



GOES-R Science Office 2013 Update



Steve Goodman

GOES-R Series Chief Scientist

<http://www.goes-r.gov>

Virtual Science Week
March 18-22, 2013





NWS Operational Advisory Team (NOAT) Yearly Guidance Memorandum for the Science and Demonstration Executive Board (SDEB) – FY13

- **Overarching NWS Science and Technology Themes**
 - Convective initiation/Warn on Forecast
 - Best state of the Atmosphere (e.g., 3-d analysis)
 - Next Generation Forecast System
 - Decision Support Information Systems
 - Integration of Social Science into the forecast process
 - Risk Reduction as a core validation activity
- **NWS Weather Ready Nation (WRN)**



NOAT Priorities

- 1. Convective Initiation
- 2. Fog and Low Stratus
- 3. Icing Threat plus Cloud Properties (cloud ice water path, cloud layers heights, cloud liquid water, cloud type). Note: these are all interrelated – cloud properties integral to this and other efforts. Also, specific guidance to pursue integrated NWP-centric approaches.
- 4. SO₂ Detection
- 5. Land Surface Model Related (emissivity, vegetation index, vegetation fraction)
- 6. Precipitation (probability of rainfall, rainfall potential, QPE)
- 7. Ice Cover
- 8. Flood and Standing Water (at full resolution)
- 9. Other Priority 2 Products not specifically noted (includes tropopause folding turbulence prediction, enhanced V overshooting top detection, visibility, and all others not covered above).

Although demonstration of products should meet these priorities, NOAT accepts the demonstration of non-baseline products as acceptable if short-term value to operations is expected.



IAC Recommendation Science Week 2012

(10) Data assimilation of hourly radiances / products (eg. AMVs) in NWP models requires more attention (eg use of 4DVAR) - JCSDA engagement in this direction need to be strengthened. Moreover, use of satellite data over land (surface viewing as well as upper tropospheric / lower stratospheric sensitive measurements) in NWP needs to be enhanced. **We need to be prepared for the generation and continuous assimilation of radiances hourly winds.** Surface emissivity also needs to be updated in the CRTM.

In general NWP readiness for GOES-R should continue to be a high priority activity.



IAC Recommendation Science Week 2012

(11) ABI does not offer a sounding product; ABI offers layer adjustments to a NWP model initial vertical profile estimate... **Utilization of the LEO high spectral resolution data rendering of moisture vertical and horizontal distributions needs to be encouraged.**

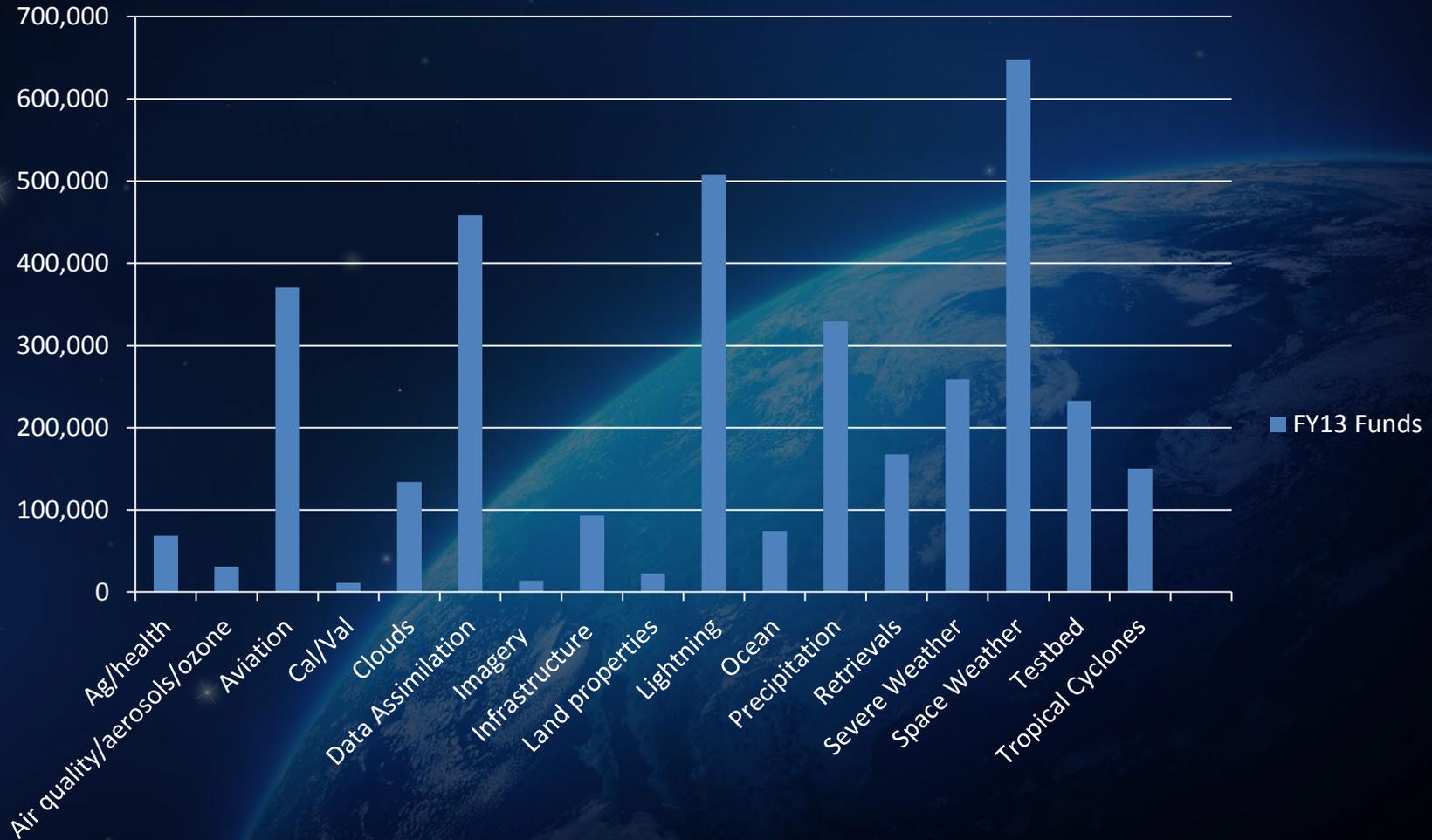
Recommendation: Regional forecasts and nowcasts necessary for a Weather Ready Nation will have to make better use of the information content from AIRS, CrIS, and IASI data; GPS data should also be included. Between LEO sounding coverage, **GOES-R data should be used to monitor temporal profile (atmospheric stability, etc) changes.**

Recommendation: To pursue the missing continuous viewing essential for capturing the rapidly changing conditions that go with severe weather, the move to a GEO high spectral resolution IR sounder should receive higher priority within NOAA. A Transition Plan and Transition Survey should be completed as soon as possible.



