The GOES-R Proving Ground

Steven Goodman
Senior Program Scientist, GOES-R
(US representative to the WMO WWRP Nowcasting Working Group)

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Boulder, CO
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http://www.goes-r.gov
Contributors

Steven Goodman and James Gurka
NOAA/NESDIS/GOES-R Program Office, Greenbelt, MD 20771

Timothy Schmit
NOAA/NESDIS/Center for Satellite Applications and Research, Madison, WI

Mark DeMaria and Daniel Lindsey
NOAA/NESDIS/Center for Satellite Applications and Research, Fort Collins, CO

Wayne Feltz, Scott Bachmeier and Kris Bedka
Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin, Madison, WI

Steven Miller
Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, CO

Eric Bruning
Cooperative Institute for Satellite Climate Studies, University of Maryland, College Park, MD

Gary Jedlovec and Richard Blakeslee
NASA/MSFC Short-term Prediction Research and Transition (SPoRT) Center, Huntsville, AL

Russell Schneider and Chris Siewert
Cooperative Institute for Mesoscale Meteorological Studies, NOAA/NWS/Storm Prediction Center, Norman, OK

Robert Rabin
NOAA/National Severe Storms Laboratory
Outline

• GOES-R Proving Ground Overview
  – Mission, Components, Framework
  – Organization, Partners

• Progress and Status

• Some Examples

• Summary
Proving Ground Mission Statement

The GOES-R Proving Ground engages NWS in pre-operational demonstrations of selected capabilities of next generation GOES

- Objective is to bridge the gap between research and operations by:
  - 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.
  - Engaging in a dialogue to provide feedback to developers from users

- The Proving Ground accomplishes its mission through:
  - Sustained interaction between developers and end users for training, product evaluation, and solicitation of user feedback.
  - Close coordination with GOES-R Algorithm Working Group (AWG) and Risk Reduction programs as sources of demonstration products, promoting a smooth transition to operations

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

- Place where technologies and ideas are tested and proven before being fielded in operations
- Evaluates how infusion of technology or process in forecast environment impacts operations
- Integrates technology or process with other available tools
- User readiness risk mitigation
- Key component: operational testing by those independent of the development process
- Key Benefit: users more accepting of fielded technology
  - They have had a say in the design
  - Design better fits an identified need
Key Components of Proving Ground

- Ability to fully test individual components
- Ability to fully test integrated components
- Testing which simulates routine low-end events
- Testing which simulates high-end non-routine events
- Testing using archived events and simulation
- Testing using live events
- Test team independence
- Test team membership made up of test experts, trainers, and operational users
- Ability to make recommendations to the decision maker based on impacts noted in test findings
### GOES-R Program Risks: User Readiness

<table>
<thead>
<tr>
<th>Rank</th>
<th>Risk ID</th>
<th>Risk Statement (Condition; Consequence)</th>
<th>Approach/Plan</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>GP0-33</td>
<td><strong>GOES-R User Readiness</strong></td>
<td>Mitigation</td>
<td>Mitigation</td>
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<tr>
<td></td>
<td></td>
<td>If user or NOAA infrastructure upgrades necessary to ensure compatibility with GOES-R are not adequately identified, prioritized, developed, and funded to coincide with planned deployment schedules;</td>
<td>✓ 1. Interface Requirements Definition &amp; Coordination</td>
<td>GOES-R User Readiness Plan to consolidate and document all user interface &amp; readiness activities and coordination.</td>
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<td></td>
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<td><strong>Then</strong>, there is a possibility that specific users will be unable to use the data products from lack of available infrastructure or from incompatibility with data distribution to meet increased performance needs resulting in schedule delays and cost impacts;</td>
<td>✓ a. Interface Requirements Docs (IRDs) (Aug. 2008)</td>
<td>Conferences, Workshops, and other forums will continue to be used to provide user community with information and transition planning</td>
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<td></td>
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<td>✓ b. GOES-R User Readiness Plan Development &amp; Approval (Sep. 2009)</td>
<td>Major event being planned includes the PG Annual Meeting (May 2009) and GOES Users Conference (November, 2009)</td>
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<td>2. External (to GOES-R) Orgs. (OSO, AWG, OSD) Communication &amp; Collaboration from Design thru. Deployment</td>
<td><strong>GOES-R Proving Ground</strong> concept is being initiated to allow for the research-to-operations. Focus is on forecaster/AWIPS-2 to prepare for the GOES-R information, to get real-world experience by leveraging existing resources, and to evaluate product tailoring. Plan in development.</td>
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<td>✓ 4. User Community Outreach &amp; Conferences</td>
<td></td>
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<td></td>
<td>5. NOAA/User Orgs. Resources and Schedule Commitments</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>Risk Owner:</strong> Steve Goodman</td>
<td></td>
<td></td>
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<tr>
<td>2x4</td>
<td>Long-Term</td>
<td></td>
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</table>

