Hazardous Weather Testbed – Final Evaluation

Project Title: 2011 Spring Experiment

Organization: NOAA's Hazardous Weather Testbed (HWT)

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

Duration of Evaluation: 9 May 2011 – 10 June 2011

Prepared By: Chris Siewert (OU-CIMMS / NOAA SPC) and Kristin Kuhlman (OU-CIMMS / NSSL)

Overview:

This report summarizes the activities and results from the 2011 GOES-R Proving Ground Spring Experiment which took place at NOAA's HWT and SPC in Norman, OK. This year 12 visiting scientists and 24 NWS forecasters invited by the GOES-R Proving Ground participated in real-time forecasting and warning exercises using a variety of experimental GOES-R products within the Spring Experiment's Experimental Forecast Program (EFP) and Experimental Warning Program (EWP) hosted by NSSL, SPC and the Norman, OK WFO. Chris Siewert (OU-CIMMS / NOAA SPC) provided overall project coordination and oversight for the GOES-R Proving Ground efforts at the HWT and SPC. Kristin Kuhlman (OU-CIMMS / NSSL) provided coordination for the GOES-R Proving Ground's efforts within the EWP.

Products generated from current satellite-based, land-based and numerical model-based datasets such as convective initiation (CI) nowcasting, overshooting top and thermal couplet (OTTC) detection, pseudo-geostationary lightning mapper (PGLM) total lightning detection and simulated satellite imagery and associated band differences helped demonstrate GOES-R capable products to operational forecasters and the broader scientific community. Other products including a 0-9 hour differential theta-e / precipitable water Nearcast, 0-3 hour severe hail probability and NSSL-WRF simulated lightning threat also helped demonstrate the utility of satellite data in combination with other datasets to provide unique decision aids. Forecasters and participants provided feedback via daily briefings, online surveys and real-time blogging throughout the experiment. The feedback gathered and discussed below was essential in identifying potential improvements and uses of the GOES-R products prior to their deployment once GOES-R becomes operationally available.

Products Evaluated:

1. **Satellite-based Convection Analysis and Tracking (SATCAST)** – University of Alabama in Huntsville (UAH) and NASA's Short-term Prediction Research and Transition Center (SPoRT)

   SATCAST is a proxy for the AWG version of the GOES-R convective initiation algorithm. The product has been flowing since the beginning of the 2010 Spring Experiment directly to SPC and HWT via the NASA SPoRT LDM feed. It is then converted into N-AWIPS gridded format at SPC and AWIPS-friendly netCDF format at NSSL and provided on the non-operational workstations within the HWT (see Fig. 1). This year the product was evaluated within the EWP and EFP, with the main emphasis being within the EWP since it is more relevant to their forecast challenges.

   The product provides a yes/no nowcast of whether an individual cloud object will develop into deep convection within the next 60 minutes as described by Mecikalski and Bedka (2006, Mon. Wea. Rev.). The product uses a day-only cloud typing algorithm described by Todd Berendes et al. (2008, J. Geophys. Res.). This year, the product developers also included day/night cloud typing to extend it out to a 24-hour product. SATCAST was also modified to include rapid-scan imagery in its nowcasts and can run during rapid-scan operations (RSO). SATCAST previously used mesoscale atmospheric motion vectors (MAMV) to predict the future position of cloud objects. This required a significant amount of computational resources and slows the delivery of the product. SATCAST was modified to use a new overlap method based on Zinner et al. 2008, which decreases the computational time significantly, and also helps SATCAST conform to the original AWG product requirements for GOES-R. This year, the producers also decreased the latency of the product delivery significantly based on feedback from the previous year's final report. The product now arrives approximately 7-8 minutes after the image stamp-time, where it had previously arrived 12-14 minutes after the image stamp-time.

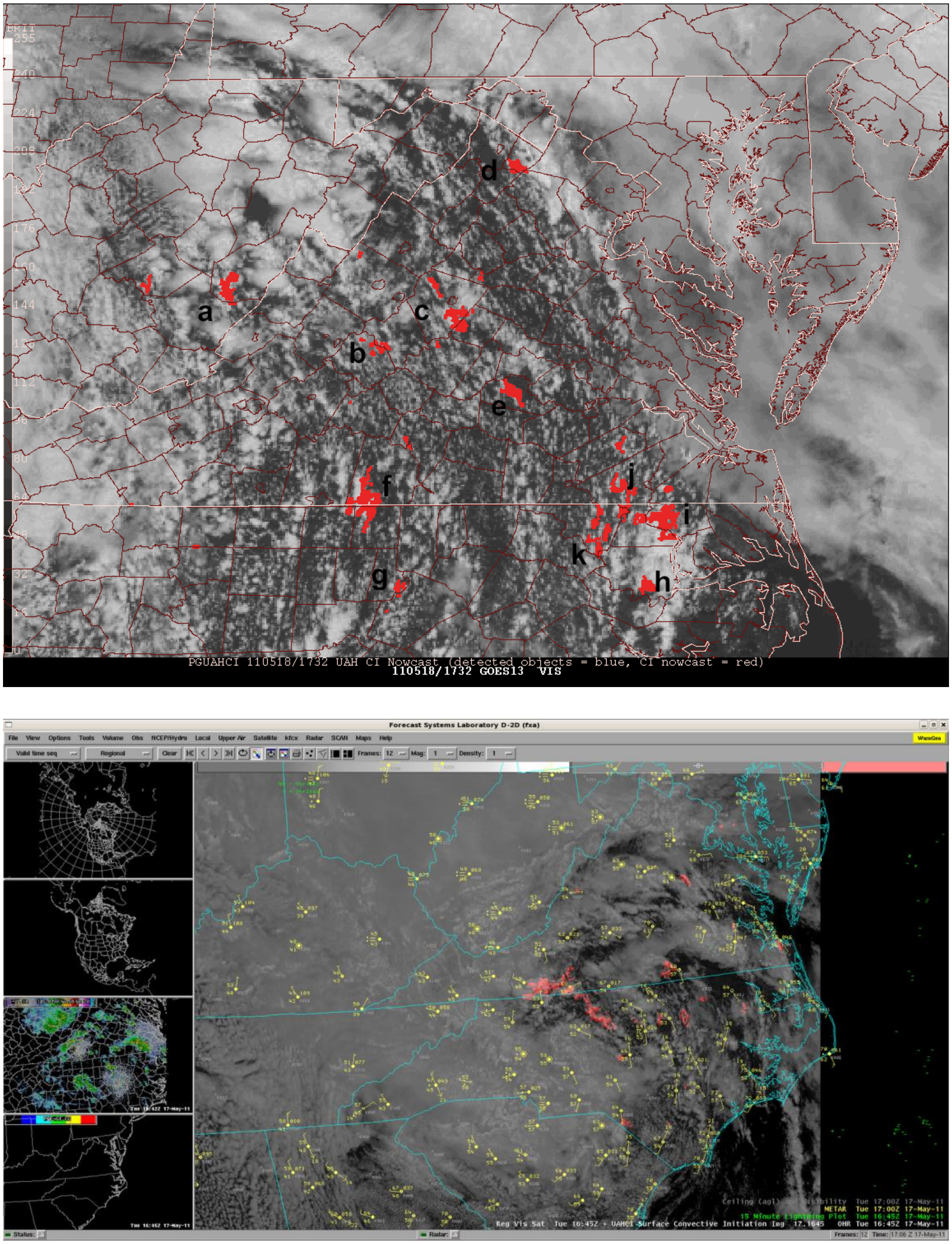

Figure 1 – SATCAST convective initiation nowcast overlaid on visible satellite imagery displayed within the SPC and HWT N-AWIPS workstations at 1732 UTC on 18 May 2011 (top), as well as the HWT AWIPS workstations at 1645 UTC of 17 May 2011 (bottom).