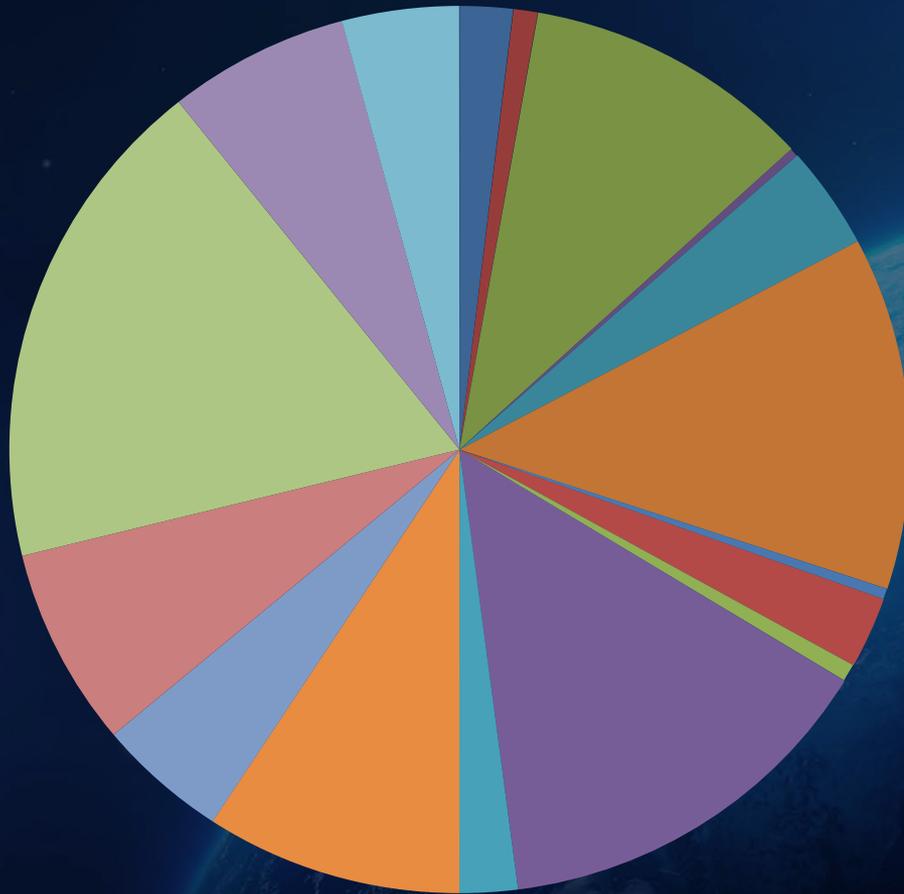
FY13 R3 Funding by Topic

FY13 Funds \$



FY13 R3 Funding by Topic

FY13 Funds



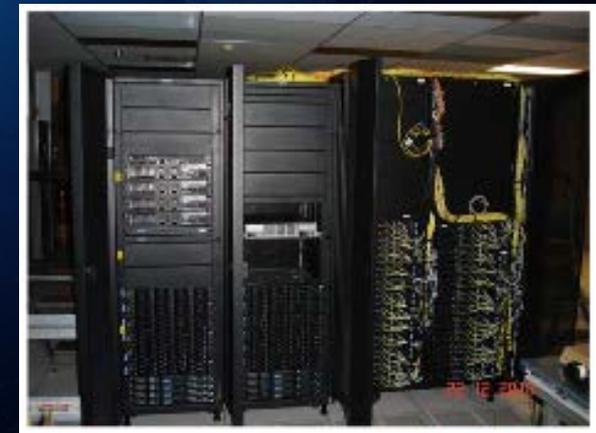
- Ag/health
- Air quality/aerosols/ozone
- Aviation
- Cal/Val
- Clouds
- Data Assimilation
- Imagery
- Infrastructure
- Land properties
- Lightning
- Ocean
- Precipitation
- Retrievals
- Severe Weather
- Space Weather
- Testbed
- Tropical Cyclones
-

GOES-R NWP Program Updates

- Visiting Scientists- High Impact Weather NWP
 - Haidao Lin- ESRL/CIRA
 - Thomas Jones-NSSL/OU-CIMMS
 - Xiaoyan Zhang- EMC/CICS
- JCSDA Computing Infrastructure Enhancements
 - S4 supercomputer at UW-CIMSS
 - Jibb supercomputer at NASA GMAO
 - Governance and User accounts in place
 - NCEP Global Forecast system installed to advance R20
- Upcoming Meetings-Workshops
 - NOAA Satellite Science Week (Virtual, March 18-22, 2013)
 - NOAA Testbed-Proving Ground Workshop (College Park, MD, April 2-4, 2013)-focus on High Impact Events
 - NOAA Satellite Conference (College Park, MD, April 8-12, 2013)- special session on NWP and Data Assimilation for TCs, hurricanes, and heavy precipitation



SPD Director Greg Mandt and Program Chief Scientist Steve Goodman tour the Super Computer for Satellite Simulation and Data Assimilation Studies (S4) at UW-CIMSS.



