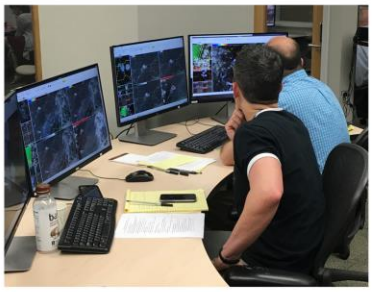
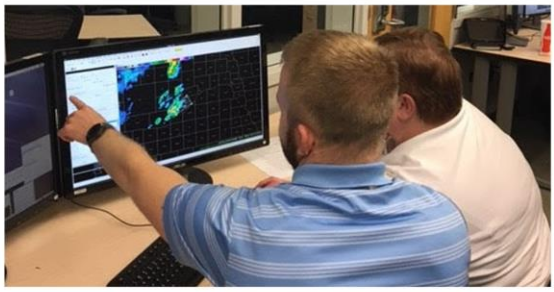
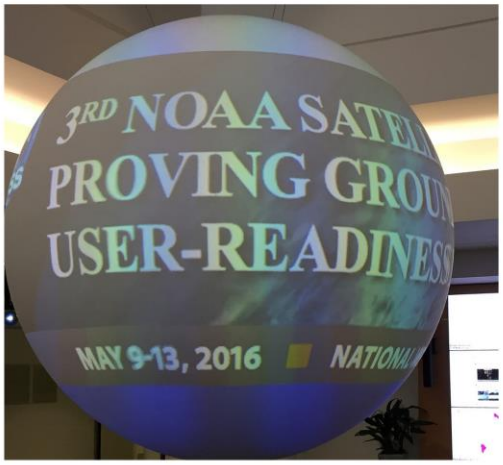
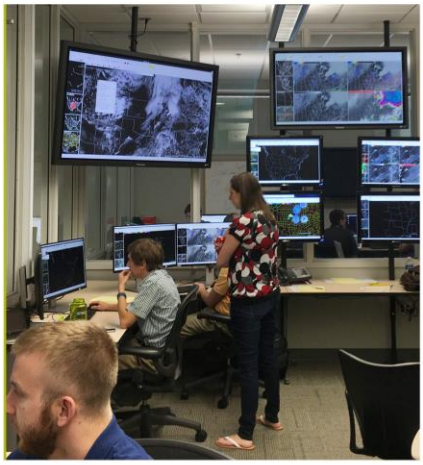
GOES-R Proving Ground
FY 16 Annual Report









Proving Ground Annual Report Fiscal Year 2016

Contents

1. Introduction and Background

The Geostationary Operational Environmental Satellite R-Series (GOES-R) Proving Ground (PG) is a collaborative effort between the GOES-R Program Office, selected National Oceanic and Atmospheric Administration (NOAA) Cooperative Institutes, National Weather Service (NWS) forecast offices, National Centers for Environmental Prediction (NCEP), the Joint Center for Satellite Data Assimilation (JCSDA), the NASA Short-Term Prediction Research and Transition Center (SPoRT), and NOAA testbeds where proxy and simulated GOES-R products are tested and evaluated in an operational environment before and subsequent to the launch of GOES-R on November 19, 2016. 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 Numerical Weather Prediction (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 Advanced Weather Interactive Processing System - Version II (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 GOES-R Proving Ground Annual Report describes the major Proving Ground (PG) activities where the operational value of the GOES-R products and capabilities is evaluated through the use

of proxy data, user feedback is collected to identify algorithm/product/service improvements, and project reports contribute to an Annual Guidance Memorandum from the Line Office representatives on the recommended priorities for future research and transition from research to operations (R2O). All report content was obtained from demonstration reports which PG participants submitted for Fiscal Year 2016 (http://www.goesr.gov/users/proving-ground.html).

