Operations Plan

for the
GOES-R Proving Ground
portion of the
Hazardous Weather Testbed and
2013 Spring Experiment

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1 Introduction

1.1 Plan Purpose and Scope

The Spring Experiment activity at the National Oceanic and Atmospheric Administration's (NOAA's) Storm Prediction Center (SPC) and Hazardous Weather Testbed (HWT) in Norman, OK provides the GOES-R Program with a Proving Ground (PG) for demonstrating pre-operational data and algorithms associated with GOES-R. The main focus of the Experiment will be demonstrating the GOES-R baseline and future capabilities products; however, it will also include operational readiness trials of products transitioning from the GOES-R Risk Reduction program. The availability of GOES-R products will demonstrate, pre-launch, a portion of the full observing capability of the GOES-R system, subject to the constraints of existing data sources to emulate the satellite sensors.

1.2 Overview

The Experimental Warning Program (EWP) and the Experimental Forecast Program (EFP) within the HWT will receive early exposure to GOES-R PG products during the 2013 Spring Experiment running from May through June. Pre-operational demonstrations of these GOES-R PG data will provide National Weather Service (NWS) operational forecasters at the SPC and from multiple Warning Forecast Offices (WFOs) at the HWT an opportunity to critique and improve the products relatively early in their development. This year, the Experiment will run from 6 May – 24 May 2013 and the focus is to again demonstrate and test GOES-R Proving Ground products within an operational framework while collaborating with broader warning/forecast community within other Spring Experiment entities. Additionally, this year will include training and evaluations on baseline and future capabilities products, as well as collaborations with developers on potential Day-2 products via development of a Weather Event Simulator (WES) case to be distributed to potential participants prior to arrival. This year the GOES-R products will be demonstrated within a real-time AWIPS-II framework within the HWT. In the absence of a satellite champion at HWT/SPC, Kristin Calhoun, Greg Stumpf and Darrel Kingfield at CIMMS/NSSL will be coordinating Proving Ground activities in Norman for the EWP. During the experiment, GOESR liaisons from other locations (Amanda Terborg during weeks 1 and 2, Chad Gravelle during week 3) will be visiting to provide additional documentation and project expertise for visiting forecasters. The final report will be compiled by the new GOESR HWT / SPC liaison, William Line, and disseminated in August 2013.

2 Goals of Proving Ground Project

There are many products competing for the attention of the WFO and SPC forecasters. This year will focus on demonstrating the GOES-R baseline and future capabilities products selected for this year's activities and identified in Table 1. This strategy has the best chance of maximizing the Operations-to-Research feedback that is one of the PG goals. The most important aspect of the interactions this spring will be to build relationships between each key product development team and the diverse user groups within both the HWT and the broader weather community. Thus, we envision that each visitor will participate in each of the existing HWT programs' experimental activities and discussions (in particular regarding satellite-based products) to improve integration of GOES-R PG effort in these HWT activities in future years.

3 GOES-R products to be demonstrated

There are three GOES-R baseline and future capabilities products identified to be demonstrated during the Spring Experiment. Additionally, the Spring Experiment will also demonstrate GOES-R Risk Reduction (R3) and GOES I/M Product Assurance Plan (GIMPAP) products. These products are listed in Table 1 and described further in the following subsections.

Table 1. Products to be demonstrated during Experiment

Demonstrated Product	Category
Cloud and Moisture Imagery	Baseline
Lightning Detection (PGLM)	Baseline
Total Lightning Tracking Tool	GOES-R Risk Reduction
Convective Initiation Nowcasting	Future Capabilities
Nearcasting Model	GOES-R Risk Reduction
Weather Research and Forecasting (WRF) based lightning threat forecast	GOES-R Risk Reduction
Cloud Top Cooling (University of Wisconsin)	GIMPAP
Sounder RGB Airmass	
Category Definitions: **Baseline Products** - GOES-R products that are funded for operational implementation as part of the ground segment base contract. **Future Capabilities Products** - New capability made possible by ABI as option in the ground segment contract. Option 1 in the ground segment contract will provide reduced product latency. **GOES-R Risk Reduction** - The purpose of Risk Reduction research initiatives is to develop new or enhanced GOES-R applications and to explore possibilities for improving the AWG products. These products may use the individual GOES-R sensors alone, or combine data from other in-situ and satellite observing systems or models with GOES-R. **GIMPAP** - The GOES Improved Measurement and Product Assurance Plan provides for new or improved products utilizing the current GOES imager and sounder	

3.1 Cloud and Moisture Imagery

Simulated cloud and moisture imagery from the Advanced Baseline Imager (ABI) will be provided for use in the Spring Experiment. This effort provides the GOES-R Proving Ground with direct collaborations within the modeling community, as synthetically produced satellite imagery can provide insight into model performance. Additionally, band differences between select GOES-R IR channels will also be provided to further analyze microphysical performance within the model, as well as simulate the capabilities of GOES-R IR channels to provide additional information to the forecasting community. The specific band differences will be determined by the product developers.

