GOES-16 Update

Matt Seybold – GOES-R Data Operations Manager,

PRO (Product Readiness & Ops) Lead

May 2, 2017 – COPC

GOES-16 FIRST IMAGES RELEASED

THE FIRST IMAGES FROM GOES-R HAVE COME IN, AND THEY ARE ABSOLUTELY INCREDIBLE

—WASHINGTON POST

THE FIRST PICTURES FROM NOAA'S NEW WEATHER SATELLITE ARE INCREDIBLE

—HUFFINGTON POST

HOW THIS UNPRECEDENTED SATELLITE COULD BE A GAME CHANGER FOR STORM FORECASTS

—CBS NEWS

SPECTACULAR FIRST IMAGES RELEASED FROM GOES-16 WEATHER SATELLITE

—CBS DENVER

FIRST SPECTACULAR IMAGES COME IN FROM NOAA'S NEW SATELLITE

—SCIENTIFIC AMERICAN

HIGH DEF FROM THE HEAVENS/ NEW WEATHER SATELLITES SENDS FIRST PHOTOS

—USA TODAY

GOES-16 FIRST IMAGES INCREDIBLE

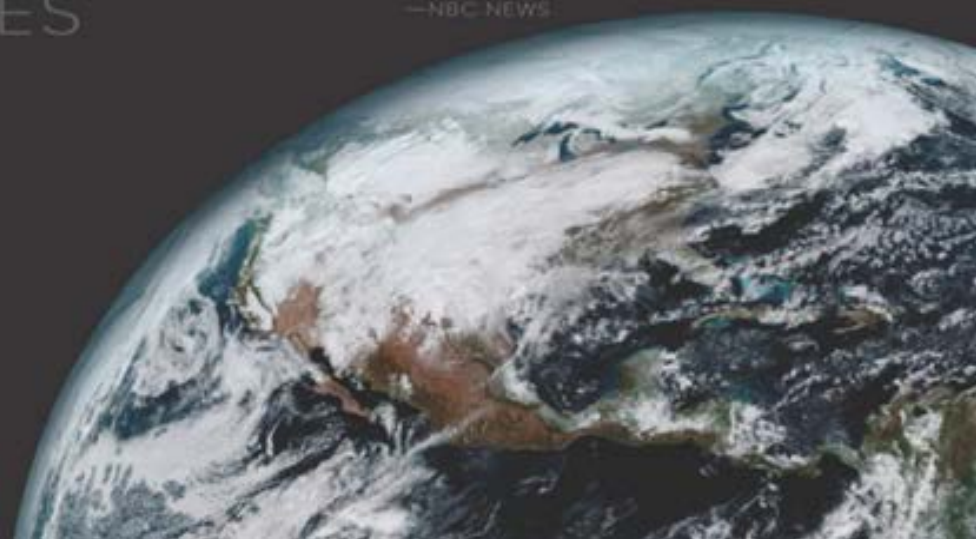
—NBC NEWS

NOAA UNVEILS FIRST STUNNING IMAGES FROM GOES-16 SATELLITE

—ACCUWEATHER

DAZZLING FIRST LOOKS AT GOES-16 SATELLITE IMAGES

—ARIZONA REPUBLIC



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HOW THIS

SPECTACULAR FIRST

FIRST SPECTACULAR

Louis Uccellini, National Weather Service Assistant Administrator:

"This is a revolutionary system that is allowing forecasters the opportunity to utilize services and capabilities that they didn't even know could exist" (NOAA Observing Systems Council, 3/22/17).

NEW WEATHER SATELLITES SENDS FIRST PHOTOS

—USA TODAY

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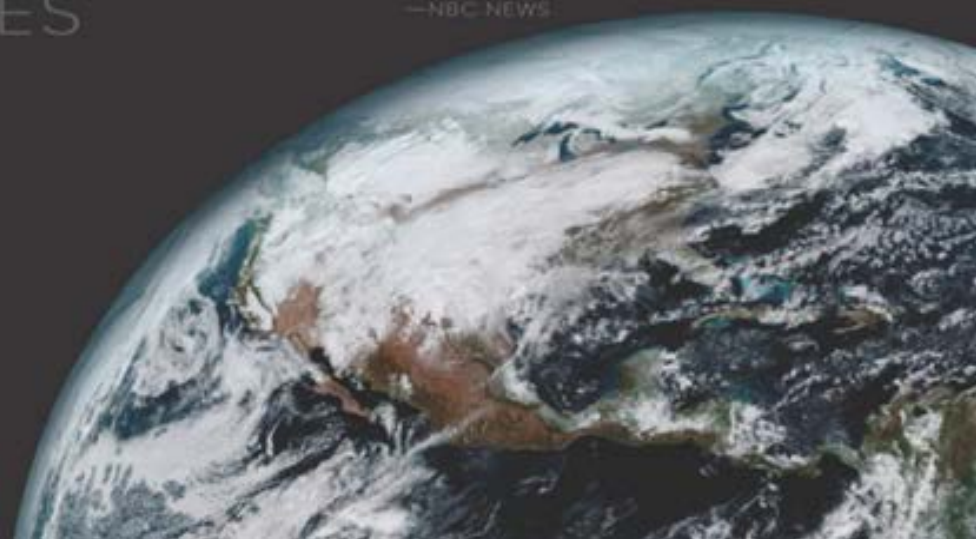
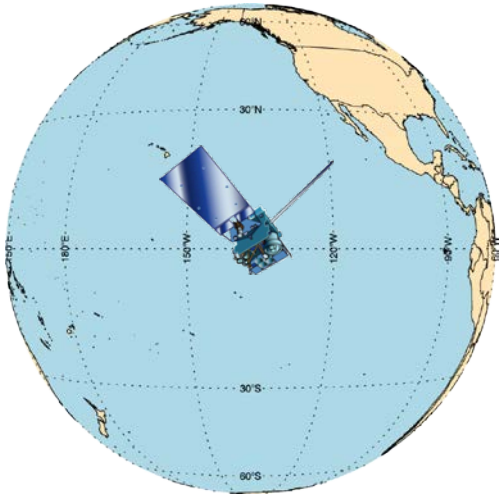
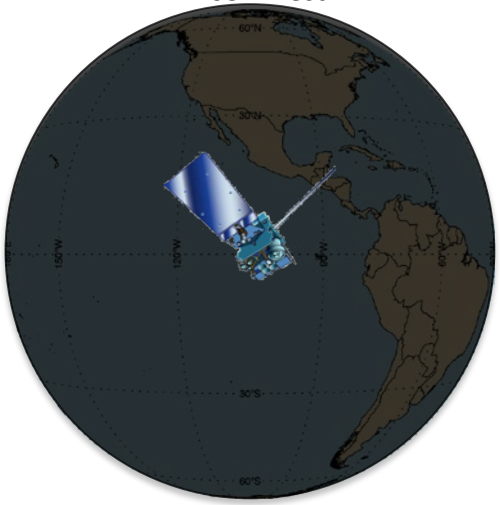


