

GOES-R Series: *The Next Generation of* **GOES**



GLM AWG Annual Science Team Meeting

Steve Goodman

GOES-R Program Senior Scientist





GLM Science Meeting Objectives

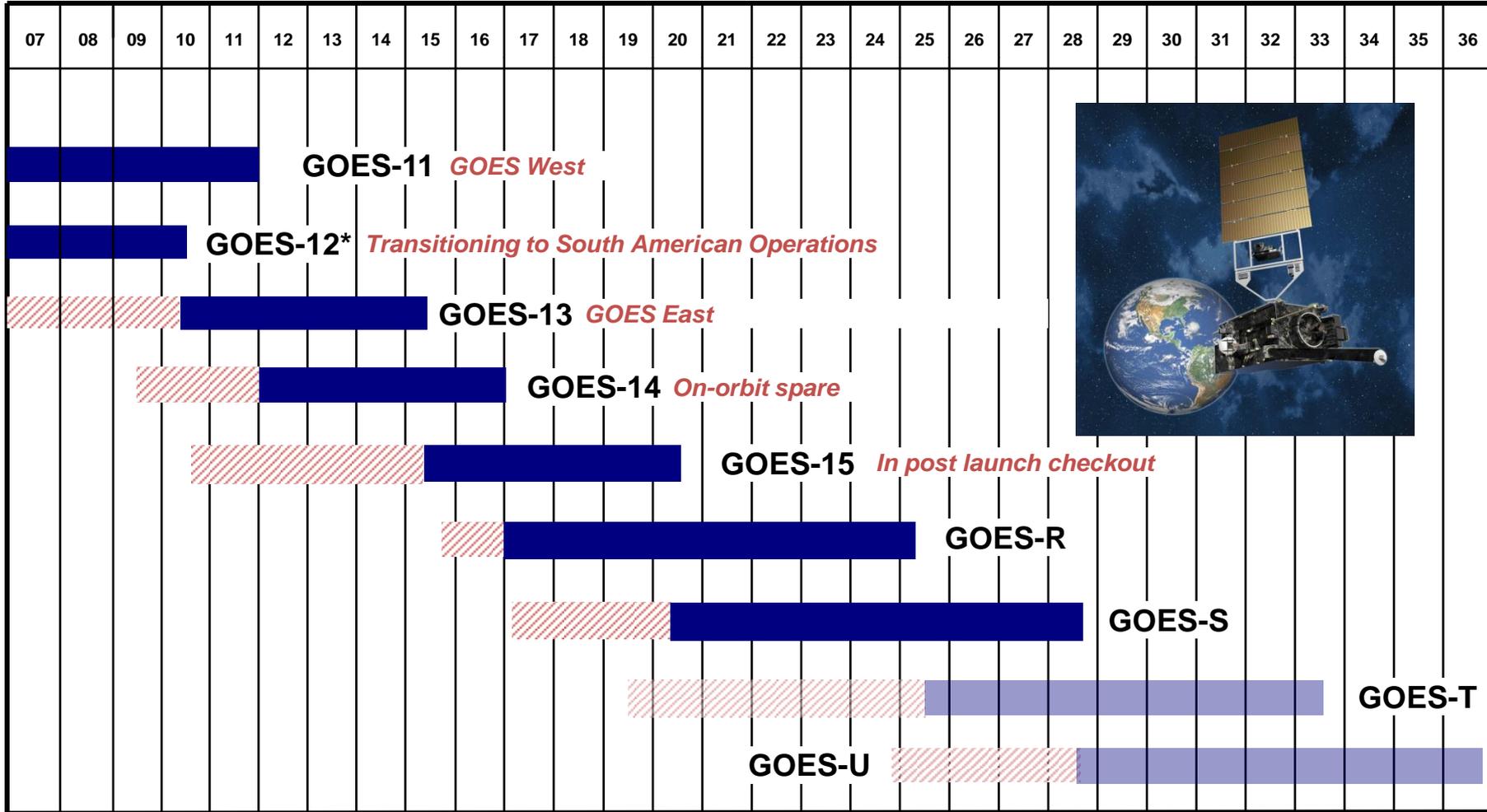


- Review progress of Risk Reduction Science projects
- Review plans for pre-launch and post-launch validation
- Address ADEB recommendation for more comprehensive validation
 - Campaigns
 - CHUVA, MC3E, DC3, HS3, HYMEX, other
 - Performance assessments (LMA, long range networks)
 - Sustaining measurements
 - OU CIMMS-West Texas LMA, North Alabama, UF Camp Blanding, other
 - Val Tools, Deep dive tools
- Visiting scientist program

Continuity of GOES Operational Satellite Program

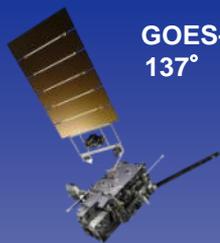
Calendar Year

As of September 1, 2010



.....▶ Satellite is operational beyond design life
▨ On-orbit GOES storage
█ Operational
▨ Future Options
 * Backup and South American Coverage beginning June 2010