Proving Ground Demonstrations at the NOAA Service Centers and Testbeds in FY2016 include:

A. Hazardous Weather Testbed (HWT)
B. National Hurricane Center (NHC)
C. NOAA Aviation Weather Center (AWC)
D. The Satellite Proving Ground for Marine, Precipitation, and Satellite Analysis (OPC, WPC, TAFB)
E. High Latitude Proving Ground (AK Region)
F. NWS Operations Proving Ground (OPG)

Project alignment with agency technical and service priorities:

- Supports Weather Ready Nation
- Satellite Observing System Continuity
- Forecaster Day-1 readiness for GOES-R

2. Performance Measures for FY 2016

Relevance Metric: Number of GOES-R products evaluated and feedback documented in the Project Plans. See Table 1 below.

GOES-R Proving Ground (GRPG) FY16 Major Tests Conducted	Transitioned to Ops	Recommended for Transition to Operations	Advanced to Experimental Testing Phase	Rejected for Further Testing	Decision Pending or Deferred on Advancement	TRL	Comments GOES-R (GOES-16) Launch 19 November, Post Launch testing January 2017, Planned operational transition to Atlantic or Pacific Basin November 2017
Himawari Derived Motion Winds		x				7	JMA GTS algorithm to transition to GOES-16 DMW algorithm; Himawari still considered experimental, not yet operational by NESDIS
GOES-R Radiances		x			x	7	GOES-16 BUFR evaluation at NCEP
Himawari Cloud Products		x				7	GOES-16 cloud product algorithms in test; Himawari still considered experimental; not yet operational by NESDIS
Probability of Severe Model		x			x	7	Decision pending to implement at NCO IDP- note IDP frozen until FY19
Meso rapid scan (GOES-14 1-min proxy for ABI)		x				7	Operational following Post Launch Test (spring 2017)
VolAsh		x				7	Operational following Post Launch Test (spring 2017), further development continues
Nearcasting Model			x			6	Continued test and development
Cloud Cover Layers		x				7	Tested at AWC
RGB Airmass			x			6	Tested at OPG
GOES-R RGB Nighttime Microphysics Product			x			6	Testing at NASA SPoRT
Dust RGB			x			6	
Hurricane Intensity Extimate (Advanced Dvorak)		x				7	
Aerosol Particle Size		x				5	NESDIS transition in FY17
Ice Concentration		x				7	NESDIS transition in FY17
Ice Age/Thickness		x				7	NESDIS transition in FY17
Ice Motion		x				7	NESDIS transition in FY17
Convective Initiation		x				5	
Overshooting Top Detection		x	x			5	Of high interest at OPC
Totals		**14**	**5**		**2**		

Table 1 GRPG 2016 Demonstration Results

3. Quality Metric:

Sound and rigorous documentation of products to be evaluated in the Project Plan.

4. Effectiveness and Efficiency:

User feedback documented in the Proving Ground blogs and in the Project Final Reports on the goes-r web page http://www.goes-r.gov/users/pg-activities-01.html

5. FY2016 Milestones

- Tales from the Testbed webinar each week of the demonstration
- Presentation of at least one paper at a national or international conference or workshop on the Proving Ground results.

6. Funding / Opportunity Announcements

Proving Ground demonstrations are supported through grants and contracts funded by the GOES-R Program Science Office via proposals for risk reduction research. Such proposals are reviewed by an Executive Panel including subject matter experts and NOAA end user Line Offices. All proposals include a demonstration in an operational environment to advance the Technology Readiness Level and to seek endorsements from potential NOAA user communities. Visiting scientists are also able to participate in the demonstrations via travel grants. In addition, technical interchange meetings are held throughout the year to review the PG demonstration projects which include quarterly All-Hands meeting of participants and an annual PG All-Hands technical interchange meeting.

A Call for Proposals for for FY2017-2019 new starts was completed in January 2017. Project selections and summaries are available at http://www.goes-r.gov/users/risk-reduce/2017.html.