When SATCAST was originally displayed within the HWT during the first week of the Spring Experiment, forecasters expressed confusion by the product's display of both cloud object (in blue) and CI nowcasts (in red) on the same screen (see Fig. 2). Quite often these cloud objects would ‘switch’ on and off from being a null forecast to having a CI forecast made on them. While this is not a flaw in the product’s design, the forecasters requested that the display only show them the CI nowcasts to help alleviate the confusion. We were able to change this with the assistance of the product developers on both the AWIPS and N-AWIPS workstations. The original display was still made available as a different ‘field’ of the SATCAST product within the N-AWIPS workstations for comparison.

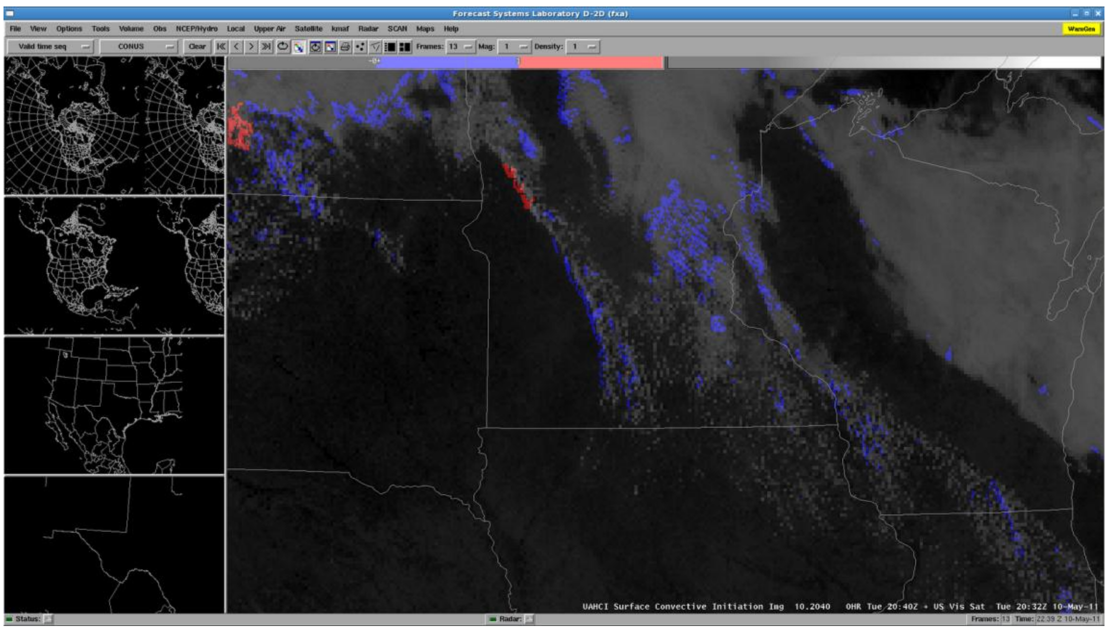

Figure 2 – SATCAST convective initiation nowcast (red) and cloud objects (blue) overlaid on visible satellite imagery at 2032 UTC on 10 May 2011.

During EWP forecast and warning operations, the forecasters have an abundance of experimental satellite, radar, lightning and model data at their fingertips. Quite often there is ‘data overload’ and many of the products get limited exposure because of the sheer amount of data the forecasters have to interrogate. In an effort to combine multiple experimental products into one decision support tool, we worked with the EWP forecasters to create what forecasters lovingly called the “Ultimate-CI” display (see Fig. 3). This 4-panel AWIPS display combines the CI nowcasts from the SATCAST and UWCI (further discussed in Section 4), reflectivity at the -10^{o} C level provided from the Multi-Radar, Multi-Sensor experimental product suite (MRMS), as well as the PGLM total-lightning flash extent density. From this 4-panel display, forecasters were able to quickly customize the display by swapping out experimental products and interrogate multiple datasets from different sensors to increase their situational awareness of CI. This display technique was created during the first week of the experiment and then saved for forecasters to use throughout the remaining weeks.

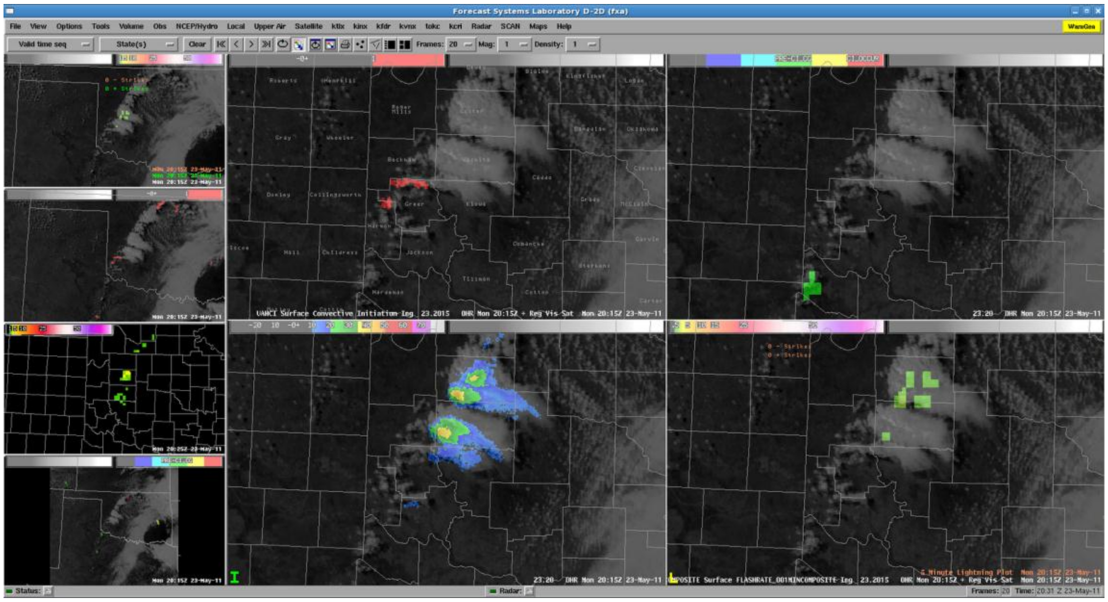

Figure 3 – AWIPS "Ultimate-CI" 4-panel display created for use by EWP forecasters during real-time forecast / warning exercises. The display contains CI nowcasts from the SATCAST and UWCI overlaid on visible satellite imaery (top left and top right), MRMS reflectivity at the -10º C (bottom right), and PGLM total-lightning flash extent density (bottom right) at 2015 UTC on 23 May 2011.

Throughout much of the Spring Experiment, EWP forecasters were positive about the use about a satellite-based CI product, but expressed disinterest in seeing a binary yes/no output provided by SATCAST:

> "The UAH CI performance was useful as a temporal signal... in the sense that enhanced 'regions' of growing cumulus. However, the Yes-No values were not useful, especially when values went back and forth from blue to red to blue. Consider adding more values, and the values themselves to allow forecasters to monitor these values and interpret these based on their own experience."

This was also an issue raised during the 2009 Spring Experiment with the UWCI product. Similar to what the product developers have done with the UWCI product output, the forecasters would like to see the background fields behind the CI nowcast, such as the cloud-top cooling rates or multi-spectral band differences and their trends. Since SATCAST has many CI 'interest fields' it may be difficult to display all of this information within the AWIPS systems and expect forecasters to look at it. NWS forecasters suggested rather than providing a yes/no nowcast, provide a probabilistic nowcast based on how strong or how many of the CI interest fields met their thresholds. This would be an alternative to displaying each of the individual interest fields as a separate output, but still retain some of that information that forecasters are seeking.

