Operations Plan

for the
GOES-R Proving Ground
portion of the
National Hurricane Center 2011 Hurricane Season PG Experiment

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Revision Date: July 7, 2011

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1 Introduction

1.1 Plan Purpose and Scope

The purpose of this plan is to identify the goals of the National Hurricane Center (NHC) Hurricane Season Proving Ground (PG) Experiment, provide an overview of the GOES-R products being demonstrated, describe the activities necessary to conduct the experiment, identify the participants and their responsibilities, establish a project timeline/schedule with milestones and deliverables, and identify related activities at the NHC. This plan will only describe the activities associated with the 2011 GOES-R PG activities at the NHC.

1.2 Overview

The NHC will receive early exposure to GOES-R PG products during the 2011 Hurricane Season Experiment running from August through the end of November. Pre-operational demonstrations of these GOES-R PG data will provide NHC operational forecasters an opportunity to critique and improve the products relatively early in their development. This activity will build on the GOES-R PG activities that began during the 2010 Hurricane Season.

2 Goals of Proving Ground Project

The goals of the NHC Hurricane Season PG Experiment are to demonstrate identified GOES-R surrogate products in real-time at the NHC during the 2011 hurricane season so the NHC forecasters can use, get familiar with, and evaluate the products and provide valuable feedback to the GOES-R Program Office (GPO).

3 GOES-R products to be demonstrated

The GOES-R products to be demonstrated include those that use proxy Advanced Baseline Imager (ABI) data from the Spinning Enhanced Visible and Infrared Imager (SEVIRI) instrument on Meteosat-9 and current GOES, and proxy Geostationary Lightning Mapper (GLM) data from global ground-based lightning networks. The products for 2011 were chosen in consultation with NHC based on feasibility, the similarity to planned GOES-R products, and forecaster availability for evaluation. These products include GOES-R Baseline and Option 2 products, as well as GOES-R Risk Reduction (R3) and Decision Aids. The products are listed in Table 1 and described further in the following subsections.

Table 1. Products to be demonstrated during Experiment

Demonstrated Product	Category
Hurricane Intensity Estimate (HIE)	Baseline
Super Rapid Scan imagery	Baseline
Overshooting Tops	Option 2
GOES-R natural color imagery product	Decision Aid
Red-Blue-Green (RGB) air mass product	Decision Aid
RGB dust product	Decision Aid
Saharan Air Layer (SAL) product	Decision Aid
Rapid Intensification Index (RII)	R3
Pseudo natural color imagery product	Decision Aid

Category Definitions:
Baseline - GOES-R products that are funded for operational implementation as part of the ground segment base contract.
Option 2 – Products that are being developed by the algorithm working group along with the baseline products, but may be implemented outside of the ground segment.
Decision Aid - Products or tools that aid the forecaster's decision process and/or automatically analyze the data and determine when the forecaster needs to react.
R3 – Products developed under the GOES-R Risk Reduction program. These include applications that supplement the Baseline and Option 2 products, with an emphasis on those that combine GOES data with information from other sources including low-earth orbit satellite, radar and in situ data, and numerical model output.

3.1 GOES-R Baseline

3.1.1 Hurricane Intensity Estimate

The Hurricane Intensity Estimate (HIE) is the only hurricane-specific product that is part of the official GOES-R Baseline set. The HIE will be a GOES-R algorithm designed to estimate hurricane intensity (mean sea level pressure (MSLP) and max surface wind) from ABI IR-window channel imagery. The code will be derived from the current Advanced Dvorak Technique (ADT), which is an objective and fully-automated algorithm that is operational now in National Environmental Satellite, Data, and Information Service (NESDIS). The Cooperative Institute for Meteorological Satellite Studies (CIMSS) has adapted the current ADT code to operate on 15-min. Meteosat-9 imagery, as a proxy to an ABI product demonstration. This year, per NHC request, the HIE will also be run with GOES-East CONUS 15-min. scan input on systems that cross 60W. The HIE will be provided to NHC via a web page, which is the same method used to provide the ADT.