GOES Constellation

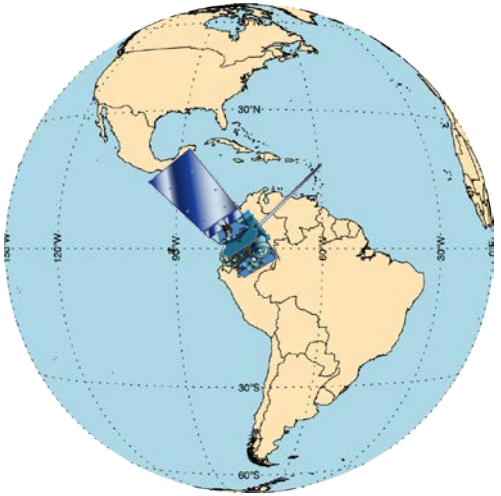
GOES-West
GOES-15
135° West



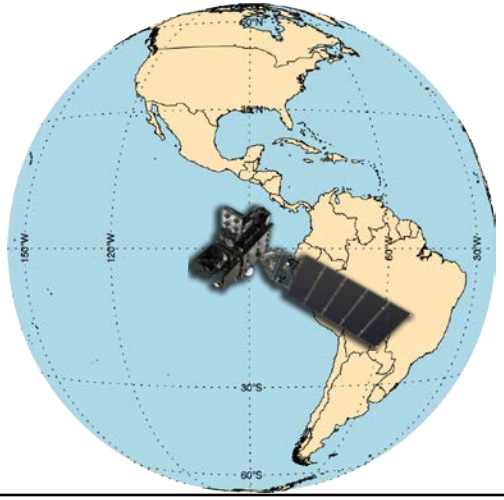
Standby
GOES-14
105° West



GOES-East
GOES-13
75° West

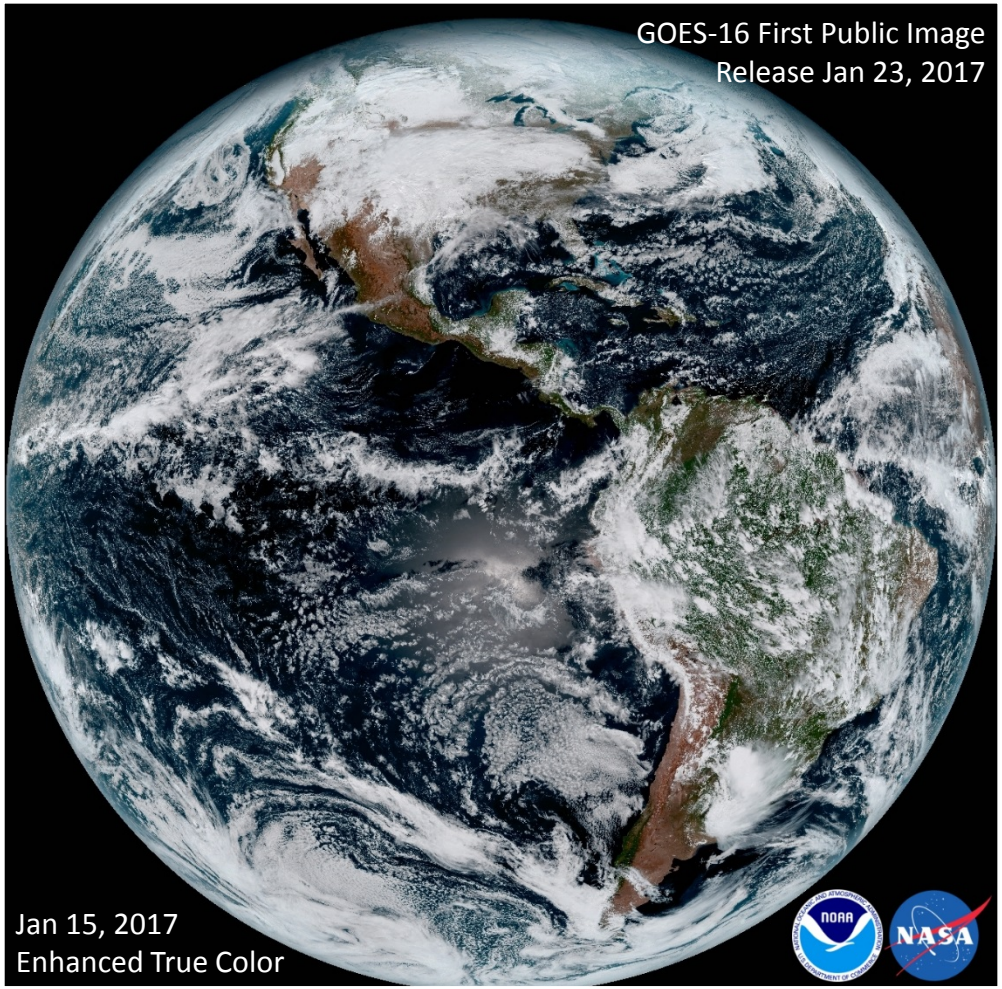


Checkout
GOES-16
89.5° West



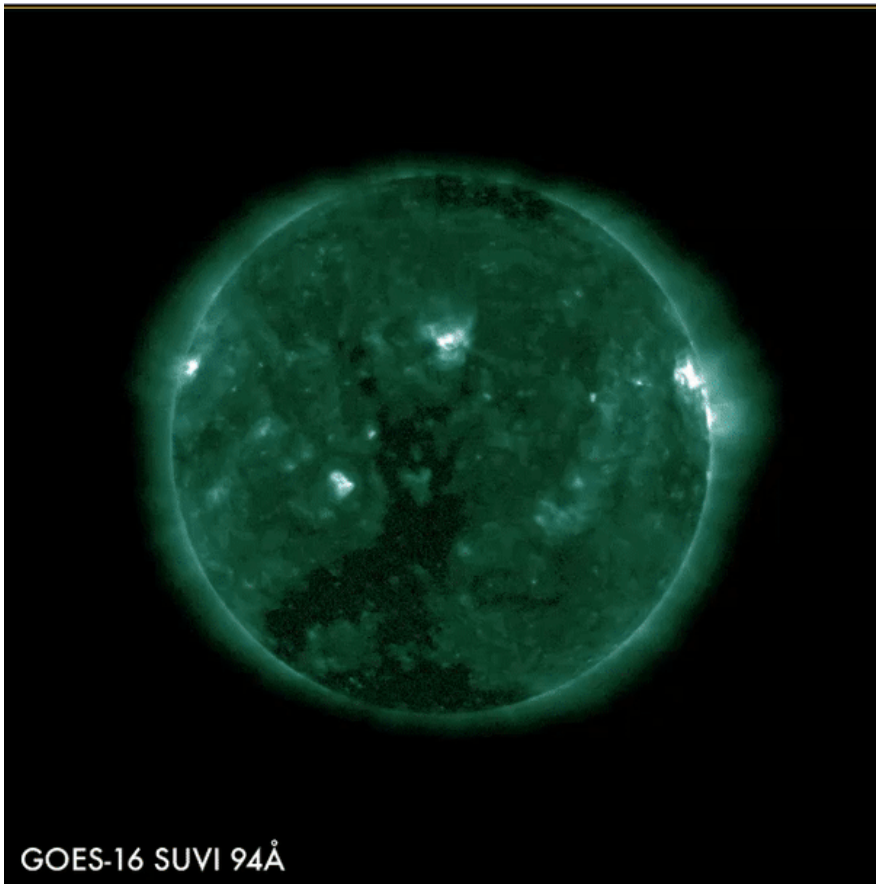
First Public Images & Animations

- First Public Image distributions completed!
  - ABI



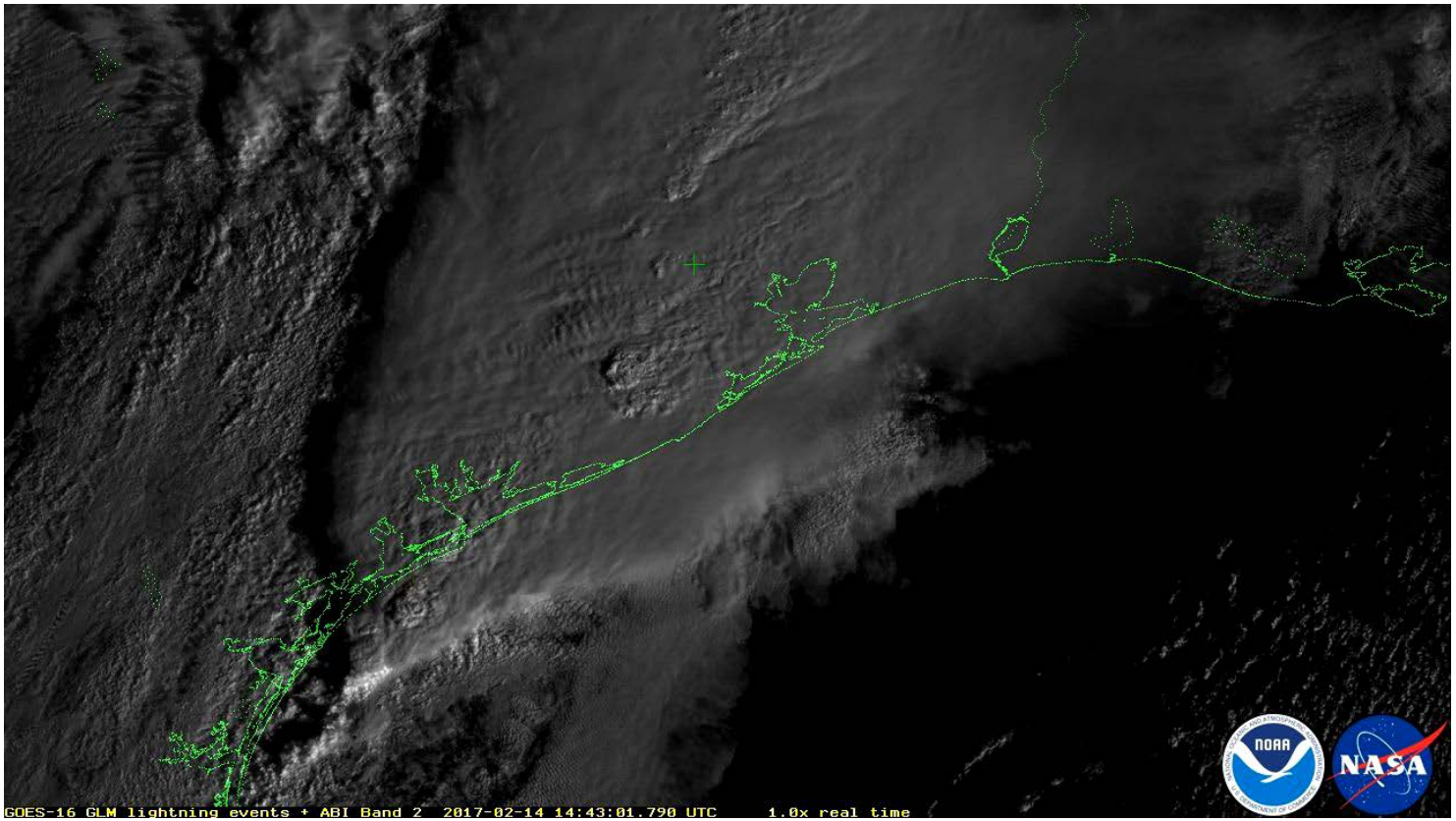
First Public Images & Animations

- First Public Image distributions completed!
  - SUVI (2/27)



First Public Images & Animations

- The final First Public Image distribution from GOES-16!
  - GLM (3/6)



