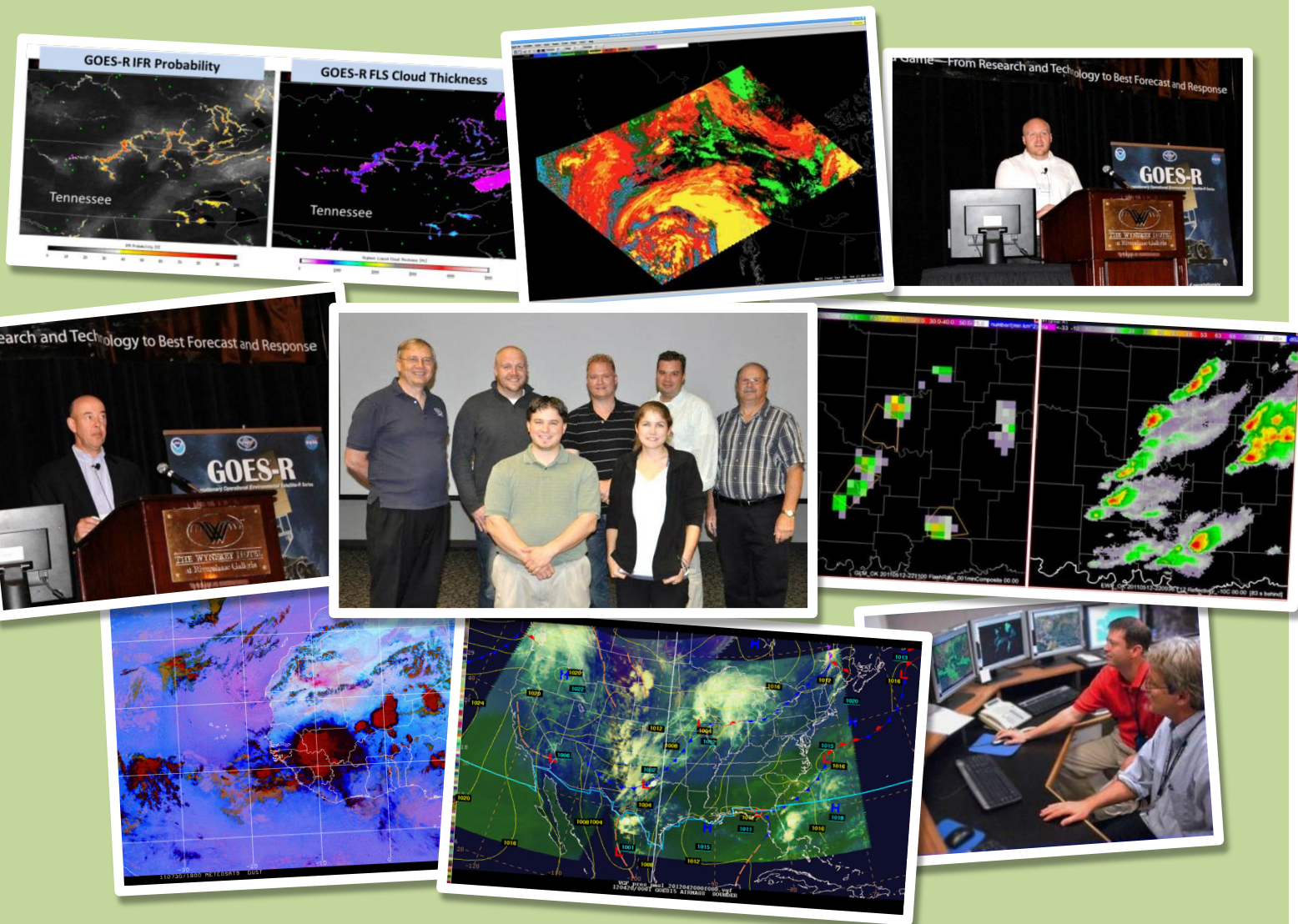


# GOES-R Proving Ground

FY12 Annual Report

November 28, 2012

Revised January 22, 2013



# GOES-R Proving Ground FY12 Annual Report<sup>1</sup>

## 1. Introduction and Background

The GOES-R Proving Ground (PG) is a collaborative effort between the GOES-R Program Office, selected NOAA Cooperative Institutes, NWS forecast offices, NCEP National Centers, the Joint Center for Satellite Data Assimilation, the NASA Short-Term Prediction Research and Transition Center, and NOAA testbeds where proxy and simulated GOES-R products are tested and evaluated in an operational environment before the GOES-R launch. The objective of the PG is to bridge the gap between research and operations by ensuring that there is two-way communication between product developers and the user communities. The intended outcome is that users will be ready for optimal use of GOES-R products on day-1 of operations.

The next generation GOES will continue providing valuable data to support high impact weather warnings as well as key inputs for global and regional NWP models. The large volume of GOES-R data will present new challenges and opportunities that require more intelligent integration of information derived from blended satellite products (e.g., geostationary and polar satellite observations), multi-dimensional classification of severe storm potential by combining satellite, radar, in-situ data and models, and new ways of visualizing GOES-R data within the AWIPS-II forecaster workstation. Algorithm developers at NESDIS, NASA SPoRT, and the NOAA cooperative institutes are already creating JAVA-based satellite application plug-ins for AWIPS-II, which will quickly accelerate the transition from research to operations at NWS.

This report will describe the PG activities leading to an evaluation of the operational value of the proxy GOES-R products and user feedback for future improvements.

## 2. Proving Ground Activities:

- a. Hazardous Weather Testbed (HWT) Spring Experiment (7 May – 15 June). Participants included 28 forecasters and 16 visiting scientists.
- b. National Hurricane Center (NHC) Tropical Cyclone Demonstration (1 Aug. – 30 Nov.) Participants included forecasters from NHC and scientists from NESDIS STAR, CIRA, and SPoRT.
- c. Aviation Weather Center (AWC) Summer Experiment (4 June – 15 June). Participants included AWC forecasters and FAA representatives.

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<sup>1</sup> Cover page images, top row, from left, 1) GOES-R Instrument Flight Rules (IFR) Fog probability product, 2) GOES-R Fog/Low Stratus Cloud Thickness product 3) Cloud Phase product from the High Latitude/Arctic 2011 Proving Ground Experiment, 4) GOES-R Satellite Liaison Chris Siewert provides an update on GOES-R Proving Ground activities at the Storm Prediction Center/Hazardous Weather Testbed during the 6<sup>th</sup> GOES Users' Conference (GUC). Middle row, from left, 1) GOES-R Project Scientist Jim Gurka provides an overview of the GOES-R Proving Ground and status update at the 6<sup>th</sup> GUC, 2) GOES-R Satellite Liaisons pose with GOES-R System Program Director and Program Chief Scientist at the 2011 NOAA Satellite Science Week, 3) Pseudo Geostationary Lightning Mapper (PGLM) total lightning product example from the Hazardous Weather Testbed showing the PGLM flash extent density on the left with the corresponding radar reflectivity on the right. Bottom row, from left, 1) SEVIRI RGB Dust Product from NHC 2011 Tropical Cyclone Demonstration, 2) GOES-Sounder RGB Air Mass Product with the HPC surface analysis overlaid for the April 2012 Nor'easter, 3) National Hurricane Center 2010 GOES-R Proving Ground experiment.