3.1.2 Super Rapid Scan Imagery

NHC indicated an interest in super rapid scan operations (SRSO) data during hurricane landfalls to gain experience with the utility of the high time resolution observations from GOES-R. Because rapid scan operations (RSO) are automatically triggered during a U.S. hurricane landfall, which precludes the possible use of SRSO, alternate approaches will be used. If there is a hurricane landfall outside the U.S., SRSO will be called if possible. Also, the auto-trigger of RSO is for the satellite closest to the landfall point (usually GOES-east). If possible, SRSO will be called on the other operational GOES satellite if the cyclone is within its field of view.

3.2 GOES-R Option 2

3.2.1 Overshooting Tops

The Overshooting Tops (OT) product uses infrared window channel imagery to identify domelike protrusions above cumulonimbus anvils associated with very strong updrafts. OTs are identified using a brightness temperature threshold method. Details can be found in Monette (2011). OTs can help to identify vortical hot towers, which are related to tropical cyclone formation (Montgomery et al. 2009) and intensification (Guimond et al. 2010). Real time OT timing and location over the tropical and subtropical Atlantic east of 55W based on 15-min Meteosat imagery will be provided via a web page at CIMSS.

3.3 GOES-R Decision Aids and GOES-R Risk Reduction

3.3.1 GOES-R natural color imagery product

The ABI will have blue and red bands, but no green band. Thus, it will not be possible to provide a true color image. However, as part of the AWG imagery team, a method to accurately estimate the green band from neighboring bands has been developed. A look-up table (LUT) approach is used, where the green band is estimated from the blue, red and near-IR bands. The green band estimated from the LUT is then combined with the red and blue bands to produce a natural color image. This algorithm will be tested using MODIS data to create storm-centered natural color images. MODIS contains the green band so actual true color images will also be produced for comparison. These products will be distributed as part of the RAMMB/CIRA tropical cyclone real time web page, which is also used to display a number of other experimental tropical cyclone forecast products. Further details on the color algorithm are described by Hillger et al. (2011)

3.3.2 Red-Blue-Green (RGB) air mass product

The air mass product is an RGB composite based upon data from infrared and water vapor channels from Meteosat Second Generation (MSG). Originally designed and tuned to monitor the evolution of extratropical cyclones, in particular rapid cyclogenesis, jet streaks and PV (potential vorticity) anomalies by scientists at European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), it is also useful for tropical/subtropical applications as the product highlights differences between dry, tropical and cold air masses. This is accomplished by differencing the two water vapor channels (i.e., ch. 5 at 6.2 μm and ch. 6 at 7.3 μm) as depicted in the red colors, where red is associated with dryer air mass conditions locally; by ozone differences by differencing ch. 8 at 9.7 μm and ch. 9 at 10.8 μm, where green indicates low ozone & typically thus tropical air masses; and by using ch. 5 at 6.2 μm to indicate gross air mass temperature differences. The air mass product helps discriminate tropical air masses (i.e., moist and lower ozone) that are predominantly green, from subtropical air masses (i.e., dryer) that are depicted as greenish red, and mid-latitude air masses, which typically have more blue colors. For tropical applications the RGB product should be helpful in determining and tracking the origin of air parcels as they interact with tropical systems, and improve identification of shallow upper-level features (cold lows and jets streaks). For more information on the interpretation of this product see Kirkman (cited 2010). The use of this product in the GOES-R proving ground will provide important feedback concerning how similar products may be tuned for improved use in tropical applications.

This product was also demonstrated in the 2010 NHC PG in Google Earth format. Forecaster feedback indicated that it would be more convenient if the product could be made available in N-AWIPS format. In 2011, this product will be generated from SEVIRI data at SPoRT and converted to N-AWIPS format. The N-AWIPS files will be posted on an ftp server for download by NHC. CIRA has also adapted this product to the GOES sounder, which will provide data over the U.S. and near coastal waters. The sounder air mass product will be produced at CIRA and sent to SPoRT for conversion to N-AWIPS and distribution to NHC via ftp.