For UW-CIMSS, the radiance calculation for each ABI infrared channel involves several steps within the forward modeling system. First, CompactOPTRAN, which is part of the NOAA Community Radiative Transfer Model (CRTM), is used to compute gas optical depths for each model layer from the WRF-simulated temperature and water vapor mixing ratio profiles and climatological ozone data. Ice cloud absorption and scattering properties, such as extinction efficiency, single-scatter albedo, and full scattering phase function, obtained from Baum et al. (2006) are subsequently applied to each frozen hydrometeor species (i.e. ice, snow, and graupel) predicted by the microphysics parameterization scheme. A lookup table based on Lorenz-Mie calculations is used to assign the properties for the cloud water and rain water species.

Visible cloud optical depths are calculated separately for the liquid and frozen hydrometeor species following the work of Han et al. (1995) and Heymsfield et al. (2003), respectively, and then converted into infrared cloud optical depths by scaling the visible optical depths by the ratio of the corresponding extinction efficiencies. The longer path length for zenith angles > 0 is accounted for by scaling the optical depth by the inverse of the cosine of the zenith angle. The surface emissivity over land was obtained from the Seeman et al. (2008) global emissivity data set, whereas the water surface emissivity was computed using the CRTM Infrared Sea Surface Emissivity Model. Finally, the simulated skin temperature and atmospheric temperature profiles along with the layer gas optical depths and cloud scattering properties were input into the Successive Order of Interaction (SOI) forward radiative transfer model (Heidinger et al. 2006) to generate simulated TOA radiances for each ABI infrared band. The cloud and moisture imager is then derived from the TOA radiances.

The CIRA procedure for creating the synthetic ABI data is similar to that described above for CIMSS. A version of the CRTM is used for the gaseous absorption, with specialized procedures for the cloudy atmosphere. The CIRA procedure reads numerical model output from the 4-km NSSL WRF and the 4-km NAM Nest, and then calculates synthetic brightness temperatures from several of the GOES-R ABI bands. For the SPC Proving Ground, the imagery is restricted to IR channels.

An automated system has been developed by a team of collaborators from CIRA, NASA, National Severe Storms Laboratory (NSSL), and SPC, and the simulated GOES-R output produced by the system will be delivered during the 2013 Spring Experiment. For the EFP, CIRA is providing (in N-AWIPS format) a simulated Infrared and Water Vapor band using output from the 4-km NAM Nest model, in addition to a 10.35-12.3 µm ABI band difference product based on output from the 4-km NSSL WRF. This band difference will be evaluated for its value in identifying low-level water vapor convergence and how that relates to Convective Initiation. For the EWP, CIRA is converting simulated 6.95 µm and 10.35 µm imagery from the NSSL WRF into a format readable by AWIPS-2 and delivering it via the LDM. The NSSL WRF forecast goes from 9- to 36-hours, and the NAM Nest output goes out to 60-hours.

3.2 Lightning Detection

A demonstration for the GOES-R Geostationary Lightning Mapper (GLM) will be evaluated during the Spring Experiment at the HWT. This product takes the raw total lightning observations, or sources, from any of the ground-based Lightning Mapping Array (LMA) networks available to the EWP and recombines them into a flash extent gridded field. These data are mapped to a GLM resolution of 8 km and will be available at 1 or 2 min refresh rate with approximately a 2-3 min latency, depending on the ground-based network being used. With the flash data, when a flash enters a grid box, the flash count will be increased by one. Also, no flash is counted more than once for a given grid box. The pseudo GLM is not a true proxy data set for the GLM as it does not attempt to create a correlation between the VHF ground-based networks and the eventual optical-based GLM (individual events, groups, flashes at 20 second latency). However, the pseudo GLM product will give forecasters the opportunity to use and critique a demonstration of GLM type data to help improve future visualizations of these data. Additionally, experience gained using LMA-based 8-km products will serve as an idea farm and reference for comparison with full GLM proxies and derived products. Products expected to be produced include 8-km flash extent density, flash initiation density, and 60-minute flash extent density track.

3.3 Convective Initiation

The University of Alabama in Huntsville (UAHuntsville), in collaboration with NOAA's Earth System Research Laboratory (ESRL) and Cooperative Institute for Meteorological Satellite Studies (CIMSS), is working on a bilateral approach to diagnosing and forecasting convective initiation. To better forecast convection in the 0-6 hour time period and beyond, satellite interest fields defined in Mecikalski and Bedka (2006) and Walker et al. (2012) are being assimilated experimentally into the Rapid Refresh (RAP) model. However, this is ongoing research that is not yet ready for proving ground activities. On the other hand, the proxy GOES-R CI Nowcasting portion of the project, based on the heritage of the algorithm called SATellite Convection Analysis and Tracking (SATCAST), is ready for operations in the 2013 Hazardous Weather Testbed GOES-R Proving Ground.