7. Publications

- **Use of Geostationary Super Rapid Scan Satellite Imagery by the Storm Prediction Center.** Line, W. E., T. J. Schmit, D. T. Lindsey, and S. J. Goodman, 2016: *Weather and Forecasting*, (In Press).

- **Forecaster Evaluations of High Temporal Satellite Imagery for the GOES-R Era at the NWS Operations Proving Ground,** Chad M. Gravelle, Kim J. Runk, Katie L. Crandall, Derrick W. Snyder, *Weather and Forecasting,* Volume 31, No. 4 (August 2016), pp. 1157-1177

- **Use of Geostationary Super Rapid Scan Satellite Imagery by the Storm Prediction Center.** William E. Line, Timothy J. Schmit, Daniel T. Lindsey, Steven J. Goodman, Weather and Forecasting*,* Volume 31, Issue 2 (April 2016) pp. 483-494

- **Demonstration of a GOES-R Satellite Convective Toolkit to "Bridge the Gap" between Severe Weather Watches and Warnings: An Example from the 20 May 2013 Moore, Oklahoma, Tornado Outbreak.** Chad M. Gravelle, John R. Mecikalski, William E. Line, Kristopher M. Bedka, Ralph A. Petersen, Justin M. Sieglaff, Geoffrey T. Stano, Steven J.

Goodman, *Bulletin of the American Meteorological Society,* Volume 97, Issue 1 (January 2016) pp. 69-84**.**

8. Proving Ground Demonstrations at the NOAA Service Centers and Testbeds in FY2016 included:

A: NOAA Hazardous Weather Testbed (HWT)

Project Title: GOES-R and JPSS Proving Ground Demonstration at the 2016 Spring Experiment - Experimental Warning Program (EWP) and Experimental Forecast Program (EFP)

Participant(s): National Weather Service (NWS) Forecasters, Broadcast Meteorologists, Storm Prediction Center (SPC), National Severe Storms Laboratory (NSSL)

Duration of Evaluation: 18 April 2016 – 13 May 2016

Discussion: Most of the products demonstrated in 2016 were involved in previous HWT experiments and have received updates based on feedback received from the HWT and other demonstrations. Products evaluated in 2016 included GOES-R All-Sky Legacy Atmospheric Profile (LAP) algorithm, atmospheric moisture and stability fields using GOES Sounder data, GOES-R Convective Initiation (CI) algorithms, ProbSevere statistical model, Geostationary Lightning Mapper (GLM) Lightning Detection, and Lightning Jump algorithm (LJA). Additionally, GOES-14 Super Rapid Scan Operations for GOES-R (SRSOR) 1-min visible (VIS), infrared (IR), and water vapor (WV) imagery was available from 18 April to 14 May.

Participants viewed the 1-min imagery in near real-time in AWIPS-II in the Experimental Warniing Program (EWP) and in National Centers for Environmental Prediction (NCEP) AWIPS (NAWIPS) in the Experimental Forecast Program (EFP). Parallax-corrected 1-min imagery was also available in AWIPS-II, as were 10-min updating Derived Motion Winds computed from the 1-min satellite data.

Several visiting scientists attended the EWP over the four weeks to provide additional product expertise and interact directly with operational forecasters. Organizations represented by those individuals included: UW/CIMSS, UAH, OU/CIMMS, NSSL, NASA/SPoRT, Science and Technology Corporation and NWS. The 2016 GOES-R and JPSS Proving Ground User Readiness Meeting took place in Norman during the final week of the experiment, providing meeting participants the opportunity to observe the HWT activities. The SPC and HWT Satellite Liaison, William Line (OU/CIMMS and NOAA/SPC), provided overall project management and subject matter expertise for the GOES-R Proving Ground efforts in the HWT with support from Kristin Calhoun (OU/CIMMS and NOAA/NSSL).