According to the post event surveys, 77% of EWP forecasters said they used the SATCAST product during their forecast / warning operations during the Spring Experiment. Responses from the survey show a wide range of lead-times for the detection of a first 35 dBZ radar reflectivity echo from the SATCAST, extending anywhere from 0 minutes up to 60 minutes. However, the most common response suggested an average lead-time of 15 minutes. When compared to the first occurrence of lightning, the average lead-time extended about an additional 15 minutes. EWP forecasters noticed an abundance of what they considered to be false alarms from SATCAST throughout much of the experiment, or CI nowcasts with no radar reflectivity exceeding 35 dBZ or lightning occurring in the future. In a few cases forecasters did mention that these false alarms could be useful in some situations:

> "Even though CI didn't always occur... false hits were useful in identifying clouds trying to break the cap."

EWP forecasters were pleased however that the product was detecting most of the instances of initiation, even with the false alarms:

> "Despite a slight hot bias, the tool kept me focused on potential areas for CI."

> "While it had a few false alarms... it appeared to do a good job of identifying some of the early convection."

> "Very useful for anticipating CI and providing public/aviation updated forecasts accordingly."

SATCAST continues to flow within the SPC non-operational N-AWIPS workstations and is available for the HWT AWIPS-II systems being installed this fall.

2. **Simulated Satellite Imagery** - UW-CIMSS and Cooperative Institute for Research in the Atmosphere (CIRA)

Simulated GOES-R ABI imagery generated from the NSSL-WRF 00Z 4km model run was provided within the HWT N-AWIPS systems by UW-CIMSS and CIRA (see Figs. 4 and 5). UW-CIMSS provided simulated satellite data for all GOES-R ABI IR bands from the 12-36 hour forecast times. In addition, CIRA provided simulated satellite band differences for GOES-R unique channels, as well as providing a backup source of imagery for the standard mid-level WV and window IR simulated imagery for the same time periods. Most data from both UW-CIMSS and CIRA arrived locally at the SPC and HWT by 12 UTC, with a second ingest around 15 UTC to retrieve any additional or missing data.

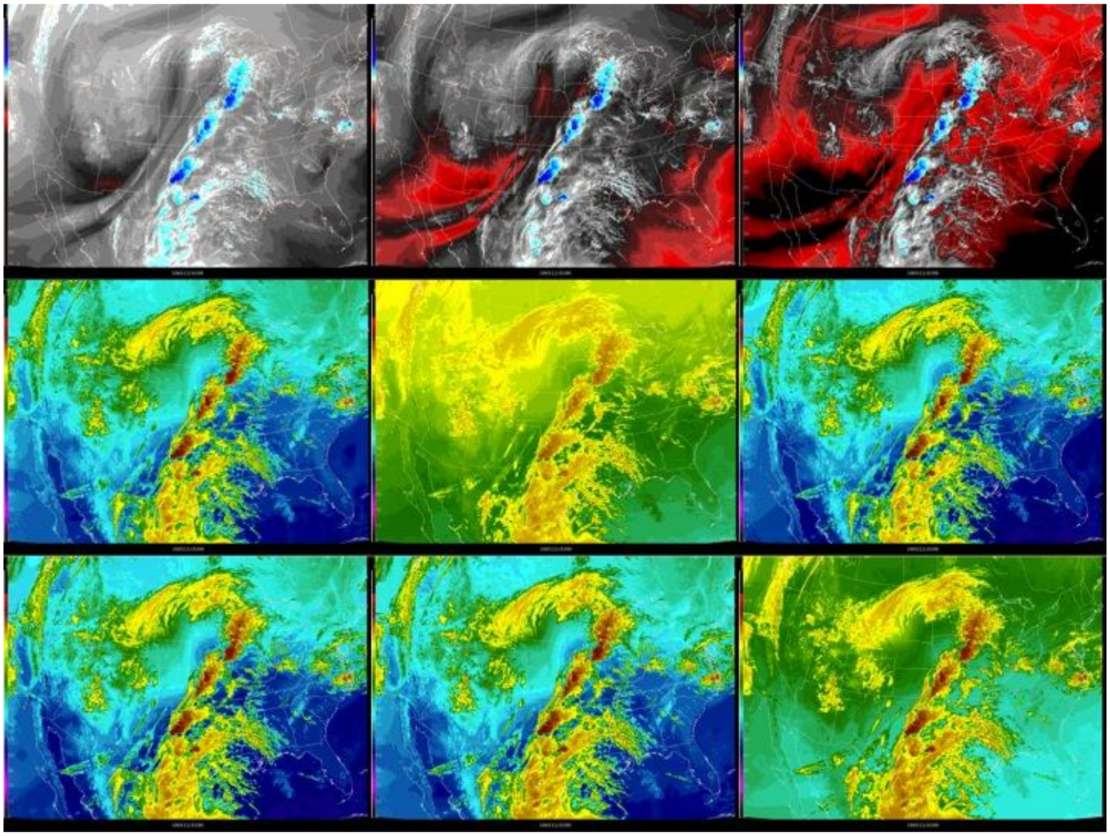

Figure 4 – UW-CIMSS NSSL-WRF simulated GOES-R ABI IR imagery. Al 9 non-solar bands can be produced from the NSSL-WRF.

The simulated satellite imagery was examined within the EFP during morning forecast operation, particularly at the newly created CI desk. Participants found the simulated satellite data invaluable during their forecasts and often used 1300 UTC forecast imagery to verify the performance of the NSSL-WRF for that day by comparing it to observed satellite imagery. While participants found the use of 3 WV channels useful in identifying mid- and upper-level atmospheric features that would lead to convection, they primarily focused on the mid-level WV channel because of the limited amount of time they had to interrogate a large amount of experimental model data.

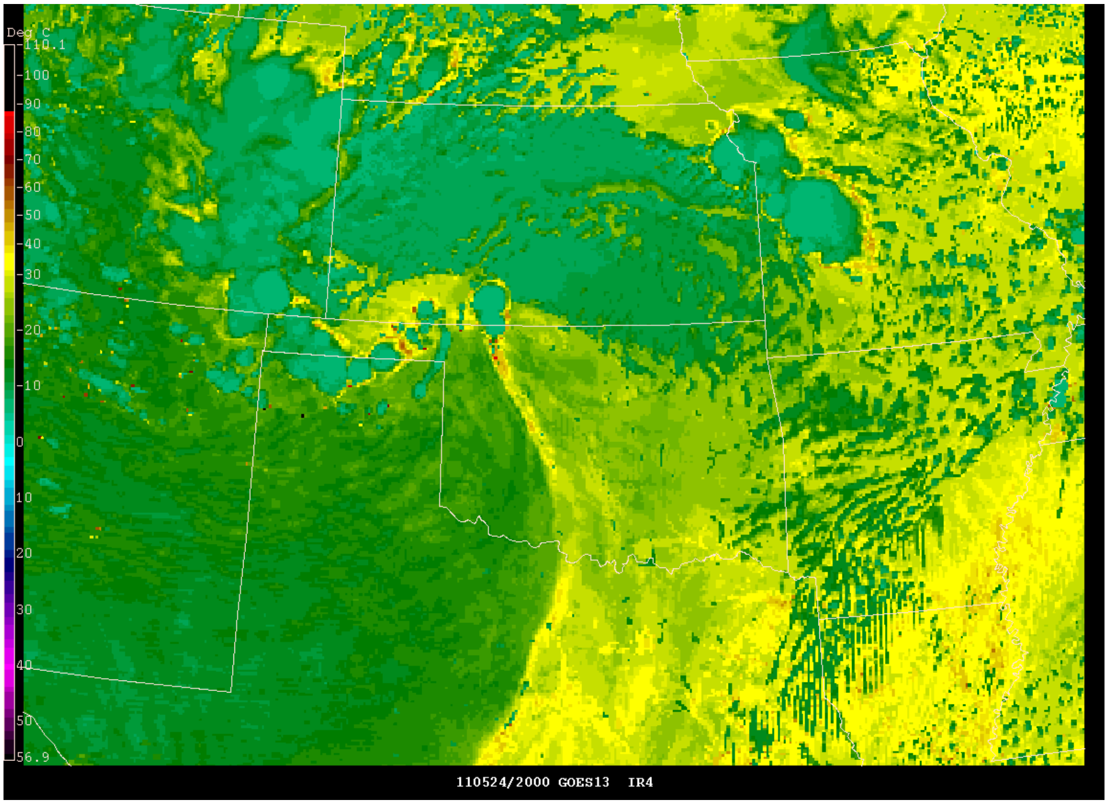

Figure 5 – CIRA NSSL-WRF simulated GOES-R ABI 10.3-12.0 micron band difference imagery for 2000 UTC on 24 May 2011. Areas of yellow and orange indicate regions of increased moisture convergence at low levels.