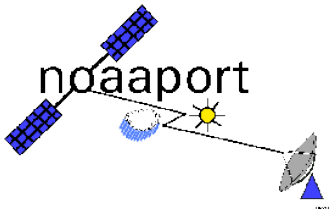
Milestones: Quality and Distribution

6 Beta Validation Maturity Reviews successfully completed!

- L1b from SEISS, ABI, EXIS, SUVI and ABI L2 CMI, Cloud Mask
- L1b from SEISS, ABI, EXIS, SUVI are in GRB.

Major Product Distribution Milestones

- ABI L1b was made available via GRB RF (3/1) ABI to the world! …w/ caveat policy

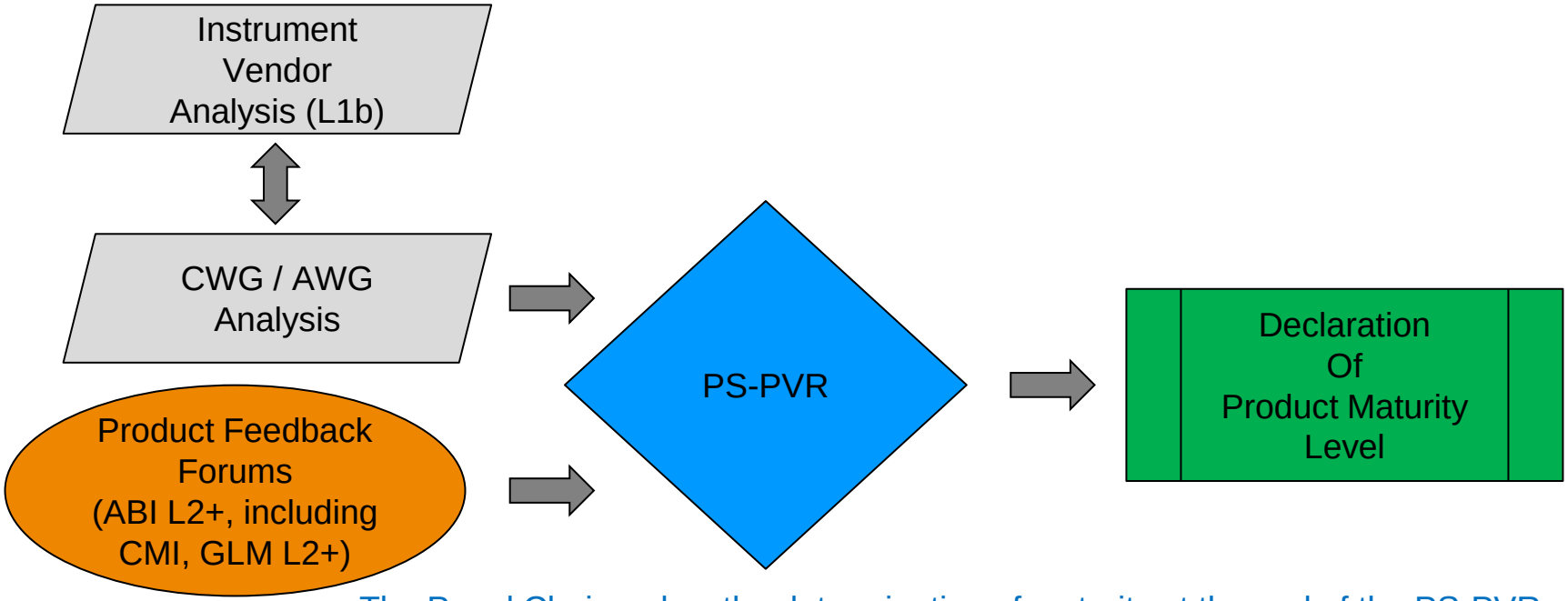


- ABI SCMI (GOES-R KPP) was made available to primary customer NWS AWIPS terminals via SBN/NOAAPORT (3/2)

- PDA subscriptions to DoD, international cal/val collaborators in Europe (EUMETSAT) and Canada (CMO) activated (3/2)