Significant Outcomes: Forecaster feedback during the evaluation was collected using several different methods, including daily surveys, weekly surveys, daily debriefs, weekly debriefs, blog posts, informal conversations in the HWT and a weekly “Tales from the Testbed” webinar. Typical feedback included: suggestions for improving the algorithms, ideas for making the displays more effective for information transfer to forecasters, best practices for product use, suggestions for

training, and situations in which the tools worked well and not so well. Forecasters' favorite aspect of the GOES-R All-sky LAP product was the multi-layer precipitable water (PW) fields, which depicted differential moisture advection throughout the atmosphere. The severe CI product was a welcomed addition to the CI suite, albeit sometimes too conservative with its probabilities. The ProbSevere model continues to impress forecasters, though improvements to performance need to be made in the presence of multicellular/linear convective modes and when wind and tornados are the hazard. The 1-min satellite imagery is a capability forecasters are most excited about, finding it to have exceptional value over current imagery throughout the full duration of a severe weather day.

Participants appreciated the high density of wind data made available from the high frequency satellite imagery, and found many ways in which it improved their environmental analysis. Forecasters were able to effectively use the lightning products to determine where thunderstorms were developing and where significant increases and decreases in activity were occurring. They look forward to the GLM capability, and anticipate benefits to local Decision Support Services (DSS) activities as well.

B. National Hurricane Center (NHC)

Project Title: The 2016 NOAA Satellite Proving Ground at the National Hurricane Center

Participant(s): NOAA/NWS National Hurricane Center (NHC), NHC Hurricane Specialist Unit (HSU) and Tropical Analysis and Forecast Branch (TAFB) forecasters

Duration of Evaluation: 01 Aug 2016 – 30 Nov 2016

Discussion: The purpose of the NOAA Satellite Proving Ground (PG) at the National Hurricane Center (NHC) is to provide NHC forecasters with an advance look at tropical cyclone-related satellite products for evaluation and feedback during the most active period of the Hurricane season (August 1 – November 30).

A total of 18 products were demonstrated during the 2016 NHC PG, including 4 GOES-R baseline products, 10 future capabilities products, and one risk reduction product. Demonstration products and algorithms were provided by NESDIS/STAR, CIRA, CIMSS, Cooperative Institute for Marine and Atmospheric Studies (CIMAS), SPoRT, and OAR. The ABI products were produced using proxy data from Meteosat, GOES, and MODIS. The GLM 2 product was produced from proxy ground-based World Wide Lightning Location Network (WWLLN) data. NHC also has access to the Vaisala GLD360 ground-based lightning data in real time on their NWS National center Advanced Weather Interactive Processing System (N-AWIPS) systems as another proxy for the GLM. Feedback on the utility of the NHC PG products was gathered through a web based form, informal email exchanges between the NHC participants and product providers, and a 2016 NHC GOES-R/JPSS PG Review was held at the National Hurricane Center in Miami, Florida on February 17, 2017. Tropical cyclone (TC) activity in both Atlantic and N.E. Pacific basins was above average, providing several opportunities for the evaluation of Proving Ground products. Two Atlantic TCs in particular, Hermine and Matthew, were particularly notable and allowed for PG evaluations during active operations.

Significant Outcomes: The primary findings from the 2016 Proving Ground include the following: 1) Although forecasters have found a great deal of value in GOES-R Advanced Baseline Imager (ABI) Super Rapid Scan Operations (SRSO), there is still concern over accommodating the large data associated with loading and displaying high resolution imagery. NHC is implementing a new NetApp filer in 2017 that has 15 times more storage space than the current NetApp. This will make the issue of storing the long SRSO loops much less of a problem.; 2) The lightning-based rapid intensification index could potentially be improved by distinguishing lightning that occurs within the radius of maximum wind from lightning outside the radius of maximum wind if the RMW could be accurately estimated in real-time; 3) We consider evaluations of 3 of the 4 GOES-R Baseline products evaluated to be mature, in that Products that have been included in NHC PG for several years, have received positive feedback, and proven useful for tropical applications. Derived Motion Winds (DMW) is the only GOES-R Baseline product included in the NHCPG that is not considered mature due to issues encountered with displaying it in N-AWIPS. Special attention will be given to the evaluation of GOES-16 DMWs during the 2017 NHCPG.