**Criticality**

- **Planned Closure**

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**Rank**

- **Risk ID**

- **Risk Statement**

- **Approach/Plan**

- **Status**

- **Mitigation**
As new ideas and algorithms are developed, validation, testing, and pre-operational assessments winnow the mature candidate list to the most promising algorithms that will be transitioned into operations.
Progress and Status of Proving Ground

- Kickoff Meeting held May 15-16, 2008 in Boulder, CO
  - Over 30 participants from GPO, AWG, CIMSS, CIRA, NWS HQ, FSL, OSD, OSDPD, SPoRT, and STAR
  - Web Site Established (cimss.ssec.wisc.edu/goes_r/proving-ground.html)
- Organization telecon held June 16, Monthly telecons on-going
  - Key message...for every product, tool or technique developed there must be a clear path to operational implementation
  - Executive Board and Advisory Team formed
  - NWS HQ and field fully engaged in plans and implementation
  - Satellite “Champion” hired at OU/CIMMS to support NWS user readiness (GOES-R funded)
  - Candidate products identified for 2009 Hazardous Weather Testbed Spring Experiment forecast and warning assessment
    - Convective Initiation (CIMSS)
    - Lightning rates, density, trends (SPoRT)
    - Probability of hail (CIRA)
- 2nd Annual Meeting May 15, 2009 at COMET in Boulder, CO
- Alaska Region/High Latitude PG Meeting Aug. 18-20, 2009 Fairbanks, AK
Proving Ground Organization

**Executive Board:**
Steve Goodman (Chair)- NESDIS/GOES-R Senior Program Scientist
Jim Gurka- NESDIS/GOES-R Ground Segment Project Scientist
Jaime Daniels-NESDIS/STAR/GOES-R AWG
Mark DeMaria-NESDIS/STAR/ GOES-R Risk Reduction
Tim Schmit-NESDIS/STAR/ASPB
Kevin Schrab- NWS

