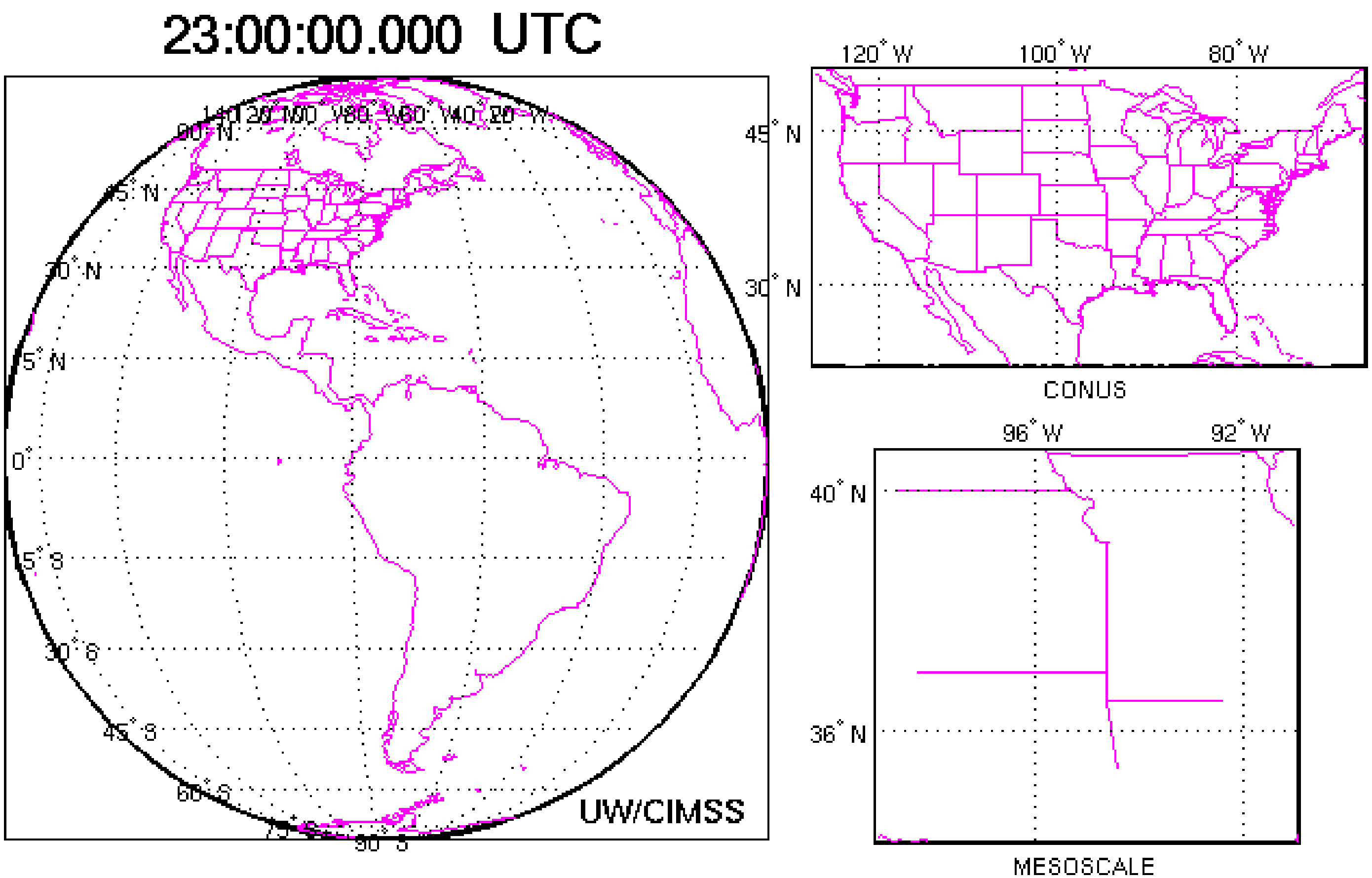
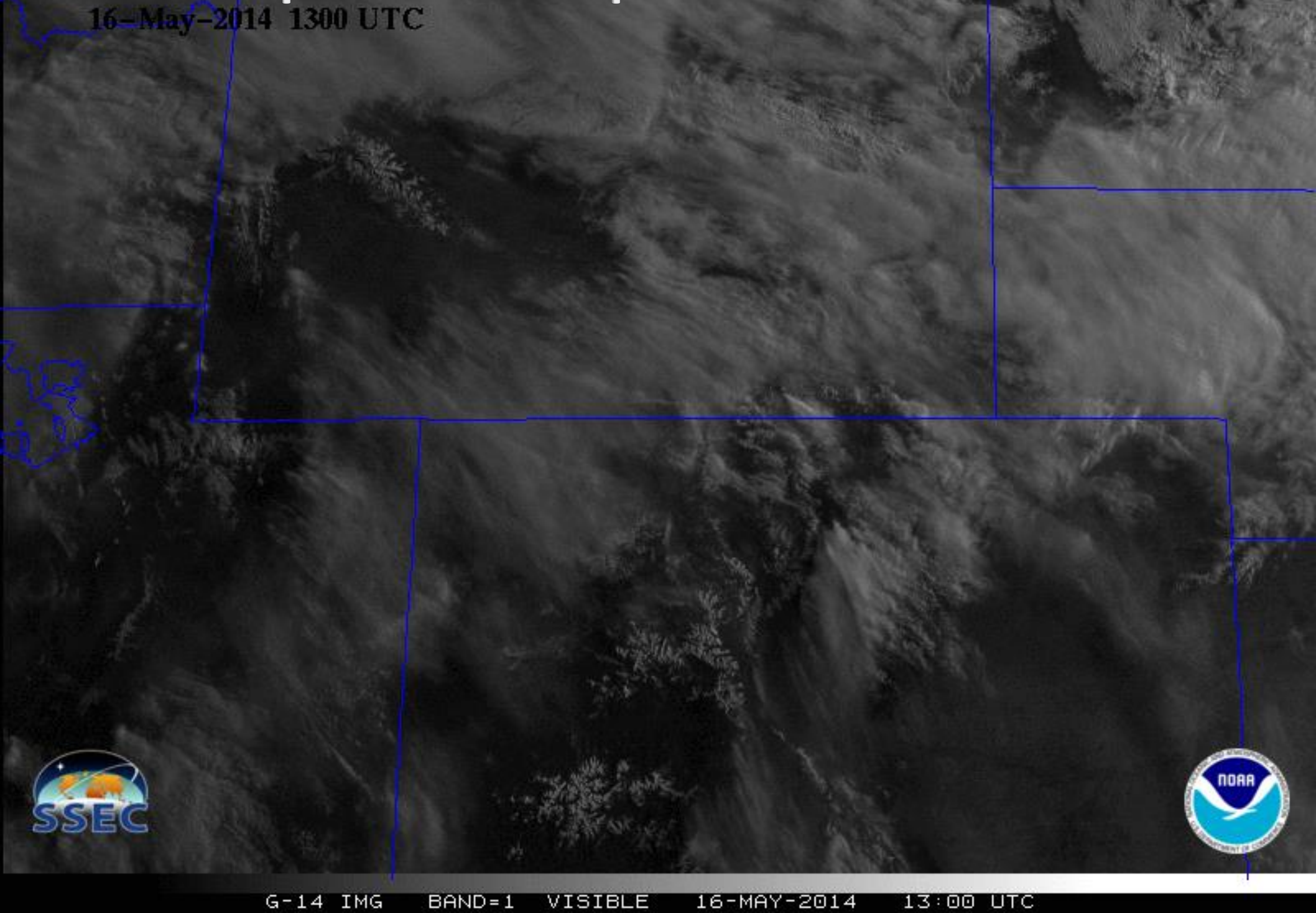
Example of Flex Mode Scanning