GOES-R System Configuration



GOES-West
137° West



GOES-East
75° West

Other Users



Remote
Backup Facility
Fairmont, WV



NOAA
Satellite Operations Facility
Suitland, MD



Command and Data Acquisition Station
Wallops, VA

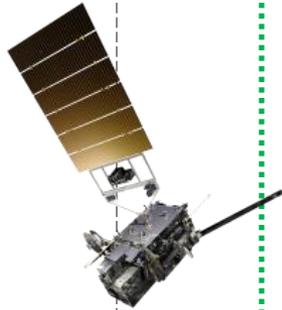


Command & control, data

Data

Command & control, data



	2007	2008	2009	2010	2011	2012	2013	2014	2015
Program /System		System Rqmts Review complete ✓			System Design Review complete			<div style="border: 1px solid black; border-radius: 15px; background-color: #f4a460; padding: 5px; text-align: center;"> Launch Readiness Oct. 2015 </div>	
Flight Segment	Spacecraft		Spacecraft SDR Complete ✓		Working towards PDR				
	Instruments	 5 Instrument contracts underway ✓ EXIS & SUVI passed CDR ✓			ABI PTM in thermal vacuum (TVAC) testing GLM CDR in December				
Ground Segment	Core contract awarded to Harris Corp. ✓ Core SRR complete ✓ 80% delivery of baseline product algorithms ✓ RBU lease awarded ✓				Antenna and GAS contracts awarded Working toward PDR				





GOES-R Spacecraft



Specifications

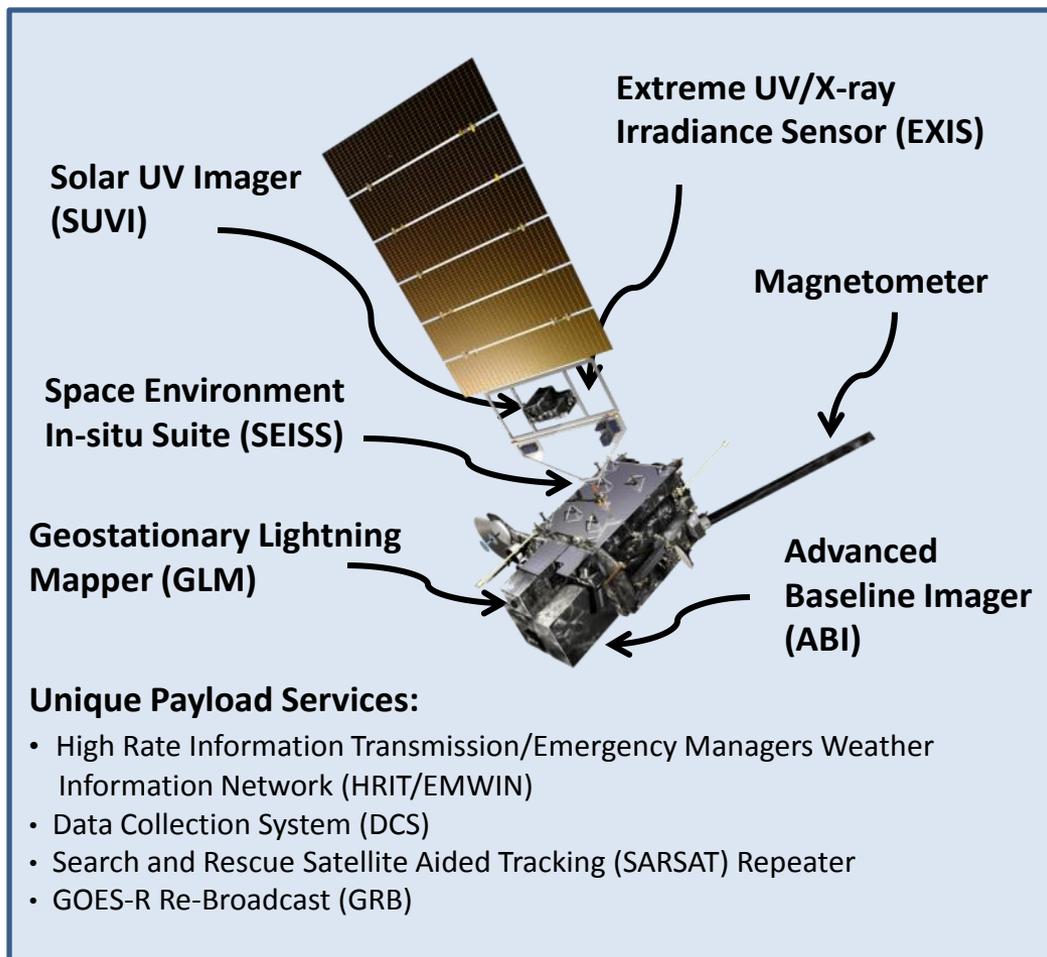
Size: ~5.5 meters (from launch vehicle interface to top of ABI)

Mass: Satellite (spacecraft and payloads) dry mass <2800kg

Power Capacity: >4000W at end-of-life (includes accounting for limited array degradation)

Current Status

- Lockheed-Martin Space Systems Co (LMSSC) of Newtown, PA is primary contractor
- Spacecraft System Definition Review (SDR) completed March 9-10, 2010.
- Spacecraft baseline established in April 2010.
- Working towards Preliminary Design Review (PDR) in January 2011.