As part of the EFP's CI desk's morning forecasts, they asked for demonstrations of the NSSL-WRF simulated 10.3-12.0 micron band difference provided to us by CIRA on multiple occasions. This channel difference was used extensively by the EFP's CI desk as a tool to forecast CI. One of the advantages of simulating satellite data from a model is that we have the opportunity to produce channels that we don't have currently. Neither of these channels is currently available together on our operational GOES satellites, but will be available on the GOES-R satellite once it launches. The 10.3-micron channel is a very clean window, and thus is very sensitive to surface temperature. The 12.0-micron channel however is sensitive to low-level water vapor. As moisture moves into a clear pixel area, the 12.0 micron brightness temperature will decrease, whereas the 10.3 micron temperature should stay the same. When this occurs, the channel difference will become strongly positive and indicates areas of moisture convergence or pooling, which can lead to destabilization and subsequent convective initiation. Participants found this very exciting and it proved to be very useful in identifying detailed areas low-level moisture convergence (see Fig. 5).

The simulated satellite imagery and band differences from the NSSL-WRF continue to flow into the SPC and HWT and are now being provided within SPC operations for year-round demonstration.

3. **Pseudo-Geostationary Lightning Mapper (PGLM)** – OU-CIMMS/NSSL and SPoRT

A pGLM product was created for testing in the HWT during the 2011 Spring Experiment. This product utilizes total lightning data from three Lightning Mapping Array (LMA) networks (Central Oklahoma, Northern Alabama, and Washington DC) and the Lightning Detection and Ranging (LDAR) network (Kennedy Space Center, Florida) that detect VHF radiation from lightning discharges. The real-time lightning data was available in 1-min intervals and sorted into flashes using algorithms available through Warning Decision Support System – Integrated Information (WDSS-II). Following flash sorting, a Flash Extent Density product was created at 8-km resolution to match that expected by the GOES-R GLM. In addition to the flash extent density product, a historical track product was also created using the flash density. This product was shown as either the maximum flash rate or accumulated flash rate for each pGLM grid cell for the previous 60 or 120 mins (see Fig. 6).

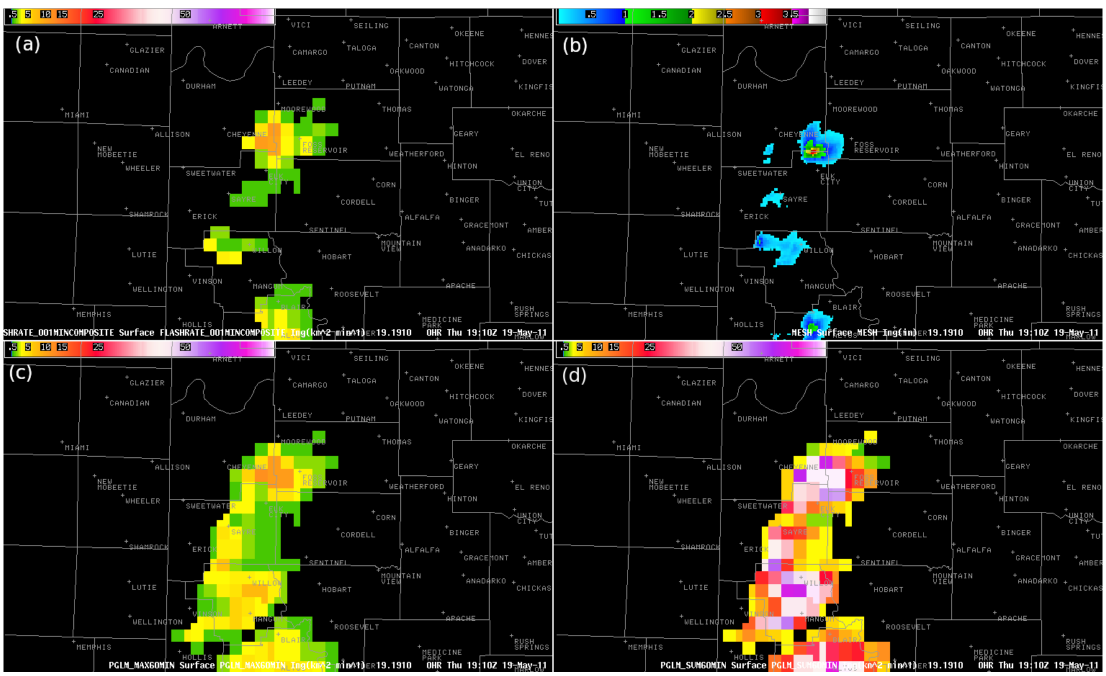

Figure 6 - (a) 1-min pGLM flash extent density (b) Maximum Expected Size of Hail (MESH) values (c) 60-min maximum pGLM flash rate and (d) 60-min accumulation of the flash rate at 1910 UTC on 19 May 2011

The pGLM product was available at 1-minute updates within AWIPS. Forecasters were able to choose their own display options, often overlaying or integrating the pGLM product with other radar (e.g., MESH as shown in Fig. 6) and satellite products. Real-time operations were typically focused on regions where activity was expected to be at least marginally severe and preference was given to areas that contained a LMA or LDAR network in order to get the maximum number of pGLM cases possible.

An archive event for 19 May 2010 was developed using the AWIPS Warning-Event-Simulator (WES). Forecasters used this archive event as training tool on their first day in the HWT. This WES case allowed them to integrate all the data from the multiple experiments (including the pGLM) into a real-time warning situation. The archive event gave a baseline for comparison of use and initial testing of the usefulness of the data in warning operations.

Forecasters examined multiple storm types on nine different days of the experiment. The storm types included tornadic supercells, isolated storms, multicell clusters and MCS and squall line events. These events provided a typical distribution of spring and early summer events throughout the country. Feedback was collected both through conversation with each of the forecasters during an event and through an online survey following each event.

Through the evaluation, forecasters commented that the pGLM could be an incredibly useful situational awareness tool and something that may provide additional guidance during a warning decision. Two specific comments made by forecasters in the online survey reflected this notion that was repeated by multiple forecasters throughout the experiment:

> "The pseudo-GLM was very useful in that it focused attention on storm intensification, and was able to pick up on flash rates much earlier than the CG network."

> "I utilized it as a situational awareness product and then kept a watch on my tried and true radar practices to issue the warning. The pGLM data gave me more confidence in my warning. Which is always something that is positive."

Forecasters were also able to see the applicability of total lightning data in a storm safety and aviation forecasting perspective. Fig. 7 contains a real-time example from the experiment of lightning safety applications on 11 May 2011. The 1-minute pGLM flash extent density (and the corresponding NLDN cloud-to-ground lightning data) is tightly clustered with the stronger convective regions also seen in radar reflectivity. However, unlike the NLDN data, the PGLM flash extent density still showed that lightning flashes extended anywhere from 8-32 km into the stratiform region.

