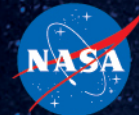# GOES-R Series Program

**Steve Goodman
GOES-R Program
Senior Scientist**

NOAA Satellite Aerosol Product Workshop

College Park, MD

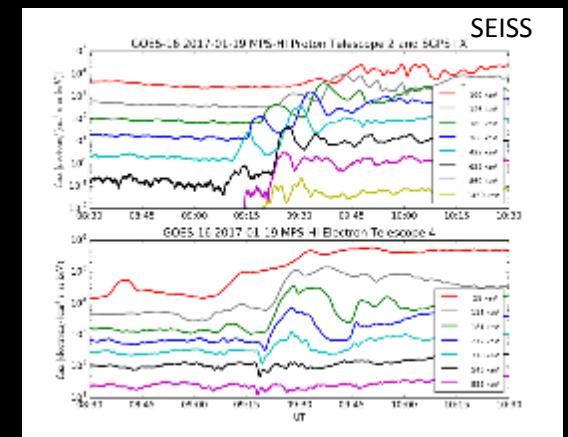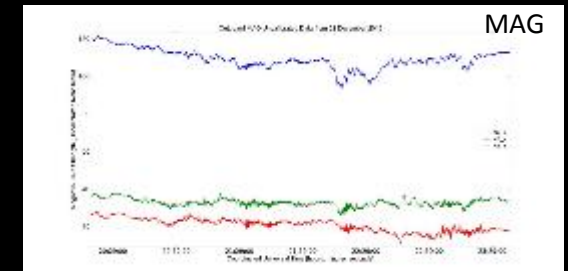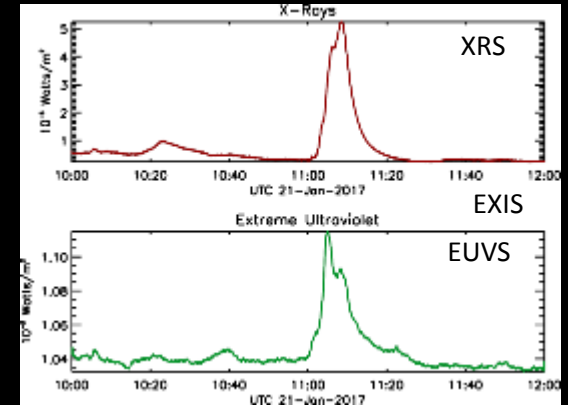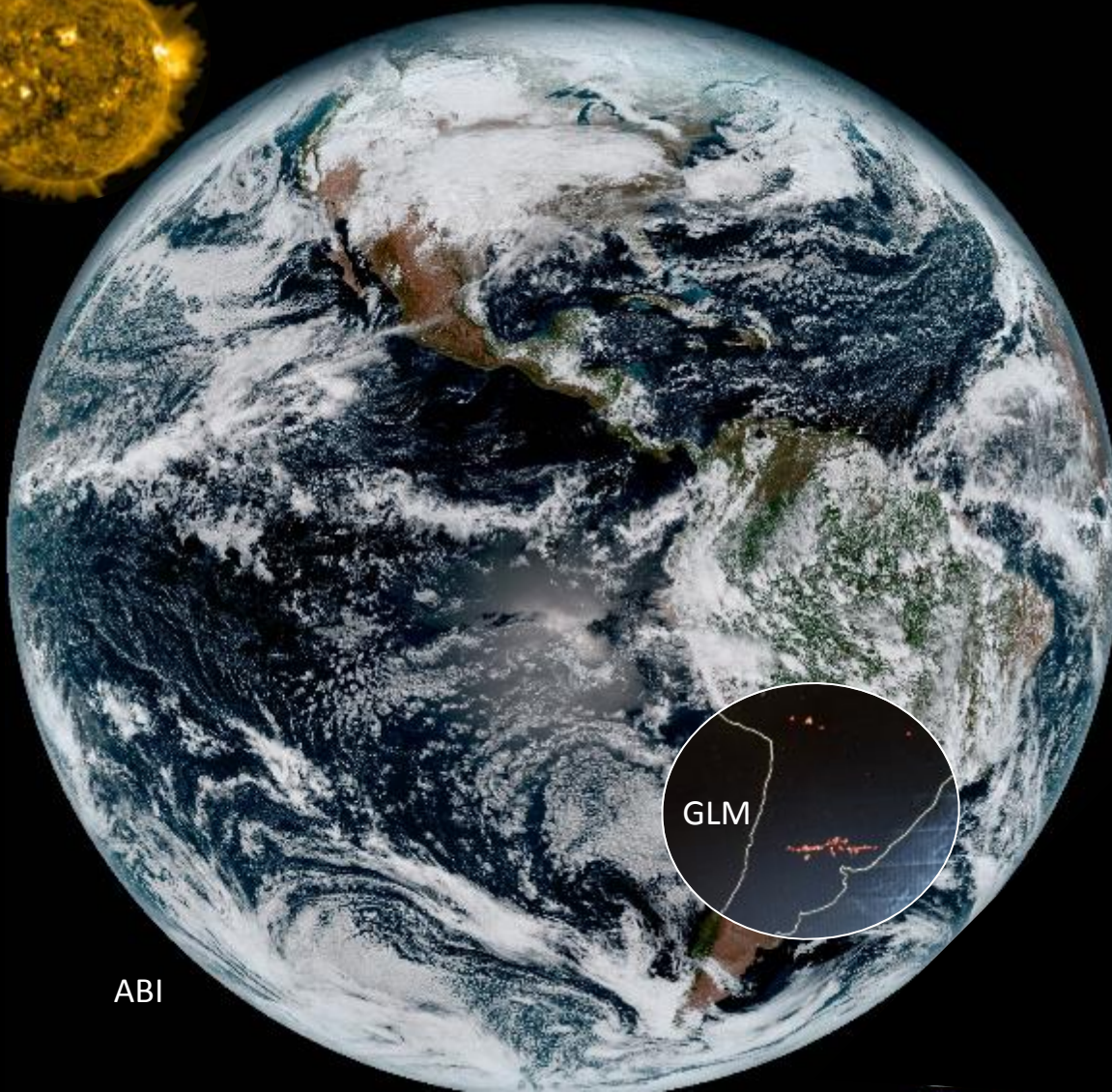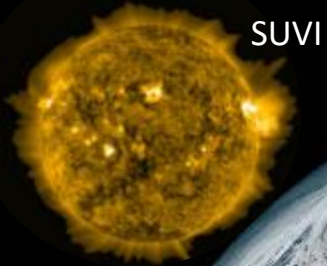**September 25-26, 2017**