Advanced Baseline Imager (ABI)

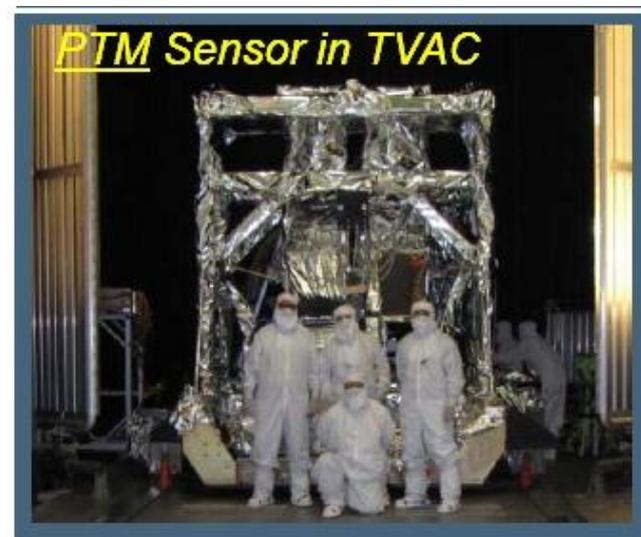


Specifications

- 16 channel imager
- Improves upon current capabilities in spectral information (3X), spatial coverage (4X), and temporal resolution (5X)
- Continues current products and will enable new products for **severe weather forecasting, fire and smoke monitoring, volcanic ash advisories, and more**

Current Status

- ITT Corporation (Ft. Wayne, IN) is primary contractor
- PTM instrument team successfully completed Bench Testing, Vibe Testing and EMI Testing early
- The ABI PTM is now undergoing thermal vacuum (TVAC) testing
 - Plan to complete testing ~ December
- ABI Flight Model activity centered on suppliers and module level Delta CDRs



ABI Proto-Type Model (PTM)



Geostationary Lightning Mapper (GLM)



Specifications

- **Detects total lightning:** in cloud, cloud to cloud, and cloud to ground
 - Aids in forecasting severe storms and tornado activity, and convective weather impacts on aviation safety and efficiency.
 - Currently no ocean coverage, and limited land coverage in dead zones

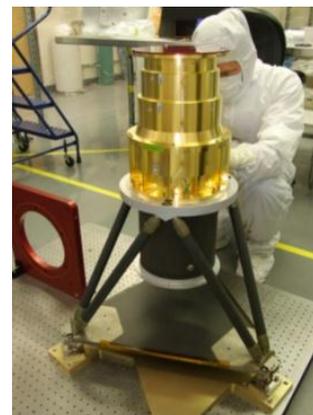
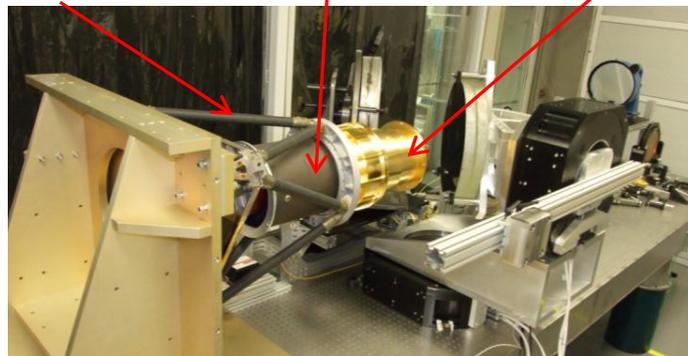
Current Status

- Lockheed Martin Applied Technology Corp (Palo Alto, CA) is primary contractor
- Critical Design Review scheduled for December 2010
- Engineering Design Unit (EDU) continuing to go thru fabrication