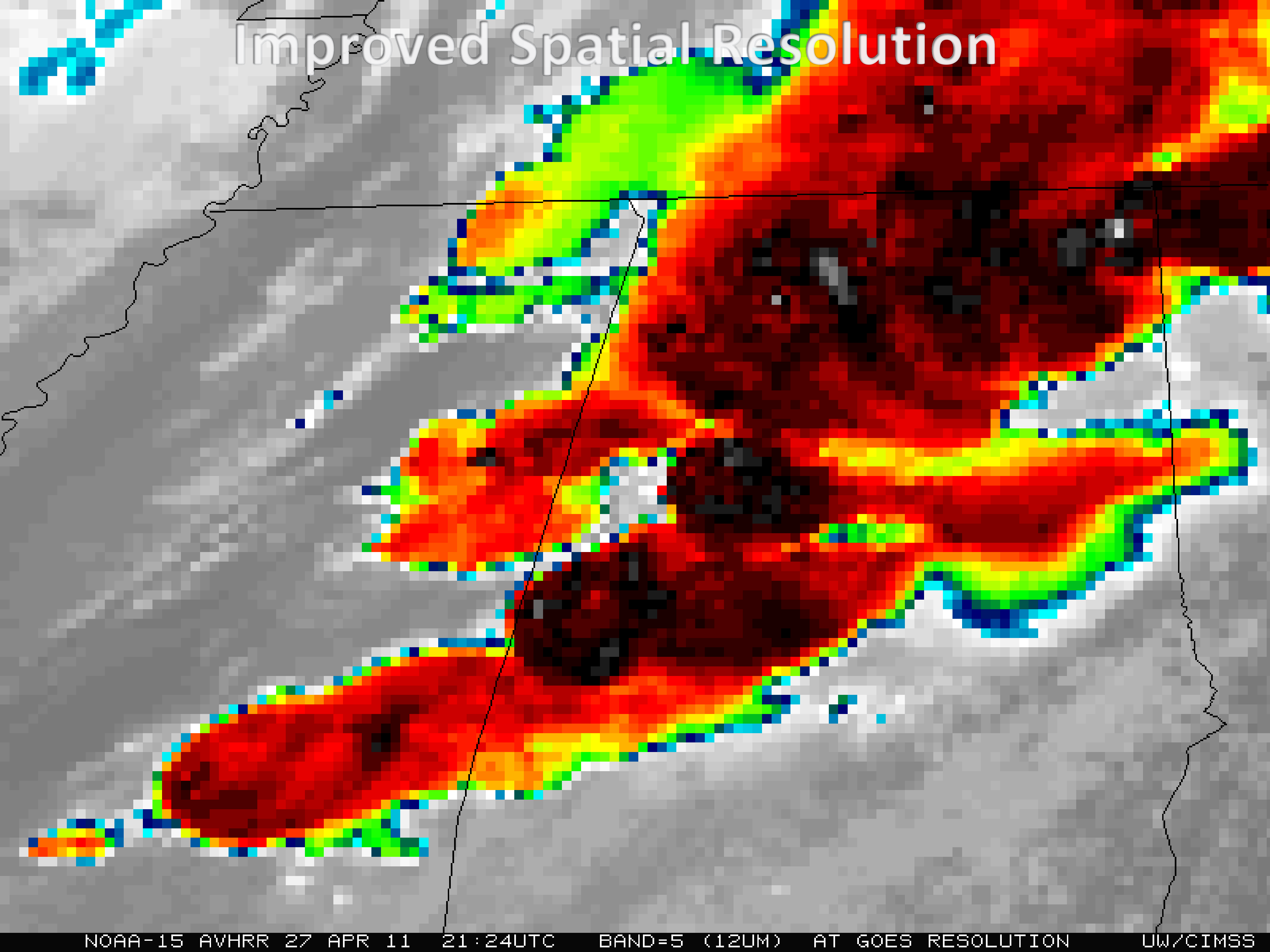


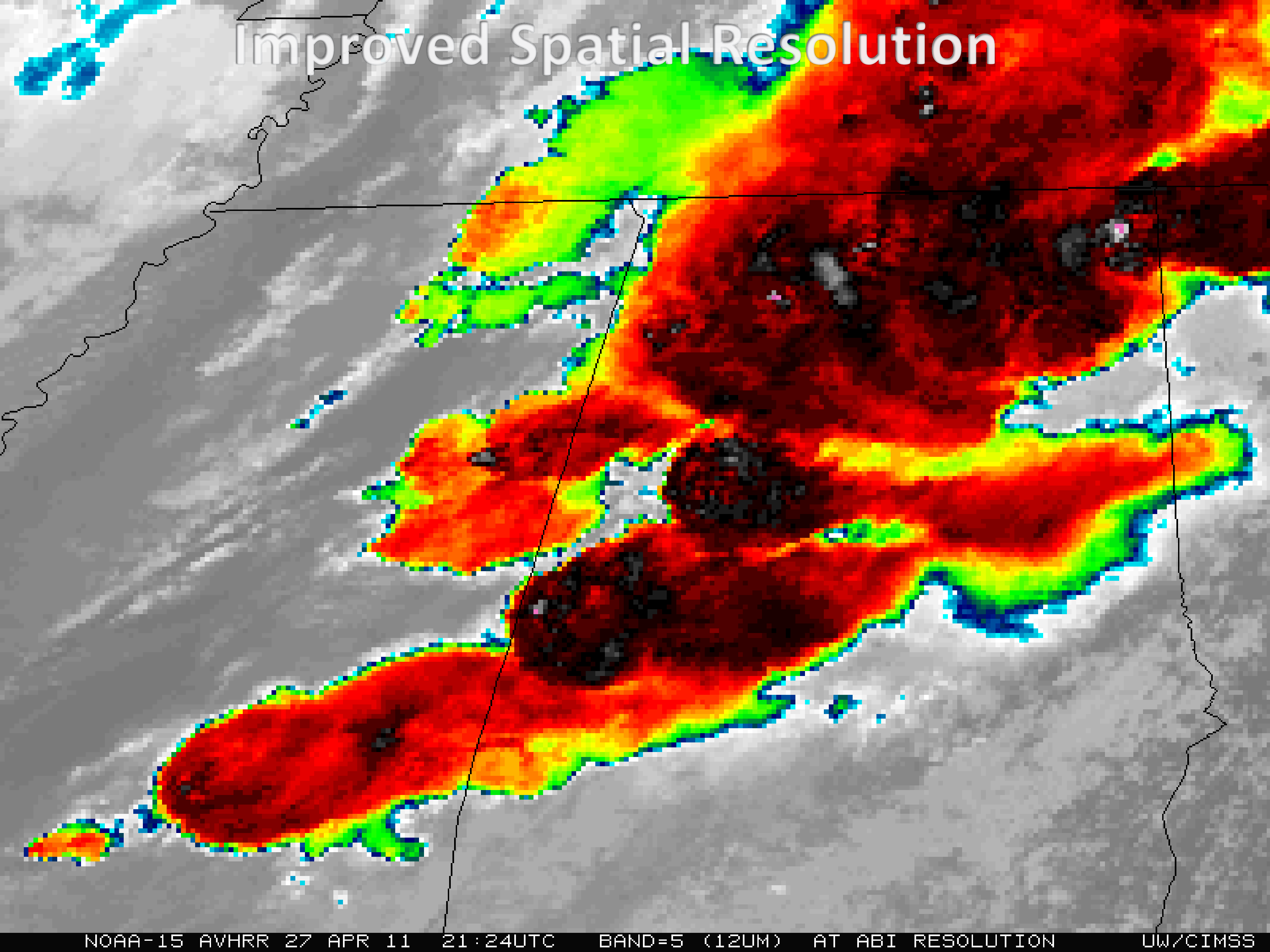
The ABI may also be operated in a five-minute continuous full disk mode.