Outline

- GOES-R Update

- GOES-16 Transition to GOES-E

- GOES-16 Science Product Validation Status

- GOES-16 Field Campaign

- GOES-S Guest Operations Planning

- Lightning, Aerosols and GLM (Tim Schmit covers ABI)

- NWS Training Plan Status

- Summary

All GOES-16 Instruments Generating Science Data

SUVI

ABI

GLM

XRS

EXIS

EUVS

MAG

SEISS

GOES-R Capabilities

Imagery: New and Improved
Spectral, Spatial, Temporal Resolution

GLM: A wholly new capability

Transformational

Game Changer

The Here and Now: Weather as it Happens

Weather Sentinel in Space

Going from B&W to HDTV

Going from Still Pictures to Movies

Omnipresent

Data Volume

Legend:
- ■ Legacy GOES Annual Volume
- ■ Legacy GOES (1-15) Cum Volume: 1975-2015
- ■ GOES-R Volume: 1st Few Years of Operation

ABI in the (Amazon) Cloud →

GOES-R Generates a Terabyte of Data Daily

Emergency Beacons

Remote Automated Weather Stations

Y-axis: TB (0.00 to 900.00)

X-axis: Year (1975 to 2015)
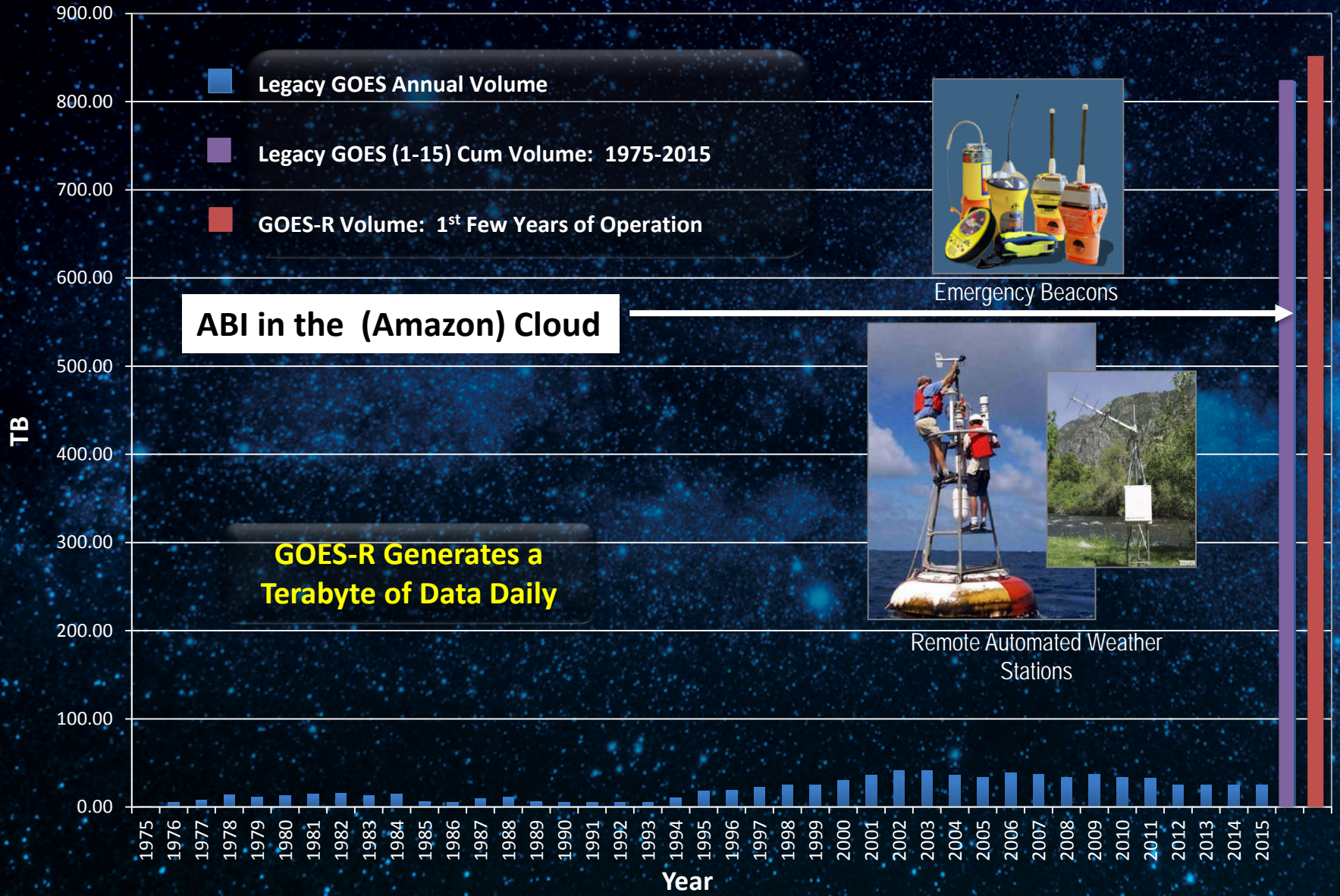
GOES-16 Will Move into Operations as GOES-East in December