Declaration of Product Maturity Levels

- A Peer Stakeholder - Product Validation Review (PS-PVR) appraises the status of product quality with respect to Program definitions.
- The PS-PVR Chair has the authority to:
  - Declare products have achieved a product maturity level
  - Provides guidance on work expected to achieve the next maturity level.
  - Affirm release of data to public via GRB (Beta)



The Panel Chair makes the determination of maturity at the end of the PS-PVR

GOES-16 Science Product Validation Status

ABI L1b Product
Radiances

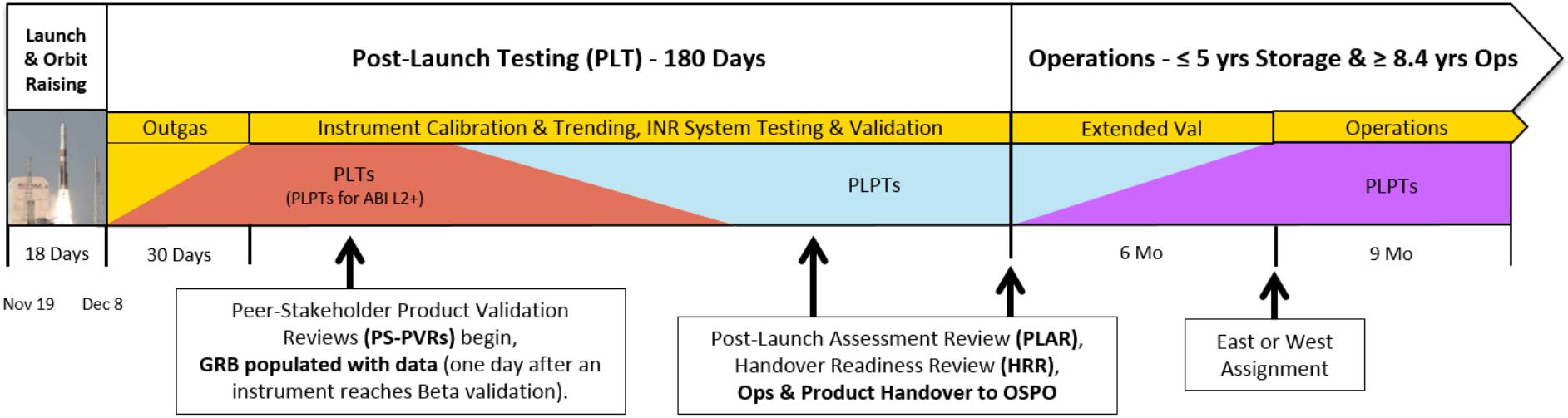
ABI L2+ Products
Cloud and Moisture Imagery (CMI) and Sectorized CMI (KPP)
Aerosol Detection (Smoke & Dust)
Aerosol Optical Depth (AOD)
Clear Sky Mask
Cloud Optical Depth
Cloud Particle Size Distribution
Cloud Top Height
Cloud Top Phase
Cloud Top Pressure
Cloud Top Temperature
Derived Motion Winds

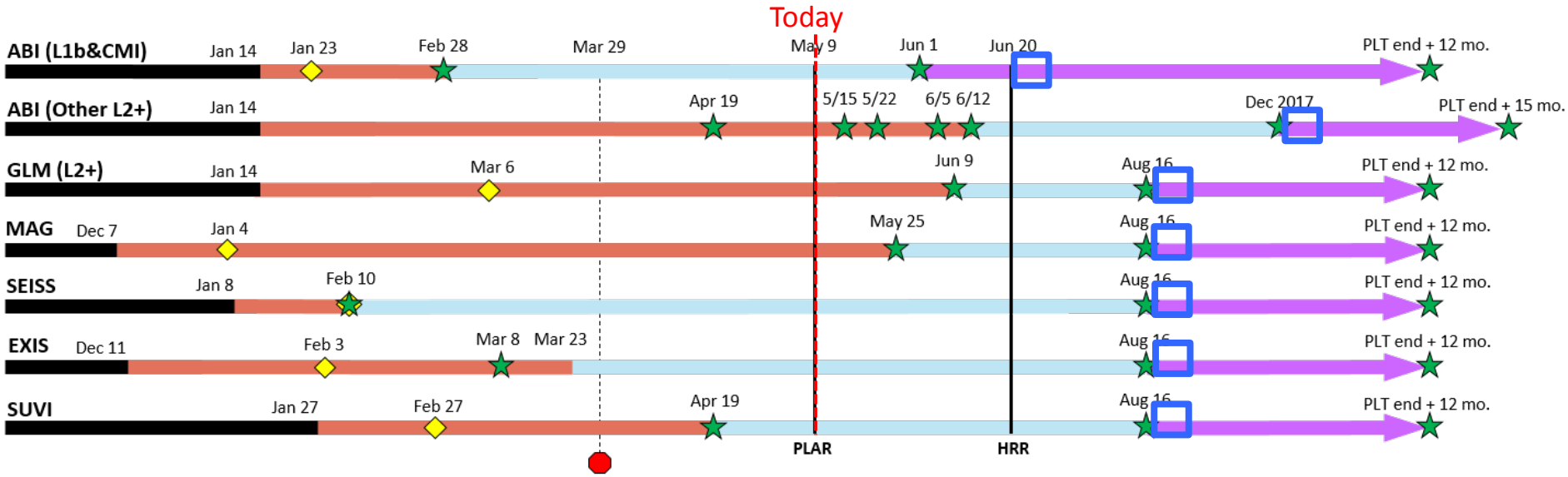
ABI L2+ Products (con't)
Derived Stability Indices
Downward S/W Radiation: Surface
Fire/Hot Spot Characterization
Hurricane Intensity Estimation
Land Surface Temperature
Legacy Vertical Moisture Profile
Legacy Vertical Temperature Profile
Rainfall Rate/QPE
Reflected S/W Radiation: TOA
Sea Surface Temperature
Snow Cover
Total Perceptible Water
Volcanic Ash: Detection and Height

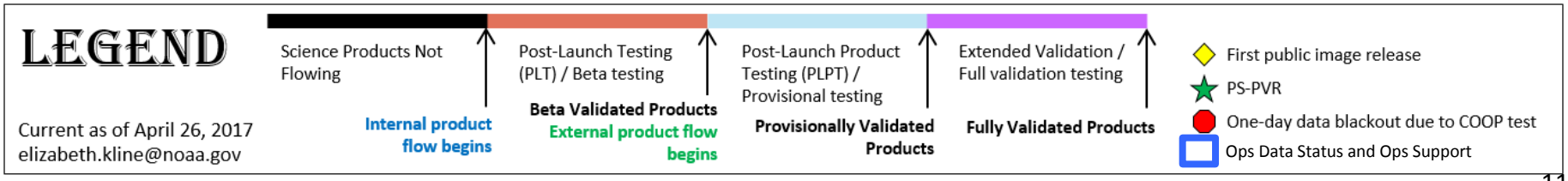
GLM L2 Product
Lightning: Events, Groups, Flashes
SEISS L1b Products
Energetic Heavy Ions
Magnetospheric e^-/p^+: Low Energy
Magnetospheric e^-/p^+: High Energy
Solar & Galactic Protons
EXIS L1b Product
Solar Flux: EUV
Solar Flux: X-ray Irradiance
SUVI L1b Product
Solar EUV Imagery
MAG L1b Product
Geomagnetic Field

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

GOES-16 Post-Launch Science Product Validation Schedule







Note: All dates are coordinated with the Flight/MOST PLT SOE group and the T&H team and are subject to change.