The Joint Center in a big box (Jibb) supercomputer at NASA GMAO

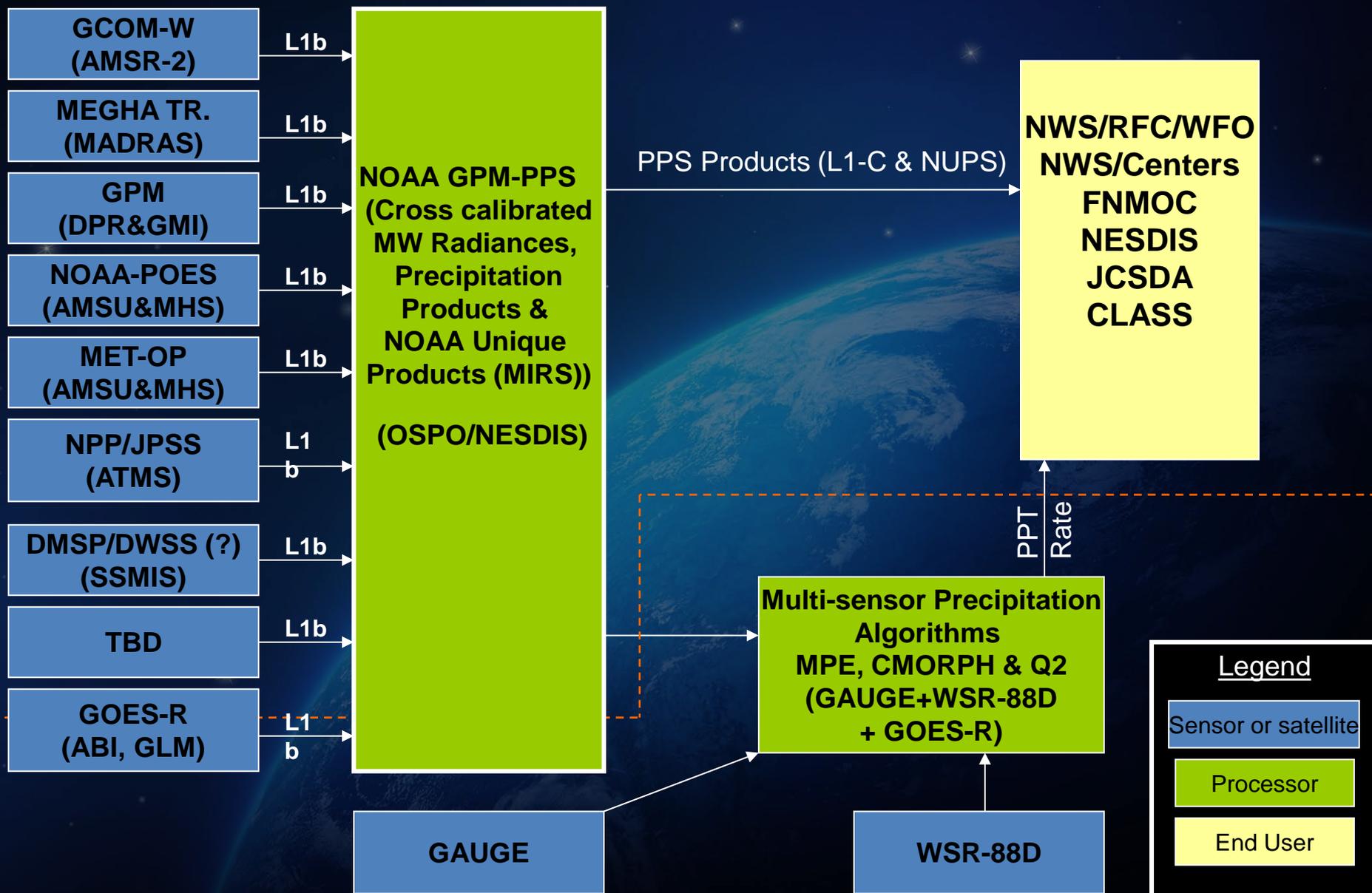


FY13 Risk Reduction New Starts

<u>GOES R3 Topic</u>	<u>Project/PI</u>
Aviation	Satellite-Detected OT/TOT CIMSS/Velden, LaRC/Bedka
Infrastructure	AWIPS-II Satellite Plug-ins (EPDT) NASA/Jedlovec, STAR-CIRA/DeMaria, STAR-CIMSS/Schmit
Clouds	Fog and Low Stratus Detection STAR/Pavolonis
Lightning	GLM Lightning Jump Algorithm Pre-Operational National Demonstration UAH/Carey, OU-CIMMS-NSSL/Calhoun
Severe Weather	Convective Initiation (GOES-R Fused NWP) UAH/Mecikalski, GSD/Benjamin, STAR/Heidinger



Unified Precipitation Processing (Concept)

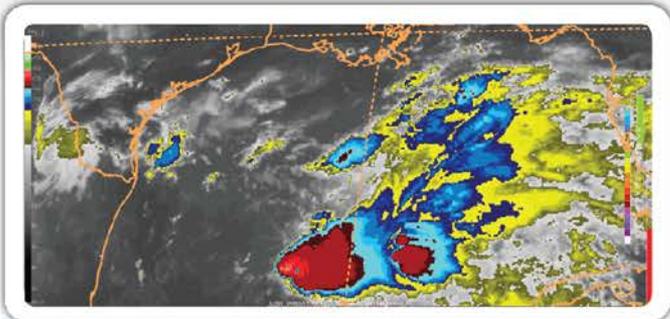




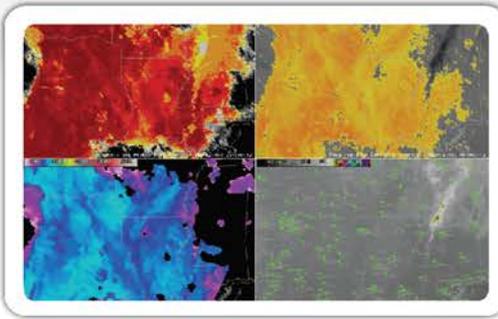
GOES-R Precipitation Projects: New Starts for NOAA Members of the NASA PMM (GPM) Science Team

<u>PI</u>	<u>Project</u>
Pingping Xie NWS/CPC	Development of CMORPH and GPM Day-1 Level 3 Precipitation Products for Improved Weather, Climate, and Water Applications
Jonathan Gurley NSSL	WiMerge: Research and Development of Unified CONUS 3-D Mosaics and QPE products

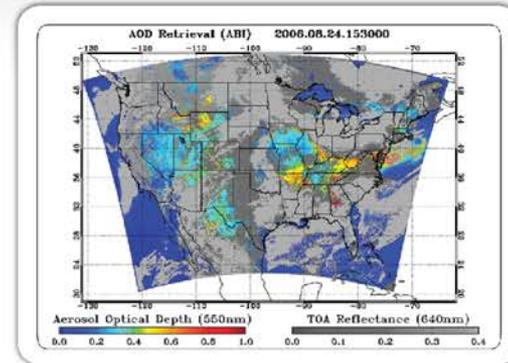
GOES-R Proving Ground Partners



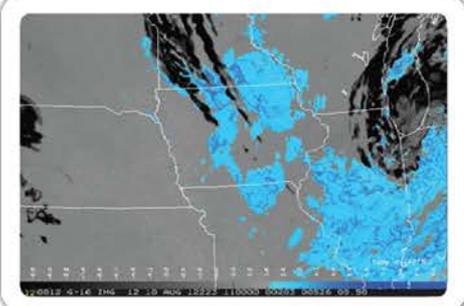
AWC – Kansas City, MO IR Imagery of Oceanic Storms