GOES-WEST
137° West

GOES-EAST
75° West
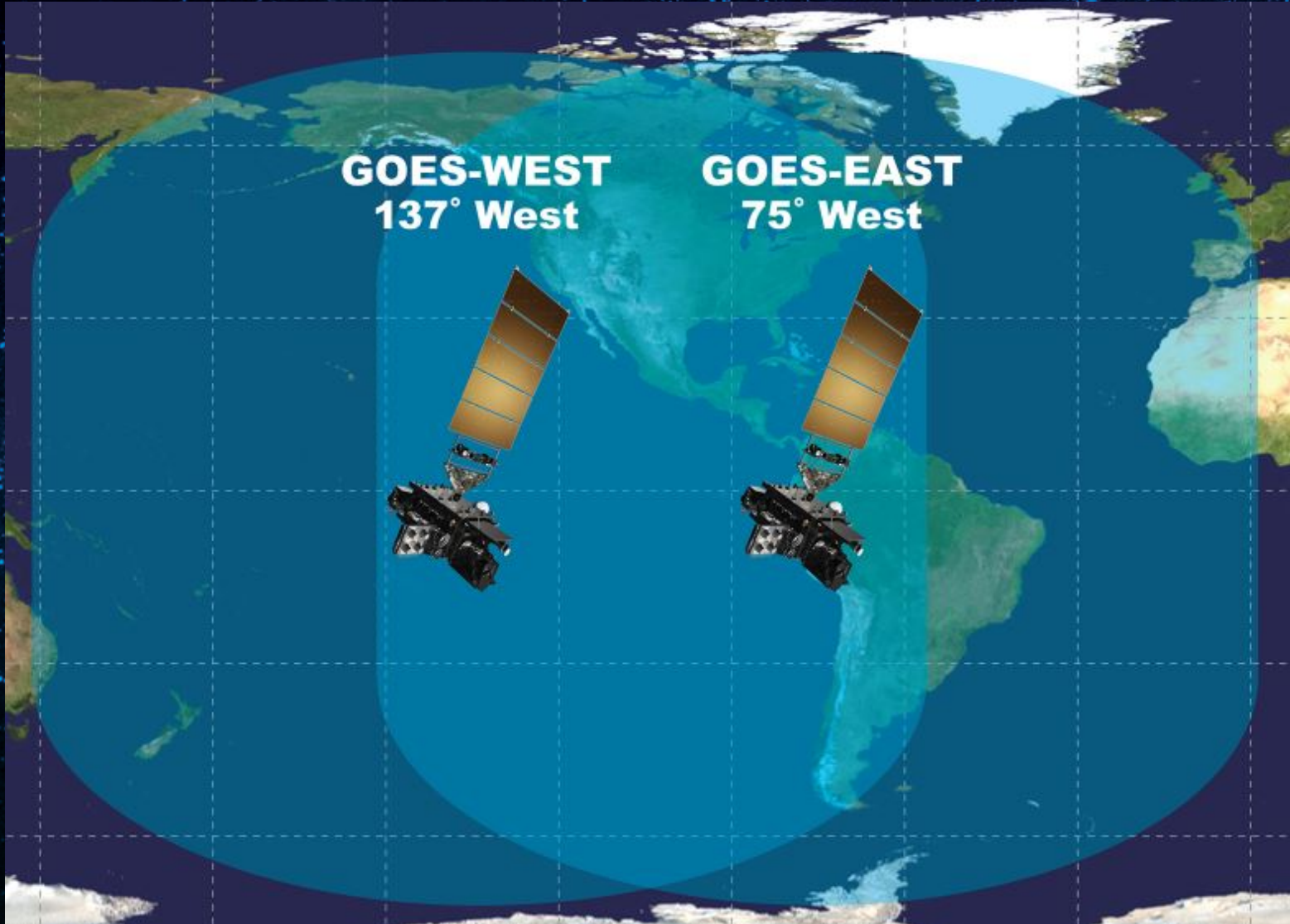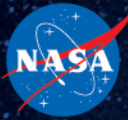
GOES-16/13 East Transition Planning

- Preliminary plans being developed to relocate GOES-16 to East operational location in late 2017

  ** **No GOES-16 imaging during the drift period! ** **

- Planning for two-week overlap in GOES-16/13 operation at 75W
  - Magnetometer & ABI image product comparison with GOES-13
  - Cannot radiate GRB/GVAR simultaneously at same longitude due to radio frequency overlap
  - Plan to relay GOES-13 GVAR through GOES-14 during the overlap period
- No maneuvers/special operations during Thanksgiving and Christmas holidays are planned
- No GOES-East transition/interruption during designated critical weather days

