Results from GOES-R Proving Ground Demonstrations at the 2014 HWT Spring Experiment

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GOES-R in the Hazardous Weather Testbed

- Product developers observe their recently developed GOES-R algorithms being used alongside standard observational and forecast data in a simulated operational forecast and warning environment (Research to Operations, R2O)
  - Includes baseline, future capability, decision aid and GOES-R3 products/capabilities
- Feedback received from participants leads to the continued modification and development of GOES-R algorithms (Operations to Research, O2R)
- Education and training received by participants helps to ensure day-1 readiness for the receipt of GOES-R data
- Collaborations are accelerated/initiated
GOES-R in the Hazardous Weather Testbed

- GOES-R Proving Ground Demonstration Plans and Final Reports available online:
  - [http://www.goes-r.gov/users/pg-activities-01.html](http://www.goes-r.gov/users/pg-activities-01.html)

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GOES-R Proving Ground Demonstration Proposal: Hazardous Weather Testbed – 2014 Spring Experiment


2. Organization: HWT/EWP, Norman, OK.

3. Products to be Demonstrated as a GOES-R Proving Ground activity at the HWT:
   - a. NSSL-WRF GOES-R ABI Synthetic Imagery (Baseline)
   - b. NearCast Model (Risk Reduction)
   - c. GOES-R Convective Initiation (Future Capability)
   - d. Probability of Severe (Decision Aid)
   - e. Overextending Top Detection (Future Capability)
   - f. Total Lightning Detection (Baseline)
   - g. Total Lightning Tracking Tool (Decision Aid)
   - h. Lightning Jump Algorithm (Risk Reduction)

4. Demonstration Project Summary:
   - Overview: The HWT will receive early exposure to GOES-R Proving Ground (PG) products during the 2014 Spring Experiment through activities led by the SPC/HWT GOES-R PG Team, William Line. The GOES-R PG portion of the Spring Experiment will take place 09 May – 06 June 2014, primarily within the FWP. The FWP provides a conceptual framework and a physical space to foster collaboration between research and operations to test and evaluate emerging technologies and science. Products will be demonstrated within a simulated warning operations environment using a real-time AWIPS II framework within the HWT. This year, in addition to National Weather Service (NWS) operational forecasters, broadcast meteorologists will participate in the experiment at the PG sites to get the broadcast community more involved in its activities. Various project scientists will also be in attendance throughout the experiment to provide further project expertise and to communicate directly with the user community. Additionally, the NearCast Model may be demonstrated informally in the Experimental Forecast Program (EPF) during particularly interesting and applicable situations as a short-term forecast tool. The exposure to prototype pre-operational GOES-R products during the height of the spring severe weather season will provide NWS forecasters, broadcast meteorologists, and scientists an opportunity to help determine operational applicability as well as critique and suggest improvements for products relatively early in their development cycle.
   - b. Plan, Purpose, and Scope: The HWT provides the GOES-R PG with an opportunity to demonstrate passive and passive capabilities/products associated with the next generation GOES-R geostationary satellite system that have the potential to improve short-term hazardous weather nowcasting and forecasting. The availability of GOES-R products will demonstrate, pre-launch, a portion of the full observing
2014 HWT Spring Experiment
GOES-R Activities

• Evaluations took place in the real-time experimental short-term forecast and warning environment of the EWP using AWIPS-II
• Weeks of May 5, May 12, May 19, and June 2
• 12 NWS forecasters (1 CWSU) and 4 broadcast meteorologists
• Training: 10-30 min Articulate Power Point for each product
• Feedback: daily debrief, weekly debrief, real-time blog posts, daily survey, informal conversation
• Schedule:
  • Mon: orientation, familiarization
  • Tues-Thurs: daily debrief, 8 hour forecast shifts
  • Fri: weekly debrief, preparation and delivery of “Tales from the Testbed” webinar
• Real-time AWIPS-II environment
• Participants worked in pairs to issue experimental mesoscale discussions (via blog) and experimental severe t-storm and tornado warnings (in AWIPS-II) for a given CWA.
  • Impacts of the experimental products on those forecast/warning decisions are highlighted.
• Participants compose updates on the performance of previous experimental issuances using the blog as well.
• Real-time storm report data is provided to participants.
2014 HWT Spring Experiment
GOES-R Activities

GOES-R: 9 products and capabilities evaluated in 2014

- NSSL-WRF Synthetic Satellite Imagery
- NearCast Model
- Convective Initiation algorithm
- ProbSevere Model
- Overshooting Top Detection algorithm
- Super Rapid Scan Operations for GOES-R (SRSOR) 1-min Imagery
- PGLM Total Lightning
- Lightning Jump algorithm
- Tracking Meteogram
“In this case a plume of cirrus/cirro-stratus is not showing up in the WRF. ... that cirrus is blocking just enough insolation to prevent storm development”
NearCast Model
CIMSS

Lagrangian model uses GFS wind and high fields to compute trajectories for GOES Sounder temperature and moisture retrievals at multiple atmospheric levels to help determine where convection is more/less likely to develop in the near (0-9 hours) future.