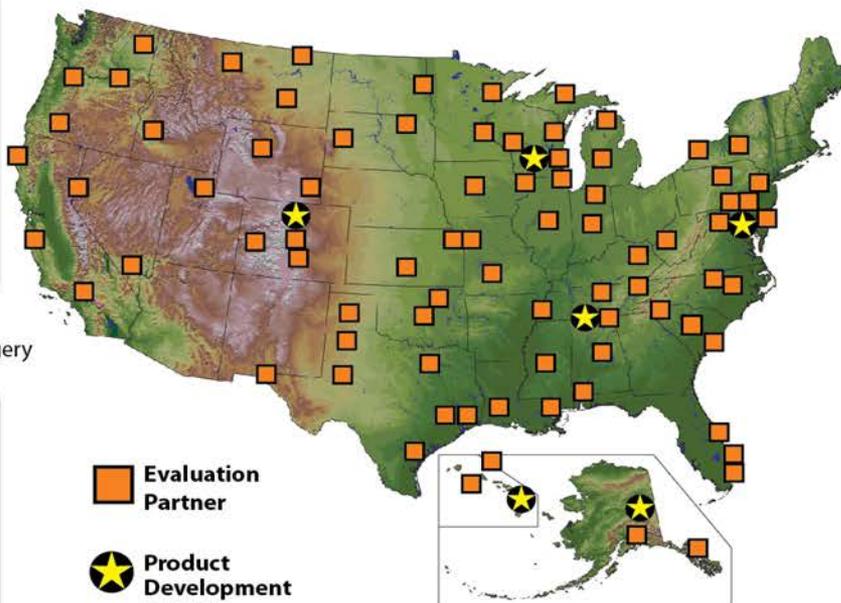
CIMSS/STAR – Madison, WI Fog/Low Stratus Product



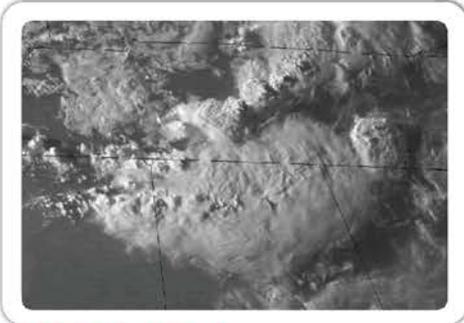
STAR/UMBC – College Park, MD Aerosol Optical Depth



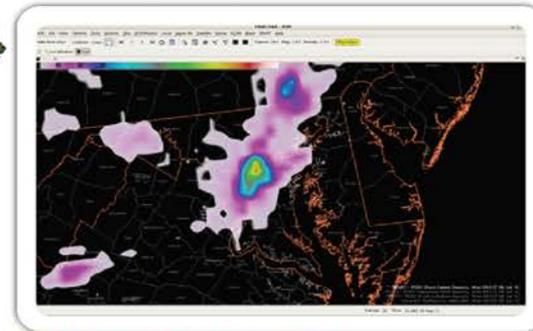
CIRA/STAR – Ft. Collins, CO ABI Synthetic Low Cloud Enhancement Imagery



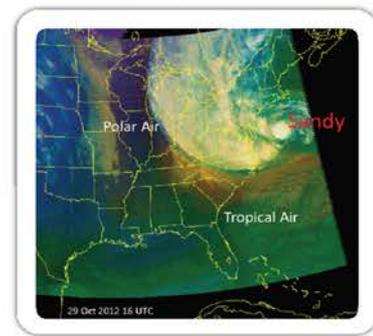
- Evaluation Partner
- ★ Product Development Partner



SPC – Norman, OK Severe Storms 1-Min Visible Imagery of Overshooting Tops



SPoRT/NASA – Huntsville, AL GLM Lightning Density



NHC – Miami, FL RGB Air Mass for Hurricane Sandy

THE GOES-R PROVING GROUND

Accelerating User Readiness for the Next-Generation Geostationary Environmental Satellite System

BY STEVEN J. GOODMAN, JAMES GURKA, MARK DEMARIA, TIMOTHY J. SCHMIT, ANTHONY MOSTEK, GARY JEDLOVEC, CHRIS SIEWERT, WAYNE FELTZ, JORDAN GERTH, RENATE BRUMMER, STEVEN MILLER, BONNIE REED, AND RICHARD R. REYNOLDS

By demonstrating the advanced capabilities of the next generation of geostationary satellites, the proving ground addresses user readiness and the research-to-operations-to-research loop.