C. NOAA Aviation Weather Center (AWC)

Project Title: 2016 GOES-R/JPSS Demonstration

Participant(s): Aviation Weather Center (AWC) forecasters, Central Weather Service Unit (CWSU) forecasters, and Air Traffic Control Systems Command Center (ATCSCC) National Aviation Meteorologists (NAMs)

Duration of Evaluation: 6 January 2016 – 30 September 2016

Discussion: The 2016 demonstration at the Aviation Weather Center (AWC) in Kansas City, MO, took place from 6 January – 30 September 2016, its purpose two-fold: (1) it provided a pre-operational environment in which to test and evaluate new GOES-R/JPSS proxy products, and (2) it also aided in familiarizing forecasters with the capabilities of our next generation GOES/JPSS satellite series. Following the structure of the last several years, the 2016 evaluation was again divided into two long-term evaluations. Additionally, two two-week long intensive experiments were also included; one Winter Experiment in February of 2016 and one Summer Experiment in August of 2016.

Participation throughout the two long-term evaluations included only AWC forecasters, while the two experimental periods consisted of a wide variety of external participants from the Center Weather Service Units (CWSUs), Weather Forecast Offices (WFOs), the Alaska Aviation Weather Unit (AAWU), Hawaii Forecast Office, the Federal Aviation Administration (FAA) and other flight services companies including FedEx and United Parcel Service (UPS), and research scientists from the Air Force Weather Agency (AFWA), the GOES-R program, and various National Oceanic and Atmospheric Administration (NOAA) laboratories. The following report details the activities and results of the entirety of the 2016 GOES-R/JPSS demonstration

Significant Outcomes: The Aviation Weather Center has a unique and challenging mission for a variety of customers, including general aviation, commercial airlines and the FAA, and also helicopter operations. The 2015 GOES-R/JPSS demonstration was designed around the needs of

these customers and the products issued by AWC forecasters. In past years, future capabilities products were evaluated in more detail. This year the Aircraft Flight Icing Threat and the various ozone products from NPP were the only ones of those evaluated. Beyond that the focus shifted to baseline products including various Cloud Height algorithms, the PGLM for GLM lightning detection, Synthetic Cloud and Moisture imagery, Derived Motion Winds, and GOES-14 1-minute SRSOR imagery.

The biggest change in the 2016 demonstration was the addition of the above-mentioned GOES-R/JPSS products to AWIPS-2. With the future in the latter system, AWC management has directed all development for N-AWIPS and AWIPS-2 to occur in parallel, with emphasis on AWIPS-2. The Winter Experiment marked the beginning of this effort, with various icing and C&V related products being displayed in D2D. The Summer Experiment further emphasized this as all convective-related products along with additional C&V products moved. A push will be made to transition some of these products – identified via the 2016 evaluation period- to the forecast floor. The ozone products from NPP are the first of this list to be successfully moved to the AWC's operational AWIPS-2 systems. Some additional training will likely be needed for these products at a later time.

Currently everything in NAWIPS operations has been trained on and reference materials such as quick guides and case studies provided. However, given the differences and particularly the improvements in AWIPS-2, some familiarization will still be needed. Some one-on-one training did occur during both experiments with those AWC forecasters who participated. Additionally, the NAMs were provided some brief training on the ozone products. Further training will occur in the 2017 demonstration period.

D. The Satellite Proving Ground for Marine, Precipitation, and Satellite Analysis (OPC, WPC, TAFB)

Project Title: 2016 Satellite Demonstrations at the Satellite Proving Ground for Marine, Precipitation, and Satellite Analysis (MPS).