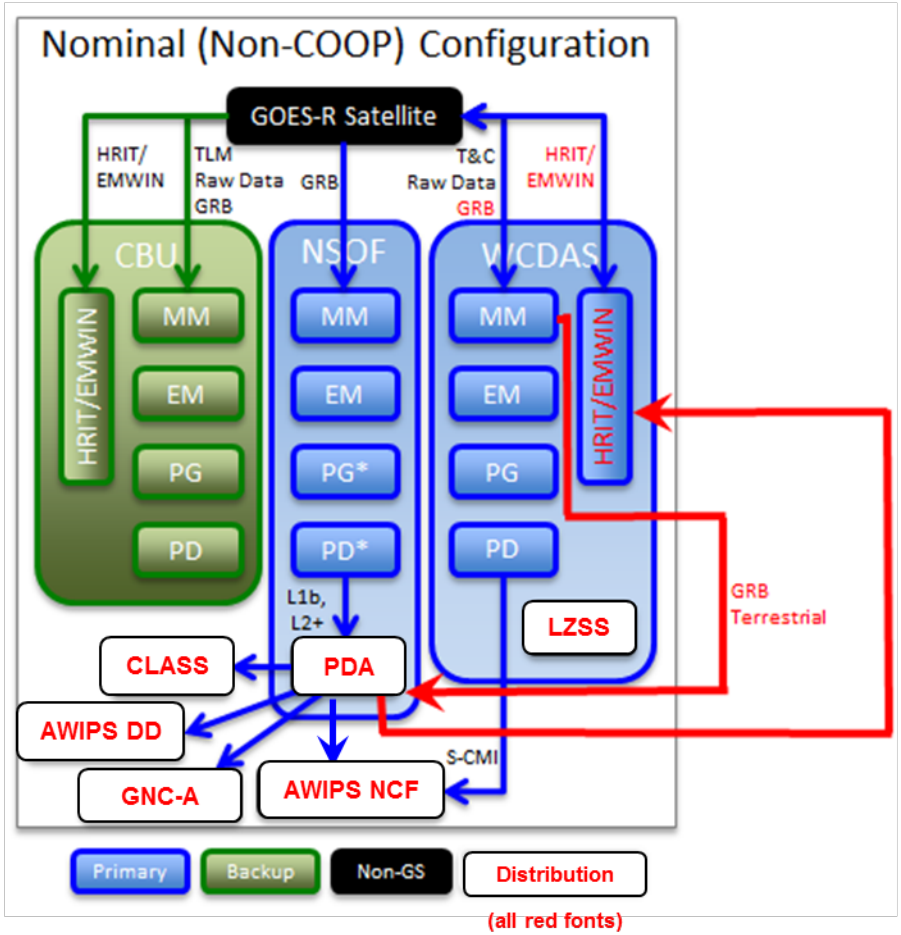
ABI L2+ Beta PS-PVRs

- Although ABI L2+ are not part of GOES-16 Post-Launch Assessment per se, they are a significant portion of PRO's GOES-16 PLT activities

- Dates for remaining Beta PS-PVRs of ABI L2+ Products:
  - Week of 5/15/2017 -- Cloud Phase, Cloud Top Temp/Pressure/Height, Soundings, Rainrate
  - Week of 5/22/2017 -- LST, AOD, ADP, SST, Fire
  - Week of 6/05/2017 -- DMW, DCOMP/NCOMP, HIE, Vol Ash
  - Week of 6/12/2017 -- Radiation

GOES-R PD Elements

1. SCMI to AWIPS NCF
2. GRB RF
3. GRB Terrestrial
4. PDA
5. PDA -> CLASS
6. PDA -> HRIT/EMWIN
7. PDA -> GNC-A
8. PDA -> AWIPS for L2
9. PDA -> AWIPS DD
10. LZSS



Status of Flow within GOES-R PD Elements

- ✓ 1. SCMI to AWIPS NCF (Started 3/2/17)
- ✓ 2. GRB RF (At this time only SEISS, ABI, EXIS Beta, fill frames and info packets)
- ✓ 3. GRB Terrestrial
- ✓ 4. PDA (PDA is receiving & distributing L1b NetCDFs from all 6 instruments to cal/val customers)
- ✓ 5. PDA -> CLASS (also NCEP, FNMOC, NAVO, EUMETSAT, CMC, INPE)
- 6. PDA -> HRIT/EMWIN (successfully tested)
- 7. PDA -> GNC-A (successfully tested)
- 8. PDA -> AWIPS for L2 (Flowing terrestrial to BNCF)
- 9. PDA -> AWIPS DD (Tested using I&T string to TNCF)
- ✓ 10. LZSS (receiving & distributing L0 & L1b NetCDF files, Instrument Cal-Engineering files from all six instruments to cal/val customers)

Status of Flows Relevant to DoD

- GRB RF on since beginning of March with data added as they reach Beta Maturity
- SBN RF on since beginning of March with data added as they reach Beta Maturity
- PDA
  - FNMOC and NAVO are fully integrated
  - 557th is in progress with completing PDA setup and training
  - JTWC has not yet initiated integration
- HRIT/EMWIN RF and GNC-A RF will contain continuous GOES-16 data beginning in June

Data Sharing Caveat Language

Partners are being asked to do two things before distributing downstream:

1. All data postings should state “GOES-16 Preliminary, Non-Operational Data”
2. Post the following caveat from NESDIS General Council Office:

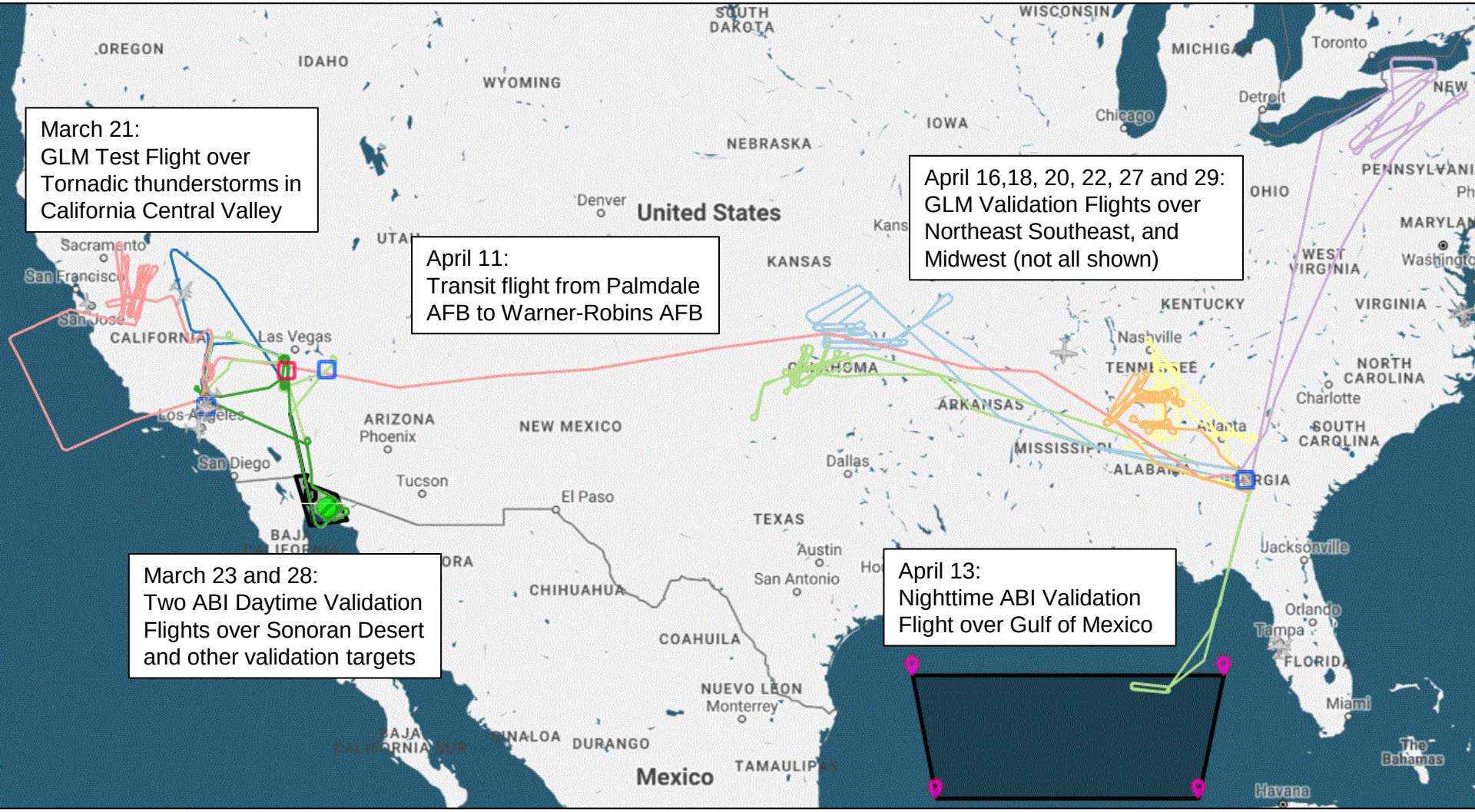
IMPORTANT: *NOAA's GOES-16 satellite has not been declared operational and its data are preliminary and undergoing testing. Users receiving these data through any dissemination means (including, but not limited to, PDA and GRB) assume all risk related to their use of GOES-16 data and NOAA disclaims any and all warranties, whether express or implied, including (without limitation) any implied warranties of merchantability or fitness for a particular purpose.*