- d. HPC/ OPC/ TAFB/ and SAB demonstrations (ongoing: focus on precipitation and ocean applications).
- e. High Latitude and Arctic Testbed (ongoing: focus on snow/ cloud/ volcanic ash/ and aviation applications). Participants include NWS Alaska Region, CIMSS and UAF.
- f. Air Quality (ongoing: focus on aerosol product development and applications). Activities led by scientists from UMBC and NESDIS STAR; participants include Battelle Memorial Institute, and UAHuntsville, as well as federal, state, and local air quality forecasters, modelers, and analysts.
- g. Pacific Region OCONUS Demonstration (ongoing: focus on tropical cyclones/ heavy rainfall/ and aviation applications) Participants include NWS forecasters and scientists from the University of Hawaii.
- h. NWS Eastern Region Fog and Low Stratus Evaluation (15 February – 15 August). Participants included NWS forecasters at Greenville-Spartanburg, SC (GSP) and Mt. Holly, NJ (PHI).

### **3. Funding / Opportunity Announcements**

The Proving Ground demonstrations are supported through grants and contracts funded by the GOES-R Program Science Office via proposals for risk reduction research as well as visiting scientist travel grants to participate in the demonstrations. Technical interchange meetings are held throughout the year to review the PG demonstration projects with a major All-Hands meeting of participants during Satellite Science Week, most recently held April 30-May 4 at the NWS Training Center in Kansas City, MO.

### **4. Publication and Presentations listed in Appendices A and B respectively**

### **5. Significant Outcomes and Product Assessment Highlights**

#### **a. Lightning Detection**

*HWT input:*

In terms of operational utility, forecasters noted that the Pseudo Geostationary Lightning Mapper (PGLM) total lightning proxy (as viewed from the 1-minute flash extent density) showed “good correlation” with updraft intensity” and was typically seen “well ahead of the first CG” (cloud-to-ground) flash. Additionally, the total lightning data “pulled focus to individual storms” of interest. This was particularly useful during days that the weather was marginally severe with numerous storms across the county warning area of operations.

In evaluating the individual products, forecasters commented the flash extent density was “very useful in determining which storms were stronger,” while the 60-minute tracks were “useful to illustrate storm trends.

*AWC input:*

The PGLM provides a preview of the future value of the GLM for air traffic flow management, since aircraft should be routed away from in-cloud lightning as well as cloud to ground lightning.

### **b. Simulated Cloud and Moisture Imagery**

*HWT input:*

In general, forecasters were very excited about the simulated satellite imagery and would like to have it provided within their operations. Many of the visiting NWS forecasters have already worked to bring this product into their forecast offices.

Synthetic Weather Research and Forecast (WRF) model-derived imagery can enhance forecasts by providing model data in a familiar satellite format which makes model analysis, model comparison to observations, and model forecast projections easier to visualize and understand.

*AWC input:*

This product did a nice job picking-up on wave turbulence activity during the experiment. This showed the situational awareness utility of the product.

### **c. Convective Initiation**

*HWT input:*

The forecasters were pleased with the new probabilistic Convective Initiation (CI) product output from the Satellite-based Convection Analysis and Tracking (SATCAST) product, with 100% of the forecasters responding “yes” in the survey when asked if they preferred the probabilistic approach tested in 2012 to the binary yes/no approach demonstrated previously.

Throughout the length of the experiment, post-event survey responses indicate that forecasters used the SATCAST product during 83% of their warning operations within the EWP. In addition, the majority of forecasters reported that they saw increased strengths of signal preceding convective initiation. Typical values reported within the post-event survey indicate strengths of signal of 50-70% are sufficient for successfully forecasting convective initiation in the future.

In general, forecasters responded that they felt comfortable using SATCAST in warning operations following the training that they received and that it worked as expected, with 88% reporting being comfortable using the product within the post-event surveys. In some occasions, forecasters mentioned that they would like to see some additional training material and display changes to help them understand some of the background data going into the SATCAST CI forecast.

SATCAST continues to flow within the SPC non-operational N-AWIPS workstations and is available for the HWT AWIPS-II systems for any additional experiments.

*AWC Input:*

While SATCAST showed a great amount of potential, many forecasters noted that it could benefit from additional development to reduce the false alarm rate (FAR)

If the probability was calibrated in tandem with the environmental information, it could help identify areas of convective initiation relevant to aviation operations.

**d. Cloud Top Cooling**

*HWT input:*

Forecasters were asked to use the University of Wisconsin CIMSS Cloud Top Cooling (UW-CTC) product in tandem with the SATCAST CI product to get an end-to-end picture of the CI process, from initial reflectivity signal on radar (from the 0-1 hr nowcast by SATCAST), to rapid intensification (as nowcast by UW-CTC), in an attempt to increase their warning lead-times on the occurrence of severe weather versus using radar alone. Forecasters were also encouraged to evaluate the UW-CTC as an additional warning decision support tool, where strong cooling rates (generally -20 C every 15 minutes or less) have been shown to have some correlation with the occurrence of severe hail (see Hartung et al., 2012).

Overall, the forecasters reported they would like more time to evaluate the product in their operations. Forecasters were asked in their post-event survey how much lead-time the UW-CTC product provided over the first occurrence of 60 dBZ composite reflectivity and 1.0" Maximum Expected Size of Hail (MESH). Responses varied from 10-90 minutes, but were most commonly around 30 minutes.

Forecasters said it was important to be aware of the surrounding environment before making a warning decision based on the UW-CTC product. Often if there was ongoing supercell activity, a forecaster would warn solely on the appearance of the UW-CTC signal exceeding about -20 C per 15 minutes.

*AWC Input:*

Reported that the forecasters are aware of the convective environment, it provides excellent situational awareness.

**e. Nearcast Atmospheric Stability Indices**

*HWT input:*

According to post event surveys, forecasters reported using the Nearcast product in their warning operations 70% of the time. In addition, forecasters were asked which fields (other than the long

lived convective parameter and CAPE) helped delineate areas of convective development, inhibition and the relative strength of convection. In each instance, forecasters responded that the theta-e difference was the most useful, gaining more than 70% of the responses in each category. In each category, the low-level theta-e field had the second most responses.

Forecasters found the instability fields from the Nearcast products particularly useful in determining convective maintenance.