Sensor Unit
Mechanical
Support Structure

Metering tube

Optical Assembly





Ground Segment Status



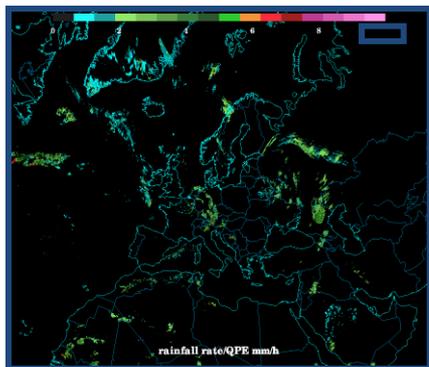
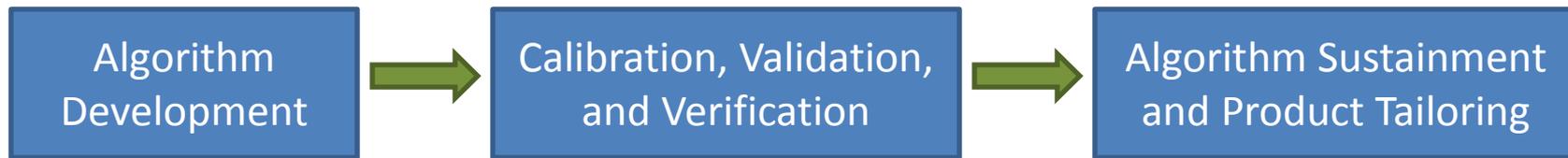
- Integrated Baseline Review (IBR): Government review of Harris concluded proper integration of planned cost and schedule into the contract baseline (November 2009)
- Core GS System Definition Review (SDR): Joint Harris/Government SDR passed with “Green” rating in April 2010
- Core GS Preliminary Design Review (PDR) scheduled for February 28 – March 4, 2011
- Established stakeholder Steering Group
- Draft GOES-R Metadata plan released



**NOAA Satellite Operation Facility (NSOF)
Suitland, Maryland**



Algorithm Working Group

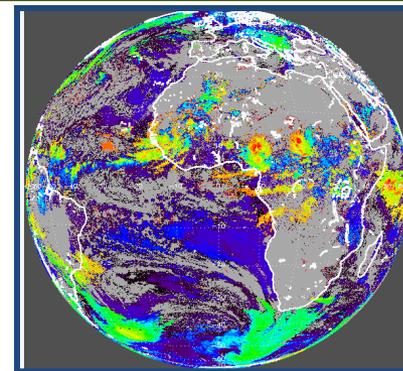
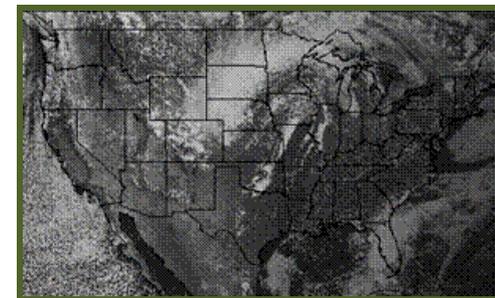


AWG Achievements:

- 80% Algorithm Packages for Baseline Products completed Sept 2009

Looking forward to:

- 100% Algorithm Packages for Baseline Products due Nov. 2010
- 80% Algorithm Packages for Option Products due November 2010



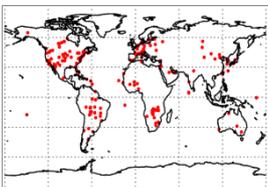


Algorithm Testing and Validation

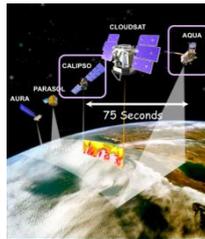
"Ground Truth" Datasets...



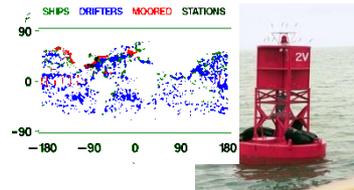
Aeronet Stations
Aerosol Optical Depth



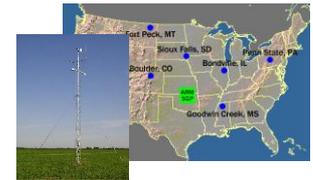
CALIPSO, CLOUDSAT
Clouds, Icing



Bouys, Ships
SST



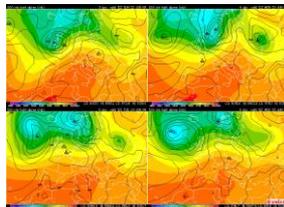
SURFRAD, ARM
LST, Radiation



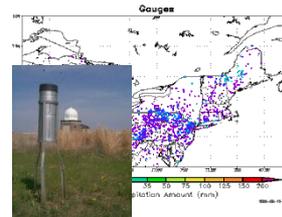
Radiosondes
Winds, Temperature,
Moisture, Stability



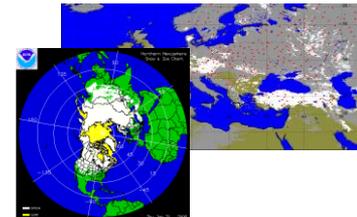
NWP Analyses
Winds, Temperature,
Moisture



