Operations Plan

for the
GOES-R Proving Ground
portion of the
Hazardous Weather Testbed and
2012 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 SPC as well as the Experimental Forecast Program (EFP) and Experimental Warning Program (EWP) within the HWT will receive early exposure to GOES-R PG products during the 2012 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 HWT an opportunity to critique and improve the products relatively early in their development. This year, the Experiment will run from May 7th – June 15th, 2012 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 will also be the first opportunity to demonstrate Proving Ground products within a real-time AWIPS-II framework within the HWT. Chris Siewert, the satellite champion at SPC, will be coordinating Proving Ground activities in Norman. He has coordinated the Spring Experiment activities at the SPC and HWT for the last several years and has since been building collaborative relationships within the local and broad operational community.

2 Goals of Proving Ground Project

There are many products competing for the attention of the SPC and Weather Forecast Office (WFO) 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
Convective Initiation	Future Capabilities
Nearcasting Model	GOES-R Risk Reduction
Weather Research and Forecasting (WRF) based lightning threat forecast	GOES-R Risk Reduction
University of Wisconsin-Convective Initiation (UWCI)	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 to the SPC 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 either WRF-ARW, Coupled Ocean/Atmosphere Mesoscale Prediction system (COAMPS) (developed at the Naval Research Laboratory, Monterey, California), or Regional Atmospheric Modeling System (RAMS), and then calculates synthetic brightness temperatures from several of the GOES-R ABI bands. For the SPC Proving Ground the emphasis is on the WRF-ARW, and the imagery is restricted to IR channels. Work is underway to utilize recent advances in the CRTM so that standard code can be used for the clear and cloudy atmospheres.

An automated system is currently being 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 to SPC during the 2012 Spring Experiment. CIRA's observational operator will read the netcdf output from the WRF model that is run at SPC. As described above, the CRTM is used to compute gaseous optical depths, and the delta-Eddington formulation is to compute brightness temperatures for the clear and cloudy areas. Five simulated bands from GOES-R's Advanced Baseline Imager will then be produced from each hourly output file from the WRF simulation. Three band differences from these channels will also be produced and provided to the SPC. CIRA has elected to simulate a subset of the full ABI band spectrum in order to be able to deliver the output to the SPC in a timely manner. The 09- to 36-hour forecasts from the first IR and Water Vapor bands are available by 09 UTC each morning, in time for use by the operational forecasters.

3.2 Lightning Detection

A pseudo-proxy for the GOES-R Geostationary Lightning Mapper (GLM) will be demonstrated during the Spring Experiment at the SPC. 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, 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 30-minute flash extent density track.

3.3 Convective Initiation

The University of Alabama in Huntsville (UAH) is developing a proxy product similar to the one they had produced for the GOES-R Algorithm Working Group (AWG) official algorithm called SATellite Convection Analysis and Tracking (SATCAST). Beginning in late 2008 through 2009, UAH developed an object tracking methodology (Alternative 1 from the GOES-R Aviation AWG Critical Design Review), based on an overlap methodology that will exploit the high temporal resolution from GOES-R. Since current GOES does not have the temporal resolution of GOES-R, the GOES-R CI algorithm cannot operate optimally with the current GOES instrument's 15-min refresh rate. In order to provide more accurate object tracking, a combination of overlap and mesoscale atmospheric motion vectors (Zinner et al. 2008) methodologies have been employed with great success. The addition of the Zinner et al. methodology allows for accurate object tracking with up to a 15-minute and, sometimes, 30-minute temporal resolution. The advantages of the object based SATCAST is that it can monitor object sizes down to 1 pixel, and easily track cloud objects between consecutive satellite scans for easy validation purposes.

Additionally, previous versions of SATCAST have produced "binary" yes/no forecast output regarding the potential of CI for tracked cloud objects. As a result of previous forecaster user feedback, however, the algorithm is currently undergoing an enhancement that will, instead, provide forecasters with a "Strength of Signal" (SS) forecast output. This method applies a linear regression approach to combine information from all available GOES IR channels into a single numerical value on a scale from 0 to 100, giving a sense for how strong the satellite-retrieved signal is for the development of cloud objects between the previous two GOES satellite scans. The new system will be deployed at the HWT Spring Experiment this year.

The SATCAST algorithm uses a daytime statistically-based convective cloud mask, performs multiple spectral differencing tests of IR fields (so-called "interest fields"), and applies atmospheric motion vector (AMV) cloud tracking. SATCAST output has shown success when implemented in well-established algorithms supported by the Federal Aviation Administration, specifically the Corridor Integrated Weather System as part of the Consolidated Storm Prediction for Aviation (CoSPA). CoSPA integrates radar observations, Numerical Weather Prediction (NWP) winds and stability fields, and other data to assist in developing convective initiation nowcasts. NWP data help remove spurious false alarms in SATCAST, which are in part caused by mesoscale AMV tracking errors, contamination from thin cirrus clouds, and the inherent difficulties associated with tracking pixel scale growing cumulus in 4 km Infrared (IR) data. John Mecikalski and John Walker are showing other potential uses in various research areas with good success, specifically within the NOAA High Resolution Rapid Refresh model.

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 SPC 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 2011 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 UWCI-Cloud Top Cooling Rates

The UWCI-Cloud Top Cooling (CTC) rate product has been delivered to the SPC as acting GOES-R CI proxy during SPC HWT testbed exercise 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.

The UWCI-CTC algorithm is an experimental satellite based product used to diagnose infared brightness temperature cloud top cooling rate and nowcast convective initiation (Sieglaff et al, 2011). The UWCI-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.