The Nearcast product continues to be delivered within the SPC and HWT N-AWIPS workstations and is still available for demonstration in HWT AWIPS II systems.

*AWC input:*

The product was very useful in terms of assessing where the atmosphere would be most favorable for convection should there be a trigger mechanism.

It may aid in evaluating the evolution of mid-level instability in data void areas and between radiosonde launches in both space and time.

#### **f. RGB Airmass Product**

*HWT input:*

Forecasters found the product generally useful in providing them with a quick look at the synoptic scale atmosphere, as well as an innovative way to display satellite imagery outside of the typical visible, water vapor and infrared display. They found it useful to show airmass movement and jet position/structure as a check against NWP models.

The Sounder RGB Airmass product continues to flow into SPC non-operational N-AWIPS workstations in real-time, and is also available for demonstration within the HWT in AWIPS II.

*NHC Tropical Cyclone Demonstration:*

The RGB Air Mass product continues to be one of the most highly utilized PG products. The training provided by satellite liaison Michael Folmer helped forecasters better understand the application of this product. The Hurricane Specialist Unit (HSU) forecasters found it useful for analyzing the moisture structure in Subtropical Storm Beryl, identification of dry air wrapping around Hurricane Gordon and monitoring the evolution of a trough upstream of that cyclone. TAFB forecasters used the product in the marine analysis of tropical lows, and as supplemental guidance for location of the center of Tropical Depression 10. More experience is still needed to understand the behavior of the product in some cases, and tuning might be needed to better represent tropical cyclone applications.

### **g. Overshooting Tops/ Enhanced V**

*AWC input:*

These products assist in situational awareness where radar returns aren't available, particularly in identifying the most intense areas of convection.

Generally it can be assumed that there is a high likelihood of moderate or greater turbulence associated with an OT, given the more intense updraft. As such, knowing which cell within a group of cells, or which portion of a squall line contained an OT would give the traffic flow managers an idea of which areas to direct traffic around or over, especially in cases where radar returns do not look particularly intense.

*NHC Tropical Cyclone demonstration:*

More basic research is needed to understand the relationships between Tropical Overshooting Tops (TOTs) and intensification. There was no obvious signal during the 2012 season so far. TAFB indicated that the TOT product was useful for documenting waning convection in a tropical wave. Hugh Cobb suggested that TAFB forecasters should make an effort to overlay the TOT locations on IR and visible imagery to better understand the relationships with tropical convection

### **h. WRF/HRRR Lightning Threat Forecast**

*AWC input:*

The general opinion of the forecasters was that the product was a good situational awareness tool in forecasting CI. It can be used to not only highlight areas of potential CI, but also areas for which the potential of lightning is the greatest.

### **i. Fog and Low Stratus product**

*AWC input:*

The feedback from this product was very positive all around. However, there was one suggestion for improvement that a majority of the forecasters mentioned. While they appreciated the IFR and LIFR differentiation, they also expressed a need for MVFR probabilities (not available for the AWC experiment) allowing for a differentiation between MVFR and IFR conditions. The Fog and Low Stratus products are now being used in AWC routine operations.

*NWS Eastern Region Evaluation:*

The MVFR and fog depth products were mentioned most often, particularly in the Aviation and Near Term sections of WFO area forecast discussions. In short, both WFOs found the MVFR product to be useful in forecast operations and in graphical forecast editor (GFE) work.

According to WFO GSP, the MVFR/IFR probabilities and the Cloud Thickness products proved to be very good at delineating fog and stratus areas, particularly during the pre-sunrise hours when no middle and high clouds were overhead. The GOES-R products usually provided a more definitive display of low stratus and fog than our traditional 11 $\mu$  - 3.9 $\mu$  fog detection method.

The GOES-R Proving Ground GEOCAT imagery has proven to be useful on a number of occasions for near-term public and aviation forecasting in the WFO PHI area. It is most helpful at night, over data-sparse marine areas, and when mid- or high-cloud layers are not present to interfere with the satellite view. Under proper conditions, the GEOCAT imagery can provide significantly better depiction of fog or low-cloud coverage and development than conventional GOES imagery.

#### **j. Hurricane Intensity Estimates (HIE)**

*NHC Tropical Cyclone demonstration:*

HSU forecasters indicated that the HIE was very responsive for Hurricane Michael and was used to upgrade it to a major hurricane. They also noted that the HIE intensity estimates tended to be on the high side compared to other methods, especially when a storm first develops an eye.

#### **k. Super Rapid Scan Operations Imagery (SRSO)**

*NHC Tropical Cyclone demonstration:*

Both TAFB and HSU forecasters indicated that there is utility for center fixing, especially for weaker systems, and obtaining intensity and center fixes closer to synoptic times. The SRSO data have greater utility for monitoring changes in convective activity, especially for storms such as Hurricane Isaac when it was in the central Gulf of Mexico, where the inner core circulation is the formative stage. TAFB forecasters found the SRSO data useful for their tropical weather discussions, and helped document convection within tropical waves.

*HPC/OPC/TAFB and SAB input:*

After Hurricane Isaac made landfall in southeast Louisiana, the new Metwatch desk at HPC also found the 1-min rapid-scan imagery useful in identifying a mesohigh which was aiding in the development of a rainband along its periphery. The mesohigh features were easily displayed with the 1-min imagery bringing high confidence to the forecast.

#### **l. RGB Dust Product:**

*NHC Tropical Cyclone Demonstration:*

The RGB Dust product is now used routinely by TAFB forecasters as input to their Tropical Weather Discussion product. It was especially useful for helping to diagnose the atmospheric stability in the early stages of Tropical Storm Florence.



### **m. Saharan Air Layer Product**

*NHC Tropical Cyclone Demonstration:*

The evaluation of this product was fairly limited due to the lack of an N-AWIPS version, but was sometimes used in combination with the Dust product

### **n. GOES-R Natural Color Imagery**

*NHC Tropical Cyclone Demonstration:*

HSU forecasters indicated that the utility of the product is limited because it is demonstrated on low-earth orbiting (LEO) proxy data, with low time resolution and some latency issues. However, it has some utility in identification of dust in the storm environment. The geostationary version after the launch of GOES-R will have greater utility for HSU forecasters and for public outreach

### **o. Pseudo Natural Color Imagery**

*NHC Tropical Cyclone Demonstration:*

HSU forecasters indicated that dust shows up very well and the cyan color helps differentiate upper-level moisture from low-level moisture. They also indicated that in the GOES-R era, this product or the natural color version might serve as the default image loop instead of a standard gray-scale visible image used now.