Rain Gauges
Precipitation



Sfc Snow Reports, NESDIS IMS
Snow



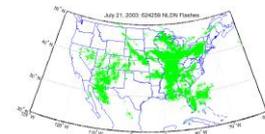
Ground-based Ozone
Ozone



Pilot Reports
Icing, Turbulence



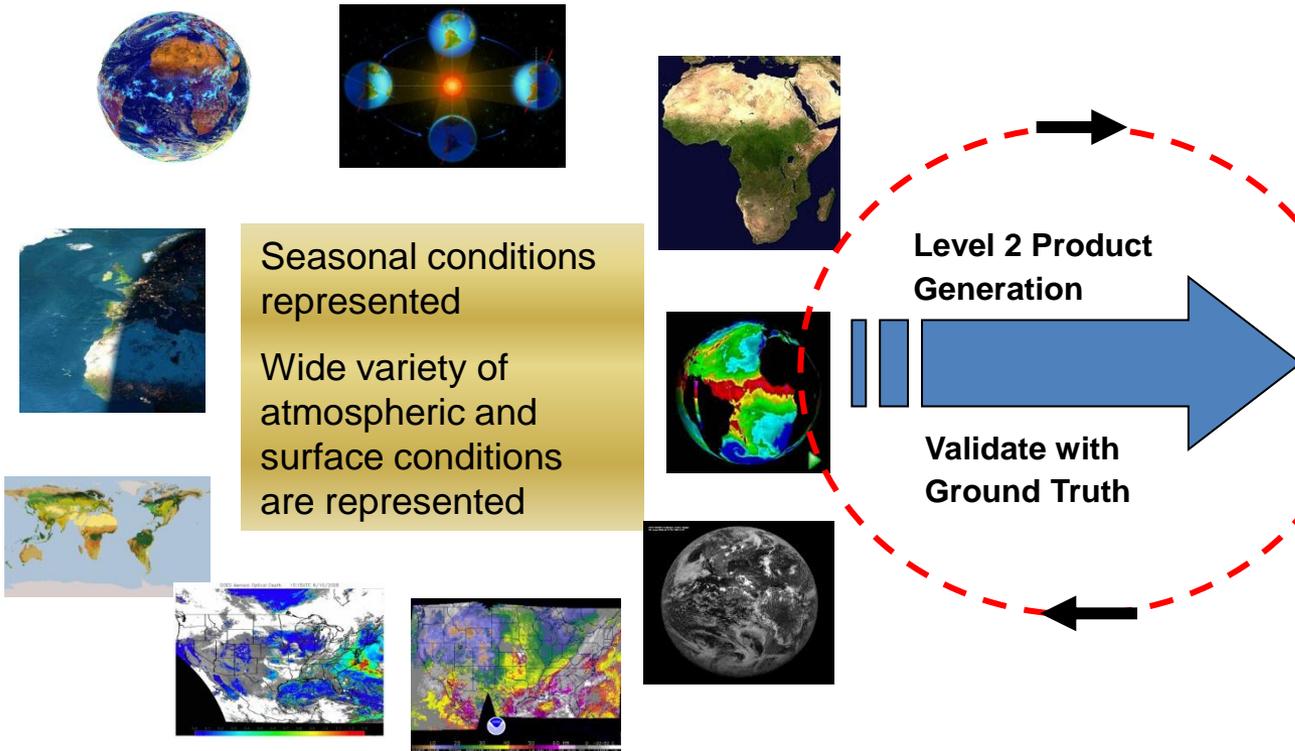
National Lightning Detection Network (NLDN)
Lightning