Improved Temporal Resolution

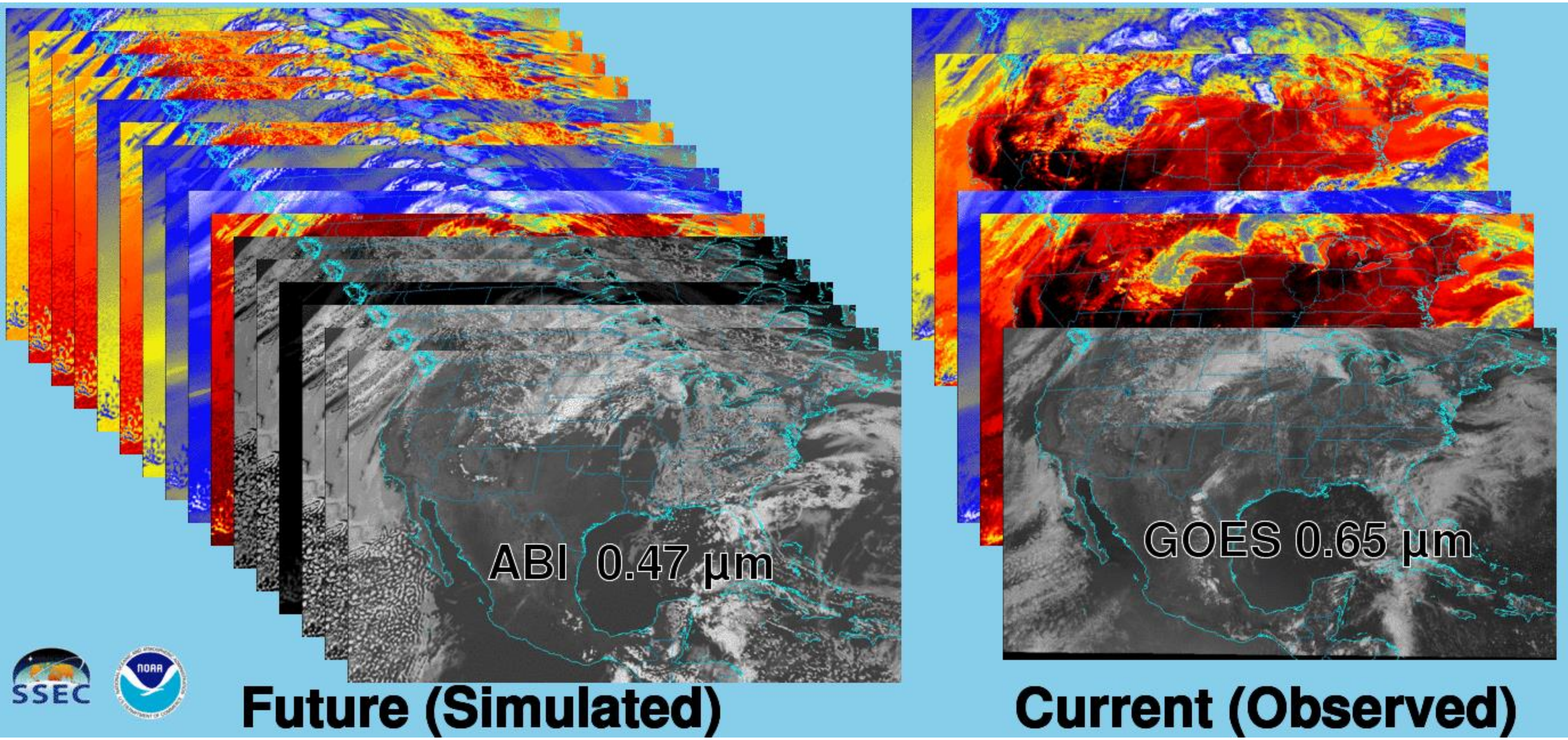


Improved Spatial Resolution




Improved Spatial Resolution
NOAA-15 AVHRR 27 APR 11 21:24UTC BAND=5 (12UM) AT ABI RESOLUTION UW/CIMSS

Future vs. Current Spectral Bands



ABI benefits are projected to be at least $4.6B over the lifetime of the series due to improved tropical cyclone forecasts, fewer