GOES-S planned launch March 2018

GOES-16 Science Product Validation Status

ABI L1b Product	Beta	Provisional	Full
Radiances	2/28/17	6/1/17	6/5/18
GLM L2 Product			
Lightning: Events, Groups, Flashes	7/5/17	1/19/18	6/5/18
SEISS L1b Products			
Energetic Heavy Ions	2/10/17	2/1/18	6/1/18
Magnetospheric e^-/p^+: Low Energy	2/10/17	2/1/18	6/1/18
Magnetospheric e^-/p^+: High Energy	2/10/17	11/1/17	6/1/18
Solar & Galactic Protons	2/10/17	2/1/18	6/1/18
EXIS L1b Product			
Solar Flux: EUV	3/23/17	12/6/18	6/1/18
Solar Flux: X-ray Irradiance	3/23/17	11/2/17	6/1/18
SUVI L1b Product			
Solar EUV Imagery	4/19/17	11/30/17	6/1/18
MAG L1b Product			
Geomagnetic Field	5/25/17	11/30/17	10/9/18

☐ **Changes since last month**

Validation Maturity Levels: | Not Validated | **Beta Maturity** | **Provisional Maturity** | **Full Maturity**

GOES-16 Science Product Validation Status

Previous Placeholder Provisional Validation dates of 12/15/17 were adjusted in July to reflect Product Precedence as well as DO.05 Build/Patch/PRO Release Cycles. Algorithms require varied months of analysis after DO.05 and DO.06 implementations. LUT updates are also built in.

ABI L2+ Products	Beta	Prov	Full
Cloud and Moisture Imagery (CMI) and Sectorized CMI (KPP)	2/28/17	6/1/17	9/3/18
Aerosol Detection (Smoke & Dust)	5/24/17	1/26/18	9/3/18
Aerosol Optical Depth (AOD)	5/24/17	1/26/18	9/3/18
Clear Sky Mask	4/19/17	12/1/17	9/3/18
Cloud Optical Depth	6/8/17	2/23/18	9/3/18
Cloud Particle Size Distribution	6/8/17	2/23/18	9/3/18
Cloud Top Height	5/16/17	12/22/17	9/3/18
Cloud Top Phase	5/16/17	12/22/17	9/3/18
Cloud Top Pressure	5/16/17	12/22/17	9/3/18
Cloud Top Temperature	5/16/17	12/22/17	9/3/18
Derived Motion Winds	6/8/17	2/23/18	9/3/18
Derived Stability Indices	5/16/17	12/22/17	9/3/18

ABI L2+ Products	Beta	Prov	Full
Downward S/W Radiation: Surface	6/23/17	3/16/18	9/3/18
Fire/Hot Spot Characterization	5/24/17	1/26/18	9/3/18
Hurricane Intensity Estimation	9/25/17	12/1/17	9/3/18
Land Surface Temperature	5/24/17	1/26/18	9/3/18
Legacy Vertical Moisture Profile	5/16/17	12/22/17	9/3/18
Legacy Vertical Temperature Profile	5/16/17	12/22/17	9/3/18
Rainfall Rate/QPE	9/13/17	TBD	9/3/18
Reflected S/W Radiation: TOA	6/23/17	3/16/18	9/3/18
Sea Surface Temperature	6/14/17	1/26/18	9/3/18
Snow Cover	12/30/17*	3/30/18*	9/3/18*
Total Precipitable Water	5/16/17	12/22/17	9/3/18
Volcanic Ash: Detection and Height	9/13/17	2/23/18	9/3/18

Changes since last month

Snow Cover has a waiver. It is dependent upon a non-baseline Albedo Product which is in development.

Validation Maturity Levels: | Not Validated | Beta Maturity | Provisional Maturity | Full Maturity |

ABI Field Campaign Analysis Working Group

L1b Validation to Full Maturity

1) RSB Desert Validation - March 23, 2017
   - JPL & UA ground support at the AVIRIS Cal/Val Site (Ivanpah)
   - Sonoran Desert collection with ABI special scans

2) RSB Desert Validation - March 28, 2017
   - JPL ground support at the AVIRIS Cal/Val Site (Ivanpah)
   - Sonoran Desert AVIRIS collection with ABI special scans

3) TEB Ocean Validation - April 13, 2017
   - Gulf of Mexico S-HIS collection with ABI special scans

L2+ Validation (Currently working with Jamie Daniels on specifics)

- Aerosol Products – March 22; April 11; May 7
- Cloud Products – All GLM Primary Flights
- Clear Sky Mask – All Flights
- Temperature/Moisture Profiles – All Flights
- SST/LST – All Flights
- Fire Products – May 7, 2017
- Reflected Shortwave Radiation (TOA) – April 11, 2017

Participants:
- Steve Goodman (Program Science)
- Frank Padula (Program Science)
- Aaron Pearlman (Program Science)
- Changyong Cao (CWG)
- Fred Wu (CWG)
- Jamie Daniels (AWG)
- Xi Shao (CWG)
- Joel McCorkel (NASA)
- Boryana Efremova (NASA)
- Sirish Uprety (S-NPP/VIIRS)
- Rob Green (JPL – AVIRIS)
- Ian Mccubbin (JPL – AVIRIS)
- Mark Helminger (JPL – AVIRIS)
- Jeff Czapla-Myers (UA – AVIRIS)
- Joe Taylor (UW – S-HIS)
- Kathy Lantz (NOAA – SURFRAD)
- Shobha Kondragunta (AWG)
- Istvan Laszlo (AWG)
- Tim Schmit (AWG)
- Andrew Heidinger (AWG)
- Bob Yu (AWG)
- Alex Ignatov (AWG)