**Advisory Team:**
Tony Mostek-NWS/COMET
Russ Schneider- NWS/NCEP/SPC
Gary Hufford- NWS Alaska Region
Shanna Pitter- PPI, NWS WW Goal Team
Cecilia Miner- NWS, C&T Goal Team
Steve Miller- CIRA
Wayne Feltz-CIMSS
Shobha Kondragunta-NESDIS/STAR AQ IPT
Gary Jedlovec-NASA SPoRT
<table>
<thead>
<tr>
<th>GOES-R 34 Baseline Products</th>
<th>GOES-R 34 Additional Products (Option 2)</th>
</tr>
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<tbody>
<tr>
<td>Aerosol Detection (incl Smoke &amp; Dust)</td>
<td>Aerosol Particle Size</td>
</tr>
<tr>
<td>Suspended Matter / Optical Depth</td>
<td>Aircraft Icing Threat</td>
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<tr>
<td>Volcanic Ash: Detection &amp; Height</td>
<td>Cloud Ice Water Path</td>
</tr>
<tr>
<td>Cloud &amp; Moisture Imagery</td>
<td>Cloud Imagery: Coastal</td>
</tr>
<tr>
<td>Cloud Optical Depth</td>
<td>Cloud Layers / Heights and Thickness</td>
</tr>
<tr>
<td>Cloud Particle Size Distribution</td>
<td>Cloud Liquid Water</td>
</tr>
<tr>
<td>Cloud Top Phase</td>
<td>Cloud Type</td>
</tr>
<tr>
<td>Cloud Top Height</td>
<td>Convective Initiation</td>
</tr>
<tr>
<td>Cloud Top Pressure</td>
<td>Enhanced “V” / Owesthooting Top Detection</td>
</tr>
<tr>
<td>Cloud Top Temperature</td>
<td>Low Cloud and Fog</td>
</tr>
<tr>
<td>Hurricane Intensity</td>
<td>Turbulence</td>
</tr>
<tr>
<td>Lightning Detection: Events &amp; Flashes</td>
<td>Visibility</td>
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<tr>
<td>Rainfall Rate / QPE</td>
<td>Probability of Rainfall</td>
</tr>
<tr>
<td>Legacy Vertical Moisture Profile</td>
<td>Rainfall Potential</td>
</tr>
<tr>
<td>Legacy Vertical Temperature Profile</td>
<td>Total Water Content</td>
</tr>
<tr>
<td>Derived Stability Indices</td>
<td>Absorbed Shortwave Radiation: Surface</td>
</tr>
<tr>
<td>Total Precipitable Water</td>
<td>Downward Longwave Radiation: Surface</td>
</tr>
<tr>
<td>Clear Sky Masks</td>
<td>Upward Longwave Radiation: Surface</td>
</tr>
<tr>
<td>Radiances</td>
<td>Upward Longwave Radiation: TOA</td>
</tr>
<tr>
<td>Downward Solar Insolation: Surface</td>
<td>Ozone Total</td>
</tr>
<tr>
<td>Reflected Solar Insolation: TOA</td>
<td>SO2 Detection</td>
</tr>
<tr>
<td>Derived Motion Winds</td>
<td>Flood/Standing Water</td>
</tr>
<tr>
<td>Fire / Hot Spot Characterization</td>
<td>Ice Cover/Landlocked</td>
</tr>
<tr>
<td>Land Surface (Skin) Temperature</td>
<td>Snow Depth</td>
</tr>
<tr>
<td>Snow Cover</td>
<td>Surface Albedo</td>
</tr>
<tr>
<td>Sea Surface Temperature</td>
<td>Surface Emissivity</td>
</tr>
<tr>
<td>Energetic Heavy Ions</td>
<td>Vegetation Fraction: Green</td>
</tr>
<tr>
<td>Magnetoospheric Electrons and Protons: Low Energy</td>
<td>Vegetation Index</td>
</tr>
<tr>
<td>Magnetoospheric Electrons and Protons: Medium &amp; High Energy</td>
<td>Currents</td>
</tr>
<tr>
<td>Solar and Galactic Protons</td>
<td>Currents: Offshore</td>
</tr>
<tr>
<td>Geomagnetic Field</td>
<td>Sea &amp; Lake Ice: Age</td>
</tr>
<tr>
<td>Solar Flux: EUV</td>
<td>Sea &amp; Lake Ice: Concentration</td>
</tr>
<tr>
<td>Solar Flux: X-Ray</td>
<td>Sea &amp; Lake Ice: Extent</td>
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<tr>
<td>Solar Imagery: X-Ray</td>
<td>Sea &amp; Lake Ice: Motion</td>
</tr>
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<thead>
<tr>
<th>ABI</th>
<th>SUVI</th>
<th>EXIS</th>
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<tbody>
<tr>
<td>GLM</td>
<td>SEISS</td>
<td>Magnetometer</td>
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</table>
"ABI" Proxy Data from Current Satellites