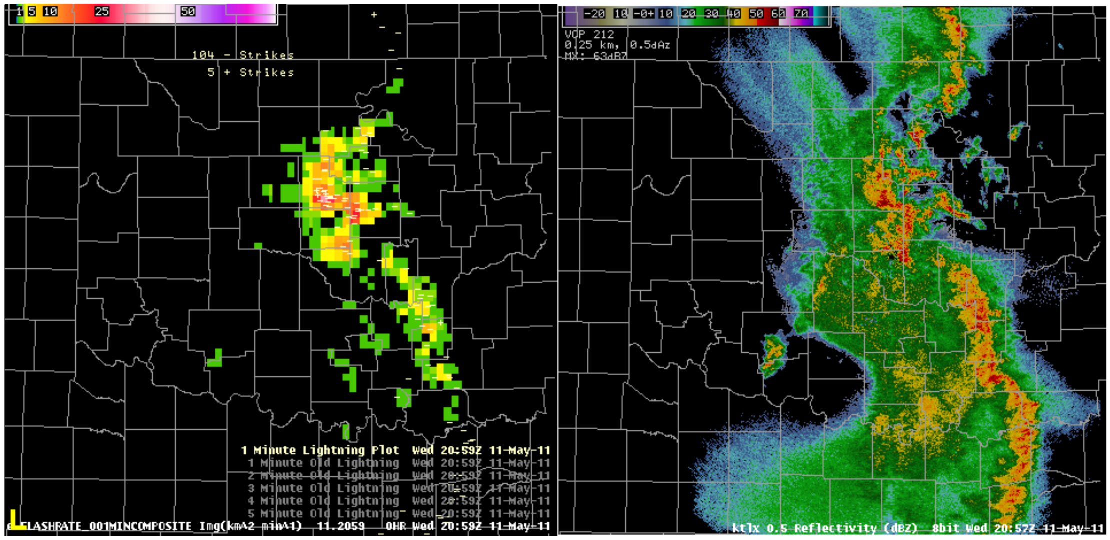

Figure 7 - 1-min PGLM flash extent density and CG flash rate (left) and 0.5 deg elevation radar reflectivity (right) from 2059 UTC on 11 May 2011.

Following suggestions from forecasters during the experiment, there will be additional development of products for future testing. Included in that is a display of the fraction of cloud-to-ground lightning to total lightning activity. Based on discussions with forecasters, there appears to be two features that make this type of product desirable to forecasters: (1) NWS offices currently have access to NLDN CG data and forecasters are familiar with CG flash rates and polarity associated with various storm types (2) research has shown that the most intense storms can have a low fraction of CG flashes relative to the total flash rate, a product that combines the two could easily pull this information out for operational forecasters dealing with large amounts of data.

Additionally, there is a plan to develop a flash-initiation product as well as track history of initiation points. These products could provide a better indication of the region of the main updraft core (than flash extent density alone), plus the history product may be able to highlight intensification periods of updrafts as well as provide a historical track of storm.

The pGLM product is expected to become available over the web real-time during the Fall of 2011 for all the domains of the LMA networks. NASA SPoRT has also developed a pGLM flash extent density mosaic, which is available for display at NCEP national centers and WFO partners within AWIPS II.

4. **University of Wisconsin Convective Initiation (UWCI)** – University of Wisconsin Cooperative Institute of Meteorological Satellite Studies (UW-CIMSS)

The UWCI and associated cloud-top cooling rate product has been delivered to the SPC and HWT since the 2009 Spring Experiment. The product was again provided to the HWT and SPC within N-AWIPS and AWIPS for evaluation within the EFP and EWP during the 2011 Spring Experiment. The product utilizes GOES-13 infrared (IR) window brightness temperature changes based on an operational day/night cloud mask to infer cloud-top cooling as a proxy for vertical development in growing cumulus clouds as described by Sieglaff et al. (2010). UWCI provides regions of ice-cloud exclusion as designated by the cloud mask, as well as 3 "levels" of CI nowcast: pre-CI growth, CI-likely, and CI-ongoing (see Fig. 8). UWCI is generated at the University of Wisconsin for each GOES-13 scan, including rapid-scans, and distributed via LDM in GRIB2 format to AWIPS and N-AWIPS systems.

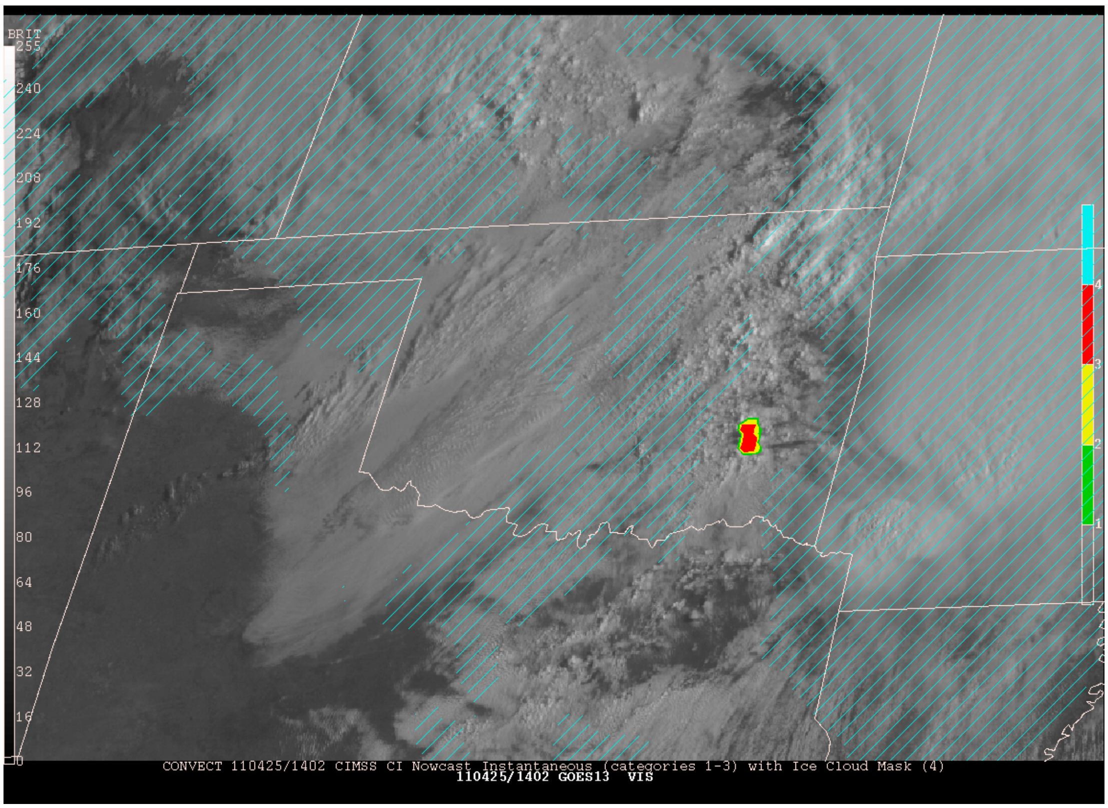

Figure 8 – UWCI overlaid on GOES-13 visible imagery within HWT N-NAWIPS workstations at 1402 UTC on 25 April 2011. Blue dashed areas indicate ice-cloud exclusion regions where the convective cloud mask has determined CI nowcasts cannot be made. Pre-CI growth is indicated by green filled areas, CI-likely is indicated by yellow filled areas, and CI-ongoing is indicated by red filled areas.

UWCI was primarily demonstrated within the EWP during the first half of their forecast period to monitor CI along with other GOES-R proving ground products. The forecasters were able to develop their own displays within AWIPS, often choosing to overlay the UWCI product on visible or IR satellite imagery. The product was also often also displayed as a 4-panel to combine information from multiple experimental products in one window (see "Ultimate-CI" Fig. 3).

According to post-event surveys, 71% of EWP participants used UWCI during their forecast/warning operations. Responses from the survey show a wide range of lead-times for the detection of a first 35 dBZ radar reflectivity echo from the UWCI, extending anywhere from 0 minutes up to 45 minutes. However, the most common response suggested an average lead-time of 15 minutes. When compared to the first occurrence of lightning, the average lead-time extended about an additional 15 to 30 minutes. EWP forecasters noticed a more conservative approach to the UWCI product in nowcasting CI versus the SATCAST product, but in general did find the idea of a satellite-based CI nowcast product useful:

> "It is conservative, but in general it seems to have a low FAR and good POD. However, it is challenged in this rapidly developing storm environment. This application definitely has potential particularly with very high-resolution satellite data. The SATCAST in contrast had a very high POD but also very high FAR."