Participant(s): The Ocean Prediction Center (OPC), NESDIS Satellite Analysis Branch (SAB), NHC Tropical Analysis and Forecast Branch (TAFB), and the Weather Prediction Center (WPC)

Duration of Evaluation: calendar year 2016

Discussion: The overarching theme of the PG continued to focus on heavy rainfall, explosive cyclogenesis, maritime convection, extratropical transition of tropical cyclones, and fog/low stratus. The Overshooting Top Detection (OTD), GLD-360 Lightning Density, GOES-R Convective Initiation, CIRA Layered Precipitable Water, and Nearcast Model were used for convective monitoring and heavy rainfall. The multispectral or RGB imagery and convective products were used for analyzing and forecasting explosive cyclones and extratropical transition. The Fog/Low Status, GeoColor, and Night-time Microphysics products were used for monitoring and forecasting fog formation in the marine zones of OPC and TAFB.

Significant Outcomes: Many forecasters found the products to be beneficial to their operations and continue to use them along with the successful implementation of the Air Mass RGB products into daily forecast routines. The GOES-14 super rapid scan operations for GOES-R (SRSOR) have been a major success in the MPS PG since about 2012 and this continued in February, April, May, and August 2016. There were many examples of use for diagnosing some heavy rain events associated with deep convection in the southern U.S., fire monitoring for SAB, and even the rapid intensification of an extratropical cyclone off the southeast U.S. coast in early February.

E. Alaska Aviation Weather Unit (AAWU)

Project Title: 2016 GOES-R/JPSS AAWU Demonstration

Participant(s): Alaska Aviation Weather Unit forecasters and Anchorage Central Weather Service Unit forecasters
Duration of Evaluation: calendar year 2016

Discussion: The 2016 demonstration took place at the Alaska Aviation Weather Unit (AAWU) and Center Weather Service Unit (ZNC) in Anchorage, AK; it's purpose two-fold: (1) to provide a pre-operational environment in which to test and evaluate new GOES-R/JPSS proxy products, and (2) to train and familiarize aviation forecasters in Alaska with the capabilities of our next generation GOES-R/JPSS satellite series. This demonstration stemmed from a request at the 2015 OCONUS Satellite meeting in Anchorage to further integrate the AAWU and ZNC into the GOES-R/JPSS Proving Ground activities, and was a collaborative effort between the Aviation Weather Testbed and the High Latitude Proving Ground. Participation included forecasters from the AAWU and ZNC. Additionally, the U.S. Air Force meteorologists from the Joint Base Elmendorf-Richardson and the 17th Operational Weather Squadron showed peripheral interest in aviation related Proving Ground activities.
A number of products were evaluated during the 2016 demonstration and are listed in the table below. Providers were CIMSS, CIRA, NASA LaRC and SPoRT.

The Fog and Low Stratus is a Future Capability nearing the end of the process to become a Baseline product. The VIIRS Day/Night band was also evaluated as a Baseline product. Future Capabilities products included the Aircraft Flight Icing Threat, which was new in 2016, and various RGB recipes that were previous available in AAWU operations; the Nighttime/24-hour Microphysics, the Natural Color, and the Snow/Cloud RGB.

GOES-R Demonstrated Product	**Category**
Aircraft Flight Icing Threat	Future Capability
Fog and Low Stratus	Future Capability/NOAT priority (2)
JPSS Demonstrated Products	**Category**
Aircraft Flight icing Threat	Future Capability
Fog and Low Stratus	Future Capability/NOAT priority (2)
VIIRS Day/Night band	Baseline
Nighttime/24-hour Microphysics	Future Capability

Natural Color and Snow/Cloud RGBs	Future Capability
Category Definitions: *Baseline Products* - GOES-R products providing the initial operational implementation *Future Capabilities Products* - New capability made possible by ABI *Risk Reduction* – Research initiatives to develop new or enhanced GOES-R applications and explore possibilities for improving current products	

Significant Outcomes: The Flight Icing Threat was the only new product introduced. The GOES-W and MODIS versions were installed in the Alaska Region WFO and RFC AWIPS-2 D2D in spring of 2016, and forecasters from both the AAWU and Anchorage CWSU forecasters subsequently received training. Feedback was relatively consistent throughout the demonstration period and resulted in a number of valuable improvements to the algorithm over Alaska. Additionally, the collection of this feedback resulted in the successful push to gain funding. This funding will be used in the 2017 demonstration to generate the FIT products on both VIIRS and AVHRR (MetOp and NOAA).