Algorithm Maturity & Validation

Proxy & Ground Truth Datasets



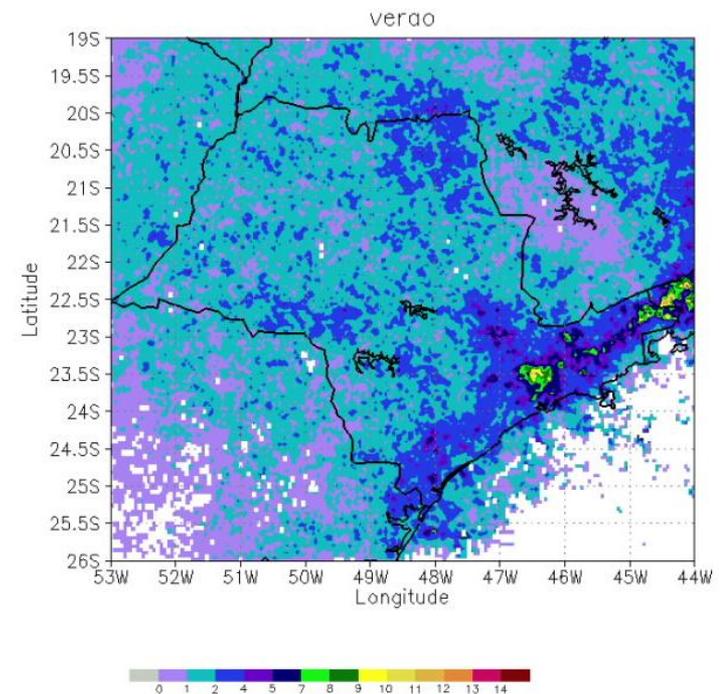
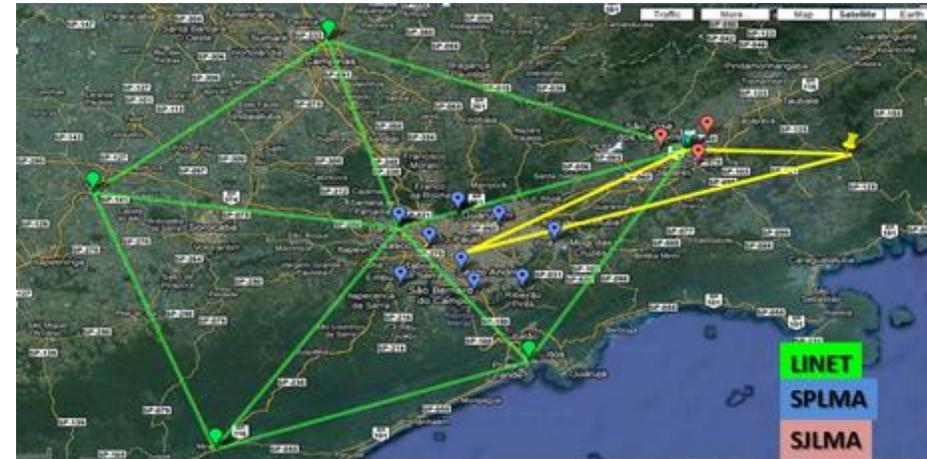
Seasonal conditions represented
Wide variety of atmospheric and surface conditions are represented

- Algorithms mature; get better algorithms
- Better estimates of product performance
- Increased confidence that on-orbit product performance will meet specs
- Increased confidence that user needs are met

CHUVA Ground Validation for GLM

São Luiz do Paraitinga Campaign

- **CHUVA- Cloud processes of the main precipitation systems in Brazil: A contribution to cloud resolving modeling and to the GPM (Global Precipitation Mission)**
- **Dates- 31 October- 22 December 2011**
- **Science Objectives:**
 - Algorithm and Proxy Data Validation
 - Validation Systems Performance Assessment
 - Storm Electrification/Physics
 - Applications for GLM+ABI+...
- **Partners:** GOES-R GLM Science Team, InPE (CPTEC/USP, ELAT), and EUMETSAT MTG Lightning Imager Science Team (LIST)
- **Key scientific measurements include:** VHF 3-D Lightning Mapping Array (LMA), LINET, TRMM/LIS, MSG SEVERI (ABI proxy data), high speed digital video, VLF lightning networks, dual-pol radar, electric-field change, airplane in-situ microphysics, and ancillary meteorological data



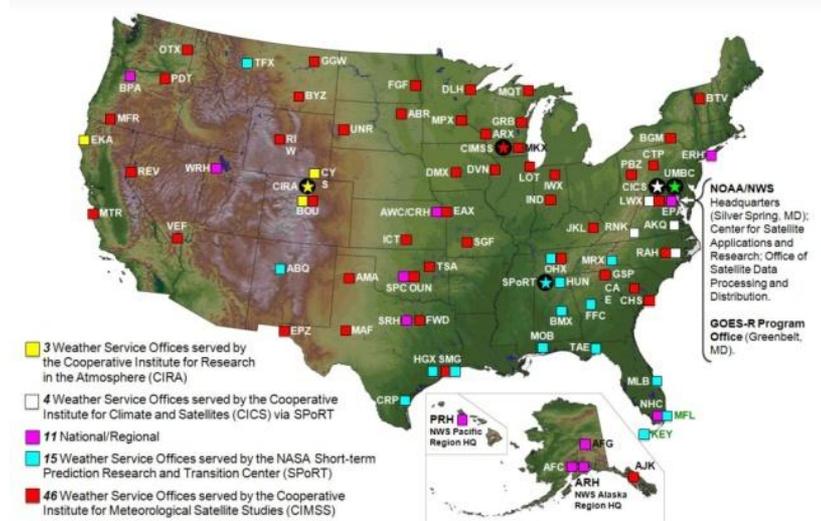


User Readiness



Training and Education

- Online training modules
- http://meted.ucar.edu/goes_r/envmon/
- <http://cimss.ssec.wisc.edu/satmet/>



Proving Ground

- Working with cooperative institutes, weather forecast offices, NCEP National Centers, and NOAA Testbeds (75+ partners)
- Intended outcomes are Day-1 readiness and maximum utilization for both the developers and users of GOES-R products, and an effective transition to operations