GOES-16 Field Campaign

GOES-R Field Campaign Phase 2 Operations

Date: May 7, 2017

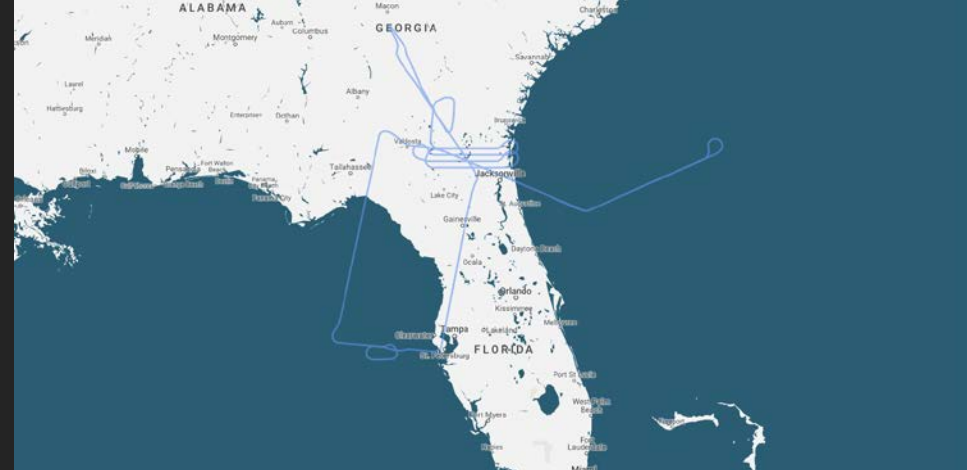**Mission Objective:** ABI Validation - active wildfire (Landsat 8 & S-NPP overpasses)

Takeoff: 1427 Z

Landing: 1950 Z

Flight Duration: 5.4 hrs

Mission Scientist: Francis Padula, Steve Goodman, Aaron Pearlman

Weather Forecast Leads: Austin Clark

Major Highlights:

Collected the West Mims wildfire along the FL/GA border and extensive plume from the source region over land to 250 nm east into the Atlantic. Conducted coincident and collocated collections with Landsat 8 & S-NPP satellites. A Terra MODIS overpass of the fire region was also observed that will compliment validation data analysis of L2+ products.

AVIRIS Data

West Mims Wildfire

West Mims Fire

GOES-16 ABI 3.9 μm

1817 Z S-NPP & ER-2

West Mims Fire
MODIS Terra: May 7, 2017 -- 15:35:30 Z

1607 Z Landsat 8 & ER-2

Anclote Branch Fire

Blue

West Mims Fire Grid

West Mims Plume & S-NPP Overpass

Landsat 8 Overpass

Anclote Branch Fire
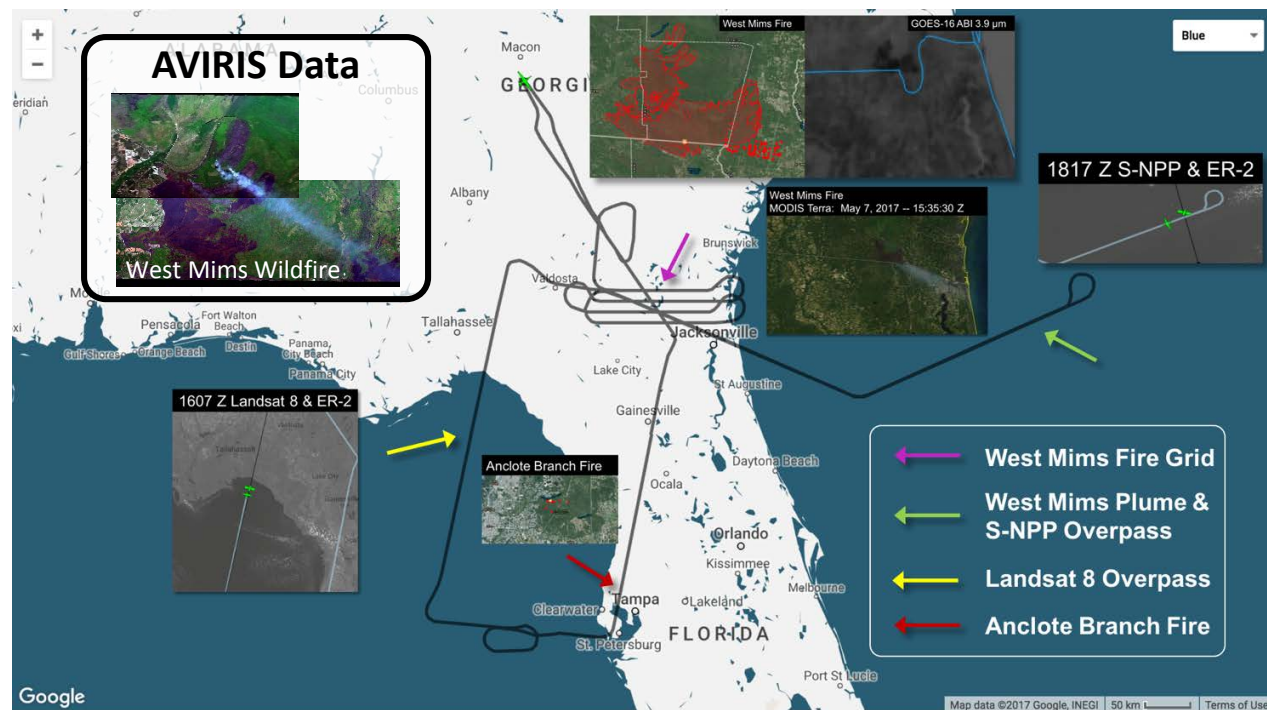
Table Summary
Map Summary