Aerosols
Heritage, clouds, etc
Vegetation
Cirrus Clouds
Snow, Cloud phase
Particle size
Fog, Fires, clouds, etc
Water Vapor
Water Vapor
WV, Upper-level SO2
Vol. Ash, Cloud phase
Total Ozone
Surface features, clouds
Heritage, clouds, etc
Low-level Moisture
Clouds

ABI Proxy from MODIS, MSG, and AIRS on 2004 April 11
EVEN WITH THE WEST SURFACE WINDS
1622Z MODIS SHOWS WARM UPPER 60
DEGREE LAKE MICHIGAN TEMPS NEAR
SHORE...WITH NO COOLER UPWELLING
SEEN. WOULD HAVE THOUGHT TEMPS
WOULD HAVE BEEN COOLER...BUT WINDS
ARE WEAK.
Convective Initiation (CI) Trend

CI TREND: 20090227 at 1945 UTC
Examples of Proving Ground Products

Mt. Redoubt has had more than 20 major eruptions since Sunday morning March 22, 2009. The eruptions have created a continuous major ash plume that has disrupted aviation across the State of Alaska. Rapid scan products of GOES imagery provided new insight on the eruptive activity of the mountain. NWS forecasters were able to use this insight to provide better information for warnings and advisories issued to the public and aviation communities.

False-color RGB image along with 3 other volcanic retrieval products: Ash loading, Ash height, and Ash effective radius. *(produced by Mike Pavolonis, CIMSS/ASPB)*

http://cimss.ssec.wisc.edu/goes/blog/archives/2228
Animation of sample ABI visible and near-IR bands in AWIPS
GLM Proxy Data

DC Regional Storms November 16, 2006

Resampled 5-min source density at 1 km and 10 km

LMA 1 km resolution

LMA @ GLM 10 km resolution

GLM Testbeds at Huntsville, AL; Norman, OK; Sterling, VA; KSC, FL
GLM Proxy Data from OKLMA
GLM Lightning Jump Algorithm: Experimental Trending Implementation in AWIPS/SCAN

Scan Cell Table

Cell S1

DC LMA total lightning

(July 04, 2007 at 21:36Z)

Courtesy Momoudou Ba
Summary

• PG is the ultimate tool for user interaction
• Program Plan under development
• Phase I spin-up at CIMSS, CIRA (2008)
• Phase II adds SPoRT, AQ, Alaska, Pacific
  – HWT IOP with VORTEX-2 (2009)
• Must be able to test individual and integrated components with independence from developers
• Ensuring pathway into operations by developing GOES-R proxy products for the AWIPS2 environment
• Need real time and archived events (AWIPS2, WES)
• Must maintain focus on clear path to operations
Summary (Cont)

• Existing and Planned collaborations for product validation and assessment with NOAA Testbeds- HWT, JHT, DTC, HMT
• NESDIS Satellite Algorithm Testbed (new)- blended products from combining GEO and LEO observations, e.g.,
  – GOES-R ABI/GLM with NASA GPM
  – GOES-R ABI-derived soundings with NPP/NPOESS/METOP (CrIS, IASI)
• NOAA-EUMETSAT GEO Working Group
  – Advanced Sounders, Lightning Imagers
  – EUMETSAT Satellite Application Facilities (SAFs)
  – Visiting Scientists
• WMO WWRP Nowcasting Working Group
  – Forecast and Research Demonstration Projects (FDPs, RDPs, e.g., Sydney 2000, B08 and SNOW-V10 Summer and Winter Olympic Games)
  – WSN09 Nowcasting and Very-Short Range Forecasting Symposium, Whistler, BC, Canada
6th GOES Users’ Conference

http://cimss.ssec.wisc.edu/ goes_r/meetings/guc2009/

3-5 November 2009
Monona Terrace Convention Center
Madison, Wisconsin

Geostationary Operational Environmental Satellites: http://www.goes-r.gov

Special Event on 2 November: 50th Anniversary of the 1st Meteorological Satellite