### **p. Rapid Intensification Index**

*NHC Tropical Cyclone Demonstration:*

Through exposure to the lightning based Rapid Intensification Index (RII) and direct display of lightning locations on their N-AWIPS systems, the HSU forecasters have gained the experience to recognize that an inner core lightning outbreak is often associated with an increase in vertical shear, and prevents intensification. Forecaster feedback on the RII indicated that the lightning input only modified the RI probabilities by a few percent. This makes it very difficult to evaluate the impact of the lightning input in just one season. This was especially difficult in the 2011 Atlantic season, where there were very few RI cases. A systematic evaluation of the impact of the lightning on the RII will be performed at the end of the 2012 season, after three years of independent data (2010-2012) have been obtained.

### **q. Aerosol Detection (Including Smoke and Dust); Aerosol Optical Depth (AOD)**

*Simulated GOES-R ABI Aerosol Product Demonstration and User Workshop*

In January 2012, UMBC hosted the 2<sup>nd</sup> Annual AQPG workshop for satellite data users from federal, state, and local agencies around the country. At the workshop, participants had the

opportunity to review simulated GOES-R ABI aerosol products from air quality events (e.g., wildfires, haze) in Georgia and the Mid-Atlantic region. This included a review of the 2011 live demonstration of the simulated ABI “day in the life” experiment. Users provided valuable feedback on the format, content, and options for viewing the simulated ABI products. The January 2012 workshop was extremely well received with comments from participants uniformly stating that it was one of the best workshops that they had ever attended. It was held in tandem with an EPA sponsored Satellite Air Quality Workshop, and EPA scientists attended the AQPG workshop. The AQPG team incorporated the recommended changes from users into a new set of simulated ABI aerosol products that will be shared with users at the next AQPG workshop in March 2013. The AQPG team is also planning their second near real-time “day in the life” demonstration of streaming simulated ABI aerosol products for Spring 2013.

**Additional product assessments will be found in the individual Proving Ground and Testbed reports at <http://www.goes-r.gov>.**

## **6. Proving Ground Activities that Worked Well:**

- a. The PGLM and other ABI Proxy GOES-R products continue to be available for demonstration within the HWT on the AWIPS II workstations and are now ingested into SPC non-operations N-AWIPS workstations in real-time.
- b. The fog and low stratus products are currently being utilized in operations at the AWC and NWS Alaska WFOs.
- c. All training material for the HWT participants was provided prior to their arrival in Norman. This provided a quicker spin-up to operations and an additional day of testing and evaluation during the week of their visit.
- d. A weather event simulator (WES) case was included in the training material for the HWT participants that allowed the forecasters to interact with the experimental products in an AWIPS environment in their office or at home.
- e. Participants in the HWT spring experiment provided 5 webinars on products they found particularly useful. They also provided 225 blog postings and 109 completed surveys.

## **7. Lessons learned that are relevant to future projects and/or agency priorities:**

In the HWT spring experiment EFP and EWP participants would also like to have more collaboration with each other throughout the day. We attempted some cross-participation previous years with a joint EFP-EWP discussion period, as well as having some of the EWP forecasters participate at an EFP desk in the morning. However, some additional planning is needed for this to work given the different rigid daily timetables of each of the programs.

Good planning and coordination will produce an effective demonstration experience. While there is no perfect substitute for face to face interaction, the use of on-line training and virtual meetings will increase. We are learning from COMET how to make these experiences and

technical interchange meetings more effective beginning with the virtual Satellite Science Week planned for March 17-22 and the OCONUS Proving Ground meeting June 17-21.

## **8. Methods to foster collaborations between research and operations/ applications and external stakeholders**

Methods used to foster collaborations between research and operations/applications and external stakeholders are the visiting scientist program, bringing forecasters and product developers to the Hazardous Weather Testbed, and also inviting broadcasters to participate in conferences and future proving ground demonstrations. These methods help to fulfill the goal of aligning the Proving Ground with the NOAA Weather Ready Nation initiative.

## **9. Project alignment with agency technical and service priorities**

The alignment with NWS and corporate service priorities is coordinated through the Office of Science and Technology and the NWS Operational Advisory Team (NOAT), comprised of the Region Scientific Services Division chiefs and a representative from NCEP.

## **10. Balance of PG portfolio (incremental evolutionary ideas vs larger revolutionary ideas)**

The PG portfolio priorities in order are user readiness for the at-launch baseline products, followed by the new products and applications made possible by the advanced capabilities of the GOES-R instruments. The revolutionary advancements will come from the development of fused products and decision aids that will be possible with enterprise processing systems and early integration into AWIPS-II.

## **11. Demonstrations of consistent practices with guidelines**

Guidelines for PG demonstrations are developed by the Science and Demonstration Executive Board in coordination with the NOAT and satellite liaisons.

## **12. Efficiency and effectiveness of PG in terms of timeliness, cost savings, cost sharing, re-use and/or low overhead.**

Efficiency is achieved through regular virtual technical interchange meetings while resources are used most effectively through partnerships with our Proving Ground partners and NOAA Testbed facility managers. Utilizing forecasters who are already on-site, and at nearby offices, to participate in demonstrations is an effective way to reduce costs in the Proving Ground. They receive product training during regularly scheduled shifts which has no additional cost to the program.

## **13. Leveraged resources from broader community**

Leveraged resources are provided by NASA SPoRT, Cooperative Institute infrastructure, and NOAA Testbeds.