Mission Number 12

GOES-S Guest Operations Update
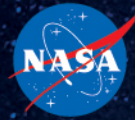
GOES-S guest operations planning calls are expected to begin after the J-1 launch in mid-November.

- Nearly 9,000 guests were invited to the GOES-R launch
- Invitations were sent out exactly two months in advance, so our target date is January 1, 2018.

Numbers are expected to be smaller than the GOES-R launch

- Materials ordering for events and launch bags is underway
- Viewing locations at Kennedy will be driven by RSVP numbers, and there may be fewer locations as a result (i.e. Banana Creek ~4,000, no Causeway/Turn Basin if not needed)

GOES-R Launch: Nov. 19, 2016

3 Hurricanes in the Atlantic Ocean Basin

Sept 8, 2017

Katia

Jose

Irma

G-16 IMG 8 SEP 17 (2017251) 17:45 UTC BAND=2 0.64 UM NOAA ASPB
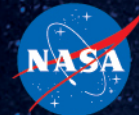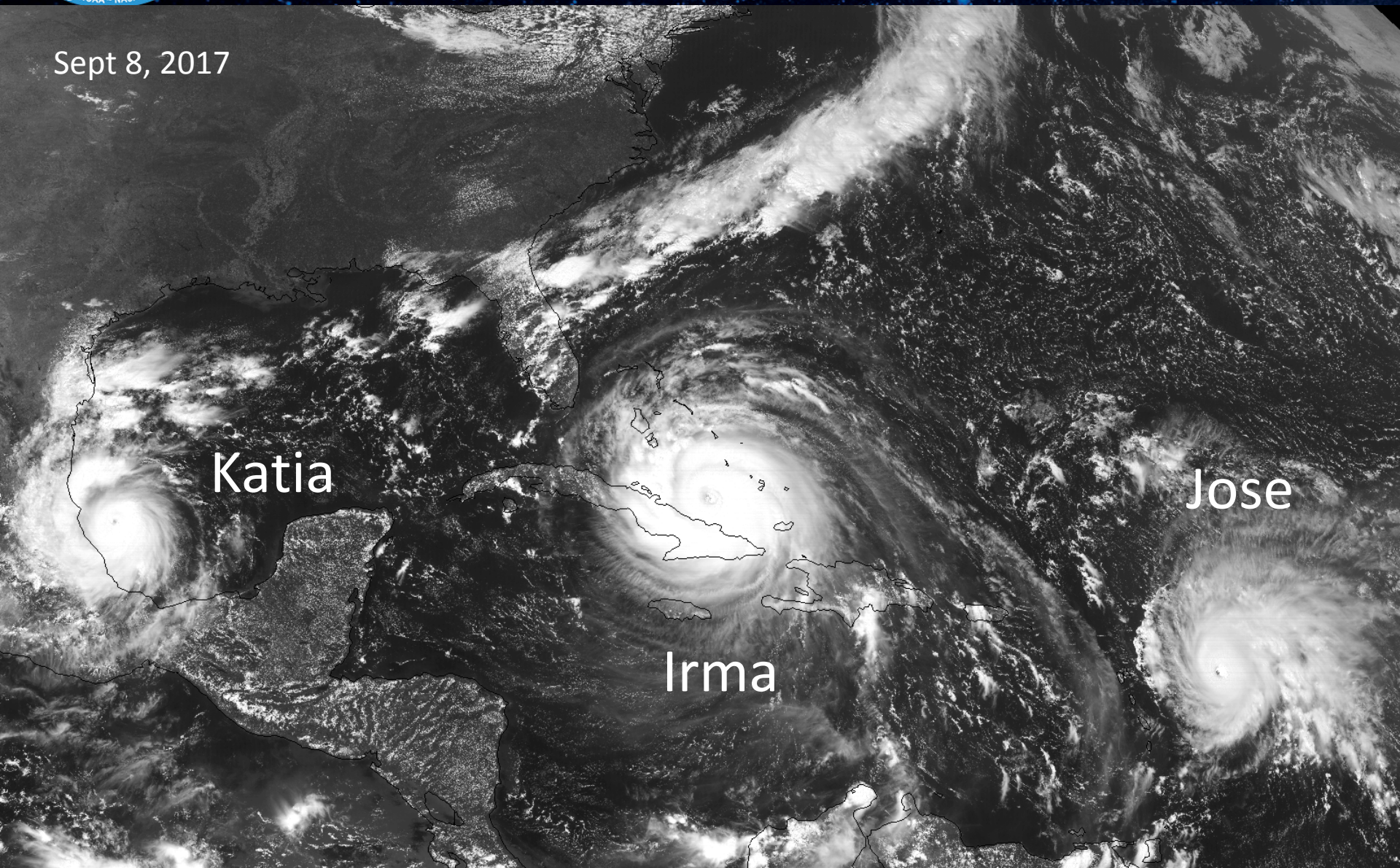
And Then Along Comes Maria