3.3.3 RGB dust product

The dust product is an RGB composite based upon infrared channel data from the Meteosat Second Generation satellite. It is designed to monitor the evolution of dust storms during both day and night. The Dust RGB product makes use of channel differences that are close to IR windows near 8.7 μm and 10.8 μm. The resulting product depicts dust in magenta and purple colors over land during day and night, respectively. A dusty atmosphere can also be tracked the

over water as magenta coloring. For more information on interpretation see Kirkman et al. (cited 2010). The dust product will allow for the monitoring of dust storms over the African continent and tracking of dust plumes into the tropical Atlantic waters where easterly waves move and sometimes develop into tropical cyclones. The dust serves as a tracer for a dry low- to mid-level air that originates over the Sahara Desert and has radiative influences on the atmosphere and affects the microphysics of cloud development. Dust plumes in the tropical Atlantic have been hypothesized to slow tropical cyclone development (Dunion and Velden 2004) and directly affect sea surface temperatures (SSTs) where tropical cyclones form (Evan et al. 2008). The RGB dust product will be delivered by SPoRT in the same N-AWIPS format described in 3.3.2 for the air mass product.

3.3.4 Saharan Air Layer Product

The Saharan Air Layer (SAL) product is another example of an enhanced image product potentially related to tropical cyclone evolution. The SAL product uses a split window (10.8 and 12.0 μm) algorithm to identify and track dry, dusty air (e.g., Saharan dust outbreaks) in the lower to middle levels of the atmosphere. These dust outbreaks traverse the Atlantic Ocean from east to west and can reach as far west as the western Caribbean, Florida, and Gulf of Mexico during the summer. There is evidence that they can negatively impact tropical cyclone activity in the North Atlantic. This product can also be used to track low- to mid-level dry air (usually dust-free) that originates from the mid-latitudes. Dry (and possibly dusty) air is indicated by yellow to red shading in the SAL product. Similar to the air mass product, the SAL product is not directly related to the mandatory baseline or option 2 products, but will be possible from GOES-R, and will provide experience with image visualization techniques. The SAL product will be delivered to NHC via a web page at CIMSS:
http://tropic.ssec.wisc.edu/real-time/sal/m8goesr_split/m8splitjava5.html

3.3.5 Rapid Intensification Index

A prototype rapid intensification index (RII) will be run in near-real time to demonstrate a decision aid using proxy GLM data from various sources. These data are combined in a discriminant analysis algorithm that provides optimal weights of the independent variables to provide a classification of whether or not a tropical cyclone will rapidly intensify (defined as an increase in intensity of $\geq$ 30 kt) in the next 24 hours. This RII algorithm is very similar to an operational guidance product available to NHC. However, the operational algorithm does not include lightning data. The comparison of operational and experimental RII products will provide an estimate of the utility of lightning data for rapid intensity prediction. This product represents an application of one of the GOES-R baseline products. The RII is a text product that will be provided via a web page at CIRA that is already being used by NHC to obtain experimental products as part of the NOAA Joint Hurricane Testbed. This development of the RII with lightning input is being supported by the GOES-R Risk Reduction program.

3.3.6 Pseudo natural color imagery product

Although the natural color product described in 3.3.1 is very close to what will be available from GOES-R, the use of MODIS data provides limited time resolution. To provide additional experience with color products with improved time resolution, a pseudo natural color product developed from SEVIRI data will be produced. Although not a quantitative algorithm like the MODIS-based natural color products, four SEVIRI bands (2 visible: 0.6 and 0.8 μm and 1 IR: 1.6 μm) are combined and special enhancement tables are applied to highlight ocean, land, aerosol, and cloud features in colors that are qualitatively similar to those in true color imagery. The 3.9 μm channel will be used to supplement the visible and near-IR channels by providing continuous

coverage through the nighttime hours. This product will be made available via a web page at CIMSS:
http://tropic.ssec.wisc.edu/real-time/sal/m8goesr_natcol/m8natcoljava5.html

4 Proving Ground Participants

The Proving Ground participants are broken into two categories, Providers and Consumers. Providers are those organizations that develop and deliver the demonstration product(s) and training materials to the consuming organization. The Consumers are those who work with the providers to integrate the product(s) for demonstration into an operational setting for forecaster interaction. For the Summer/Fall Experiment at the NHC, there are four providers, CIRA, CIMSS, SPoRT and Cooperative Institute for Marine and Atmospheric Studies (CIMAS), and there is one consumer, the NHC.

4.1 CIRA

CIRA will be providing the following products to the NHC for demonstration and evaluation during the 2011 Hurricane Season.