Rather than rely strictly on IR satellite interest fields (see Walker et al. 2012), the proxy GOES-R CI Nowcasting algorithm has now fused NWP data into the product. Previous versions of the SATCAST algorithm relied heavily on satellite-only observations, with early versions only producing binary yes/no CI forecasts, while recent upgrades used a logistic regression approach to the satellite interest fields to create a "Strength of Signal" value (0-100). In 2012, the "Strength of Signal" used only 5 satellite interest fields within the logistic regression, including cloud-top temperature, cloud-top cooling, 6.5-10.7 μm spectral difference, 13.3-10.7 μm spectral difference, and the 15-minute trend of the 13.3-10.7 μm spectral difference. The new proxy GOES-R algorithm not only increases the number of satellite fields by including cloud type information at times 1 and 2 and cloud object size at times 1 and 2, but also includes 15 NWP variables from the RAP model, including CAPE, CIN, and LI among others. Incorporating model data provides more information to the nowcasting algorithm, which in turn should provide better forecasts. The logistic regression equation used within the algorithm was created using a training dataset of nearly 10,000 cloud objects, and will be updated as the database can be updated. Future upgrades to the algorithm will include incorporating the GOES-R cloud properties into algorithm, which will help identify the physical processes occurring at cloud-top, which can be a source of information of future cloud development (Mecikalski et al. 2013)

UAHuntsville has participated in past HWT spring experiments. This year's product is the result of the continuous feedback we have received after each experiment we have attended. We anticipate the GOES-R CI Nowcasting product will help forecasters with decision support and help them focus on what areas need to be monitored for future thunderstorm growth.

3.4 Nearcasting Model

A NearCasting model that assimilates full resolution information from the current 18-channel GOES sounder and generates 1-9 hour NearCasts of atmospheric stability indices will be included in the Spring Experiment. Products generated by the NearCast model have shown skill at identifying rapidly developing, convective destabilization up to 6 hours in advance. The system fills the 1-9 hour information gap, which exists between radar nowcasts and longer-range numerical forecasts. NearCasting systems must be able to detect and retain extreme variations in the atmosphere (especially moisture fields) and incorporate large volumes of high-resolution asynoptic data while remaining computationally efficient. The NearCasting system uses a Lagrangian approach to optimize the impact and retention of information provided by GOES sounder. It also uses hourly, full resolution (10-12 km) multi-layer retrieved parameters from the GOES sounder. Results from the model enhance current operational NWP forecasts by successfully capturing and retaining details (maxima, minima and extreme gradients) critical to the development of convective instability several hours in advance, even after subsequent IR satellite observations become cloud contaminated.

3.5 WRF-based Lightning Threat Forecast

The WRF based lightning threat forecast is a model-based method for making quantitative forecasts of fields of lightning threat. The algorithm uses microphysical and dynamical output from high-resolution, explicit convection runs of the WRF Model conducted daily during the 2013 Spring Experiment. The algorithm uses two separate proxy fields to assess lightning flash rate density and areal coverage, based on storms simulated by the WRF model. One field, based on the flux of large precipitating ice (graupel) in the mixed phase layer near -15C, has been found to be proportional to lightning flash peak rate densities, while accurately representing the temporal variability of flash rates during updraft pulses. The second field, based on vertically integrated ice hydrometeor content in the simulated storms, has been found to be proportional to peak flash rate densities, while also providing information on the spatial coverage of the lightning threat, including lightning in storm anvils. A composite threat is created by blending the two aforementioned threat fields, which is then thresholded appropriately to ensure threat areal coverage is approximately accurate.

3.6 UW-Cloud Top Cooling (UW-CTC) Rates

The UW-Cloud Top Cooling (CTC) rate product has been delivered to the HWT spring experiment for iterative feedback from operational forecasters. This input and feedback from operations is critical for improving this experimental product and preparing forecasters for GOES-R CI decision support information and gauging utility of satellite growth rates as predictors toward future storm intensity.

The UW-CTC algorithm is an experimental satellite based product used to diagnose infrared brightness temperature cloud top cooling rates and nowcast convective initiation (Sieglaff et al. 2011, 2013). The UW-CTC algorithm uses GOES imager data to determine immature convective clouds that are growing vertically and hence cooling in infrared satellite imagery. Additionally, cloud phase information is utilized to deduce whether the cooling clouds are immature water clouds, mixed phase clouds or ice-topped (glaciating) clouds. Based upon HWT forecaster feedback the UW-CTC algorithm has been improved to operate in areas of thin cirrus clouds during daytime hours by including GOES cloud optical depth retrievals beginning in 2012. The 2013 focus will be using the UW-CTC rates as a prognostic tool for future NEXRAD observations. The two NEXRAD fields of focus will be reflectivity (composite and/or reflectivity at -10°C isotherm) and Maximum Expected Hail Size (MESH). The goal is to show how the relationships of the NEXRAD-based validation of the UW-CTC rates performed by Sieglaff et al. 2013 and Hartung et al. 2013 could potentially be used to increase severe thunderstorm warning lead-time ahead of NEXRAD-only guidance. This concept was successfully introduced in 2012. As such, training materials were updated for 2013 with examples from the 2012 HWT as well as feedback from testbed participants.