GLM

WWLLN Lightning at 0.1 deg

SHIP TRACKS

Aerosol PM2.5

Seasonal lightning

Lightning

Aerosols

CAPE
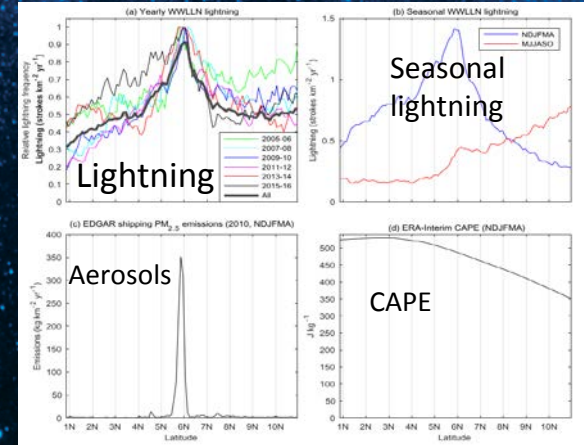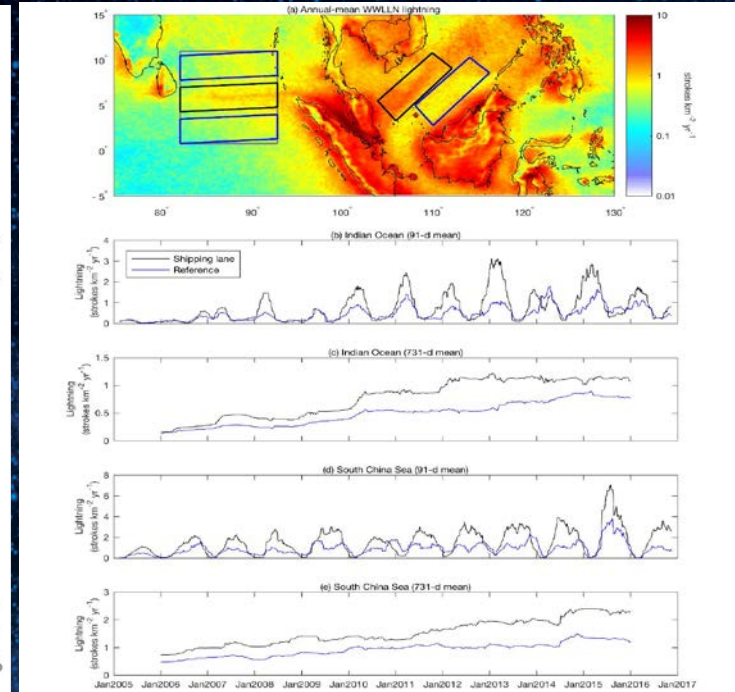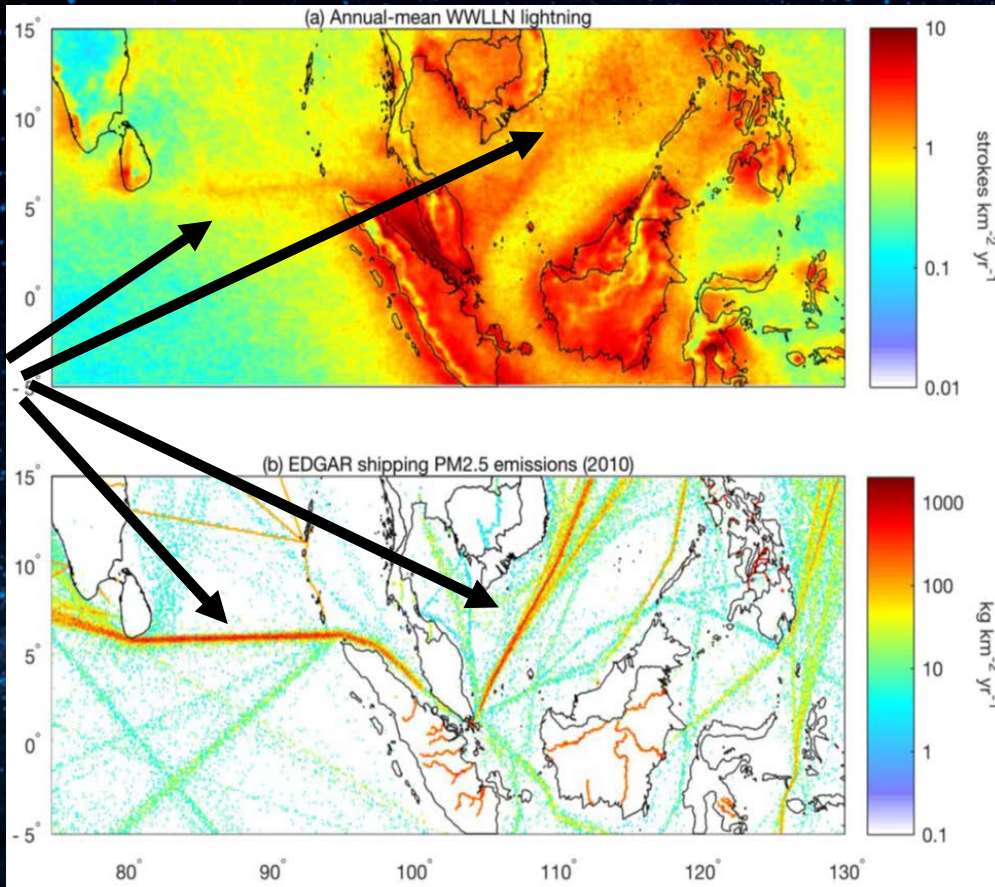
Latest Result from UW Atmos. Sci, ESS, JISAO and NASA:

Joel A. Thornton, Katrina S. Virts, Robert H. Holzworth, and Todd P. Mitchell, Lightning Enhancement Over Major Oceanic Shipping Lanes , Geophys. Res. Letters. (accepted 8/24/17) (in press) 2017

Conclusion: first evidence that ships affect storm intensity and lightning.