The remaining products, the FLS and RGBs, were those that already exist in both AWIPS-2 systems, but on which forecasters requested additional and continual refresher training. This training was provided throughout the year, supplemented by various cases studies. AAWU forecasters are slowly gaining confidence in the RGB concept and are beginning to utilize them more often in operations. This has re-emphasized the RGB discussion in Alaska Region regarding client-side RGBs. Now that AAWU forecasters are becoming more comfortable with RGBs, they are joining the voice of other Alaska Region forecasters supporting the desire to build their own. With the capability being built into the latest versions of AWIPS-2, it appears that this future will become a reality fairly soon. The 2017 demonstration at the AAWU will continue to explore this road**.**

F. NWS Operations Proving Ground (OPG)

Project Title: Evaluating Applications and Visualizations of Multiple Spectral Bands for the GOES-R Era

Participant(s): NWS Operations Proving Ground (OPG), NWS Forecasters,

Duration of Evaluation: Between March and April 2016

Discussion: The NWS OPG hosted and facilitated three week-long Operational Impact Evaluation (OIE) sessions where NWS forecasters evaluated applications of multiple spectral bands for the GOES-R-series era. These evaluations focused on accomplishing various analysis and forecasting tasks by correctly using and interpreting imagery from fifteen spectral bands and several red-green-blue (RGB) composites, all of which will be available when GOES-R becomes operational.

Evaluation exercises were designed around four objectives:

1. Using H8 imagery and a phenomenon-based approach, gain insight into which spectral bands, channel differences, and/or RGB composites offer the most operational value in the opinions of participating forecasters.
2. Assess forecasters' ability to interpret and understand RGB imagery for various diagnostic tasks.
3. Assess and document any Advanced Weather Interactive Processing System (AWIPS) performance issues experienced while interrogating high-resolution satellite imagery.
4. Obtain feedback on the usefulness of the AWIPS Integrated Training Plugin, developed by NASA SPoRT and the NWS Experimental Plugin Development Team (EPDT), and document forecaster insights regarding needs for GOES-R multispectral application-based training.
atmospheric and land-based phenomena. These phenomena included fog and stratus (4 exercises), wildfire detection (3 exercises), smoke (3 exercises), convection (3 exercises), mid-latitude cyclones (3 exercises), and melting snowpack (2 exercises).

Significant Outcomes: A significant majority of participants shared the opinion that a subset of spectral band imagery available on GOES-R will be valued and readily embraced by forecasters for a variety of practical applications, while others will likely be used for more limited and specific purposes. They also concluded that the complexity of some RGB composite imagery (e.g., Air Mass and Nighttime Microphysics) will require the development of in-depth training and operationally- relevant examples in order for many NWS forecasters to achieve the level of understanding needed to apply them for decision making.
The AWIPS Integrated Training (AIT) Plugin received extremely favorable ratings from all nine forecasters. This is not surprising since the capability to immediately acquire product resources through an AWIPS workstation meets a need that has been expressed by numerous field forecasters in multiple forums (e.g., 2014 WR Region SOO Conference, 2015 National SOO Meeting, and 2014-2015 OPG Operational Readiness Evaluations). The benefits of having refresher information available at the moment the forecaster needs it, within his/her decision support system, are self-evident. In addition, the AIT framework represents an excellent structure for hosting a library of locally developed application/use cases. Many forecasters were impressed by the quality of the training resources as well. In fact, several commented that these materials (one-page quick guides and short, focused micro-lessons) would serve as a valuable supplement to GOES-R foundational training, and should be required for all NWS forecasters to complete as pre-launch training.