4.1.1 Super Rapid Scan Imagery

CIRA will be involved in arranging the schedules for the super rapid scan operations (SRSO) data, in coordination with NHC and the NESDIS Office of Satellite Operations (OSO). CIRA will also archive the SRSO data for later use in research and training activities.

4.1.2 GOES-R Natural Color Imagery Product

The natural color product will be produced at CIRA and made available as part of their tropical cyclone real time products web page (http://rammb.cira.colostate.edu/products/tc_realtime/). This web page is used to demonstrate a number of experimental satellite products and NHC already has some experience using it. The page is organized by ocean basin and includes products for global tropical cyclones. Although the emphasis of the NHC PG is on the Atlantic and eastern Pacific, the natural color products will be produced globally.

4.1.3 RGB Air Mass Product

The RGB Air Mass product is generated from MSG channels 5 (WV6.2), 6 (WV7.3), 8 (IR9.7), and 9 (IR10.8). The raw imagery is ingested from NESDIS operational servers and generated using the Man computer Interactive Data Access System (McIDAS) and the following recipe:

Beam	Channel	Range	Gamma
Red	WV6.2 – WV7.3	-25 ... 0 K	1
Green	IR9.7 – IR10.8	-40 ... +5K	1
Blue	WV6.2	+243 ... +208 K	1

The channel differences are scaled over the ranges provided above and the individual color composites are created in satellite projection. These components are then remapped onto a 3-km rectilinear grid. These remapped components are then combined to create a composite RGB. The Air Mass product will be generated at SPoRT in an N-AWIPS format and distributed to NHC via an ftp server. CIRA will obtain this same data from SPoRT for quality control and archive, and will be responsible for coordination with NHC to obtain user feedback. CIRA will also

generate a version of the product from GOES-east and –west sounder data and send that to SPoRT for conversion to N-AWIPS format and distribution to NHC.

Depending on the availability of NHC technical support, the implementation of a system to get the data from SPoRT and display it on their local systems may not be in place by the start of the NHC PG. The Google Earth format used in 2010 is already available and can be used as a stop-gap in case of delay of the availability of the product in the NHC N-AWIPS system. The Google Earth version of the product is available from
http://rammb.cira.colostate.edu/products/google_earth/nhc/

4.1.4 RGB Dust Product

The RGB Dust product is generated from MSG channels 7 (IR8.7), 9 (IR10.8), and 10 (IR12.0). The raw imagery is ingested from NESDIS operational servers and generated using MCIDAS and the following recipe.

Beam	Channel	Range	Gamma
Red	**IR12.0 – IR10.8**	**-4 .... +2 K**	**1**
Green	**IR10.8 – IR8.7**	**0 .... +15 K**	**2.5**
Blue	**IR10.8**	**+261 ... +289 K**	**1**

The use of a gamma factor other than one means that the scaled difference is stretched using a power of $1/\gamma$ [e.g., in this case $\delta^{1/\gamma}$, where δ is scaled brightness temperature difference (i.e., 0 to 1 over a range of 0 to 15 K)]. The same distribution and evaluation process as described in Section 4.1.3 will be used for the Dust Product, although there not will be a GOES sounder version of this product. Similar to the Air Mass Product, this will be available in Google Earth format at http://rammb.cira.colostate.edu/products/google_earth/nhc/ for use until the N-AWIPS version from SPoRT is ingested at NHC.

4.1.5 Rapid Intensification Index

A prototype rapid intensification index will be run in near real time to demonstrate a decision aid using proxy GLM data. The lightning data will be from the World Wide Lightning Location Network (WWLLN) feed that is already established at CIRA through a commercial data purchase by the GPO. The product will also use input from other sources, including GOES imagery and NCEP model fields. This product represents an application of one of the GOES-R baseline products. The operational RII is provided to NHC in a text format via an ftp process from the NCEP IBM computer system located in Maryland. The experimental RII will be provided in a similar format via ftp from CIRA (ftp://rammftp.cira.colostate.edu/demaria/NHCPG/). A quantitative evaluation of the product will be performed by CIRA and RAMMB following the season.

4.2 CIMSS

CIMSS will be providing several of the products demonstrated in the NHC PG Experiment and they are described below.