> "The CI product had a 0 FAR, but a relatively low POD (probably around 0.50). Although I call this a weakness, it does provide some value, as it indicates that "triggering" of the CI product essentially guarantees convective development."

The UWCI products will continue to flow within the SPC and HWT N-AWIPS systems, and will also be available for evaluation within the HWT AWIPS-II systems.

5. **Overshooting-top and Thermal Couplet detection (OTTC)** – UW-CIMSS

The OTTC has been provided to the SPC and HWT since the 2010 Spring Experiment and was once again provided within the 2011 Spring Experiment. The product utilizes GOES-13 IR window brightness temperature spatial testing to identify overshooting-top and thermal couplet (also known as enhanced-V) features within mature convective storm cloud-tops as described by Bedka et al. (2010). The OTTC product provides detections and relative magnitudes of overshooting-top and thermal couplet features in real-time (see Fig. 9). Similar to the UWCI product, the OTTC product is generated at the University of Wisconsin for each GOES-13 scan, including rapid-scans, and distributed via LDM in GRIB2 format to AWIPS and N-AWIPS systems.

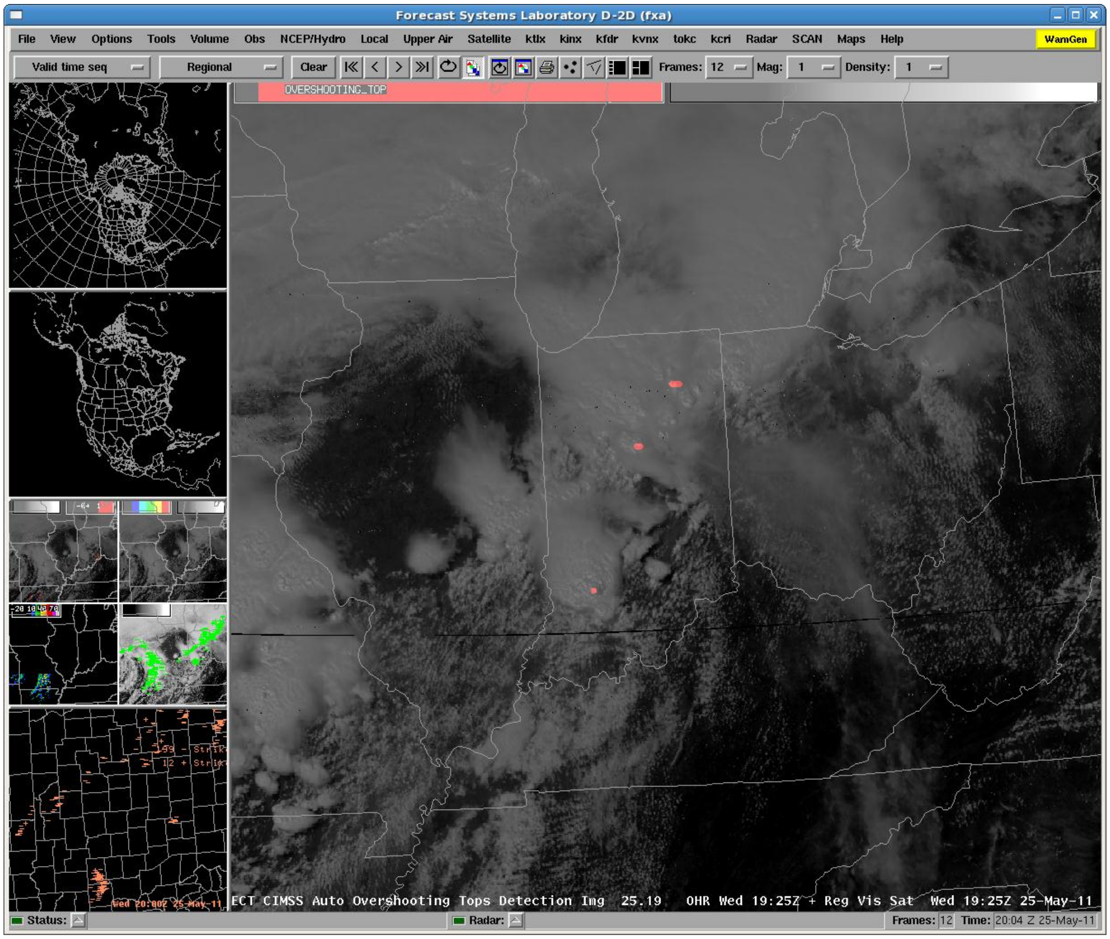

Figure 9 – OTTC overlaid on GOES-13 visible imagery within HWT AWIPS workstations at 1925 UTC on 25 May 2011. Red areas indicate detections of overshooting-tops by the OTTC product.

The OTTC product was examined exclusively within EWP warning operations when the product seemed the most relevant to severe weather. Similar to last year, the EWP forecasters saw the potential uses for the OTTC, but the spatial and temporal limitations of the current GOES satellite made utilizing the OTTC product during warning operations very difficult, especially with rapidly updating radar during times where satellite data may not arrive for 30 minute periods. Quite often the operator via visible/IR satellite imagery or radar made OTTC detections before the OTTC product would detect anything:

> "Thermal couplet showed up over SW WI, but warning was already issued and radar was showing clear signals of severe weather."

However, when OTTC detections were made, forecasters generally noticed increases in reflectivity aloft on radar, sometimes a few minutes following the OTTC detection. This is promising for when satellite data increases in spatial and temporal resolution with GOES-R and these features are more readily detectable.

The OTTC products will continue to flow within the SPC and HWT non-operational N-AWIPS systems and will also be available for evaluation within the HWT AWIPS-II systems.

6. 0-9 Hour differential Theta-e / Precipitable Water Nearcast – UW-CIMSS

A Nearcast model that assimilates full resolution information from the current 18-channel GOES sounder and generates 1-9 hour "nearcasts" of atmospheric stability indices was provided within the 2011 SPC Spring Experiment. The system fills the 1-9 hour information gap, which exists between radar nowcasts and longer-range numerical forecasts. The Nearcast 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. The Nearcast products were delivered to SPC and HWT within the Spring Experiment in GRIB2 format via the University of Wisconsin LDM for display within the EFP N-AWIPS (see Fig. 10) and EWP AWIPS systems (see Fig. 11).