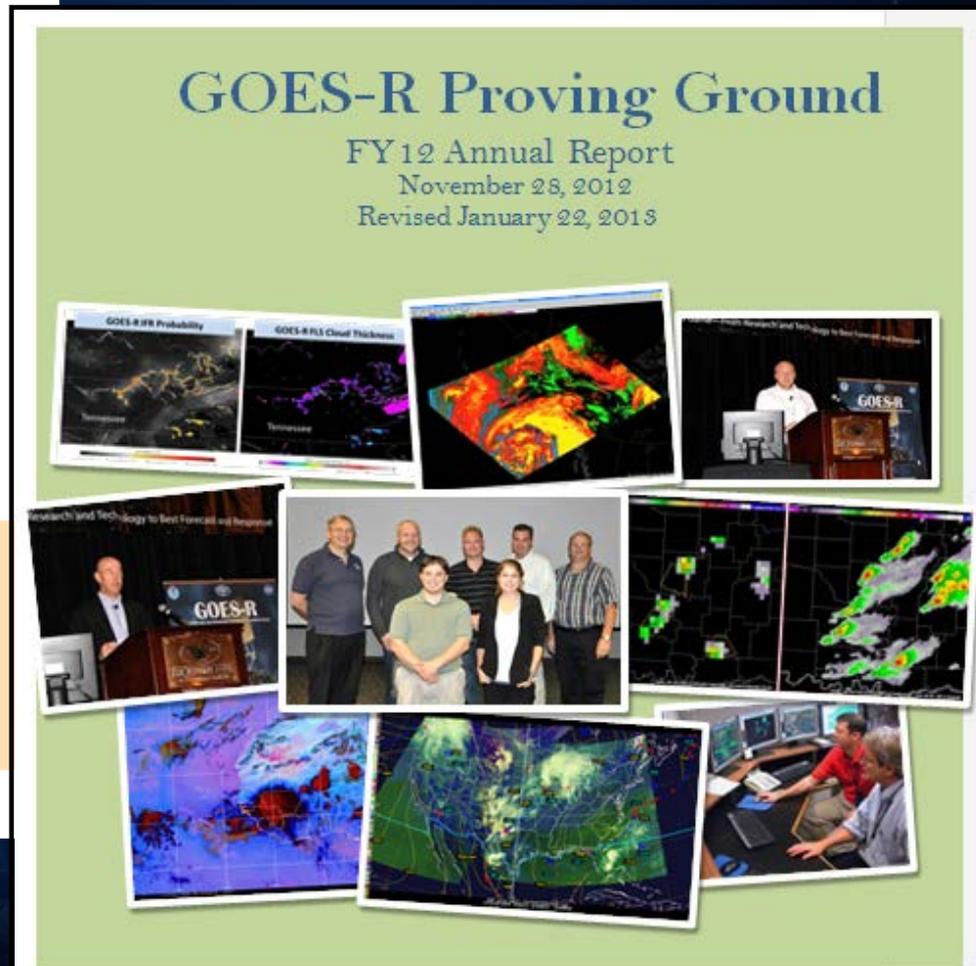
The Geostationary Operational Environmental Satellite R series (GOES-R) Proving Ground (PG) is an initiative to accelerate user readiness for the next generation of U.S. geostationary environmental satellites. The GOES-R system is a joint development between the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA), with NASA responsible for the space segment (spacecraft and instruments) and NOAA responsible for the overall program and ground segment. The GOES-R PG is a collaborative effort between the GOES-R Program Office (GPO); NOAA Cooperative Institutes; NASA's Short-Term Prediction Research and Transition Center (SPoRT); National Weather

Service (NWS) Weather Forecast Offices (WFOs); NWS National Centers for Environmental Prediction (NCEP); National Environmental Satellite, Data, and Information Service (NESDIS) Office of Satellite and Product Operations (OSPO) and the Center for Satellite Applications and Research (STAR); and NOAA test beds to conduct demonstration activities to gain early experience with GOES-R capabilities in an operational environment. Improved spacecraft and instrument technology will support expanded detection of environmental phenomena, resulting in more timely and accurate forecasts and warnings. The Advanced Baseline Imager (ABI), described by Schmit et al. (2005), is a 16-channel imager with 2 visible channels, 4 near-infrared channels, and 10

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2012 Demonstrations



- Hazardous Weather Testbed
 - Focus on Severe Storms
- NHC/Joint Hurricane Testbed
 - Focus on tropical cyclones/hurricane intensity and track
- Aviation Weather Testbed
 - Focus on High Impact Convective Weather
- OPC and SAB (Camp Springs MD)
 - Focus on offshore thunderstorms
- High Latitude and Arctic Experiment (Alaska Region)
 - Focus on precipitation/snow/cloud/ash/aviation
- HPC and SAB (Camp Springs MD)
 - Focus on precipitation/QPF
- Air Quality (UMBC)
 - Focus on aerosol detection
- Pacific Region (Hawaii)
 - Focus on tropical cyclones/heavy rainfall/aviation
- Space Weather (NWS SWPC: Boulder CO)
 - Focus on GOES-R like level 2 products

GOES 14 SRSOR Experiment

http://cimss.ssec.wisc.edu/goes/srsor/GOES-14_SRSOR.html

- Outcomes: Operational use of ABI and GLM for nowcasting
 - 1 min imagery, 1 minute lightning, 1 min radar volume scans
- Time: August 16-October 31, 2012
- Locations:
 - Norman, OK- NEXRAD, MPAR, OKLMA (primary site)
 - Huntsville, AL- NEXRAD, UAH dual-pol radars, NALMA
 - Sterling, VA- NEXRAD, TDWR, DCLMA
 - Fort Collins, Colorado- NEXRAD, CSU-CHILL, NCLMA
 - Melbourne/KSC, FL- NEXRAD, LDAR II
 - Atlantic Ocean/GulfMex Basin- NASA EV-1 Hurricane and Severe Storm Sentinel-HS3 science flights 20 Sept-5 Oct coincidence with GOES-R products (<http://espo.nasa.gov/missions/hs3>)

GOES-14 SRSOR 1-min Imagery Experiment

The GOES-R **Algorithm Work Group** in partnership with the GOES-R **Risk Reduction Science Program** and **Proving Ground Demonstration Program** have developed a number of products and decision aids undergoing evaluation and feedback with NWS forecasters across the country.

In the GOES-R Proving Ground, Baseline and Future Capability Products are demonstrated with and receive feedback from forecasters using proxy and simulated data sets. Some of the key products that are very useful for high impact weather forecasts and warnings include:

- Cloud and Moisture Imagery
- Hurricane Intensity Estimate
- Convective Initiation
- Overshooting Top Detection
- Lightning Detection

A deficiency in these product demonstrations is our inability to more fully demonstrate the added utility of the GOES-R imagery products at the higher 30 sec to 1 min mesoscale refresh rate that will be routinely possible with the ABI.