weather-related flight delays, improved production of electricity and natural gas, and increased efficiency in irrigated water usage (Centrec, 2/2008).

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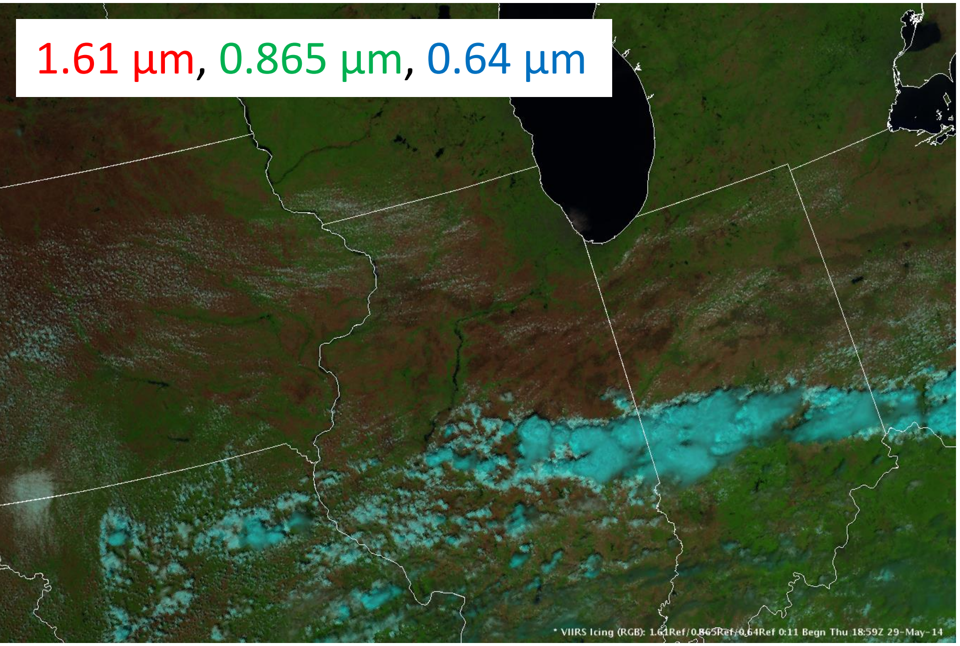
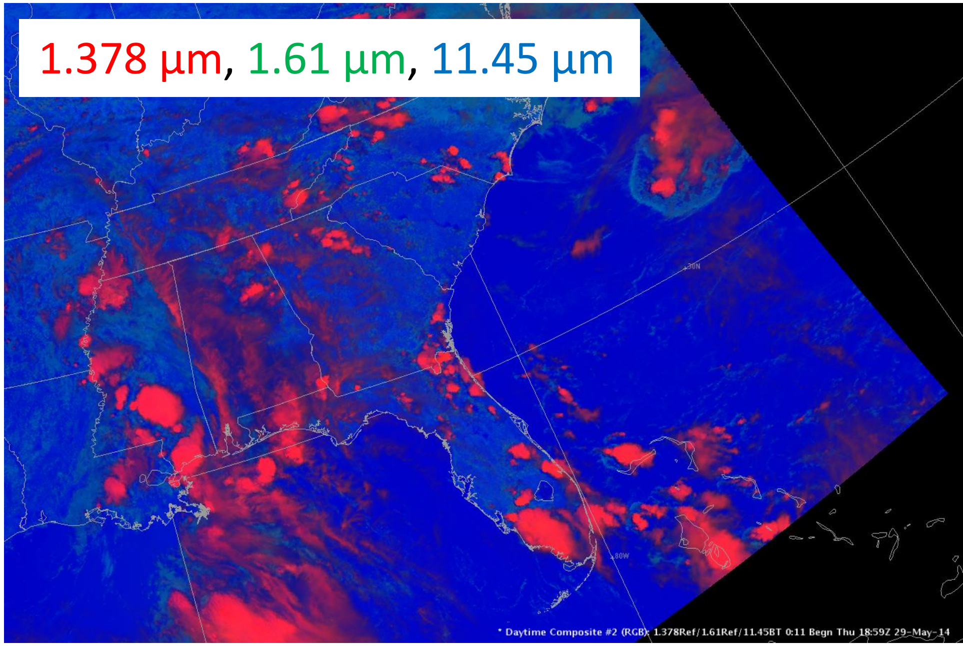
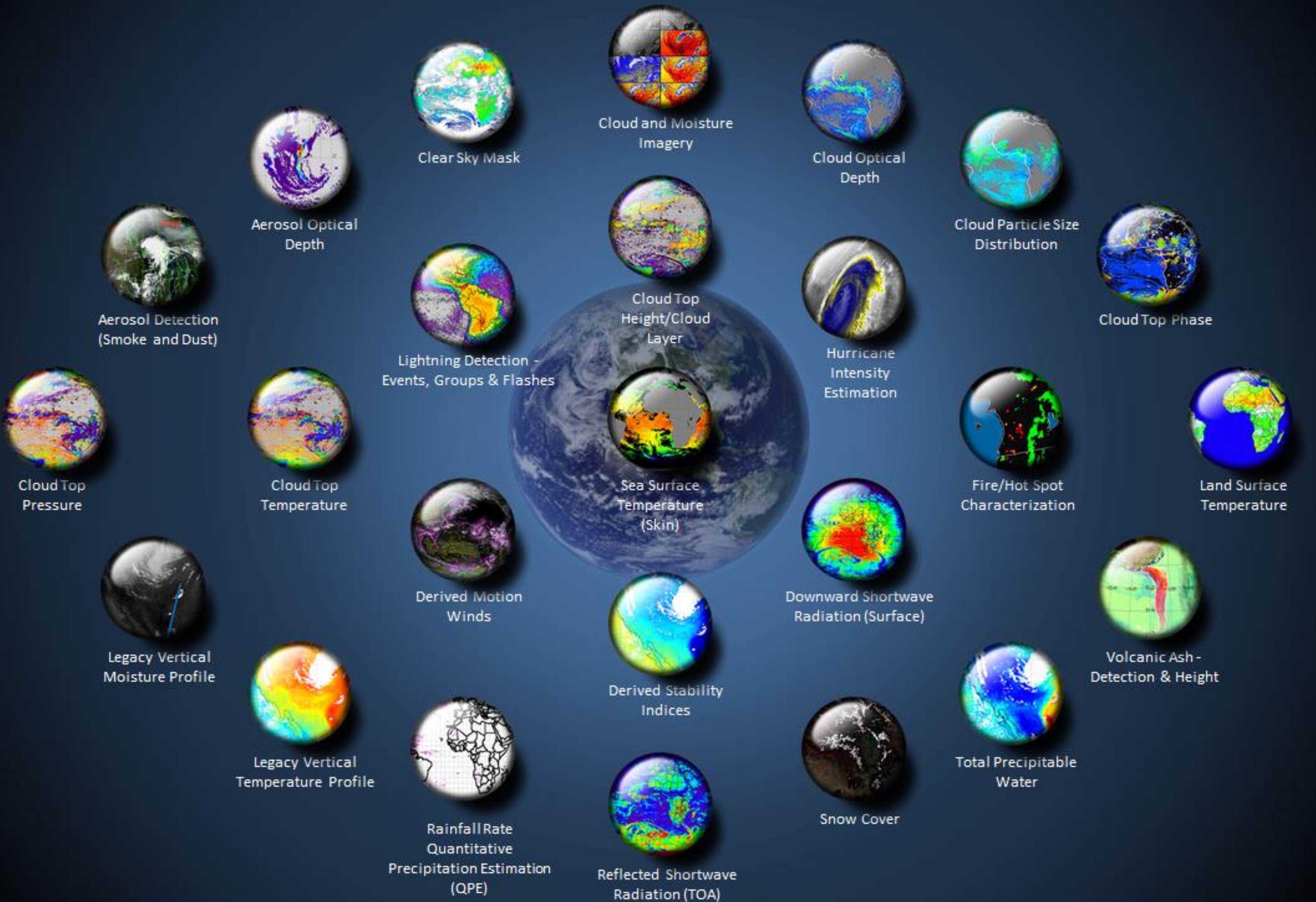
Value of More Spectral Bands