3.7 Sounder RGB Airmass

The GOES sounder-based RGB Airmass product is created using the same recipe developed by EUMETSAT for use by Meteosat Second Generation Satellite, but makes use of GOES sounder channels. More specifically the Channel (Ch) 12 - Ch10 difference is stretched over the temperature range -25C to 0C and forms the red component, the Ch9 - Ch8 difference is stretched over the -40C to 5C temperature range and forms the green component, and the Ch12 is stretched over the 243K to 208K range and forms the blue component. Noting that Channels, 8, 9, 10 and 12 correspond to 11.03, 9.71, 7.43 and 6.51 µm wavelengths. By combining CONUS sounder sectors from the GOES East at H-1:46 and from GOES West at H:01, where H is the hour, into a single image the product can be produced hourly over the entire CONSUS region.

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 and provide the product assessments (e.g., testbed operators and forecasters). For the Spring Experiment at the HWT, there are three core providers, CIMSS, NASA's Short-term Prediction Research and Transition (SPoRT) Center and CIRA, and there are two consumers, NSSL-EWP (with NWS Forecast Offices) and SPC-EFP. In addition to the staff located in Norman, two GOESR Proving Ground Liaisons (Amanda Terborg and Chad Gravelle) and multiple project scientists funded by GOES-R Proving Ground, Risk Reduction or Visiting Scientist funding will participate in HWT activities. 18 NWS forecasters round out the experiment team. Interaction between the forecasters and visiting scientists are described in the below for each of the projects.

4.1 CIMSS

CIMSS will provide three products for demonstration in the Spring Experiment and they are described below.

4.1.1 Cloud and Moisture Imagery

00 UTC initialized NSSL WRF ARW NWP model generated ABI synthetic infrared radiances will be prototyped and available via internet quicklook site and McIDAS area format for evaluation. Forecasters can use the derived synthetic satellite data to key in on ABI water vapor or IR window band features of interest such as convective development and location rather then using NWP derived fields. Quicklooks of simulated WRF ABI radiances are available at: http://cimss.ssec.wisc.edu/goes_r/proving-ground/nssl_abi/nssl_abi_rt.html

4.1.2 UW-Cloud Top Cooling (CTC) Rates

The UW-CTC rate products are being delivered in GRIB2 format via the University of Wisconsin LDM to the HWT and SPC and transferred to a format suitable for display in AWIPS II and the NCEP Advanced Weather Interactive Processing System (NAWIPS). Forecasters will evaluate UW-CTC products to determine if the products offer additional lead time in warning processes and provide information for SPC watch determination in marginal convective weather situations.

Outputs to be displayed within AWIPS II (in bold are fields of most interest in 2013):

- **Instantaneous box-averaged cooling rate** (normalized to degrees K / 15 minutes)
- **Accumulated box-averaged cooling rate** (summation of most recent 60 minutes of UW-CTC points; aviation forecasters in recent years often had a preference for the 60 minute accumulated field)

4.1.3 Nearcasting Model

The NearCasting products will be delivered to the HWT and SPC and within the Spring Experiment in GRIB2 format via the University of Wisconsin LDM for display within the EFP N-AWIPS and EWP AWIPS II systems. NearCasting products using GOES data include Low- and Mid-level Total Precipitable Water (TPW), Low- and Mid-level Equivalent Potential Temperature (Theta-E), Convective Instability (the difference between Lower- and Mid-Level Theta-E and a new parameter to diagnose the potential for sustained convection (the product of

Convective Instability and Low-Level Theta-E and TPW. Forecasters will evaluate the NearCasting model products to see if it offers improved spatial and temporal convective initiation forecasts as well as additional watch/warning lead time during severe weather situations. Additional fields containing information about Wind Shear may also be introduced.

4.1.4 Weather Event Simulator (WES) Case

Additionally, CIMSS will be working with NSSL and the Cooperative Institute for Mesoscale Meteorological Studies (CIMMS) to identify a WES training case and provide associated data sets to include Convective Initiation, Cloud and Moisture Imagery and Nearcast. The cases identified from 2011 Spring Experiment will be 24 May 2011.

4.2 NASA SPoRT

NASA SPoRT will provide access to convective initiation (with UAH), lightning (with NSSL/CIMMS and other ground-based LMA data providers) with the AWIPS II visualization plug-in, the total lightning tracking tool, and the sounder RGB airmass (with CIRA) products for demonstration within the EWP and EFP.