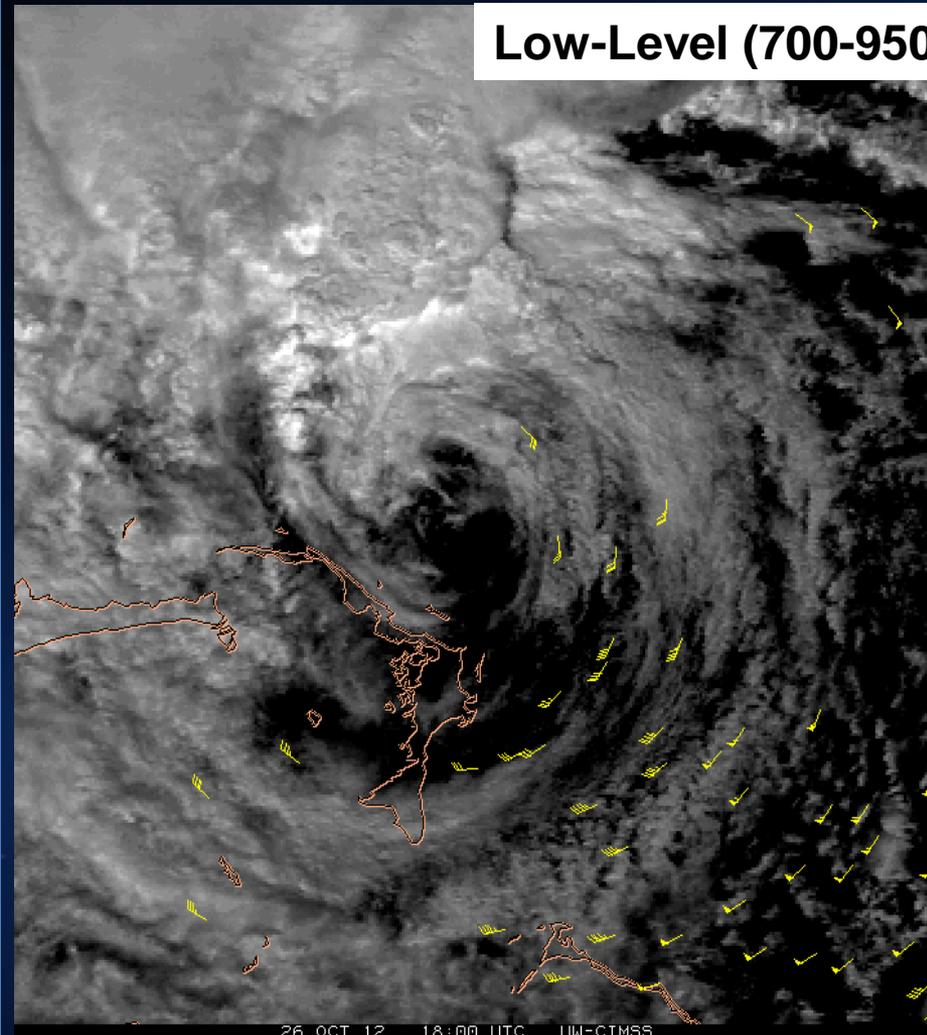
Atmospheric Motion Vectors from GOES-R



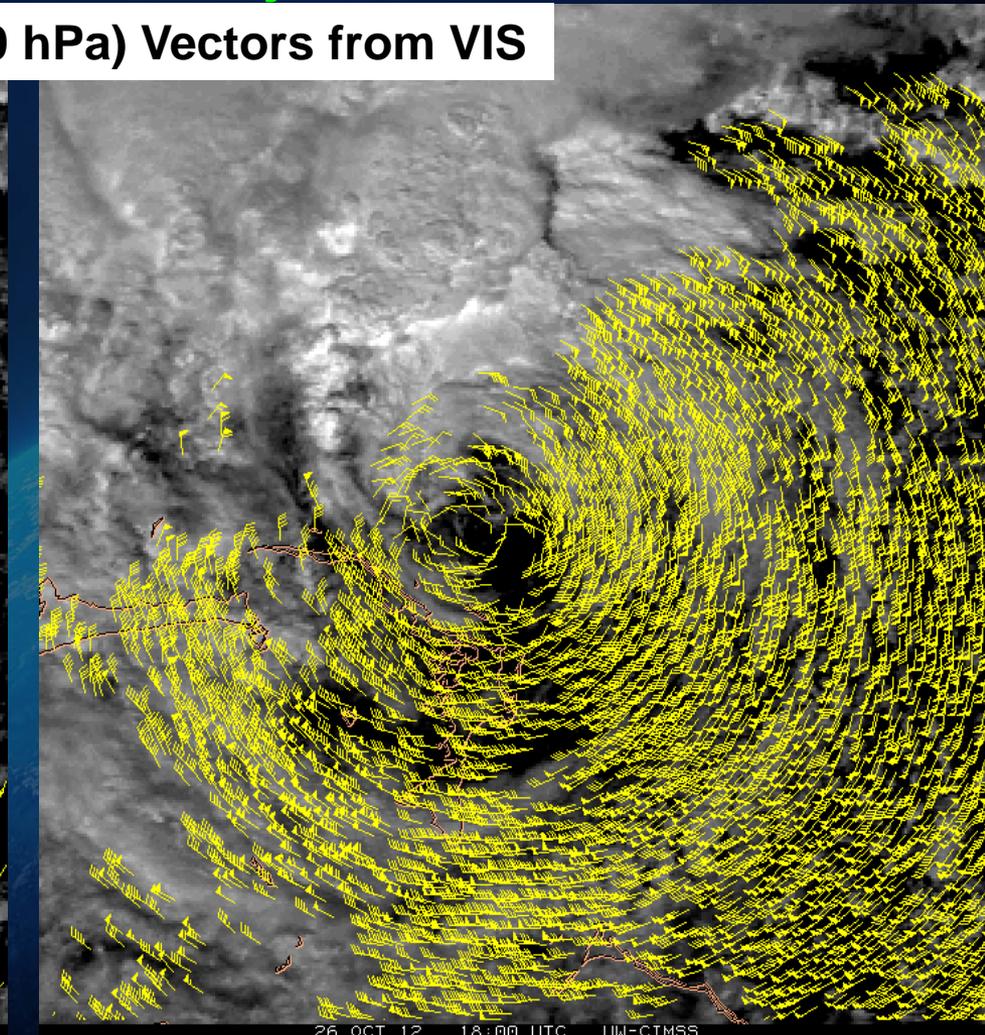
Proxy: AMVs from special GOES-14, 1-min super-rapid-scan operations