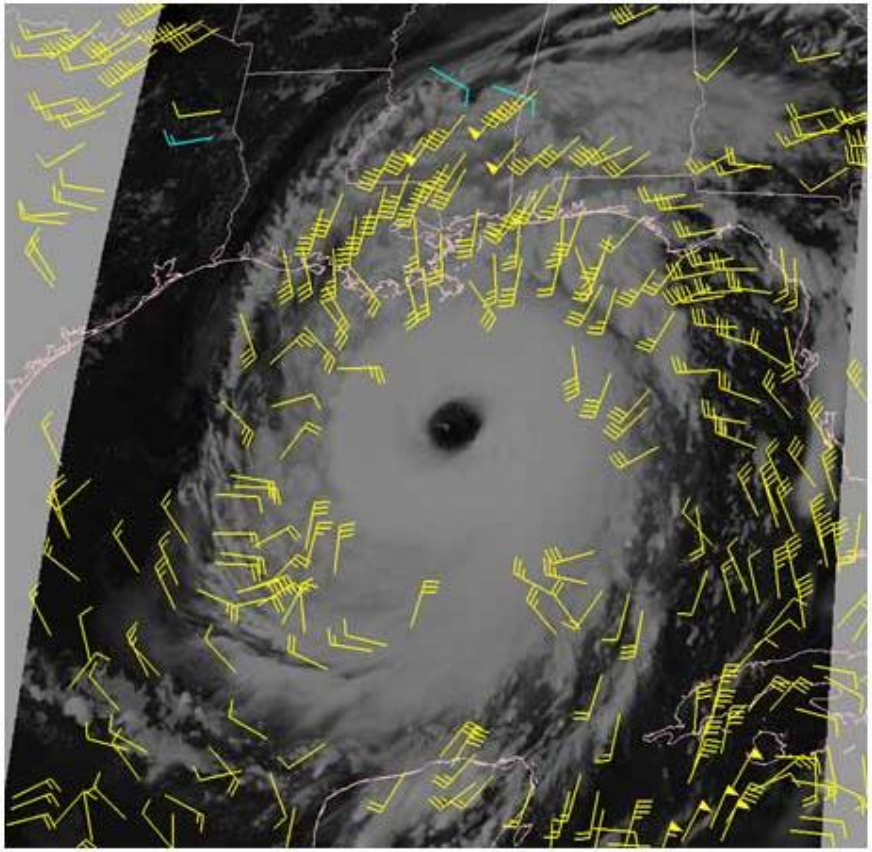


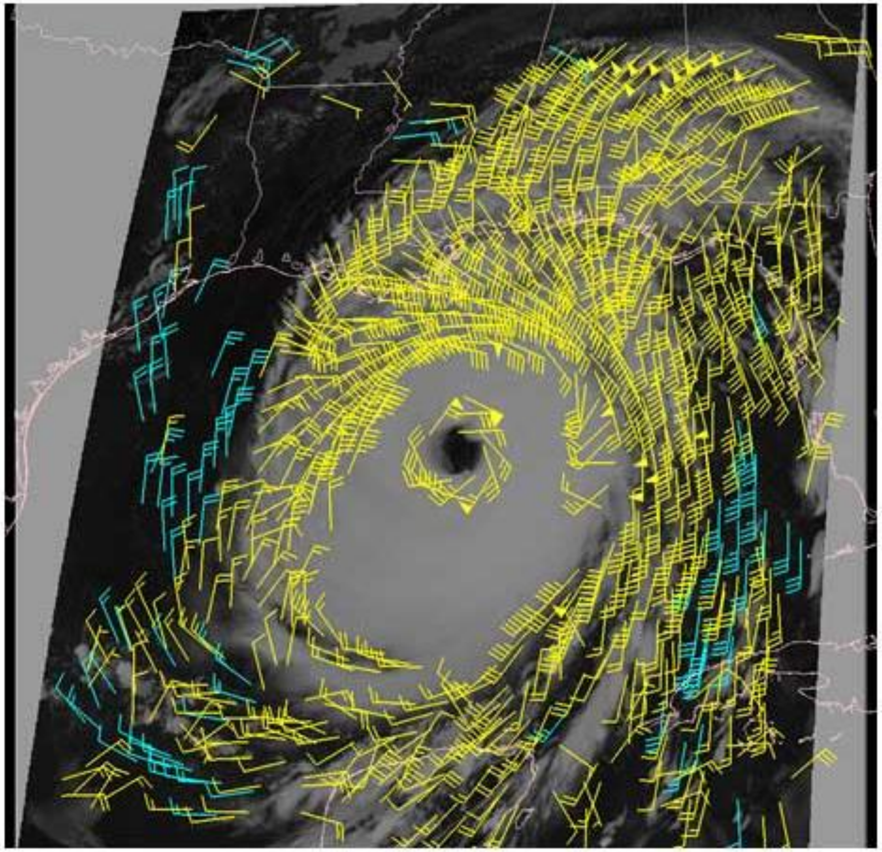
Using similar spectral bands from the Suomi National Polar-orbiting Partnership (NPP) satellite, the value of additional spectral bands is evident. Meteorologists can combine multiple bands into one image to enhance a particular atmospheric, cloud, or land feature.