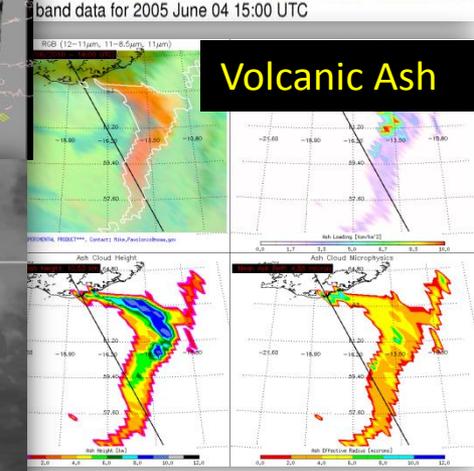
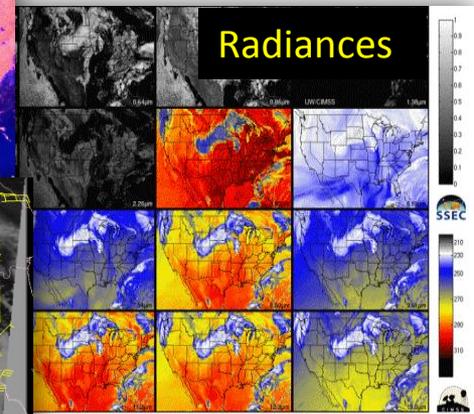
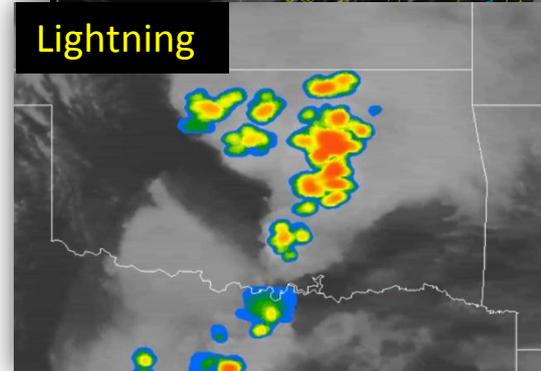
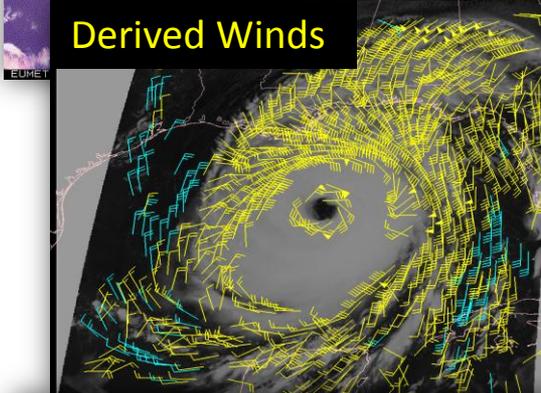
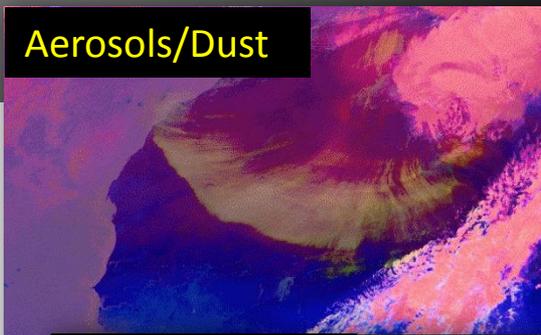


GOES-R Proving Ground



GOES-R Proving Ground bridges the gap between research and operations:

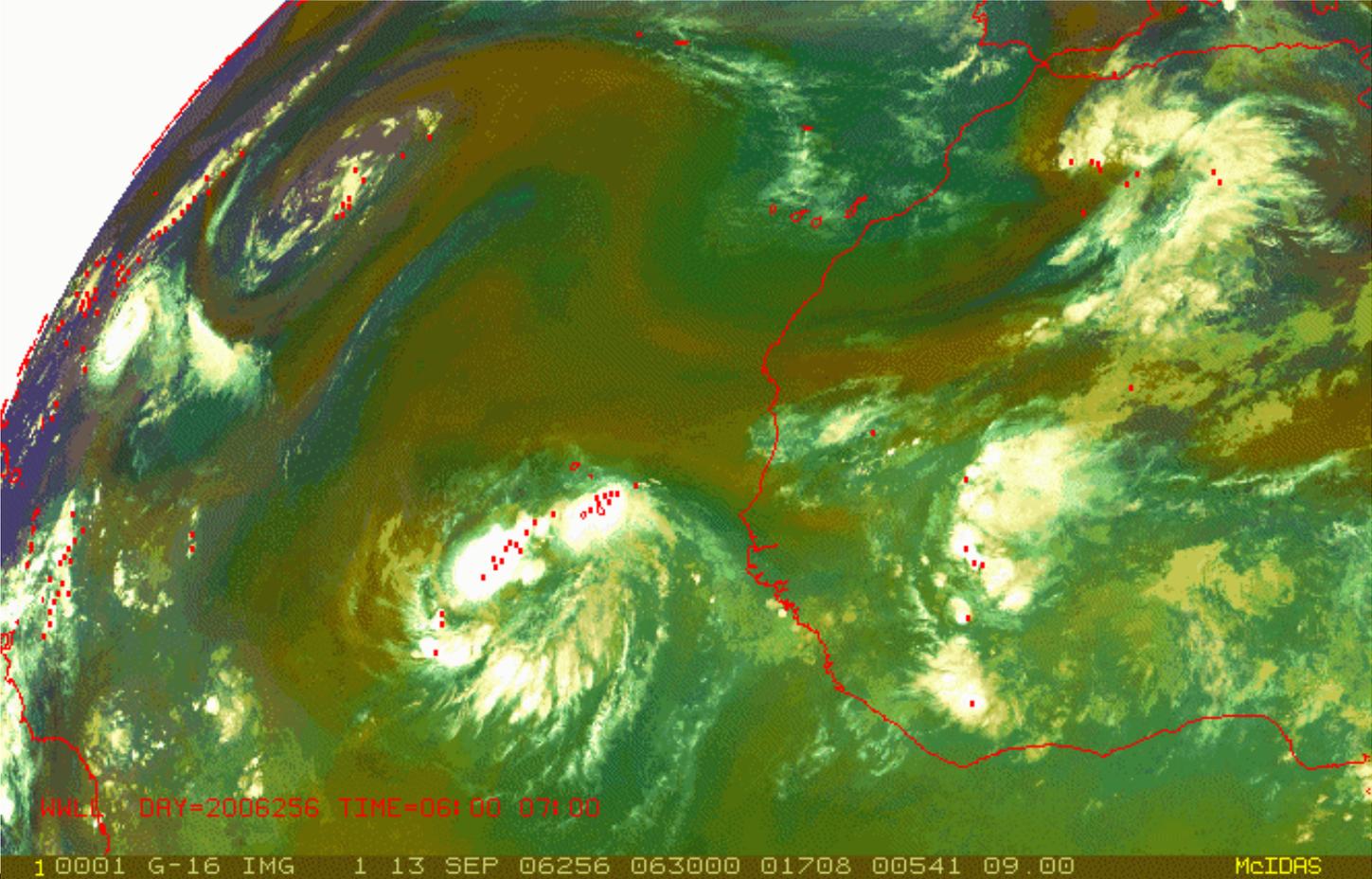
- Utilizing current systems (satellite, terrestrial, or model/synthetic) to emulate future GOES-R capabilities
- Infusing GOES-R products and techniques into NWS operations with emphasis on AWIPS and transitioning to AWIPS-II.
- Putting prototype GOES-R products in hands of forecasters
- Keeping lines of communication open between developers and forecasters
- Allowing end user to have say in final product, how it is displayed and integrated into operations





RGB Air Mass Product with WWLLN Lightning

CIRA Cooperative Institute for Research in the Atmosphere
NOAA Satellites and Information National Environmental Satellite, Data, and Information Service
RAMMB Regional and Mesoscale Meteorology Branch





GOES-R Warning Product Set



The following sets of products offers opportunity for near-real time Warning Related utility.

Products:

- Volcanic Ash: detection & Height
- Cloud and Moisture Imagery
- Hurricane Intensity
- Lightning Detection: Events, Groups & Flashes
- Rainfall Rate / QPE
- Total Precipitable Water
- Fire/Hot Spot Characterization
- Aircraft Icing Threat
- Convective Initiation
- Enhanced "V" / Overshooting Top Detection
- Low Cloud and Fog
- SO₂ Detection



Summary

- GLM instrument development on schedule
 - EDU risk reduction completion 2010
 - Full GLM System CDR December 2010
- Ver. 1 of ATBD, Val Plan, Proxy Data, L2 Prototype S/W
 - Product demonstrations at NOAA Testbeds
 - Hazardous Weather Testbed (2010 Spring Program with VORTEX-II IOP, Summer Program)
 - Joint Hurricane Testbed (NASA GRIP, NSF PREDICT)
 - Aviation Weather Testbed (NextGen)
 - Continue Regional WFO demonstrations (Norman, Huntsville, Sterling, Melbourne, ...)
- New Risk Reduction/Advanced Product Initiatives
 - Data Assimilation: JCSDA FFO 2010 funding two new GLM investigations
 - Fuelberg, MacGorman
 - New Supercomputer at CIMSS- GOES-R has first priority access
 - High Impact Weather Working Group- GOES-R DA focus on short-range NWP
 - Combined sensors/platforms (e.g., ABI/GLM ; ABI/GLM/GPM)
 - NASA GPM - GLM proxy data 12-mo. campaign in Sao Paulo in partnership with InPE and CHUVA GPM pre-launch ground validation program
 - Training- GLM AWG Fact Sheet