Hurricane Sandy

Low-Level (700-950 hPa) Vectors from VIS



26 OCT 12 18:00 UTC UW-CIMSS



26 OCT 12 18:00 UTC UW-CIMSS

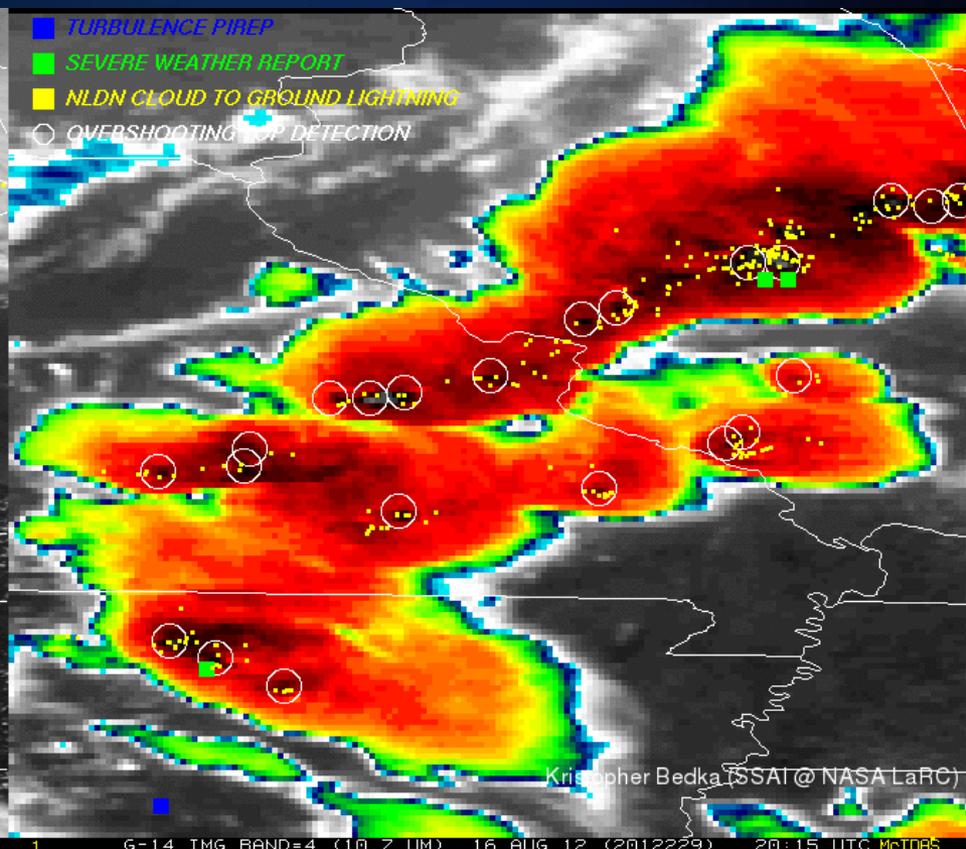
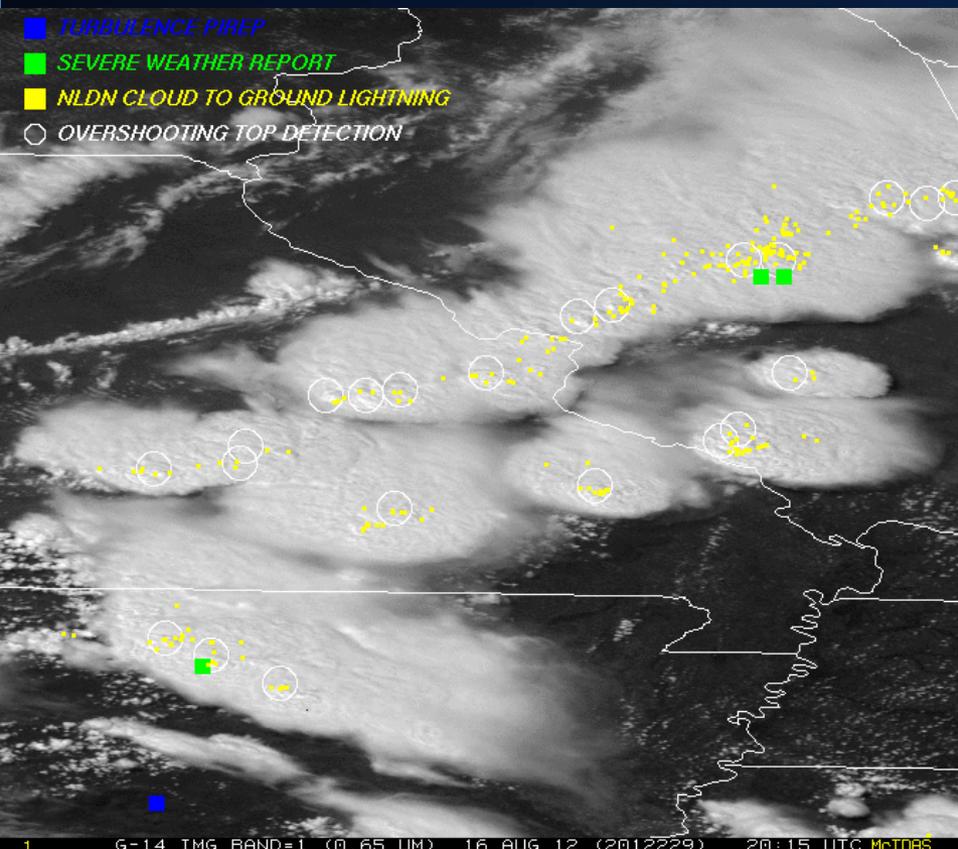
AMVs from **15-min images** (routine **GOES** sampling)

AMVs from **1-min images** (meso **GOES-R** sampling)