GOES-R Baseline Products



Atmospheric Motion Vectors



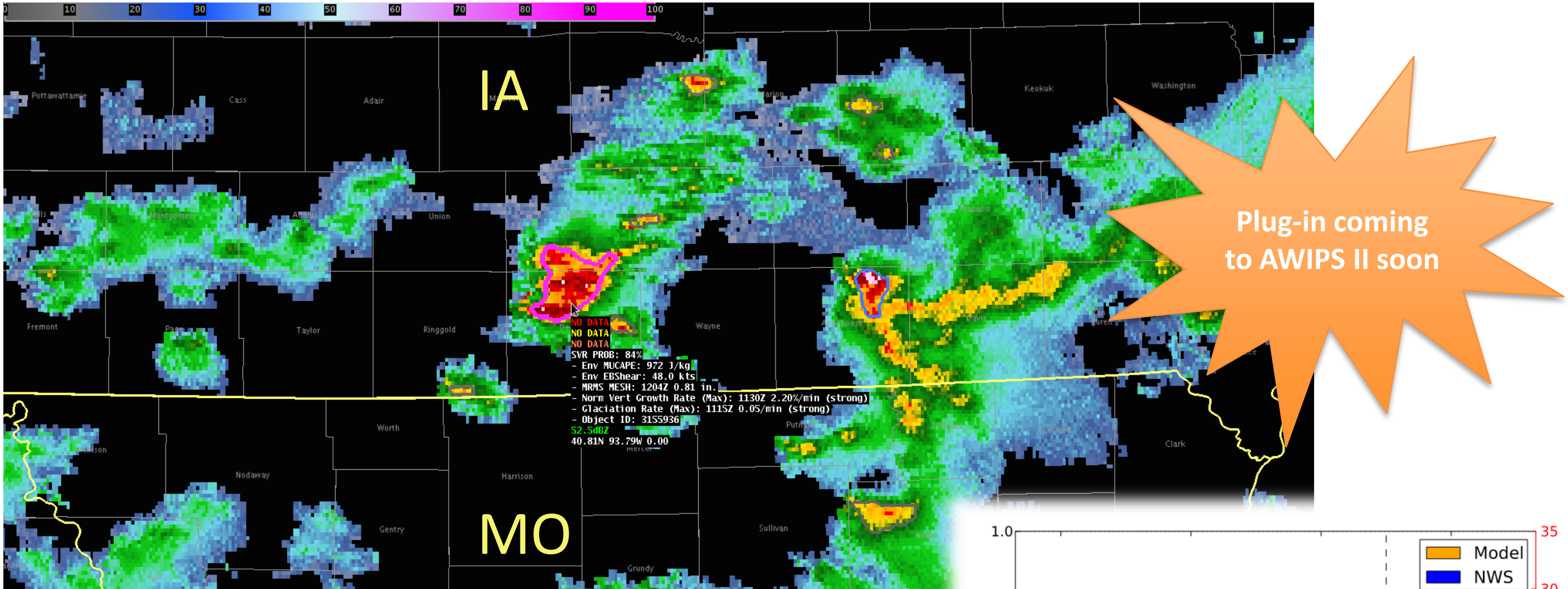


Low-mid level vectors- cyan   Upper-level vectors - yellow

IR AMVs derived from current GOES-12
4km resolution; 15-minute time step

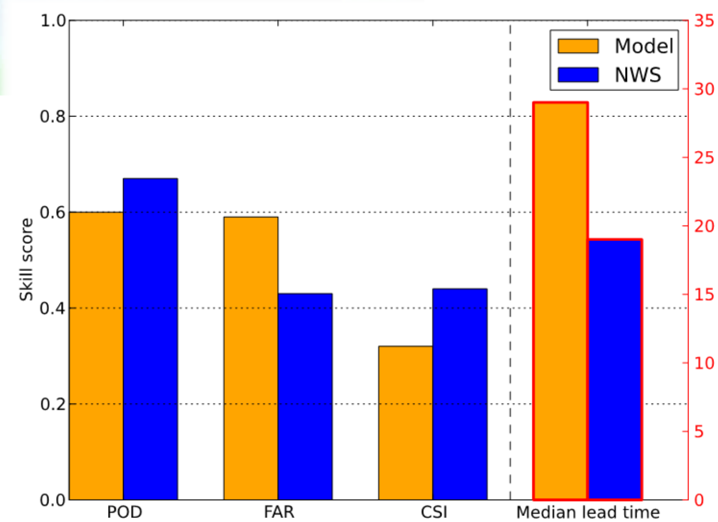
IR AMVs derived from WRF model images
using simulated future GOES-R radiances
2 km resolution; 5-minute time step

NOAA/CIMSS ProbSevere Model



- An example of NWS-promoted "data fusion"
- Object-tracking in both GOES and radar imagery
- Predictors from GOES-derived cloud products, MRMS products, and RAP-derived fields
- Use trained statistical model to compute probability of future severe weather:

P(severe) = *f* (GOES, RAP, MRMS) + lightning