4.2.1 Convective Initiation

In collaboration with University of Alabama at Huntsville, SPoRT will provide access to the proxy AWG CI Nowcast algorithm running on GOES to be included for real-time demonstration in the Spring Experiment within AWIPS-II and N-AWIPS systems. 0-1 hour nowcasts of CI for tracked cloud objects will be provided from this AWG CI proxy this year.

4.2.2 WRF-based Lightning Threat Forecast

For the EFP, SPoRT will provide a WRF based lightning threat forecast based on the real-time NSSL forecasts. There will be three output fields based on graupel flux, vertically integrated ice, and a blended combination of the two. These model runs will expose forecasters to the ability to incorporate a short-term prediction of potential lightning activity into their forecasts and the results will be routinely displayed as hourly cumulative maximum gridpoint values, with units of flashes per square km per 5 min, on the NSSL WRF website, www.nssl.noaa.gov/wrf. When available, the lightning threat forecast will be included within the CAPS ensemble output within the EFP on N-AWIPS workstations and evaluated alongside other ensemble output fields.

4.2.3 Lightning Detection

The 2013 EWP continues to build on the multi-agency collaboration that has existed for demonstrating future GLM capabilities. The collaboration draws on data provided by several high frequency (VHF), ground-based total lightning networks across the country. The NASA SPoRT program has worked with each of these partners to bring together the data streams from these networks, process the data into the pseudo-GLM product set, and then visualize through an AWIPS II plug-in. The pseudo GLM is a direct outgrowth from discussions at the 2009 Spring Experiment expressing the need for a flash-based GLM demonstration product. NSSL/CIMMS and SPoRT have utilized a flash creation algorithm to combine the VHF total lightning data into flashes, and then created a flash extent product available at the GLM resolution. The overall emphasis of the pseudo GLM is to provide forecasters the opportunity to use real-time data that is representative of the future capabilities of the GOES-R Lightning Mapper and to provide feedback for visualization tools. In addition to these real-time products, archived data will be utilized by the EWP when real-time events are not available. This will be supported with product training (SPoRT), a WES example (NSSL/CIMMS), and discussions with forecasters during the EWP. It is anticipated that a total lightning / GLM subject matter expert will participate in the EWP each week.

The LMA network data delivery will take place over an established LDM feed to NSSL every 2 minutes, with an average latency of 2-3 minutes.

New for 2013 will be a visualization tool built for AWIPS II designed by NASA SPoRT and the Meteorological Development Laboratory. This tool addresses the primary requests from forecasters in previous evaluations; generating a time series trend of PGLM data in real-time. The total lightning tracking tool is manually implemented by forecasters and relies on forecaster experience for cell tracking. This removes some problems associated with automated cell trackers such as merging and splitting cells. Emphasis will be placed on the forecaster interface for this tool and additional development needed for operational implementation. It is estimated that such a tool could be a useful way of monitoring lightning activity in a given storm cell or cluster and could be used to infer a "lightning jump." Additionally, forecasters will be provided options on the display of lightning from color tables to smoothing factor within the AWIPS2 platform and asked to document their preference and reasons why.

4.2.4 Sounder RGB Airmass

The three components of the hourly GOES Sounder-based RGB products are produced at CIRA. Those components are provided to SPoRT via the LDM. SPoRT creates the combined RGB image that is displayable in N-AWIPS/GEMPAK and makes it available via anonymous ftp and LDM. Processing is complete by about 25 to 30 minutes following the synoptic hour.

4.2.5 Weather Event Simulator (WES) Case

Additionally, SPoRT will be working with UAH, NSSL and the CIMMS to develop a WES training case and provide associated data sets to include the convective initiation, pseudo GLM and sounder RGB airmass products. The case identified from 2011 Spring Experiment will be 24 May 2011.

4.3 CIRA

CIRA and the National Environmental Satellite, Data, and Information Service (NESDIS) Center for Satellite Applications and Research (STAR) Regional and Mesoscale Meteorology Branch (RAMMB), located at Colorado State University in Ft. Collins, CO will be providing cloud and moisture imagery for demonstration within this year's Spring Experiment.

4.3.1 Simulated Imagery

An additional GOES-R Risk Reduction activity, the generation of simulated ABI imagery calculated from WRF radiances will be included in the Spring Experiment. The simulated imagery will be converted to McIDAS AREA format and made available on the CIRA ADDE server, which can then be displayed with the N-AWIPS system during the EFP portion of the Spring Experiment. In addition, simulated imagery in the proper format will be provided via LDM so it can be ingested and displayed in AWIPS-2 as part of the EWP. Simulated satellite imagery calculated from model radiances will provide forecasters with a tool to evaluate model performance, as well as to be able to examine the use of all GOES-R IR bands within an operational framework. Simulated band differences from the synthetic radiance data will also be provided by CIRA to demonstrate the capabilities of GOES-R in detecting atmospheric features using methods not available on the current suite of GOES satellites. Specifically, as part of the 2013 Experimental Forecast Program (EFP), the 10.35-12.3 μm band difference will be examined to help evaluate low-level water vapor convergence, and its potential role in convective initiation.