## Appendix A: Publications

- Bedka, K. M., R. Dworak, J. Brunner, and W. Feltz, 2012: Validation of Satellite-Based Objective Overshooting Cloud-Top Detection Methods Using *CloudSat* Cloud Profiling Radar Observations. *J. Appl. Meteor. Climatol.*, 51, 1811-1822, doi: 10.1175/JAMC-D-11-0131.1
- Bikos, D., D. T. Lindsey, J. Otkin, J. Sieglaff, L. Grasso, C. Siewert, J. Correia Jr., M. Coniglio, R. Rabin, J. S. Kain, and S. Dembek, 2012: Synthetic Satellite Imagery for Real-Time High Resolution Model Evaluation. *Weather and Forecasting*, 27(3), 784-795, doi: 10.1175/WAF-D-11-00130.1
- DeMaria, M., R. T. DeMaria, J. A. Knaff, D. Molenaar, 2012: Tropical Cyclone Lightning and Rapid Intensity Change. *Mon. Wea. Rev.*, 140(6), 1828-1842, doi: 10.1175/MWR-D-11-00236.1
- Denlinger, R. P., M. Pavolonis, and J. Sieglaff, 2012: A robust method to forecast volcanic ash clouds, *J. Geophys. Res.*, 117, D13208, doi:10.1029/2012JD017732
- Dworak, R., K. Bedka, J. Brunner, and W. Feltz, 2012: Comparison between GOES-12 Overshooting-Top Detections, WSR-88D Radar Reflectivity, and Severe Storm Reports, *Weather and Forecasting*, 27(3), 684-699, doi: 10.1175/WAF-D-11-00070.1
- Goodman, S. J., J. Gurka, M. DeMaria, T. J. Schmit, A. Mostek, G. Jedlovec, C. Siewert, W. Feltz, J. Gerth, R. Brummer, S. Miller, B. Reed, and R. R. Reynolds, 2012: The GOES-R Proving Ground: Accelerating User Readiness for the Next-Generation Geostationary Environmental Satellite System. *Bull. Amer. Met Soc.*, 93, 1029 -1040.
- Heidinger, A. K., A. T. Evan, M. J. Foster, and A. Walther, 2012: A Naïve Bayesian Cloud Detection Scheme Derived from *CALIPSO* and Applied within *PATMOS-x*, *J. Appl. Meteor. Climatol.*, 51(6), 1129-1144, doi: 10.1175/JAMC-D-11-02.1
- Hoff, R. M., S. Kondragunta, P. Ciren, E.-S. Yang, H. Zhang, C. Xu, S. Christopher, and A. K. Huff, 2012: Development of Synthetic GOES-R Aerosol Products. Submitted to *J. Atmos. Oceanic Technol.*
- Huff, A.K., R.M. Hoff, S. Kondragunta, H. Zhang, P. Ciren, C. Xu, S. Christopher, E.-Y. Su, and J. Szykman, 2012: Preparing the Air Quality Community for GOES-R Aerosol Products through the Air Quality Proving Ground (AQPG). *EM Magazine*.
- Lakshmanam, V., R. Rabin, J. Otkin, J. S. Kain, and S. Dembek, 2012: Visualizing Model Data Using a Fast Approximation of a Radiative Transfer Model. *J. Atmos. Oceanic Technol.*, 29, 745-754, doi: 10.1175/JTECH-D-11-00007.1
- Lindsey, D. T., T. J. Schmit, W. M. MacKenzie Jr., C. P. Jewett, M. M. Gunshor, and L. Grasso, 2012: 10.35 $\mu$ m: atmospheric window on the GOES-R Advanced Baseline Imager with

- less moisture attenuation. *J. Appl. Remote Sens.*, 6(1), doi:10.1117/1.JRS.6.063598
- Miller, S. D., C. C. Schmidt, T. J. Schmit, and D. W. Hillger, 2012: A case for natural colour imagery from geostationary satellites, and an approximation for the GOES-R ABI. *Int. J. Rem. Sens.*, 33(13), 3999-4028, doi: 10.1080/01431161.2011.637529
- Monette, S. A., C. S. Velden, K. S. Griffin, and C. M. Rozoff, 2012: Examining Trends in Satellite-Detected Tropical Overshooting Tops as a Potential Predictor of Tropical Cyclone Rapid Intensification. *J. Appl. Meteor. and Climatol.*, 51, 1917-1930.
- Otkin, J. A., 2012: Assimilation of water vapor sensitive infrared brightness temperature observations during a high impact weather event. *J. Geophys. Res.*, 117, D18213, doi:10.1029/2012JD017568
- Otkin, J. A., 2012: Assessing the Impact of the Covariance Localization Radius when Assimilating Infrared Brightness Temperature Observations Using an Ensemble Kalman Filter. *Mon. Wea. Rev.*, 140(2), 543-561. doi: 10.1175/MWR-D-11-00084.1
- Petrenko, B., A. Ignatov, N. Shabanov, and Y. Kihai, 2011: Development and evaluation of SST algorithms for GOES-R ABI using MSG SEVIRI as a proxy. *Rem. Sens. of Env.*, 115(12), doi: 10.1016/j.rse.2011.09.003.
- Ralph, M., J. Intrieri, D. Andrea, Jr., R. Atlas, S. Boukabara, D. Bright, P. Davidson, B. Entwistle, J. Gaynor, S. Goodman, J. Gwo-Jiing, A. Harless, J. Huang, G. Jedlovec, J. Kain, S. Koch, B. Kuo, J. Levit, S. T. Murillo, L. P. Riishojgaard, T. Schneider, R. Schneider, T. Smith, and S. Weiss, 2012: The Emergence of the Weather-focused Testbeds Linking Research and Forecasting Operations. Accepted for publication in *Bull. Amer. Met. Soc.*
- Remer, L. A., S. Mattoo, R. C. Levy, A. Heidinger, R. B. Pierce, and M. Chin, 2012: Retrieving aerosol in a cloudy environment: aerosol product availability as a function of spatial resolution. *Atm. Measurement Techniques*, 5(7), 1823-1840, doi: 10.5194/amt-5-1823-2012
- Schultz, C. J., W. A. Petersen, and L. D. Carey, 2011: Lightning and Severe Weather: A Comparison between Total and Cloud-to-Ground Lightning Trends. *Weather and Forecasting*, 26(5), 744-755, doi: 10.1175/WAF-D-10-05026.1
- Walther, A. and A. K. Heidinger, 2012: Implementation of the Daytime Cloud Optical and Microphysical Properties Algorithm (DCOMP) in PATMOS-x. *J. Appl. Meteor. Climatol.*, 51, 1371-1390, doi: 10.1175/JAMC-D-11-0108.1
- Wang, C., P. Yang, B. A. Baum, S. Platnick, and A. K. Heidinger, 2011: Retrieval of Ice Cloud Optical Thickness and Effective Particle Size Using a Fast Radiative Transfer Model. *J. Appl. Meteor. Climatol.*, 50(11), 2283-2297, doi: 10.1175/JAMC-D-11-067.1

- Webley, P. W., T. Steensen, M. Stuefer, G. Grell, S. Freitas, and M. Pavolonis, 2012: Analyzing the Eyjafjallajökull 2010 eruption using satellite remote sensing, lidar and WRF-Chem dispersion and tracking model. *J. Geophys Res.*, 117, D00U26, doi:10.1029/2011JD016817
- Yu, Y., D. Tarpley, J. L. Privette, L. E. Flynn, H. Xu, M. Chen, K. Y. Vinnikov, D. Sun, and Y. Tian, 2012: Validation of GOES-R Satellite Land Surface Temperature Algorithm Using SURFRAD Ground Measurements and Statistical Estimates of Error Properties. *IEEE Trans. on Geo. and Rem. Sens.*, 50(3), 704-713, doi: 10.1109/TGRS.2011.2162338
- Zhang, H., Lyapustin, A., Wang, Y., Kondragunta, S., Laszlo, I., Ciren, P., and Hoff, R. M., 2011: A multi-angle aerosol optical depth retrieval algorithm for geostationary satellite data over the United States, *Atmos. Chem. Phys.*, 11, 11977-11991, doi:10.5194/acpd-1111977-2011.
- Zupanski, D., M. Zupanski, L. D. Grasso, R. Brummer, I. Jankov, D. Lindsey, M. Sengupta, M. DeMaria, 2011: Assimilating synthetic GOES-R radiances in cloudy conditions using an ensemble-based method. *Int. J. Rem. Sens.*, 31(24), 9637-9659, doi: 10.1080/01431161.2011.572094

Other publications:

Schmit, T., 2012: The ABI on GOES-R. *NWA Newsletter*, 12(4).