4.2.1 Hurricane Intensity Estimate

The HIE will be run in real-time at UW/CIMSS in Madison, WI, during Atlantic tropical cyclone events. It will be automatically activated upon NHC declaring any such system a Tropical Depression or greater strength. Estimates will be provided at 15-minute intervals, simulating

what will be possible with GOES-R. The SEVIRI version of the HIE will run until target storms reach 60W, after which the viewing angle from Meteosat becomes suspect. For storms further west and north of 15N, the HIE will be run on 15-min GOES-east CONUS data. Forecasters at the NOAA National Hurricane Center (NHC) will be able to access the real-time Meteosat ADT/HIE output via a dedicated web site at CIMSS (http://tropic.ssec.wisc.edu/real-time/adt/goesrPG/adt-PG.html). The product format will follow the convention of the current ADT output and displays; a format that NHC is already familiar with.

Forecasters participating in the GOES-R Proving Ground demo at NHC will provide a brief evaluation of the proxy HIE performance at the end of the 2011 Atlantic hurricane season. The Tropical Analysis and Forecast Branch (TAFB) at NHC is primarily responsible for satellite-based tropical cyclone intensity estimates, so a TAFB representative will provide this feedback.

4.2.2 Overshooting Tops

The OT algorithm and related output products are new this year and will be generated at CIMSS using 15-min. SEVIRI data over the tropical North Atlantic east of 55W. These products will be made available via a CIMSS web page (http://cimss.ssec.wisc.edu/goes_r/proving-ground/nhc/ot/).

4.2.3 Saharan Air Layer Product

The SAL product will be generated in real-time at UW/CIMSS in Madison, WI in coordination with CIMAS. The imagery will be derived from Meteosat SEVIRI channels (simulating GOES-R ABI), and will be produced every 15 minutes, include a capability for looping (2-3 and 12 hr loops). The images will be made available to NHC via a CIMSS web page: (http://tropic.ssec.wisc.edu/real-time/sal/m8goesr_split/m8splitjava5.html

This product is also available in Google Earth format from:
http://rammb.cira.colostate.edu/products/google_earth/nhc/

Forecasters participating in the GOES-R Proving Ground demo at NHC will provide a brief evaluation of the proxy SAL product at the end of the 2011 Atlantic hurricane season.

4.2.4 Pseudo Natural Color Imagery Product

The generation, distribution and evaluation of this product is analogous to that for the SAL product. It will be produced at CIMSS in coordination with CIMAS and provided on a CIMSS web page:
http://tropic.ssec.wisc.edu/real-time/sal/m8goesr_natcol/m8natcoljava5.html

NHC forecasters will provide product feedback of the Pseudo Natural Color Product at the end of the 2011 Atlantic hurricane season.

4.3 SPoRT

NASA SPoRT will be supporting the NHC demonstration of GOES-R product by providing the RGB air mass and dust products in N-AWIPS format and making them available to NHC via ftp. They will also coordinate with CIRA on the product archival.

4.4 CIMAS

CIMAS will be responsible for generating the SAL and Pseudo Natural Color Imagery Products and the development of training on those products.

4.5 NHC

The NHC will be providing one of the six products demonstrated in the NHC PG Experiment and it is described below.

4.5.1 Super Rapid Scan imagery

The SRSO and RSO data can be made available through the existing NHC GOES ingest and display systems. The collection and display of this data will provide forecasters with experience with the higher time resolution imagery that will be available from GOES-R. The SRSO and RSO data archived at CIRA will also be provided to NHC for training.

5 Responsibilities and Coordination

5.1 Project Authorization

- Jack Beven; Hurricane Specialist, NHC
- Steve Goodman; GOES-R Chief Scientist and PG Program Manager

5.2 Project Management

- Mark DeMaria; NOAA/NESDIS/STAR/RAMMB
- Renate Brummer; CIRA/Colorado State University (CSU)

5.3 Technical Support at NHC

- Jiann-Gwo Jiing; Technical Support Branch Chief, NHC
    - Implementation of all product delivery mechanisms at NHC will be coordinated with the TSB Chief