4.3.2 Weather Event Simulator (WES) Case

Simulated imagery data for the 24 May 2011 WES case was provided by CIRA. The imagery highlights the use of the GOES-R ABI band 9 (6.95 µm) and band 13 (10.35 µm) for model evaluation in a severe weather forecast scenario. In addition to the data, job sheets have been provided to facilitate the training exercise for forecasters.

4.4 National Severe Storms Laboratory - Experimental Warning Program

The primary objective of the EWP is to evaluate the accuracy and the operational utility of new science, technology and products in a testbed setting in order to gain feedback for improvements prior to their potential implementation into National Weather Service (NWS) operations. The EWP brings together 16+ forecasters from NWS Warning Forecast Offices around the country (usually 1-2 from Norman WFO) to participate in the development and trial of new short-term and warning-focused forecast applications. Data (satellite, observational, and model) from new products provided within the EWP enable forecasters to examine a variety of real-time cases at the location(s) with the best opportunity for severe and near-severe weather. In addition, archive cases, or WES cases, are provided to the forecasters to assess applicability of lightning data to other events. Forecasters will be asked to evaluate products in terms of use for early diagnosis, warnings and other forecast applications.

4.5 Storm Prediction Center – Experimental Forecast Program

The EFP focuses on the regional forecast of severe weather from a few hours to a day in advance. For previous years, evaluation and discussion of high-resolution ensemble NWP drove creation of an initial forecast, with updates based on more recent NWP and observational data. Product developer-participants are asked to issue real-time, concrete forecasts of convective behavior. As a product developer becomes invested in the forecast issuance process, many subtleties are illuminated that research-minded scientists might not otherwise have in mind. An afternoon map discussion provides an opportunity for further group discussion about what worked and where forecast products had room for improvement. During this time, it is also expected that the EFP and EWP participants will collaborate on the day’s forecasting issues. Because of the often-diverse perspectives in the room, map discussions facilitate detailed assessment of the soundness of the physical underpinnings of the techniques used in trial products.

This year the EFP’s focus this year will be using ensemble models to drive thunderstorm probabilities for three hour time periods. Two teams of forecasters will be issuing the probabilistic guidance which will then be transferred to the EWP NWS forecasters. Some of the GOESR mesoscale and forecast products (e.g., Nearcast, RGB Airmass, and simulated satellite) may be used by the EFP in the product development phase. The GOESR lightning products will be used for evaluation and verification of the thunderstorm probabilities.

5 Responsibilities and Coordination

5.1 Project Authorization

Russ Schneider – SPC Director
Travis Smith – Program Director EWP
Steve Weiss – Program Director EFP
Steve Goodman – GOES-R Chief Scientist and PG Program Manager

5.2 Project Management

Kristin Calhoun – EWP and temporary GOES-R Liaison to the HWT

Greg Stumpf – EWP Coordinator

5.3 Product Evaluation

Kristin Calhoun - EWP
Steve Weiss – EFP
Chad Gravelle, - Visiting GOES-R Liaison
Amanda Terborg – Visiting GOES-R Liaison

5.4 Project Training

Greg Stumpf – EWP Coordinator
Darrel Kingfield – EWP - WES focal point / AWIPS2 focal point

5.4.1 General Sources

GOES-R training is developed and provided by a number of different partners across the weather enterprise. NOAA, collaboratively through NESDIS and the NWS, partners with the COMET, VISIT, and SPoRT to develop and deliver training on the new features, operations, and capabilities of the GOES-R satellite. Training for the GOES-R Proving Ground Hazardous Weather Testbed Spring Experiment will be developed and provided through e-learning training modules, seminars, weather event simulations, and special case studies.

5.4.2 Product Training References

5.4.2.1 Cloud and Moisture Imagery

UW-CIMSS is providing real-time simulated ABI infrared band data from NSSL WRF ARW thermodynamic profile output.