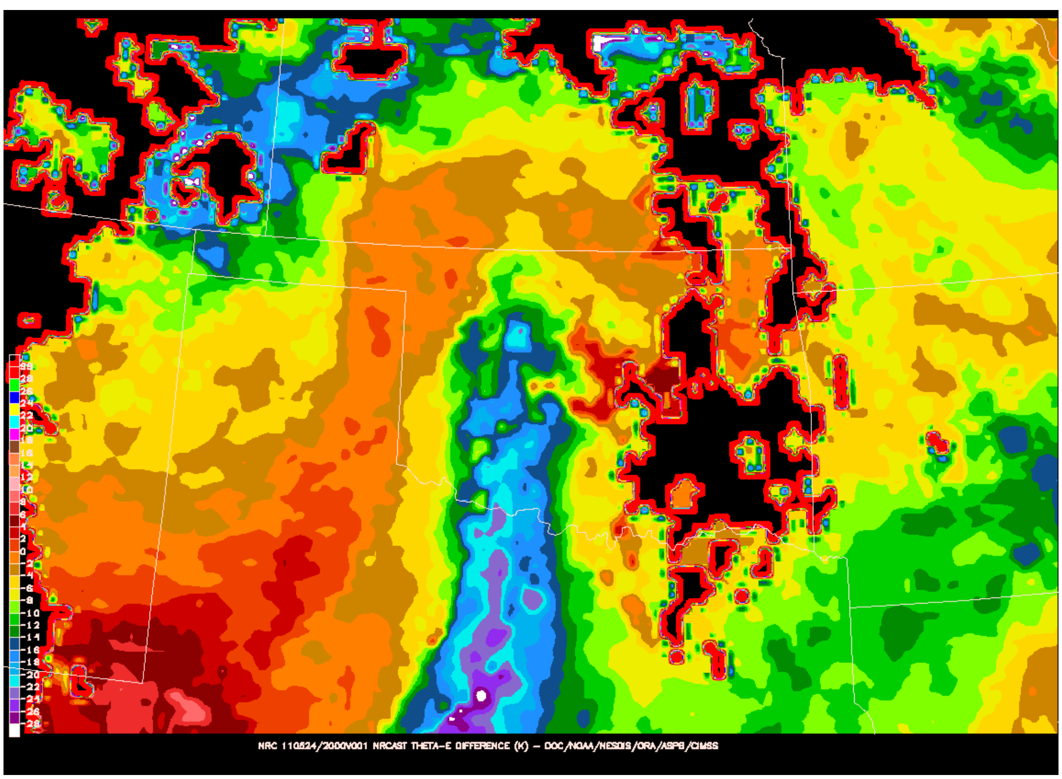

Figure 10 – Nearcast differential theta-e product displayed within HWT N-AWIPS workstations at 2000 UTC on 24 May 2011.

The product was demonstrated equally within the EFP CI, severe and QPF desks, as well as the EWP morning forecast shift, where it was used to help forecaster determine areas conducive to future convective development leading to severe weather, tornadoes and flooding. There were also occasions where EWP forecasters would use the Nearcast output of differential theta-e and precipitable water to monitor near-storm environments during warning operations. In these instances forecasters would use the 0-2 hour forecasts and analyze environments that mature storms were moving into and diagnose whether the storm would intensify or weaken based on the environment it was moving into (see Fig. 11). The information provided to them by Nearcast would help them decide whether or not to continue warning on a storm that had already shown severe characteristics.

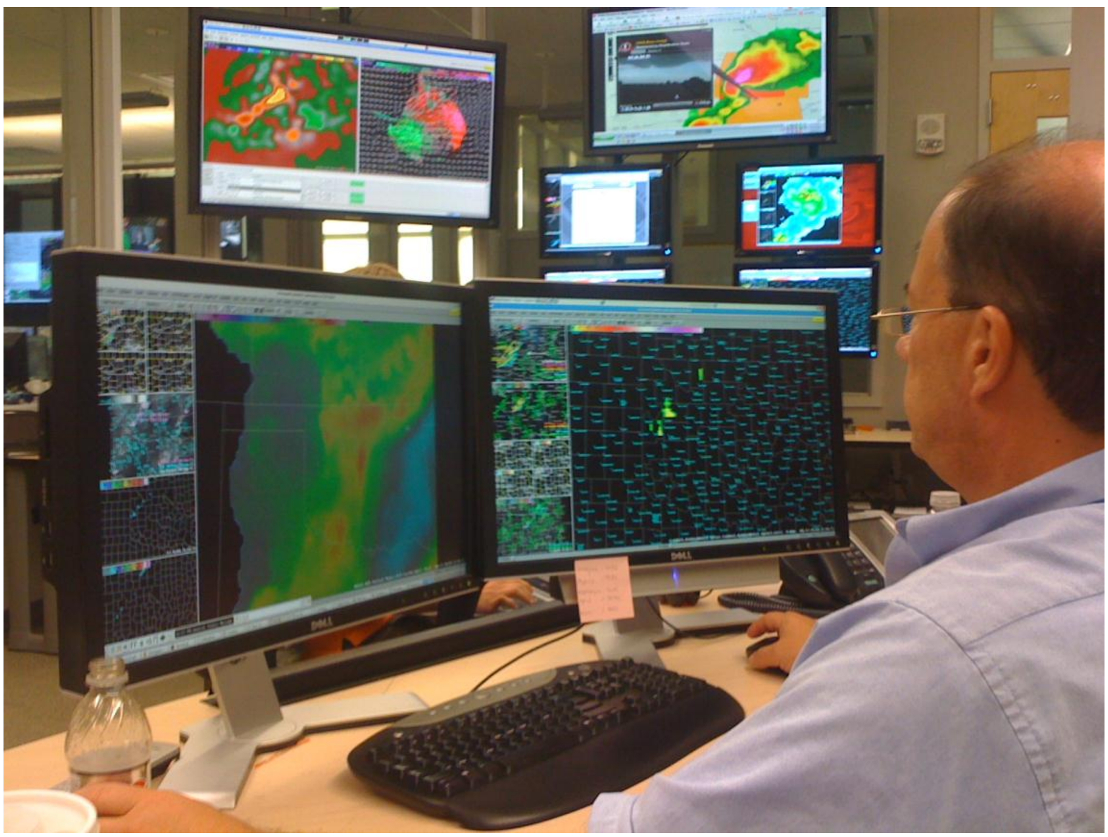

Figure 11 – Nearcast differential theta-e product evaluated by NWS forecaster during EWP warning operations on 9 June 2011.

EFP forecasters used the Nearcast product daily as part of their afternoon forecast updates, taking advantage of the rapidly updating nature of the product, as well as its increased amount of horizontal detail, which model guidance did not provide. The usefulness of the data varied from day to day, with some days performing better than others. This was sometimes due to the amount of cloud cover early on in the day, limiting new sounder retrievals of theta-e and precipitable water over the areas of interest. In these cases, the Nearcast product had to rely on older retrievals that may not have been as representative of the atmospheric conditions because of the rapidly changing nature of these severe environments:

> "I can see the utility in using this product to diagnose how convective instability is evolving with time (keeping its limitations in mind). However, I would rely more on trends than on raw numbers."

Quite often, convective initiation occurred along boundaries, or gradients, within the differential theta-e or precipitable water fields, and the shape of the convection often resembled these gradients, which suggests that the product may have some utility in forecasting convective mode:

> "Initial convection in area of responsibility was correlated with higher values as indicated by vertical precipitable water difference products."

According to EWP post-event surveys, the Nearcast product was used 41% of the time during their forecast/warning operations. EWP forecasters noticed a lead-time on convective initiation of less that 1 hour in 53% of the events, with between 1 and 2 hours being the next most common at 24%. These results may be somewhat biased because the EWP forecasters did not begin looking at the Nearcast product often until after lunch. EWP forecasters did often see how it could be used within WFO operations:

> "I think it could be useful during elevated instability/elevated convection cases, especially when the larger-scale pattern is more dynamic."

The Nearcast product continues to be delivered within the SPC and HWT N-AWIPS and AWIPS workstations and is expected to receive some exposure within SPC operations starting this fall.

7. **Simulated Lightning Threat** – NASA SPoRT and UAH

Prior to the 2010 Spring Experiment, NASA SPoRT provided code to NSSL for generating experimental total lightning threats, following the technique described in McCaul et al. (2009, Wea. Forecasting). The lightning threats were included in the 4-km CONUS NSSL daily WRF runs and demonstrated within the EFP (see Fig. 12). Unlike the simulated satellite imagery, the lightning threat output was provided for the entire NSSL-WRF forecast time period.

In this year's EFP, the lightning threat output was vital to the operation of the CI desk. The CI desk used the lightning threat output as one of their 3 indicators of CI from the NSSL-WRF. Participants used the lightning threat to forecast the first occurrence of CI. Participants at the EFP's severe desk also used the output deterministically to determine the severity of convection produced by the NSSL-WRF (see Fig. 12).