5.4 Additional POCs

- Jack Beven – Primary NHC focal point
    - Coordinate with other hurricane specialists as well as forecasters from the NHC Tropical Analysis and forecast Branch.
- Michael Brennan – Alternate focal point at NHC
    - Assist Jack in planning, preparation, and execution
- Andrew Levine – NHC focal point for the Tropical Analysis and Forecast Branch (TAFB)
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- Mark DeMaria (NOAA/NESDIS/STAR/RAMMB)
    - Overall NHC PG project management
    - Lightning-based rapid intensification index
- John Knaff (NOAA/NESDIS/STAR/RAMMB)
    - MSG product generation
    - POC for Super Rapid Scan Imagery
- Don Hillger (NOAA/NESDIS/STAR/RAMMB)
    - GOES-R true color algorithm
- Debra Molenar (NOAA/NESDIS/STAR/RAMMB)
    - Technical support
- Andrea Schumacher (CIRA/CSU)
    - Overshooting tops interpretation, CIRA product training
- Kevin Micke (CIRA/CSU)
    - Technical support
- Jason Dunion (U. of Miami, CIMAS-NOAA/Hurricane Research Division)
    - Coordinate with CIMSS and CIRA on demonstrating RGB aerosol/dust product

    - Saharan air layer product
    - Pseudo natural color imagery product
- Chris Velden (U. Wisconsin, CIMSS)
    - POC for HIE and overshooting tops product
- Gary Jedlovec (SPoRT)
    - Provision of RGB products in N-AWIPS format

5.5 Product Evaluation

- Jack Beven; Hurricane Specialist, NHC/HSU
- Michael Brennan; Hurricane Specialist, NHC/HSU
- Andrew Levine, Forecaster, NHC/TAFB
- Mark DeMaria; NOAA/NESDIS/STAR/RAMMB
- John Knaff; NOAA/NESDIS/STAR/RAMMB
- Chris Velden; U. Wisconsin, CIMSS
- Jason Dunion; CIMAS and NOAA/Hurricane Research Division

5.6 Product Training

Similar to the 2010 NHC PG, a two-tiered approach will be taken for the training. A general overview of the products will be provided to NHC forecasters from the product producers via a conference call and GoToMeeting. The training session will be about one hour long and occur shortly before the start of the NHC PG on August 1st. More detailed product descriptions will be provided via web pages as described below.

5.6.1 Hurricane Intensity Estimate

Training on this product will be available on the CIMSS product page of the Proving Ground web page http://cimss.ssec.wisc.edu/goes_r/proving-ground/products_list.html. This training will include links to documentation on the ADT, which is very similar to the HIE. Training on the HIE will also be part of the PowerPoint presentation that will be provided to the Forecasters before the start of the experiment period.

5.6.2 Super Rapid Scan Imagery

NHC is already very familiar with rapid scan imagery from GOES, so little training will be needed. A brief description and links to examples of SRSO data from tropical cyclones is available from
http://rammb.cira.colostate.edu/research/goes-r/proving_ground/cira_product_list/super_rapid_scan_imagery.asp

5.6.3 Overshooting Tops

Training on this product is available from the CIMSS web page at
http://cimss.ssec.wisc.edu/goes_r/proving-ground/nhc/ot/TOT_tutorial.html

5.6.4 GOES-R Natural Color Imagery Product

Training on this product is available on the CIRA PG products web page
http://rammb.cira.colostate.edu/research/goes-r/proving_ground/cira_product_list/.

5.6.5 RGB Air Mass

Training on this product is available on the CIRA Proving Ground products web page
http://rammb.cira.colostate.edu/research/goes-r/proving_ground/cira_product_list/msg-based_rgb_air_mass_product.asp . This training includes links to EuMetSat Training from which the product was derived and general RGB training at COMET.

5.6.6 RGB Dust

Training on this product is available on the CIRA Proving Ground products web page http://rammb.cira.colostate.edu/research/goes-r/proving_ground/cira_product_list/msg-based_rgb_dust_product.asp.

5.6.7 Saharan Air Layer

Training on this product will be available from the CIMSS Proving Ground products page at: http://cimss.ssec.wisc.edu/goes_r/proving-ground/products_list.html

5.6.8 Rapid Intensification Index

Training on this product is available on the CIRA product page at http://rammb.cira.colostate.edu/research/goes-r/proving_ground/cira_product_list/nhc_lightning-based_tc_intensity_prediction.asp . Links to training on the operational version of the rapid intensity index will also be provided.