Frequency of Full Disk Scanning

There are alternative ABI scan strategies under study that may be possible in the future. Here are the number of full disk scans possible within one hour, comparing GOES-R to other contemporary international geostationary weather satellites.

12

GOES-R ABI Continuous Full Disk Mode

4

GOES-R ABI Flex Mode

6

Himawari AHI (JMA)

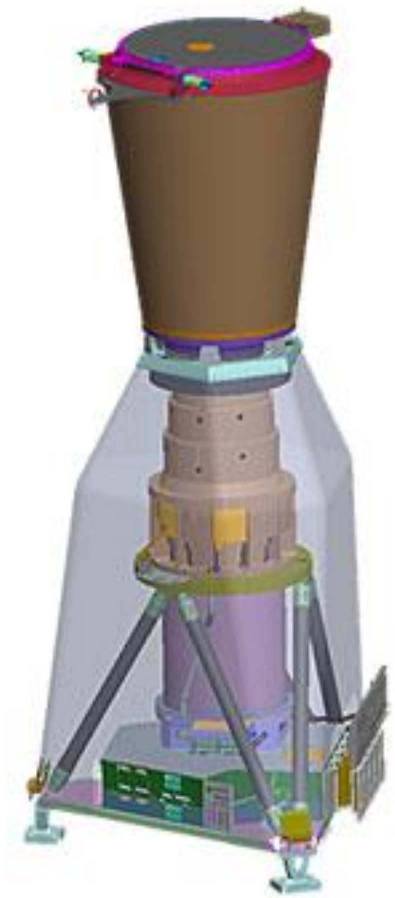
6

MTG-FCI (EUMETSAT)

CIMSS

Geostationary Lightning Mapper

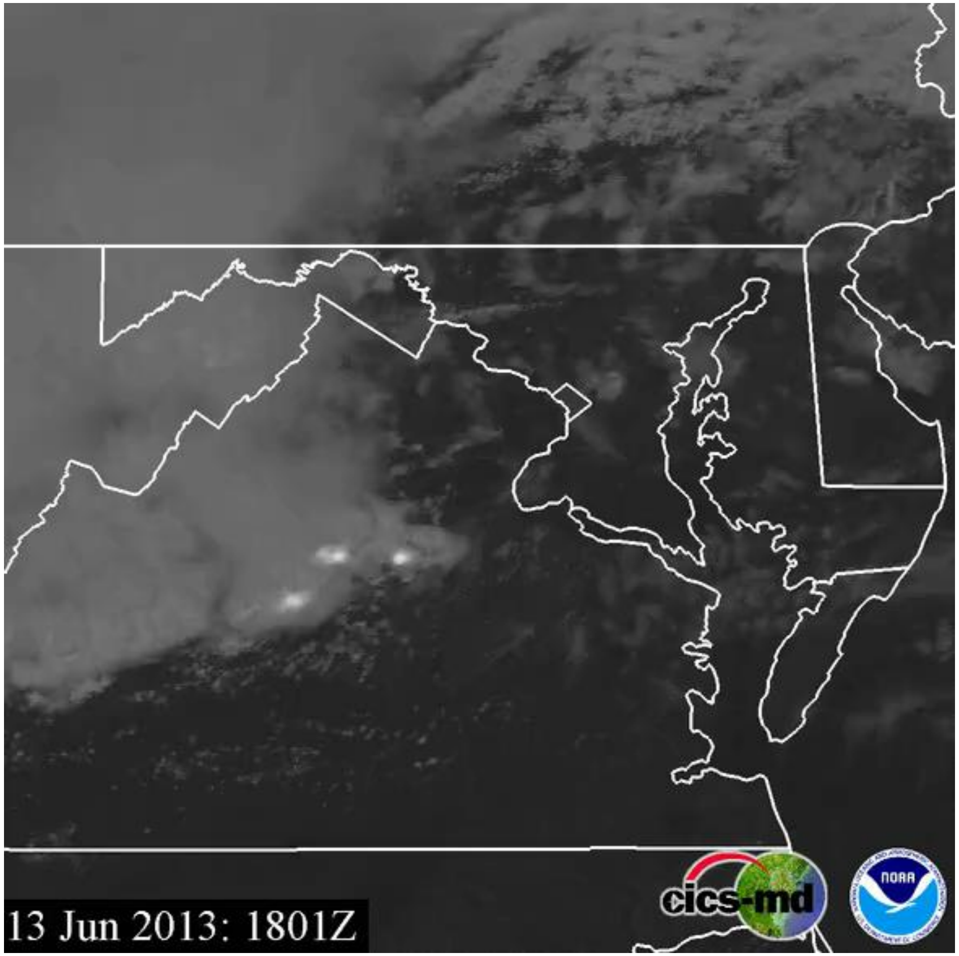
- Near uniform spatial resolution 8 km nadir, 14 km edge FOV
- Coverage up to 52 degrees N latitude
- > 80% flash detection day and night
- Single band 777.4 nm
- 2 ms frame rate
- 7.7 Mbps downlink data rate
- < 20 second product latency