(1) UW-CIMSS will provide a WES case (beta version). This includes not only simulated data, but a guide as well.
(2) CIRA has provided a WES case from 24 May 2011 highlighting the use of simulated imagery, an Orientation Presentation in Powerpoint Articulate Format, and has put together a VISIT training session titled "Synthetic Imagery for Forecasting Severe Weather."
The 10-min articulate presentation is available here:
https://secure.nssl.noaa.gov/projects/ewp2013/Articulate/SimuSat/player.html
A few options for viewing the session are found here:
http://rammb.cira.colostate.edu/training/visit/training_sessions/synthetic_imagery_in_forecasting_severe_weather/
(3) ABI VISITView from 2003 (somewhat dated) -
http://www.ssec.wisc.edu/visit/briefings/abi03/viewbriefing.html
(4) GOES-R 101 VISITView -
http://rammb.cira.colostate.edu/training/shymet/forecaster_GOESR101.asp
(5) GOES-R ABI VISITView "Classic"
http://www.ssec.wisc.edu/visit/briefings/abi03/viewbriefing.html

5.4.2.2 Lightning Detection

Prior to the start of the Spring Experiment, an online training module articulate presentation for the GLM products will be available. This includes background on the use of total lightning data on forecasters, how the pre-GLM products are created, and how to interpret the output. Forecasters will be able to review the module before arrival for the Spring Experiment. A WES case and associated job sheets developed by NSSL, CIMMS and SPoRT will be distributed to forecasters prior to their arrival for hands on training within their AWIPS systems. Additionally, further in-person training and discussion on total lightning data will be provided to forecasters upon their arrival at the beginning of each shift week.

The 20-min PGLM articulate presentation is available via this link:
https://secure.nssl.noaa.gov/projects/ewp2013/Articulate/PGLM/player.html

5.4.2.3 Convective Initiation

A WES case and the associated job sheets developed by UAH and SPoRT will be distributed to forecasters prior to their arrival for hands on training within their AWIPS systems. UAH will also provide a training session at the HWT Spring Experiment via a PowerPoint presentation. The training package will be available to the forecasters prior to and throughout the duration of the Experiment. The information provided for training within the HWT will help prepare participants for use prior to real-time forecasting exercises. Case examples and an algorithm overview will be the main focus points of the presentation.

The 11-min articulate presentation for UAH-CI is available here:
https://secure.nssl.noaa.gov/projects/ewp2013/Articulate/UAHCI/player.html

5.4.2.4 Nearcasting Model

A WES case and associated job sheets developed by CIMSS, NSSL and CIMMS will be distributed to forecasters prior to their arrival for hands on training within their AWIPS systems. In addition, a training module will be made available to participants prior to and during the Spring Experiment.

Real-time UW-CIMSS NearCasts can be viewed on the web at:
http://cimss.ssec.wisc.edu/model/nrc/.

Web images are generated using the NWS/NCEP N-AWIPS software system. In addition to producing high quality graphics, these products can be directly included into operational workstations at AWC and SPC. Background and initial training materials can be accessed through the CIMSS NearCasting web page at: http://cimss.ssec.wisc.edu/model/nrc/. These materials will be referenced during the Spring Experiment.

The 14-min Nearcast articulate presentation is available via this link:
https://secure.nssl.noaa.gov/projects/ewp2013/Articulate/NearCast/player.html

5.4.2.5 WRF-based Lightning Threat Forecast

SPC forecasters have had experience with the WRF based lightning threat forecast since the 2009 Spring Experiment within operations and are familiar with the product. While the EFP does not provide formal training to new participants as part of their operations plan, any training material will be made available on the EFP internal webpage for participants to view during the experiment.

5.4.2.6 UW-Cloud Top Cooling (UW-CTC) Rates

Training documentation and PowerPoint Articulate training material will be delivered either to participants prior to arrival or on the first day of participation (details below). PowerPoint Articulate training has been recorded to provide UW-CTC training with an emphasis on 2013 UW-CTC goals. The UW-CTC PowerPoint Articulate training focuses on the UW-CTC rate and

NEXRAD relationships for use in the warning determination process; this material will be distributed to participants prior to arrival. A WES case and associated job sheets developed by UW/CIMSS will be distributed to forecasters prior to their arrival for hands-on training within their AWIPS systems. UW-CIMSS will provide in-field training to EWP participants throughout the experiment. Amanda Terborg and Chad Gravelle (UW/CIMSS GOES-R Satellite Liaisons) are knowledgeable about UW-CTC products and will additionally assist with in-field support. The following training materials will be provided by UW-CTC PIs: (1) UW-CTC PowerPoint Articulate training with focus on relating UW-CTC rates to future NEXRAD reflectivity and Maximum Expected Hail Size and WES case and training sheets. (2) Previous NOAA HWT Blog examples are available: http://goesrhwt.blogspot.com/search/label/UWCI (3) UW/CIMSS personnel will provide a 1-page UW-CTC fact sheet with training highlights to participants on the first day of each week that can be quickly referenced during the experiment.

The 11-min articulate presentation for UW-CTC is available here: https://secure.nssl.noaa.gov/projects/ewp2013/Articulate/UWCTC/player.html

5.4.2.7 Sounder RGB Airmass

A WES case and associated job sheets developed by SPoRT, NSSL and CIMMS will be distributed to forecasters prior to their arrival for hands on training within their AWIPS systems. In addition, a training module will be made available to participants prior to and during the Spring Experiment.