## **Appendix B: Conference/Meeting Presentations**

Jim Gurka and Steve Goodman gave oral presentations on the GOES-R Proving Ground at the following conferences/meetings:

- 1) GOES Users' Conference/joint with the National Weather Association (NWA) Annual Meeting in Birmingham, AL (Oct. 2011)
- 2) American Geophysical Union Annual Meeting in San Francisco, CA (Dec. 2011)
- 3) 8<sup>th</sup> Annual AMS Symposium on Future Environmental Satellite Systems at the Annual AMS meeting in New Orleans, LA (Jan. 2012)
- 4) EUMETSAT Convection Working Group Meeting in Prague, Czech Republic (Mar. 2012)
- 5) Vaisala International Lightning Detection and Meteorology Conference in Broomfield, CO (Apr. 2012)
- 6) Office of the Federal Coordinator for Meteorology (OFCM) Meeting in Silver Spring, MD (June 2012)
- 7) 40<sup>th</sup> AMS Broadcast Meteorology Conference in Boston, MA (Aug. 2012)
- 8) WMO Symposium on Nowcasting and Very Short Range Forecasting in Rio de Janeiro, Brazil (Aug. 2012)
- 9) EUMETSAT Users' Conference in Oslo, Norway (Sept. 2012)
- 10) National Weather Association Annual Meeting in Madison, WI (Oct. 2012)
- 11) WMO Workshop on NWP for Nowcasting in Boulder, CO (Oct. 2012)

Michael J. Folmer gave oral presentations on the GOES-R Proving Ground at the following conferences/meetings:

- 1) The 2012 GOES-R product demonstrations for marine and precipitation applications, 37<sup>th</sup> Annual NWA meeting in Madison, WI (Oct. 2012)
- 2) The Use of the RGB Airmass Product at the HPC, OPC, NHC, and SAB GOES-R Proving Grounds during the 2011 Atlantic Hurricane Season, AMS 30<sup>th</sup> Conference on Hurricanes and Tropical Meteorology (Apr. 2012)
- 3) The Use of the RGB Products at the HPC, OPC, NHC, and SAB Proving Grounds, NOAA Satellite Science Week (May 2012)
- 4) CICS annual science meeting (Sept. 2012)

### **Air Quality presentations:**

Huff, A. K, H. Zhang, R. M. Hoff, C. Xu, P. Ciren, S. Kondragunta, E.-S. Yang, S. A. Christopher. The GOES-R Air Quality Proving Ground: Introducing the Air Quality User Community to the Next Generation of NOAA Geostationary Satellite Products, IN53C-1640, American Geophysical Society Annual Meeting, San Francisco, Dec. 5-9, 2011.

St. Pé, A., R. M. Hoff, H. Zhang, A. Huff, S. Kondragunta, C. Xu, P. Ciren, S. Christopher, and E.S. Yang. Air Quality Proving Ground: Evaluating GOES-R ABI Products with Proxy Data, American Meteorological Society Annual Meeting, New Orleans, LA, January 22-26, 2012.

Hoff, R. M., H. Zhang, A. Huff, S. Kondragunta, C. Xu, P. Ciren, S. A. Christopher, and E. S. Yang. The GOES-R Air Quality Proving Ground: Building An Air Quality User Community for the Next Generation of Products. American Meteorological Society Annual Meeting, New Orleans, LA, January 22-26, 2012.

Zhang, H., R. M. Hoff, S. Kondragunta. IDEA-like GOES-R air quality data distribution system, NOAA Science Week, NWS Kansas City Office, Kansas City, MO, May 2-5, 2012.

Hoff, R. M. NOAA Profiling Workshop Commentary, Sterling VA, March 28, 2012.

Hoff, R.M. DISCOVER-AQ: An urban air quality field experiment using satellites, aircraft and ground-sites, EC ACTRIS Plenary Meeting, Stresa, Italy (INVITED; AQPG was discussed in context of the real-time demonstration experiment).

Zhang, H., R. M. Hoff, S. Kondragunta, I. Laszlo, A. Lyapustin. Aerosol Optical Depth (AOD) Retrieval using GOES-East and GOES-West Reflected Radiances over the Western United States, Paper A23J-05, American Geophysical Union Fall Meeting, San Francisco, CA , December 3-7, 2012.

### **SPoRT conference presentations:**

**Burks, J., M. Smith, and K. McGrath, 2012:** NASA SPoRT AWIPS II Activities. 37<sup>th</sup> NWA Annual Meeting, October 6-11, Madison, WI.

**Burks, J., Smith, M. 2012:** SPoRT AWIPS II Activities. NOAA Satellite Science Week, April, Kansas City, MO.

**Burks, J., Smith, M., McGrath, K. 2012:** NASA SPoRT / AWIPS II Activities. NOAA Satellite Science Week, April, Kansas City, MO.