ABI/GLM Field Campaigns Status

Frank Padula, Field Campaign Lead

- All Field Campaigns have commenced
- Operations support teams are nominal
  - Support team includes forecasting, phased rehearsals, contingency scheduling, staffing, and data access web portal
- Activities by measurement platform
  - NASA ER-2 aircraft field campaign of 100 hours for ABI radiometric and GLM flash detection validation
    - Phase 1 Western Domain: 18.8 flight hours of Sonoran desert collects for ABI between March 12-29 (plus 4.8 hour transit flight to Warner-Robins AFB, GA)
      - Completed ABI primary Reflective Solar Band (RSB) validation objectives during 2 sorties (March 23, 28)
      - Required diplomatic flight clearance with Mexican government, aircraft special maneuvers, ABI special scans, and coordination with ground validation teams
      - The two sorties represent unprecedented validation activities for a geostationary earth imager and are a major achievement toward post-validation of the next generation of GOES imagers
    - Phase 2 Eastern Domain: SE Severe Storms emphasize on GLM between April 12 through May 18 (~43 hours of flight time conducted so far in Phase 2)
      - Nighttime ABI Validation flight over Gulf of Mexico on April 13
      - GLM Validation flights on April 16, 18, 20, 22, 27, and 29
  - UAS drone campaign for ABI radiometric validation
    - Flights at Red Lake dry lake bed, AZ April 3-7

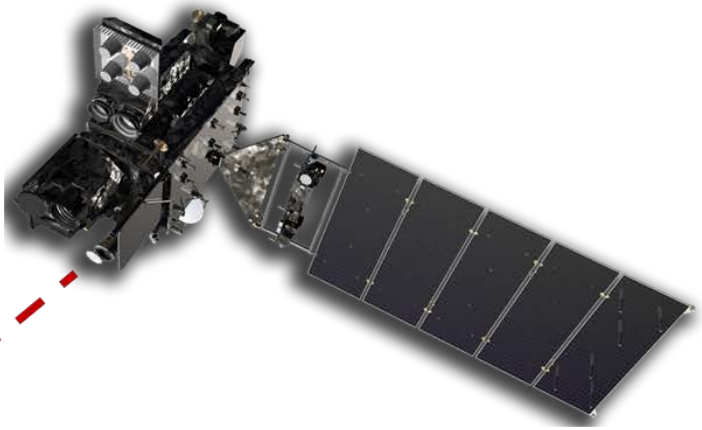
ABI/GLM Field Campaigns Status

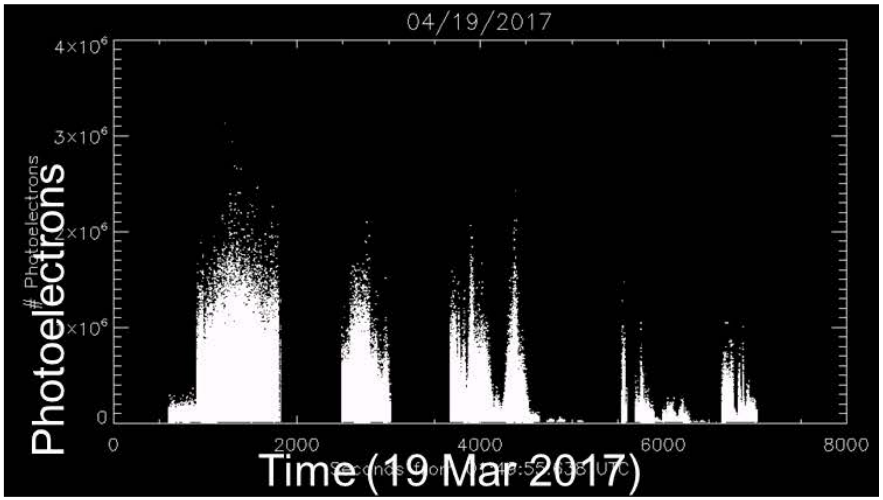


NASA SLR Laser Field Campaign for GLM INR Validation

April 19, 2017:

- From 0150 to 0352 UT, Greenbelt SLR laser (777nm) illuminated GLM
- Photoelectrons (>100,000 e^-/pulse) per detection exceed success criteria
- Early May installing laser at Monument Peak, CA site for two-laser operations
- Early assessment: ~7 km INR error
- Second successful session April 29