5.6.9 Pseudo Natural Color Imagery Product

Training on this product will be available on the CIMSS PG product page http://cimss.ssec.wisc.edu/goes_r/proving-ground/products_list.html.

5.6.10 General Sources

- Training materials on most products are already available on the GOES-R Proving Ground web page using the template for the other PG products. Training on the remaining products will be produced in similar format.
- Links are provided in the PG training pages to more in-depth material.
- Links are provided to COMET training on RGB products.
- Links are provided to EUMETSAT training on related Meteosat products.
- Links are provide to journal articles on the rapid intensity index.

6 Project Schedule

There are many activities that lead up to the successful execution of the NHC 2011 Hurricane Season PG Experiment such as identifying participants, coordinating schedules, delivering and integrating algorithms and products, and developing and delivering training materials. These specific activities are identified in the table below.

Table 6.1 2011 NHC Project Timeline

Date	Task
Mar 2011	Preliminary discussion of products for the 2011 NHC PG during the Interdepartmental Hurricane Conference (completed)
May 2011	Final selection of 2011 NHC PG Products (completed)
Jul 1-31, 2011	Implementation and testing of real time products
Jul 22, 2011	Completion of PG product link pages at NHC
Jul 25, 2011	Completion of N-AWIPS product implementation by NHC
Jul 27, 2011	Live product overview training to NHC forecasters from providers via conference call
Aug 1, 2011	NHC PG Begins
Sep, 2011	Mid-project review at NHC

Oct 15, 2011	Mid-year report completed
Nov 30, 2011	NHC PG Ends
Jan, 2012	Conference call with NHC on preliminary results
Feb 24, 2012	Final report completed
Mar 2012	Presentation of PG summary at the Interdepartmental Hurricane Conference

7 Milestones and Deliverables

7.1 Products from Providers

Products to be demonstrated within this year's Experiment should be delivered to NHC no later than August 1st.

7.2 Training materials from Providers

Each product delivered to the GOES-R PG Experiment will be accompanied by related training material. NHC forecasters and scientists participating in the Experiment may not be familiar with the products; therefore, it is important that they receive training in order to properly evaluate product performance during real-time forecasting exercises. Training on each of the products being demonstrated will occur in late July, in coordination with Jack Beven and Michael Brennan. This will consist of a PowerPoint presentation of no longer than 60 minutes in length and will be presented by participating product experts. In addition, a short write-up explaining how the product works and its uses, including example images, will be provided for distribution amongst the NHC forecasters for reference via web pages.

7.3 Mid-term evaluation report

A mid-term evaluation report shall be provided to the project authorization team at the date specified within the operations plan timeline. This report shall detail the current status and progress of the GOES-R PG Experiment activities and suggest changes if needed. This will be coordinated by a visit to NHC in mid-September.

7.4 Final report

A final report detailing the GOES-R PG NHC 2011 Hurricane Season Experiment activities during the entirety of the experiment shall be provided to the GOES-R Program Office at the date specified within the operations plan timeline. This report will discuss how each product was demonstrated within the various experiments. The report will also present feedback provided by participants of the Experiment as well as suggestions for improvements upon the GOES-R PG Experiment activities for years to come. This feedback will be captured by Jack Beven and Michael Brennan during their interactions with the participants throughout the Experiment timeframe, in coordination with Mark DeMaria and the product developers. The developers will assist with quantitative evaluations where possible. In particular, the HIE and GLM rapid intensity forecast product provide quantitative information that can be evaluated statistically following the experiment.

8 Related activities and methods for collaboration

The NHC is also involved in a number of other demonstration projects including the Joint Hurricane Testbed (JHT) and the Hurricane Forecast Improvement Project (HFIP). Efforts will be made to coordinate those activities with the PG to make sure the forecasters are not overwhelmed

with the evaluation of experimental product evaluations. The mid-project review planned for mid-September will be used to determine if adjustments to the PG are needed.

9 Summary

This year's GOES-R PG Experiment activities at the NHC will support the PG effort to demonstrate the defined GOES-R products within an operational framework through various experimental programs. Feedback gathered from these activities will aid in successful product training for forecasters as well as improvements in product performance by product developers.

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