- Carcione, B., **J. Burks, M. Smith, and K. McGrath**, 2011: Preparing NASA SPoRT Data Sets for the Next Generation of AWIPS. 36<sup>th</sup> NWA Annual Meeting, October 17-20, Birmingham, AL.
- Folmer, M. **B. Zavodsky, and A. Molthan**, 2012: Operational use of the AIRS Total Column Ozone Retrievals along with the RGB Airmass product as part of the GOES-R Proving Ground. AGU Fall Meeting, San Francisco, CA.
- Fuell, K.K., A. Molthan**, M. Folmer, M. DeMaria 2012: Demonstration of RGB Composite Imagery at NOAA National Centers in Preparation for GOES-R. 7<sup>th</sup> GOES Users' Conference Annual Meeting, October 15-20, Birmingham, AL.
- Fuell, K.K., A. Molthan, 2012**: RGB Imagery Applications within U.S. National Weather Service: Demonstrating Future GOES-R Capabilities with Current Instruments. 2<sup>nd</sup> RGB Composite Satellite Imagery Workshop, September 17-19, Seeheim, Germany.
- Fuell, K.K., G. J. Jedlovec, A. L. Molthan, and G. T. Stano**, 2012: NASA/SPoRT's GOES-R Activities in Support of Product Development, Management, and Training. AGU Fall Meeting, San Francisco, CA.
- Fuell, K. K., M. Smith, and G. Jedlovec**, 2012: Early Transition and Use of VIIRS and GOES-R Products by NWS Forecast Offices. 8<sup>th</sup> Annual Symposium on Future Operational Environmental Satellites, 92<sup>nd</sup> AMS Annual Meeting, 22-26 January 2012, New Orleans, LA.
- Fuell, K. K.** and A. L. Molthan, 2012: Transition and Evaluation of RGB Imagery to WFOs and National Centers by NASA SPoRT. NOAA Science Week, April, Kansas City, MO.
- Jedlovec, G.**, M. Demaria, T. Schmit, 2012: RGB activities for the GOES-R Proving Ground. NOAA Science Week, April, Kansas City, MO.
- Jedlovec, G.**, 2011: Overview of GOES-R Proving Ground Activities at SPoRT. 7<sup>th</sup> GOES Users Conference, October 19-21, Birmingham, AL.
- McCaul, E. W., **J. L. Case**, S. J. Goodman, S. R. Dembek, and F. Kong, 2011: Optimizing the Lightning Forecast Algorithm within the Weather Research and Forecasting Model. 7<sup>th</sup> GOES Users Conference, October 19-21, Birmingham, AL.
- Molthan, A. L., H. K. Oswald, and K. K. Fuell**, 2011: Developing and Evaluating RGB Composite MODIS Imagery for Applications in National Weather Service Forecast Offices. 7<sup>th</sup> GOES Users Conference, October 19-21, Birmingham, AL.
- Molthan, A., H. Oswald, and K. Fuell**, 2012: Developing and Evaluating Multispectral RGB Satellite Imagery for Applications in National Weather Service Forecast Offices or National Centers. 8<sup>th</sup> Annual Symposium on Future Operational Environmental Satellites, 92<sup>nd</sup> AMS Annual Meeting, 22-26 January 2012, New Orleans, LA.
- Molthan, A. L., K. K. Fuell**, J. Knaff, and T. Lee, 2012: Current Usage and Future Prospects of Multispectral (RGB) Satellite Imagery in Support of NWS Forecast Offices and National Centers. 37<sup>th</sup> NWA Annual Meeting, October 6-11, Madison, WI.
- Smith, M, K. McGrath, J. Burks**, and B. Carcione, 2012: Application Programming in AWIPS II. 10<sup>th</sup> Symposium on the Coastal Environment, 92<sup>nd</sup> AMS Annual Meeting, 22-26 January 2012, New Orleans, LA.
- Stano, G. T.** and B. Carcione, 2012: Latest Activities and Evaluations as NASA SPoRT Prepares for the Geostationary Lightning Mapper. 8<sup>th</sup> Annual Symposium on Future



Operational Environmental Satellites, 92<sup>nd</sup> AMS Annual Meeting, 22-26 January 2012, New Orleans, LA.

**Stano, G. T.**, 2012: Utilizing Space-based Lightning Observations to Improve Lightning Awareness and Safety. 7<sup>th</sup> Symposium on Policy and Socio-Economic Research, 92<sup>nd</sup> AMS Annual Meeting 22-26 January 2012, New Orleans, LA.

**Stano, G. T.**, C. Siewert, and K. M. Kuhlman, 2011: Evaluation of NASA SPoRT's Pseudo-Geostationary Lightning Mapper Products in the 2011 Spring Program. 36<sup>th</sup> NWA Annual Meeting, October 17-20, Birmingham, AL.

**Stano, G. T.**, and B. Carcione, 2011: Total Lightning Visualizations to Enhance Forecast Operation. 36<sup>th</sup> NWA Annual Meeting, October 17-20, Birmingham, AL.

**Stano, G. T.**, 2012: Preparing for GOES-R: The Pseudo Geostationary Lightning Mapper. Preprints, 37<sup>th</sup> Natl. Wea. Assoc. Annual Meeting, Madison, WI.

**Stano, G. T., K. K. Fuell, and G. J. Jedlovec**, 2012: NASA SPoRT's GOES-R Proving Ground Activities. NOAA Satellite Science Week, April, Kansas City, MO.

**White, K. D., G. T. Stano**, and B. Carcione, 2012: An Investigation of North Alabama Lightning Mapping Array Data and Usage in the Real-time Operational Warning Environment During the March 2<sup>nd</sup>, 2012 Severe Weather Outbreak in Northern Alabama. 37<sup>th</sup> NWA Annual Meeting, October 6-11, Madison, WI.

#### **CIRA Conference Presentations:**

Connell, B., M. Davison, T. Mostek, and K. Caesar, 2011: What drives online participation patterns for a focus group? CALMet IX Conference, October 3-7.

Szoke, E., 2011: Update on CIRA GOES-R Proving Ground products. Boulder WFO Winter Workshop, October 4 and 13.

Lindsey, D., L. Grasso, D. Bikos, C. Stewart, R. Rabin, and J. Kain, 2011: 36<sup>th</sup> NWA Annual Meeting and GOES Users' Conference, October 17-21 (poster).

Lindsey, D., D. Hillger, D. Molenar, J. Knaff, M. DeMaria, S. Miller, R. Brummer, L. Grasso, S. Kidder, D. Bikos, J. Braun, B. Connell, E. Szoke, H. Gosden, K. Micke, and R. DeMaria, 2011: 36<sup>th</sup> NWA Annual Meeting and GOES Users' Conference, October 17-21 (poster).

Grasso, L., D. Hillger, and S. Miller, 2012: Synthetic Natural Color ABI Products. 2<sup>nd</sup> Annual NOAA GOES-R Air Quality Proving Ground Workshop, January 12.

Hillger, D., and T. J. Schmit, 2012: GOES Science Tests: Results for the Last Two of the Current GOES Series. 18<sup>th</sup> Conference on Satellite Meteorology, Oceanography and Climatology/First Joint AMS-Asia Satellite Meteorology Conference, 92<sup>nd</sup> AMS Annual Meeting, January 23-26.

Hillger, D., and T. J. Kopp, 2012: First Images and Products From VIIRS on NPP. Eighth Annual Symposium on Future Operational Environmental Satellite Systems, 92<sup>nd</sup> AMS Annual Meeting, January 23-26.

DeMaria, M., J. A. Knaff, A. B. Schumacher, J. F. Dostalek, and R. T. DeMaria, 2012: Applications of Atms/CrIS Soundings to Tropical Cyclone Analysis and Forecasting. Eighth Annual Symposium on Future Operational Environmental Satellite Systems, 92<sup>nd</sup> AMS Annual Meeting, January 23-26.

Connell, B., and K. Gebhart, 2012: Golden Words from Elementary Kids: Can I Show You My Observation! 21<sup>st</sup> Symposium on Education, 92<sup>nd</sup> AMS Annual Meeting, January 23-26.