Geostationary Lightning Mapper

1) Improvement in tornado and severe thunderstorm lead times and false alarm reduction
2) Early warning of lightning ground strike hazards
3) Advancements in the initialization of numerical weather prediction models
4) Improved routing of commercial, military, and private aircraft over oceanic regions
5) Improved ability to monitor intensification or decay of storms during radar outages, or where radar coverage is poor or scarce
6) Better detection and short range forecasts of heavy rainfall and flash flooding
7) Ability to monitor the intensity change of tropical cyclones
8) Continuity and refinements of lightning climatology within the GOES field of view

Geostationary Lightning Mapper



The Future of Satellite Data

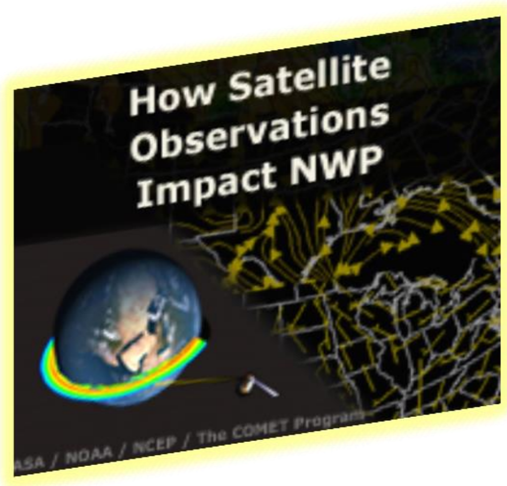
- Data availability on par with convective evolution timescales
  - Improved warning decision-making
- Decreased use of satellite-only “stovepipe” products
- More blended/combined products
  - New techniques/models which favor probabilistic solutions that incorporate satellite data
- Increased automated feature identification from satellite data
  - Fires
  - Volcanic ash
- Increased incorporation into numerical weather prediction (NWP) models
- Real-time comparisons with NWP model output

GOES-R User Readiness

- Official GOES-R homepage
  https://www.goes-r.gov
- GOES-R Facebook page
  https://www.facebook.com/GOESRsatellite
- GOES-R Proving Ground
  - Demonstrations
  - CIMSS, CIRA, SPoRT, HWT blogs
- Visiting Scientist Program
- Forecaster Feedback
- Training and Outreach
- Fact sheets
- Tri-fold brochure
- User Readiness Plan

GOES-R Proving Ground

- Collaborative effort between the GOES-R Program Office, selected NOAA Cooperative Institutes, NWS forecast offices, NCEP National Centers, NASA SPoRT, JCSDA, and NOAA Testbeds
- Responsible for user readiness testing of GOES-R baseline products and future capabilities prior to launch
- Where proxy and simulated GOES-R products are tested, evaluated, and integrated into operations before the GOES-R launch
  - Satellite liaisons at NWS National Centers
  - Develop training for users
  - Prepare for display within AWIPS/AWIPS-II/N-AWIPS
  - Initial focus on High Impact Weather and warning related products requested by NWS
- A key element of GOES-R User Readiness (Risk Mitigation)
- Proving Ground activities are having an impact **NOW!**

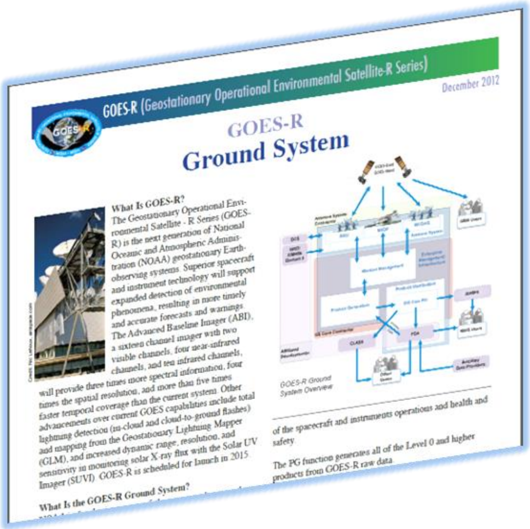


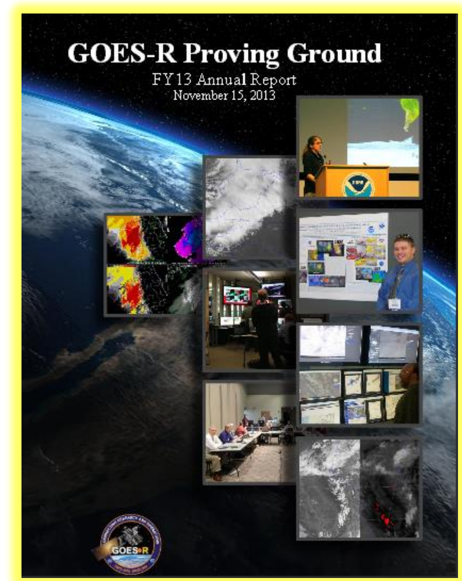
Online Training Modules

- How Satellite Observations Impact NWP
- GOES-R ABI: Next Generation Satellite Imaging (COMET)
- GOES-R: Benefits of Next-Generation Environmental Monitoring (COMET)
- Satellite Hydrology and Meteorology for Forecasters (SHyMet)
- SPoRT product training modules
- VISIT Training Resources
- Commerce Learning Center

Printed Materials

- GOES-R Fact Sheets (18)
- User Readiness Plan
- GRB Downlink Specifications and Product Users Guide
- Proving Ground Demonstration Final Reports and Annual Reports





Questions? Comments?

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