More formal training for this product will follow the training plan that was developed for the Hydrometeorological Prediction Center (HPC), the Ocean Prediction Center (OPC), the National Hurricane Center Tropical Analysis and Forecast Branch (TAFB), and the NESDIS Satellite Analysis Branch (SAB) Proving Ground. The GOES-Sounder RGB Airmass product was introduced using a training packet developed by EUMETSAT (http://oiswww.eumetsat.int/~idds/html/doc/airmass_interpretation.pdf) that covers the basic features of the SEVIRI-based RGB Airmass product, but is applicable to this product. This product has also been used with the NCEP North America Model (NAM) and Global Forecast System (GFS) model-derived 300 hPa absolute vorticity, 500 hPa absolute vorticity, and 400 hPa relative humidity to show how the RGB Airmass imagery highlights features such as potential vorticity anomalies, stratospheric intrusions, and warm air advection (WAA) regimes that could be associated with anomalous precipitable water (PW). Using the GOES-Sounder RGB Airmass product with model data could provide valuable insight into how well a model initialized the present state of the atmosphere or how well the model performed in the first few time steps. This understanding is vital to forecasters as it help improve confidence in model simulations of significant events, and therefore leads to more accurate forecasts.

6 Project Schedule

There are many activities that lead up to the successful execution of the Spring Experiment such as identifying participants, coordinating schedules, delivering and integrating algorithms, and developing training materials. These specific activities are identified in the chart below.

1. Identify and invite project leads – 15 March 2013
2. Develop WES for AWIPS-II – 15 April 2013
3. Identify forecasters for EWP/EFP participation – 10 April 2013
4. Stress-test EWP AWIPS-II systems – 26 April 2013
5. Deadline for all product availability – 19 April 2013

6. Deliver training materials – 19 April 2013
7. Verification of integration – 22-26 April 2013
8. Spring Experiment start – 6 May 2013
9. Spring Experiment end – 24 May 2013
10. Final evaluation report – 2 August 2013

7 Milestones and Deliverables

7.1 Products from Providers

Products to be demonstrated within this year's Spring Experiment should be delivered to the HWT by April 19 to ensure that product dataflow and display work correctly within the HWT programs. Products demonstrated within the EWP will be displayed within AWIPS-II and will be coordinated with Darrel Kingfield at NSSL/CIMMS.

7.2 Training materials from Providers

Each product delivered to the GOES-R PG Spring Experiment will be accompanied by related training materials. Forecasters and scientists participating in the Spring 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. NWS forecasters participating in the Spring Experiment will be provided with hands-on training via WES case within their local AWIPS workstations In addition, a short write-up explaining how the product works and its uses, including example images, will be provided for distribution amongst Spring Experiment participants for reference. New in 2013, all projects are expected to be accompanied by a powerpoint articulate presentation that the forecaster can review prior to arrival at the HWT. The presentation is expected to be no longer than 20 minutes total in length, if the articulate format is not used or the length is over 20 min total, this part of the training will become optional for the forecaster.

It is expected that the product developer provide the training material. Following each forecasting exercise, and at the end of each week, participants will be asked to provide feedback on the training they received. Participants will be asked if they felt prepared to use the products in a real-time forecasting situations and what material they would like to see in the future. This feedback will be invaluable in preparing formal training for future GOES-R products.

7.3 Final report

A final report detailing the GOES-R PG Spring 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 Spring Experiment as well as suggestions for improvements to the GOES-R PG Spring Experiment activities for years to come. This feedback will be captured by the visiting GOESR liaisons and project scientists during interactions with the participants throughout the Experiment timeframe.

8 Related activities and methods for collaboration

8.1 EFP

GOES-R Proving Ground products will be provided within the existing framework of the EFP as developed by Steve Weiss at SPC. The products will be used during three forecast periods throughout the day in regards to regional severe weather and convective initiation forecasting across the country as chosen by the EFP leader. Once per day the products will be discussed alongside other operational and experimental model-based products during an afternoon map briefing.

8.2 EWP
GOES-R Proving Ground products will be provided within the existing framework of the EWP as developed by Travis Smith, Greg Stumpf, Kristin Calhoun and Darrel Kingfield at NSSL/CIMMS. The products will be used throughout the day during real-time regional severe weather events across the country as chosen by the EWP weekly coordinator. Upon completion of the week, the participants will be asked to provide feedback via surveys and provided to the EWP leader.

8.3 GOES-R Risk Reduction Products and Decision Aids
GOES-R Risk Reduction products and decision aids will be demonstrated in addition to the baseline and future capabilities products. The risk reduction products and decision aids demonstrated in the Spring Experiment are described in Section 3.

9 Summary
This year's GOES-R PG Spring Experiment activities at the HWT will support the PG effort to demonstrate the defined GOES-R baseline products within an operational framework through various experimental programs. Direct collaboration with the operational warning and forecasting communities through the EWP and EFP respectively are currently ongoing. 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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