Notice how both Lightning peak, and Aerosol PM2.5 is centered on 6 degrees latitude.

Notice that CAPE shows no such relationship (so not a natural weather phenomenon.

NOAA/NWS Training for User Readiness for GOES-R

September 2017 Update

Satellite Training Timeline

| FY16 | Nov 19 2016 Launch | Real Data | GOES-S 2018 |

Prerequisites → Foundation → Application → Exercises → Making it Stick → Continuous Learning
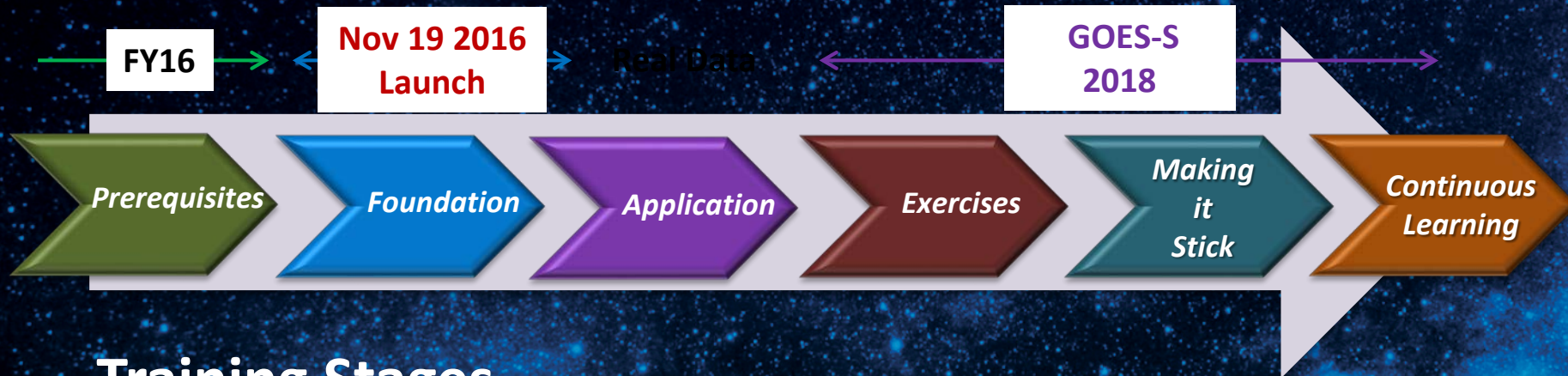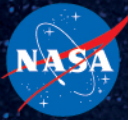
Training Stages

- Prerequisites – overall basics - COMPLETED

- Foundation – satellite specifics - COMPLETED

- **Application – operational setting**

- **Exercises – simulations, practice**

- Making it Stick – multi-situational, sharing

- Continuous Learning – evolve and update

GOES-16 Applications Webinars

- Peer-to-peer webinars from NWS operational forecasters
- Archived at CIRA

http://rammb.cira.colosta te.edu/training/visit/satell ite_chat/

| Title	Date
GOES-16 Convective Strategies	2017-08-16-PM
NHC discussion of GOES-16 Imagery for Current Tropical Cyclone Activity	2017-08-01-AM
Fog / low cloud / moisture gradient applications of the Nighttime Microphysics RGB product	2017-07-26-AM
Smoke and Dust applications of the Geocolor product	2017-07-12-AM
Memphis Derecho of 27 May 2017	2017-06-28-PM
Blowing Dust in Montana	2017-06-14-PM
GOES-16 Water Vapor bands orographic applications	2017-05-24-PM
Hail Swaths observed with GOES-16	2017-05-10-AM
GOES-16 Split Window Difference Product	2017-04-26-PM
GOES-16 convective RGB	2017-04-14-AM
GOES-16 examples and March 14 Blizzard LPW	
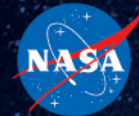
GOES-16 Job Aids - TBD

In-depth information on specific topics

Other	Fire/Hot Spot Characterization	
Other	Hurricane Intensity Estimate	
GLM	Work into AWIPS procedures	
GLM	Information beyond radar and ground-based lightning	
GLM	Severe weather operations	
GLM	Public safety	
GLM	NWS products incorporating lightning information	
GLM	Changes to WarnGen	
GLM	Null events	
GLM	Events vs Groups vs Flashes	
GLM	Optical intensity (radiance)	
GLM	Data quality product	
GLM	Automated tools for tracking flash rate	
GLM	Previous lightning training	
GLM	Winter weather and lightning	
GLM	Tropical cyclones	

Summary – For More Information
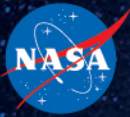
Thank you

For more information visit **www.goes-r.gov**

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