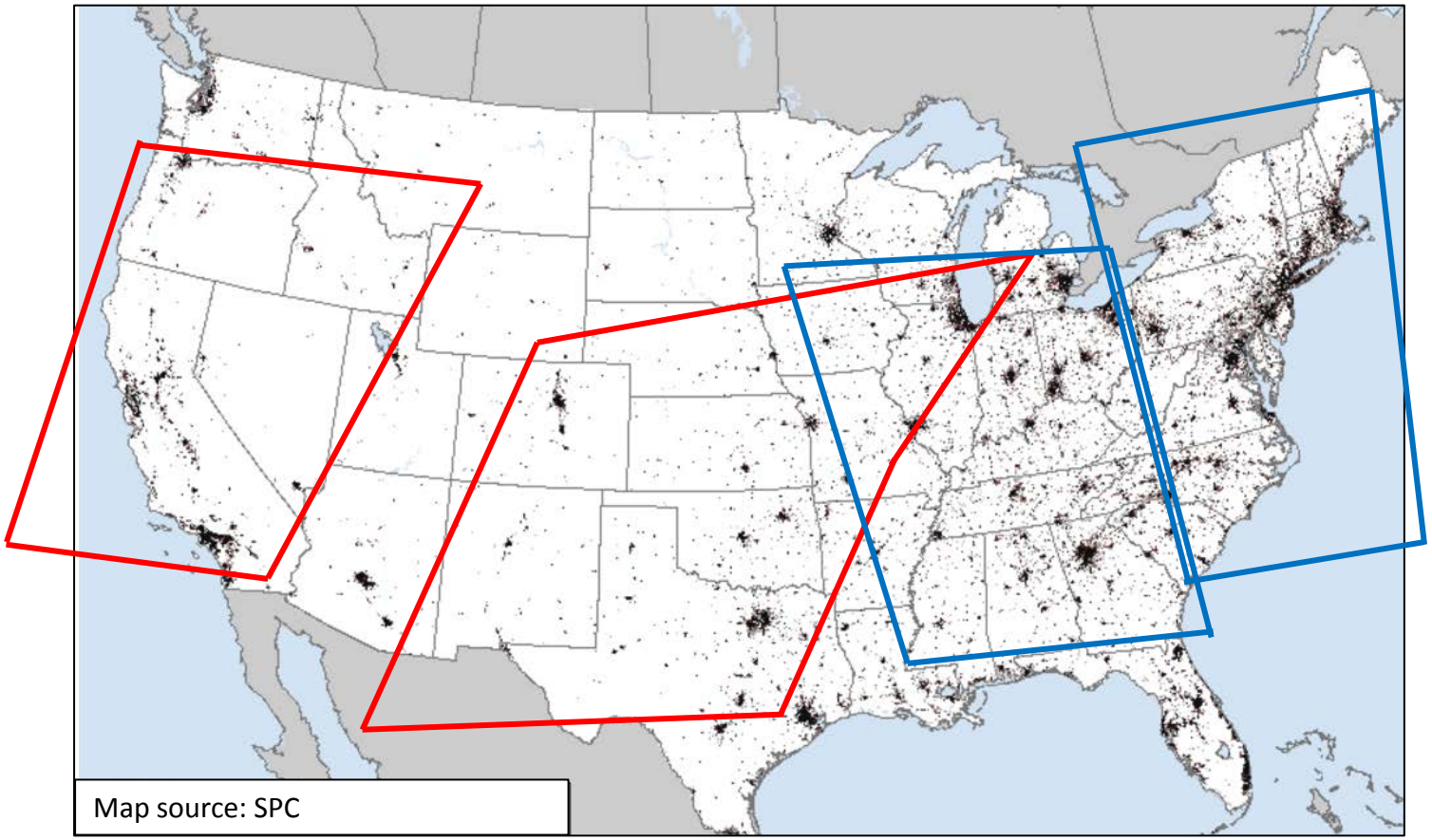
Photoelectrons detected from a 49x49 km region centered over laser location.

MDS are now following RSO requests

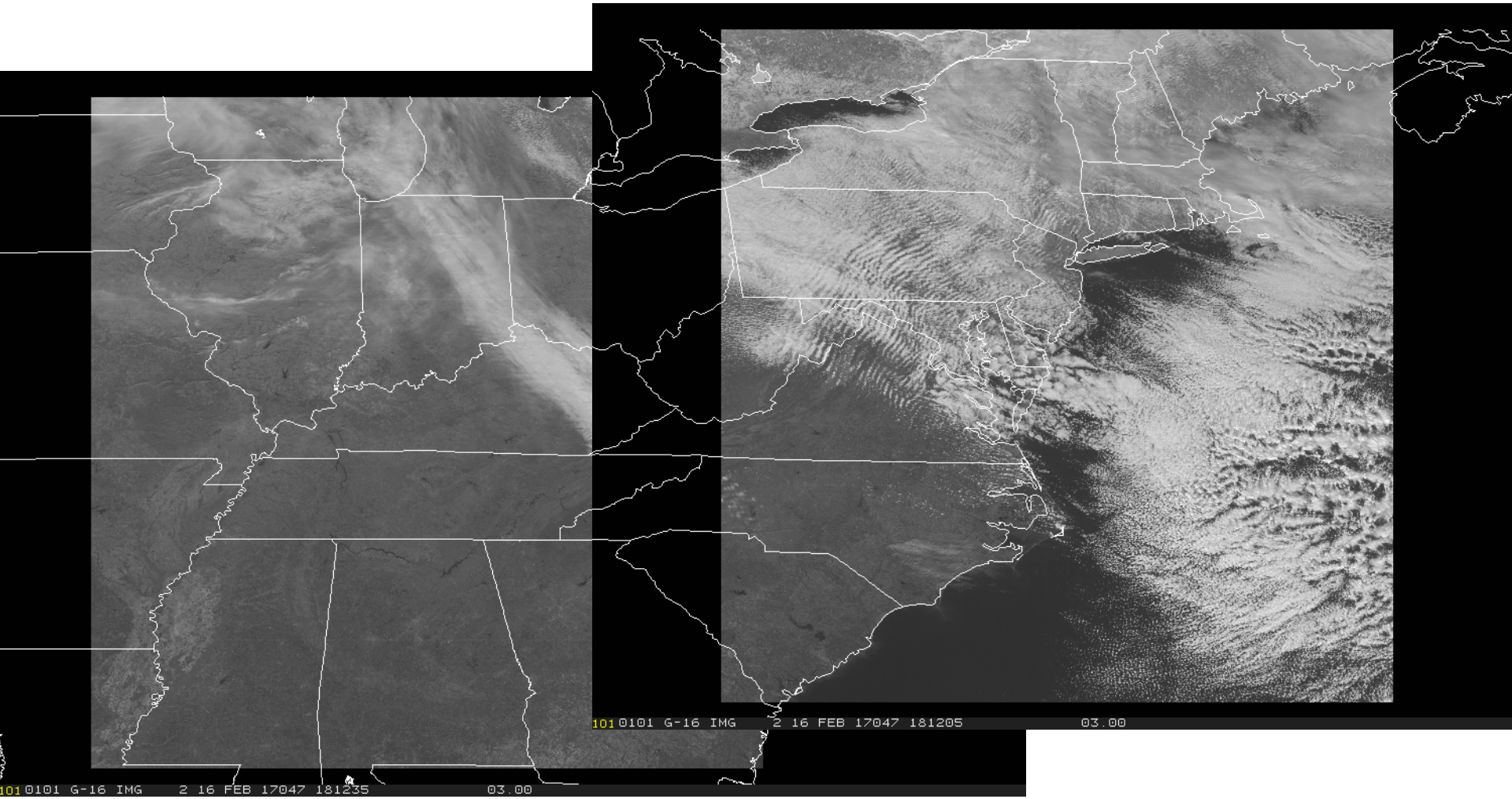
- Effective 3/1 through Handover in June, NWS is submitting MDS requests to track RSO (GOES-13/15)
- After Handover in June, MDS will be located by request or positioned at default locations (next slide)
- After Handover in June, DoD requests may be submitted to the NESDIS/OSPO 24x7 Satellite Analysis Branch:

  (301) 683-1400 sabsupervisor@noaa.gov

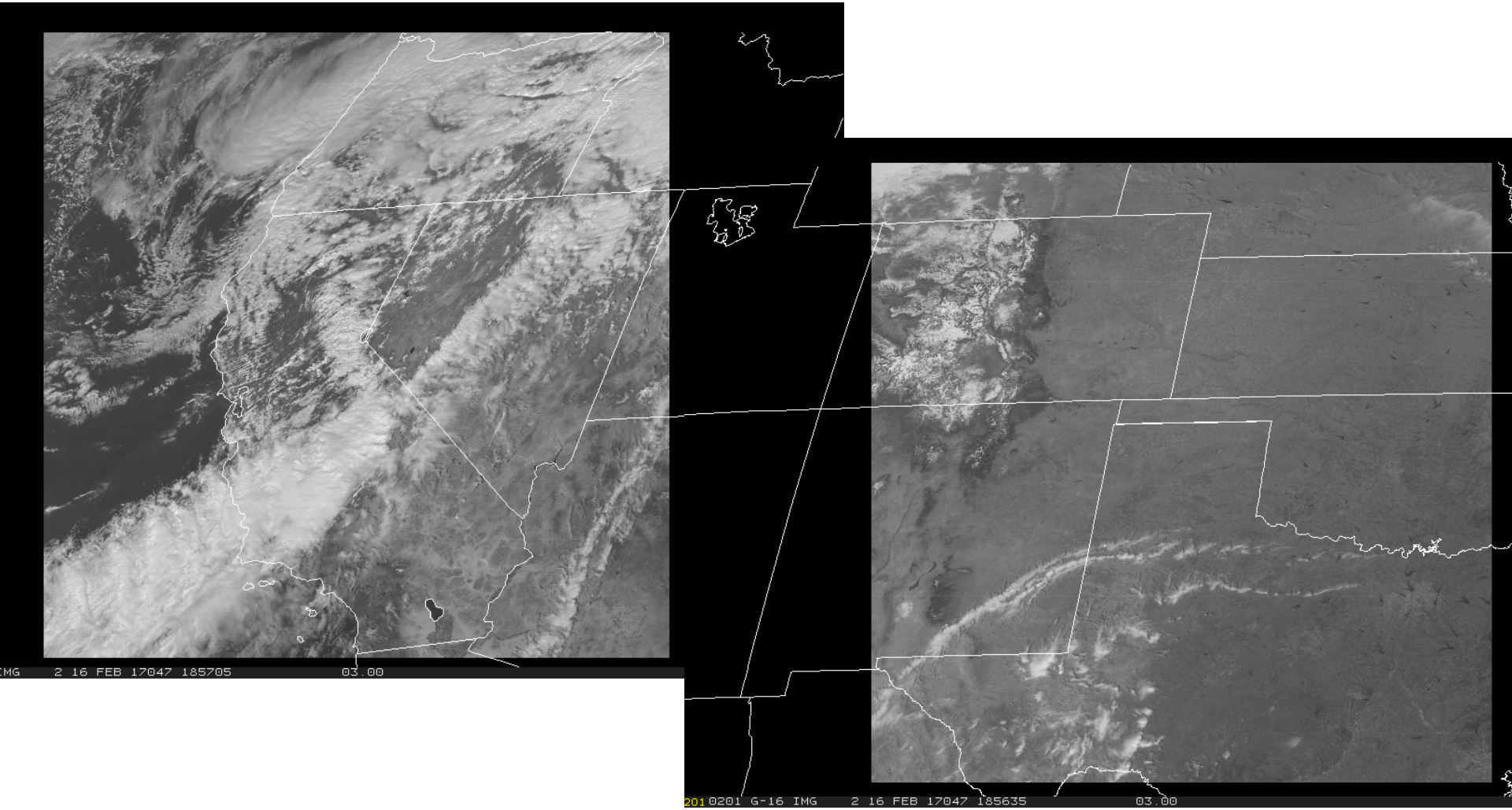
Population and Approximate Location of Default Positions



GOES-E Default MDS (approximate taken from Checkout Satellite Location)



GOES-W Default MDS (approximate taken from Checkout Satellite Location)



Multiple Request Situations: SDM will Follow Priority List

1. SPC High or Moderate Risk
2. Volcanic ash eruption and plume directly over or approaching the US or US Territories
3. SPC Enhanced Risk
4. Major Hurricane (CAT 3-5) forecast to make landfall to US or US Territories Day 1 or 2
5. Event or circumstance with national importance requiring elevated DSS (e.g… Super Bowl, Olympics, large hazmat event, etc…)
6. Solar Diffuser Scans (will have a window but *must* occur during that window)
7. Lunar calibration scan (1 MDS, 2x/month, less than 2 minutes)
8. SPC Extreme Fire Weather criteria
9. Hurricane (CAT 1-2) forecast to make landfall to US or US Territories Day 1 or 2
10. SPC Marginal or Slight Risk or forecast OCONUS Severe Thunderstorm or Tornado Warnings
11. SPC Critical Fire Weather or OCONUS Fire Weather Watch with at least one active wildfire occurring
12. WPC High or Moderate Risk of Excessive Rainfall or WFO issuance of Flash Flood Watch
13. LIFR Conditions (widespread) at Large and/or Medium FAA Hub Airports
14. Winter Storm Warning criteria (including blizzard and ice storm warning criteria)
15. Tropical Storm forecast to make landfall to US or US Territories Days 1-4
16. Two or more Tropical Storms (or Hurricanes) outside of the CONUS domain invoking a switch to Mode 4
17. Volcanic ash plume not directly over or approaching the US or US Territories
18. Two or more volcanic eruptions outside of the CONUS domain invoking a switch to Mode 4
19. Blowing dust or sand conditions with ¼ mile or less visibility
20. ABI calibration/validation activities (N/S scans)
21. LIFR or worse conditions (widespread) over small FAA Hub Airports
22. Winter Weather Advisory criteria
23. SPC General Thunder
24. Other NWS requests
25. DoD requests
26. SAB responsibility interests for non-US/non-Canadian high impact conditions
27. SAB responsibility interests for two or more non-US/non-Canadian high impact conditions invoking a switch to Mode 4
28. Canadian Operational Need (requested from Canada per MoU)
29. Operations request from non-US/Canadian interests*
30. US research interests (non-operational, and coordinated through the research community)
31. Canadian research interests per MoU
32. Non-US/Canadian research interests (non-operational, and coordinated through the SPSD User Services Coordinators)

Request Content & Submission

- Which satellite (East/West) and change (either MDS 1-min or 30-sec or mode change request)
- Center Point in decimal degrees
- Start date/time of location change
- End date/time of coverage
- Requesting organization
- Reason, or phenomenon

The requested duration must not exceed 18 hours. If a longer duration is necessary, a new request must be initiated near the end of the 18 hour period

DoD requests are submitted to 24x7 Satellite Analysis Branch:
(301) 683-1400 sabsupervisor@noaa.gov

Summary

- PLPTs (Post Launch Product Tests) continue to proceed as scheduled
- All L1b products and ABI CMI are on track to reach Provisional Maturity prior to GOES-16 assignment to the GOES-East/West position
- Product Feedback Forum with NWS is very active and feeds PS-PVRs
- Field Campaigns are hitting objectives and are on schedule
- ABI MDS request process is being thoroughly exercised
- Customer feedback has been tremendously enthusiastic!

Backup

Product Validation Maturity Levels

Beta Validation Maturity

- Products are made available to users to gain familiarity with data formats and parameters. It has been minimally validated and may still contain significant errors and is not optimized for operational use.

Provisional Validation Maturity

- Product ready for operational use with any known issues documented. Product analyses are sufficient to communicate product performance to users relative to expectations.

Full Validation Maturity

- All known product anomalies are resolved and/or documented and shared with the user community.

Access Points to GOES-16 Data

Direct Readout (requires receiving system)

NWS SBN	Satellite Broadcast Network – serves AWIPS
GRB	GOES ReBroadcast
HRIT/EMWIN	High Resolution Information Transmission / Emergency Managers Weather Information Network
GNC-A	GeoNetCast – Americas

Terrestrial Access

PDA – Product Distribution & Access
- Operational real-time users
- Apply for access

CLASS – Comprehensive Large Array-data Stewardship Systems
- Request and setup access