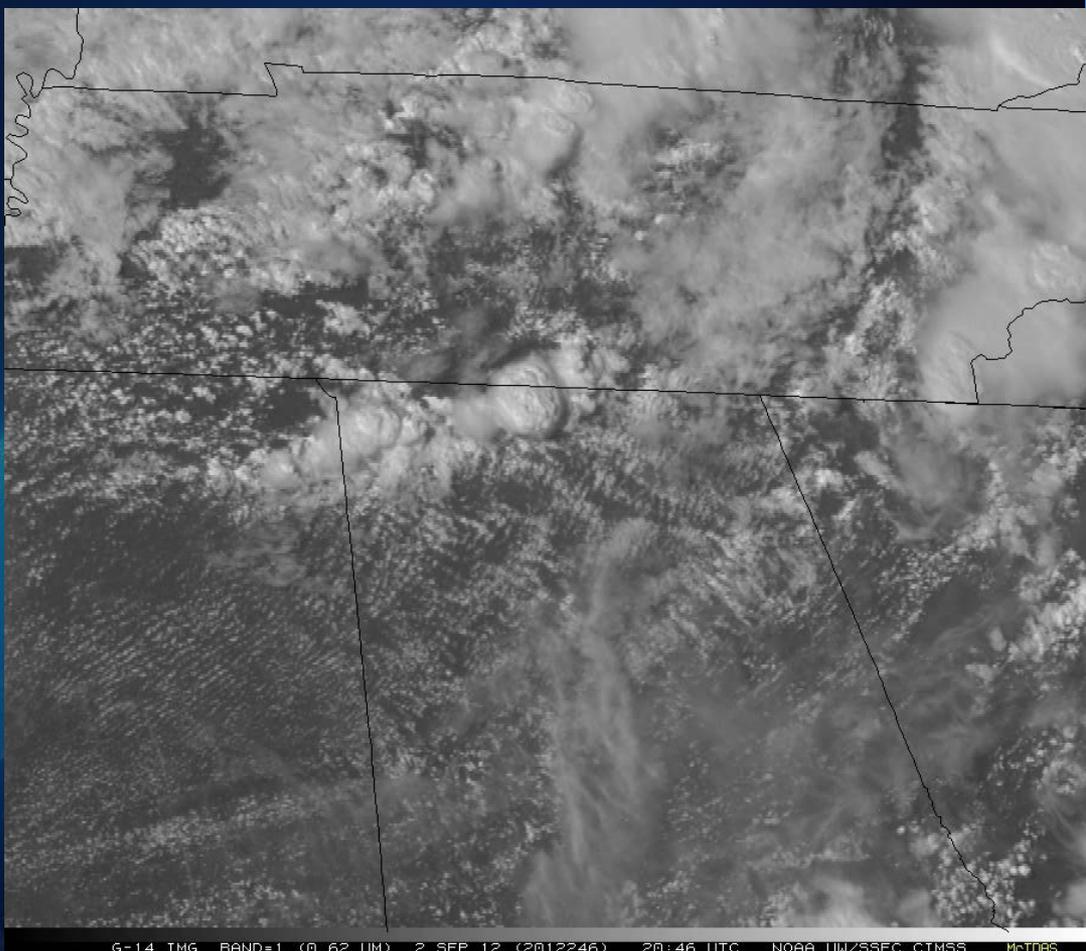
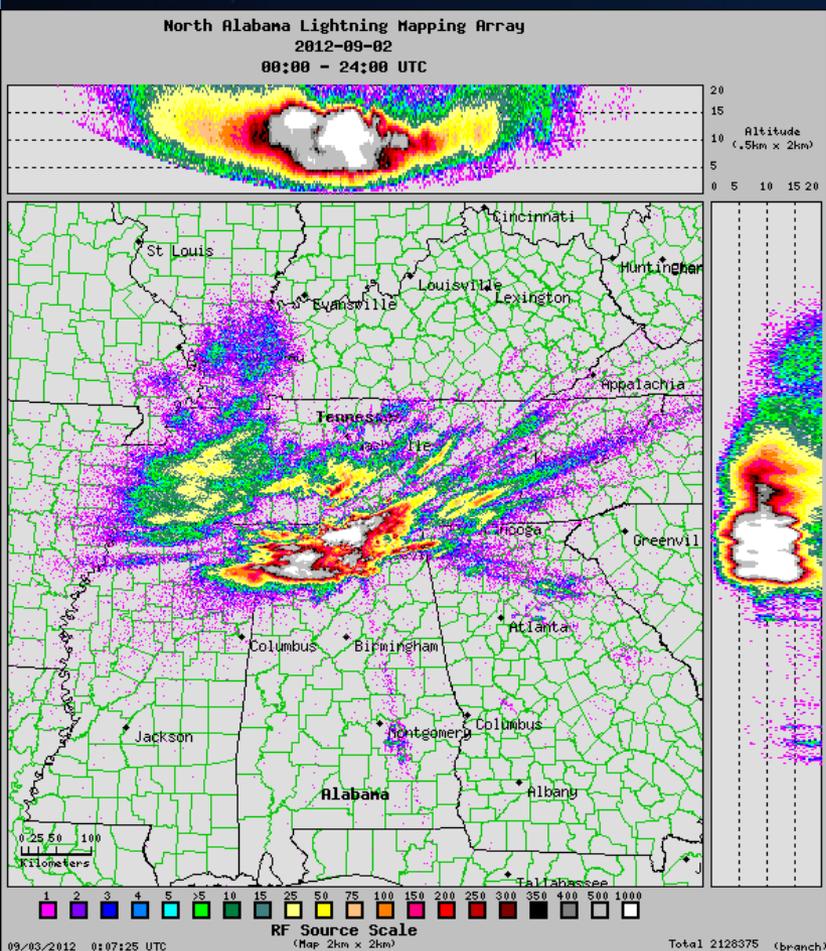
1800 UTC 26 Oct, 2012

C. Velden (CIMSS)

GOES-14 SRSOR Experiment : Overshooting Top Detection



GOES-14 SRSOR Experiment : GLM Testbed Lightning Detection





NWS Vision to Integrate ABI and GLM Products with Other Data and Models

A Potential Operational Example: Convective Initiation/Severe Wx

How can we integrate the information in future tools?

CI

Convective Initiation (BLI check): 20090323 at 1915 UTC

Over-shooting tops

Overshooting Tops: 20091029 at 2315 UTC

Lightning Jumps

Source Density

Warning Issued

Lightning Jump



Next Generation Warning System

An ensemble of storm-scale NWP models predict the path of a potentially tornadic supercell during the next 1 hour. The ensemble is used to create probabilistic tornado guidance.

Developing thunderstorm

Lightning

EF-1

Why NWS needs this?

- Situational Awareness
- Warning confidence
- Decision Support (venues)

Situational Awareness:

User comment: 'Cloud Top Cooling product is an excellent source of enhancing the situational awareness for future convective initiation, particularly in rapid scan mode'.

AWC Testbed forecaster (June 2012)

Summary

Pre-launch demonstrations with proxy data benefits users to prepare them to fully exploit all GOES-R instruments and capabilities

- Continue to apply lessons learned to incorporate new improvements each year.
- Demonstrate products and decision aids in NOAA Testbeds, NCEP Centers, WFOs, and the NWS Proving Ground at Training Center
- Transition from Warning Related Products to remaining Baseline Products, Day 2 Future Capability, fused products, Impact-based Decision Aids, Decision Support Services
- Continue to develop, demonstrate, and test as part of decision support services
- Enhanced collaboration with JPSS, international, and broadcaster community