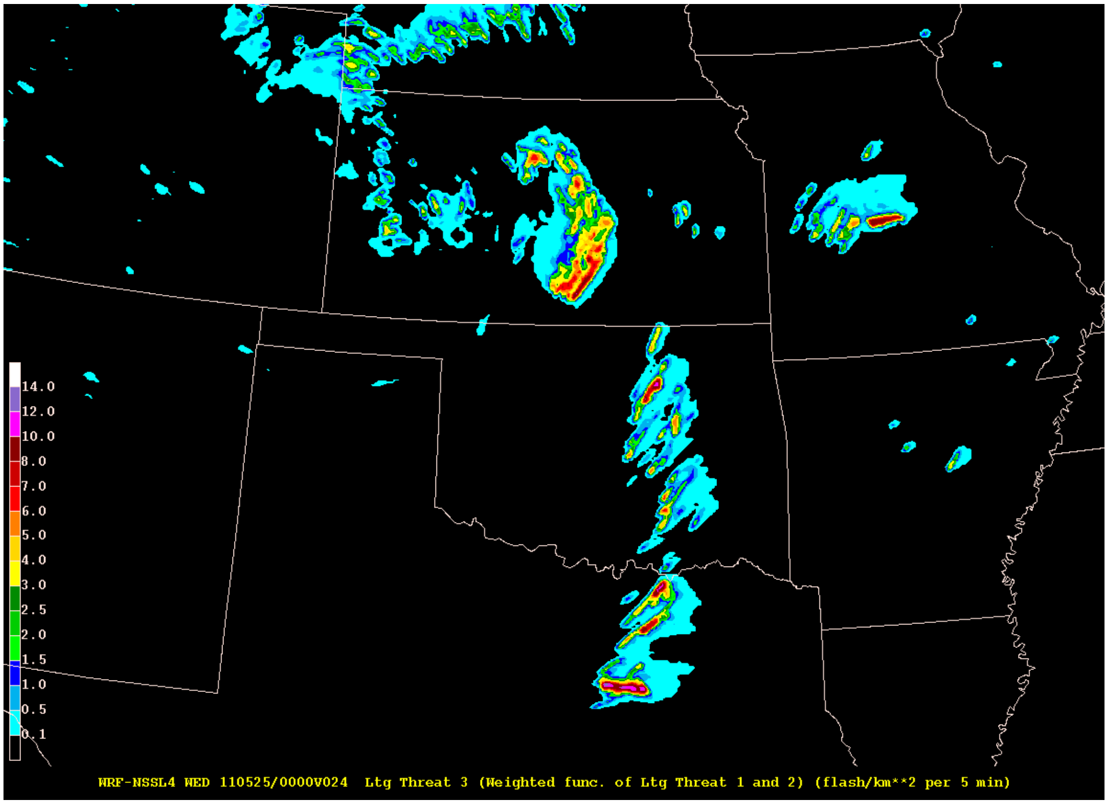

Figure 12 – 24-hour forecast NSSL-WRF simulated lightning threat for 0000 UTC on 25 May 2011.

NSSL continues to generate the total lightning threat forecasts and they are provided within SPC and HWT N-AWIPS workstations. It is expected that these data will provide a valuable tool within operations and future experiments, including this year's Fire Weather experiment.

8. **0-3 Hour Severe Hail Probability** – CIRA

The severe hail probability product from Dan Lindsey at CIRA has been provided within the SPC and HWT N-AWIPS systems since the 2009 Spring Experiment, and since has been expanded from a 1-hour to a 3-hour forecast based on feedback from that experiment (see Fig. 13). Since the 2010 Spring Experiment, a probability of significant severe hail (>2") was created and provided to the SPC and HWT for evaluation (see Fig. 13). The product was informally evaluated during the 2010 and 2011 Spring Experiments since it did not directly fit into the EFP or EWP frameworks.

The product did well in forecasting the occurrence of severe hail 1-2 hours in the future, but it did not seem as if the 3-hour forecast was truly realized due to the reliance of the product on observational data. Unlike previous years, the product no longer seems to have similar probabilities for storms that do not produce hail to those that do.

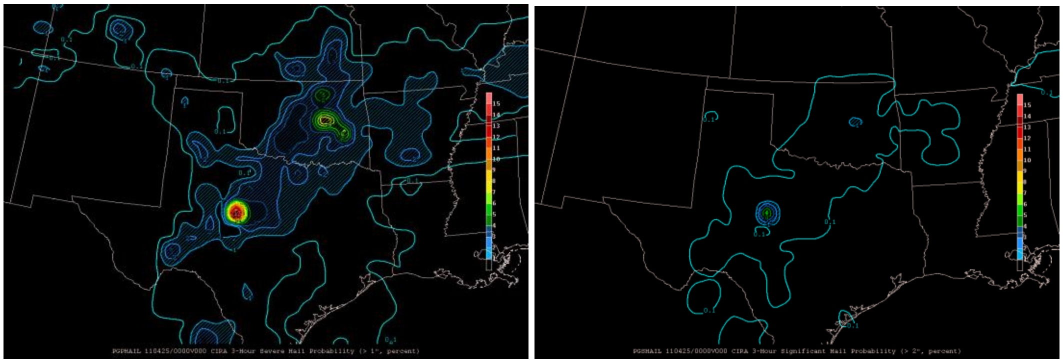

Figure 13 – 3-hour severe hail (left) and significant severe hail probabilities at 0000 UTC on 25 April 2011.

The 0-3 severe and significant severe hail probabilities continue to flow into the SPC and HWT N-AWIPS non-operations systems.

Conclusion

The 2011 Spring Experiment continued the previous years' interactions with the EFP severe and QPF desks, as well as the EWP warning operations. These interactions proved fruitful over past years and continued this year with valuable feedback gathered via direct visiting scientist interaction with forecasters, as well as online post-event surveys and real-time blogging. This year the GOES-R Proving Ground expanded the interactions within the Spring Experiment by including the newly created EWP morning forecast shift and EFP CI desk. Both of these interactions helped to greatly increase the exposure of the GOES-R Proving Ground products within the experiment by demonstrating the products within forecast strategies that were more directly applicable to the products that we were demonstrating.

Some things we can improve upon for future experiments include providing forecasters with some articulate training material, such as recorded modules, for each of the products that they can go through at their WFO prior to their arrival. We may also consider providing a WES case with all of the experimental products to accompany the training material that they can go through on their own time to familiarize themselves with the products. By doing this, day one of the experiment we can get up and running without wasting a day on training. EFP and EWP participants would also like to have more collaboration with each other throughout the day. We attempted some cross-participation this year with a joint EFP-EWP discussion period, as well as having some of the EWP forecasters participate at the EFP CI desk in the morning. However, some additional planning is needed for this to work given the different rigid daily timetables of each of the programs.

Overall, participant feedback was positive. NWS forecasters and visiting scientists from the non-satellite community were excited by the potential of the demonstrated capabilities that will be available on GOES-R once it launches. Based on post-event surveys, 51% of EWP participants reported an increased confidence in satellite-based convective initiation products (SATCAST, UWCI and Nearcast) following their participation, with only 5% reporting a decrease in confidence. NWS forecasters were also generally pleased with the training they received prior to the use of the GOES-R Proving Ground products in real-time forecast and warning operations. 80% of participants reported being comfortable with the SATCAST product prior to real-time operations, with 75% reporting similarly for the UWCI product. 42% of EWP participants reported being comfortable with the Nearcast product and 52% reported being comfortable with the PGLM product, suggesting that there is some room for improvement in the training modules for these products. In particular, forecasters reported that they would like to see more case examples of how the data was or could be used in an operational situation. In addition, forecasters do not like to only be shown obviously positive case events; they also need to know when the product will not do well and would like to see examples of that as well so they know what to expect prior to use in operations.

The complete EWP post-event survey result can be found at:
http://www.zoomerang.com/Shared/SharedResultsSurveyResultsPage.aspx?ID=L26GZV2Q6QZG

More detailed feedback and case examples from the 2011 Spring Experiment can be found on GOES-R Proving Ground HWT blog at:
http://goesrhwt.blogspot.com

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