Over 90% of participants felt that the NearCast analyses and forecasts would be at least moderately (3/5) useful additions to their forecast office, with over 40% answering they would be very (5/5) useful additions.

4:41pm: “Storms initiated on the boundary and as they moved into the unstable air, they became stronger as they followed the unstable air. Also, the storms that formed in the lighter blue actually began to weaken as more stable air moved in. The storms moved like this model showed from NW to SE.”
Fused product combines various GOES convective cloud properties and Rapid Refresh model environmental fields in a logistic regression framework to produce (~0-2 hour) probabilities of convective initiation.

- “There were a few really good examples of this algorithm giving 15 minutes to 1 hour of lead time to storm initiation.”

- 54% felt it had “some” impact in the operational nowcast/forecast process, 19% large or very large impact.
ProbSevere Model
CIMSS

- “This may be a very useful tool in more effectively separating marginal events from those that have a greater impact and giving us better confidence to warn on the higher impacts.”
- 78% felt the model increased confidence in issuing svr warnings, 47% answered that it increased lead-time to warning issuance, and 98% would use during warning ops.

Statistical model that fuses NWP, satellite, and radar fields to produce a probability that a developing storm will first produce any severe weather in the next ~60 minutes.
Algorithm uses satellite-observed spatial gradients in the infrared window channel, GFS tropopause temperature, and satellite brightness temperature thresholds to identify and determine the magnitude of OTs.

- “Decreasing trends did correspond to storm weakening.”
- “In areas where radar coverage is sparse or when a radar is down, I see more utility in helping to identify where the strongest updrafts are.”
- “I think with 5 and 1 minute data, this would be more useful, especially at night.”
Super Rapid Scan Operations for GOES-R (SRSOR) 1-min Imagery

The GOES-R Advanced Baseline Imager, when in flex mode, will provide one mesoscale sector (1000x1000 km) of 30-second imagery, or two such sectors of 1-minute imagery.

“On radar I was not able to tell that the convective tower had failed, but with the [1-minute] visible imagery I was able to see that the tower had failed to mature and soon the radar echo dissipated.”

Quicker and more confident identification of boundaries, improved lead time and confidence that convective initiation is occurring, more value in identifying overshooting tops and other cloud top features and their trends, enhanced ability to differentiate between stronger and weaker updrafts....
SRSOR 1-min Imagery in SPC ops


- “Satellite imagery at 1-min temporal resolution needs to become the new standard for severe weather operations.”
- “... faster recognition of CI and earlier detection of cloud-manifest boundary processes.”
- “... having the data available routinely would very likely, over time, allow forecasters to gain a better understanding of processes related to convective initiation, as these processes occurring within a cu field would be visually revealed in high temporal-resolution data in a way that 15- or 30-minute imagery cannot as clearly depict.”
- “The lightning tools were helpful to identify storms that were likely to go severe and based on the trends in lightning, warning confidence was increased.”
- “Once a jump - or more precisely a series of jumps occurred - there seem to be excellent correlation to an increase in storm intensity.”

Proxy Geostationary Lightning Mapper (PGLM) products are produced from LMA total lightning data to help prepare users for the total lightning detection capability of the GOES-R GLM.

The LJA used fully automated methods for storm cell identification, tracking, and lightning jump detection.
Tracking Meteogram
SPoRT/MDL

22 May 2014

Tool allows forecasters to manually generate a time series of PGLM total lightning products as well as radar, satellite and other fields in real-time.

- “I can see this being used after the fact, looking at a storm [for research purposes], but not in real-time. It is too labor intensive.”
- Many technical issues associated with this iteration of the tool made it difficult to use.
- Forecasters liked being able to track multiple storms and multiple fields at once, most notably total lightning, radar reflectivity, and MRMS products.
“Overall, I think this procedure will be of operational use, especially once GOES-R is actually launched and these products increase in overall utility.”

“As the storms began to break out, I used the prob severe tool in combination with the total lightning initiation and total lightning extent and lightning jump and based on how they all came together, I felt comfortable issuing the warning. About 15 minutes later, golf ball size hail was reported.”
2015 GOES-R Demonstrations in the HWT

- Similar concept as 2014 experiment
- Weeks of May 4, 11, 18, June 1, 8
- 6 forecasters per week (including one broadcast met.)
- GOES-R demonstration to include: ProbSevere, CI, LJA, PGLM, GOES Sounder derived products using GOES-R LAP
  - GOES-14 SRSOR 1-min imagery: May 18 – June 12 (with OT’s)
  - JPSS NUCAPS soundings also to be demonstrated
  - HRRR Satellite Validation in EFP
Questions/Comments?

- GOES-R HWT Blog: http://www.goesrhwt.blogspot.com/
- HWT SE Webpage: http://hwt.nssl.noaa.gov/spring_experiment/
- GOES-R Proving Ground demonstration plans and final reports: http://www.goes-r.gov/users/pg-activities-01.html

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