- Connell, B., D. Bikos, J. Braun, A. S. Bachmeier, S. Lindstrom, A. Mostek, M. Davison, K. A. Caesar, V. Castro, L. Veeck, M. DeMaria, and T. J. Schmit, 2012: Satellite Training Activities: VISIT, SHyMet and WMO VLab Focus Group. Eighth Annual Symposium on Future Operational Environmental Satellite Systems, 92<sup>nd</sup> AMS Annual Meeting, January 23-26 (poster).
- Lindsey, D., T. J. Schmit, W. M. MacKenzie Jr., L. Grasso, M. M. Gunshor, and C. P. Jewett, 2012: The 10.35 Micrometer Band: A More Appropriate Window Band for GOES-R ABI than 11.2? . Eighth Annual Symposium on Future Operational Environmental Satellite Systems, 92<sup>nd</sup> AMS Annual Meeting, January 23-26.
- Lindsey, D., and L. Grasso, 2012: Predicting Where Convective Clouds Will Form with the GOES-R ABI. Eighth Annual Symposium on Future Operational Environmental Satellite Systems, 92<sup>nd</sup> AMS Annual Meeting, January 23-26 (poster).
- Miller, S., 2012: Introducing DEBRA: A Dust Enhancement with Background Reduction Algorithm Applicable to Next-Generation Optical Spectrum Imaging Radiometers. 18<sup>th</sup> Conference on Satellite Meteorology, Oceanography and Climatology/First Joint AMS Asia Satellite Meteorology Conference, 92<sup>nd</sup> AMS Annual Meeting, January 23-26.
- Miller, S. T. F. Lee, C. Elvidge, and J. D. Hawkins, 2012: Dramatic Improvements to Nighttime Imaging with the VIIRS Day/Night Band. Eighth Annual Symposium on Future Operational Environmental Satellite Systems, 92<sup>nd</sup> AMS Annual Meeting, January 23-26
- Grasso, L. R. Brummer, R. DeMaria, D. Lindsey, and D. Hillger, 2012: GOES-R ABI as a warning aid. Warn-on Forecast and High Impact Weather Workshop, February 23-25.
- DeMaria, M., 2012: Improvements in Statistical Tropical Cyclone Forecast Models: A Year 1 Joint Hurricane Testbed Project Update. 66<sup>th</sup> Interdepartmental Hurricane Conference, March 5-8.
- Szoke, E., 2012: Overview of CIRA Products. Pueblo WFO Spring Workshop, March 13.
- Szoke, E., 2012: Update on CIRA Products. Boulder WFO Spring Workshop, April 6 and 13.
- Knaff, J., M. DeMaria, D. W. Hillger, D. T. Lindsey, D. A. Molnar, J. L. Beven II, M. J. Brennan, H. D. Cobb III, R. Brummer, A. B. Schumacher, J. Dunion, K. K. Guell, A. K. Molthan, C. S. Velden, 2012L Overview of the GOES-R Proving Ground Activities at National Hurricane Center. AMS 30<sup>th</sup> Conference on Hurricanes and Tropical Meteorology, April 16-20 (poster).
- Miller, S., 2012: VIIRS Imagery. NOAA Satellite Science Week, April 30 – May 4.
- DeMaria, M., 2012: New Tropical Cyclone Products from GOES-R and JPSS. NOAA Satellite Science Week, April 30 – May 4.
- Gosden, H., 2012: Potential Applications in AWIPS II. NOAA Satellite Science Week, April 30 – May 4.
- Lindsey, D., L. Grasso, J. Mecikalski, J. Walker, L. Schultz, C. Velden, S. Wanzong, R. Rabin, and B. Vant-Hull, 2012: Convective Storm Forecasting 1-6 Hours Prior to Initiation. NOAA Satellite Science Week, April 30 – May 4 (poster).
- Knaff, J., M. DeMaria, and C. Rozoff, 2012: Improved Understanding and Diagnosis of Tropical Cyclone Structure and Structure Changes. NOAA Satellite Science Week, April 30 – May 4 (poster).
- DeMaria, M., J. A. Knaff, J. L. Beven, M. J. Brennan, S. Miller, A. Schumacher, R. DeMaria, J. Dostalek, D. Welsh, 2012: Application of Joint Polar Satellite System Imagers and Sounders to Tropical Cyclone Track and Intensity Forecasting. NOAA Satellite Science Week, April 30 – May 4 (poster).

- Connell, B., 2012: National and International Training: Merging New and Old Frontiers. NOAA Satellite Science Week, April 30 – May 4 (poster).
- Szoke, E., R. Brummer, H. Gosden, S. Miller, M. DeMaria, D. Linsdey, D. Molenaar, 2012: The GOES-R Proving Ground: An opportunity for forecasters to shape the satellite products of the future. 46<sup>th</sup> Canadian Meteorological and Oceanographic Society and 21<sup>st</sup> AMS NWP and 25<sup>th</sup> WAF Conference, May 29 – June 1.
- Bikos, D., J. Braun, B. Connell, S. Lindstrom, and S. Bachmeier, 2012: Recent VISIT and SHyMet Training: Applications of Satellite Imagery and Products to Operational Forecasting. 37<sup>th</sup> NWA Annual Meeting, October 6-11 (poster).
- Grasso, L., D. Hillger, R. Brummer, and R. DeMaria, 2012: Synthetic GOES-R ABI imagery of hazardous aerosols. 37<sup>th</sup> NWA Annual Meeting, October 6-11 (poster).
- Szoke, E., R. Brummer, H. Gosdeb, S. Miller, and M. DeMaria, 2012: An Update on CIRA's GOES-R Proving Ground Activities. 37<sup>th</sup> NWA Annual Meeting, October 6-11 (poster).
- Lindsey, D., J. Otkin, J. Sieglaff, D. Bikos, and L. Grasso, 2012: Improving Forecasts of Clouds and Convection using Simulated Satellite Imagery. 37<sup>th</sup> NWA Annual Meeting, October 6-11.
- Szoke, E., 2012: Update on CIRA GOES-R Proving Ground products. Boulder WFO Winter Workshop, October 19 and 23.

**CIMSS Conference Presentations can be found at the following website:**

[http://library.ssec.wisc.edu/research\\_Resources/bibliographies/goesr](http://library.ssec.wisc.edu/research_Resources/bibliographies/goesr)  
(Listed under “Gray Literature”)

Posters:

- 1) GOES-R Fog and Low Cloud Product Demonstration Within the National Weather Service Central Region - **Chad M Gravelle**, CIMSS/SSEC/University of Wisconsin-Madison, NWS Operations Proving Ground, Kansas City, MO, Michael J Pavolonis and Corey G Calvert (presented at NWA Oct. '12)
- 2) The 2011 HPC/OPC/SAB GOES-R Proving Ground Demonstration – **Michael J. Folmer** University of Maryland – ESSIC, CICS, B. Reed, S. Goodman, J. M. Sienkiewicz, E. Danaher, D. R. Novak, and J. Kibler (presented at AMS Jan. 2012)