New for 2012, based on previous SPC HWT forecaster feedback, the UWCI-CTC algorithm has been improved to operate in areas of thin cirrus clouds during daytime hours by including GOES cloud optical depth retrievals. Additionally, for 2012 the focus will be using the UWCI-CTC rates as a prognostic tool for future NEXRAD observations. The two NEXRAD fields of focus will be composite reflectivity 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 Hartung et al., 2012 could potentially be used to increase severe thunderstorm warning lead-time ahead of NEXRAD-only guidance.

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 and SPC-EFP. Invited visiting scientists funded by GOES-R Proving Ground, Risk Reduction or Visiting Scientist funding include Bob Aune and Jordan Gerth (Nearcasting); Jason Otkin and Dan Lindsey (Synthetic Cloud and Moisture Imagery); John Walker, Justin Sieglaff, Lee Cronce, Chris Jewett, Lori Schultz and Wayne Feltz (Convective Initiation); Geoffrey Stano and Chris Schultz (pseudo-GLM); and Bill McCaul (WRF-based lightning threat forecast). The visiting scientists and the NWS forecasters round out the experiment team and their participation are described in the following paragraphs.

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 UWCI-Cloud Top Cooling Rates

The UWCI-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 the NCEP Advanced Weather Interactive Processing System (NAWIPS) and Warning Decision Support System - Integrated Information (WDSS-II), as well as AWIPS-II. Forecasters will evaluate improved UWCI-CTC products (based on feedback from the 2011 Spring Experiment participation) to determine if the products offer additional lead time in warning process and provide information for SPC watch determination in marginal convective weather situations.

Outputs to be displayed within N-AWIPS/ AWIPS II (in bold are fields of most interest in 2012):

- **Instantaneous box-averaged cooling rate** (normalized to degrees K / 15 minutes)
- Instantaneous convective initiation signal
    - Value 0: No CI nowcast
    - Value 1: "Pre-CI Cloud Growth" associated with growing liquid water cloud
    - Value 2: "CI Likely" associated with growing supercooled water or mixed phase cloud

- Value 3: "CI Occurring" associated with cloud that has recently transitioned to a thick ice cloud top
- Value 5: "Ice Cloud Mask" associated with areas where cloud contamination will inhibit CI nowcasts

UWCI-CTC is also available in McIDAS AREA format.

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, lightning and the sounder RGB airmass 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 (SATCAST) 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

In collaboration with NSSL and CIMMS, a pseudo GLM product created from very high frequency (VHF), ground-based total lightning network data from North Alabama, Oklahoma, Kennedy Space Center, and Washington DC will be provided to the EWP. 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. SPoRT also will provide support in establishing the data flow from the total lightning networks outside Oklahoma to the Spring Experiment. This will be supported with product training 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 1 minute.

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 SPC's Spring Experiment. Simulated satellite imagery calculated from model radiances will provide forecasters with a tool to evaluate model performance, as well as 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.

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 will shift slightly to include a more convective initiation forecast strategy. Close collaborations with the OAR and the development of its Convective Initiation desk will drive this effort. While the detailed plan for how this will be accomplished has not yet been established, it is expected that there will be three forecast groups within the room with one each focusing on regional forecasts of severe weather, QPF and CI.

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

Chris Siewert – SPC Proving Ground Liaison

5.3 Product Evaluation

Chris Siewert – Lead, SPC
Kristin Kuhlman - EWP
Steve Weiss - EFP

5.4 Project Training

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 put together a VISIT training session titled "Synthetic Imagery for Forecasting Severe Weather." 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 for the GLM products will be available at http://weather.msfc.nasa.gov/sport/training/. 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.

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.

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.

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 UWCI-Cloud Top Cooling Rates

Training documentation and VISITView training material is provided below. Visitiview training has been recorded to provide UWCI training and was conducted before and since 2009 SPC HWT experiment. The VISITview training session has a focus toward the convective initiation nowcasts, while the 2012 UWCI-CTC powerpoint training will focus on the UW-CTC rate and NEXRAD relationships for use in the warning process. A WES case and associated job sheets developed by 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 and EFP participants throughout experiment. Chris Siewert is already knowledgeable about UWCI-CTC products and has provided a Wiki web site with in-field support.

(1) University of Wisconsin convective initiation strength and weaknesses fact sheet http://cimss.ssec.wisc.edu/goes_r/proving-ground/GOES_CINowcast.html
(2) UWCI-CTC training powerpoint (with 2012 focus on relating UW-CTC rates to future NEXRAD composite reflectivity and Maximum Expected Hail Size)
(3) VISITView training module (Scott Lindstrom)
    http://rammb.cira.colostate.edu/visit/uwci.html
(4) CIMSS Blog case study examples are available: http://cimss.ssec.wisc.edu/
(5) SPC UWCI WIKI webpage

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 – March 1, 2012
2. Develop WES for AWIPS-II – March 16, 2012
3. Identify forecasters for EWP/EFP participation – April 13, 2012
4. Stress-test EWP AWIPS-II systems – April 20, 2012
5. Deadline for all product availability – April 20, 2012
6. Deliver training materials – April 20, 2012
7. Verification of integration – April 23-27, 2012
8. Spring Experiment start – May 7, 2012
9. Spring Experiment end – June 8, 2012
10. Final evaluation report – August 3, 2012

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 20 to ensure that product dataflow and display work correctly within the HWT programs. Delivered products to the SPC and within the EFP will be displayed within N-AWIPS and will be coordinated with Chris Siewert at the SPC. 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. Training on each of the products being demonstrated will also occur briefly on the first day of each experiment week. This will consist of a powerpoint presentation of no longer than 10 minutes in length and will be presented by a participating product expert. 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. 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 Chris Siewert and Kristin Kuhlman 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 two 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 Kuhlman 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 leader. 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 SPC 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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