GOES-R Convective Product Demonstrations at HPC, OPC, TAFB, and SAB

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Overview of the Proving Ground

The Hydrometeorological Prediction Center (HPC), the Ocean Prediction Center (OPC), the National Hurricane Center's Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB) of NESDIS received early exposure to GOES-R and JPSS Proving Ground (PG) products in 2012. Pre-operational demonstrations of these GOES-R and JPSS PG data provided HPC, OPC, TAFB, and SAB operational forecasters and analysts an opportunity to use, critique, and make suggestions on improvements to the products prior to the launch of GOES-R (~2015) and the JPSS satellites (~2017).

Goals of the Proving Ground Project

Precipitation and QPF type products will be demonstrated and evaluated within the HPC, offshore thunderstorm and convective-type products will be demonstrated and evaluated within the OPC and TAFB, and hazardous weather related products will be demonstrated and evaluated within the SAB. These products will be provided (near) real-time so the HPC, OPC, TAFB, and SAB forecasters can use, get familiar with, and evaluate the products and provide valuable feedback to the GOES-R Program Office (GPO).

Product Demonstrations in 2012 and 2013

The GOES-R products demonstrated include those that use proxy Advanced Baseline Imager (ABI) and proxy Geostationary Lightning Mapper (GLM) data. The initial products for 2012 were chosen in consultation with HPC, OPC, TAFB, and SAB based on their mission areas, areas of responsibility, feasibility, the similarity to planned GOES-R and JPSS products, and forecaster availability for evaluation. These products are listed below:

- GOES-14 Super Rapid Scan Operations (HPC/OPC/SAB)
- Overshooting Tops Detection (OPC/TAFB/SAB)
- Lightning Detection and Density (OPC/TAFB/SAB)
- Convective Initiation (OPC/TAFB/SAB)

GOES-14 Super Rapid Scan Operations

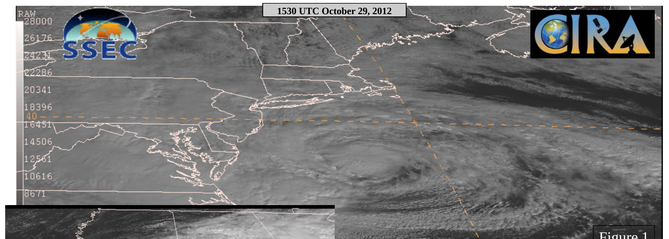

Figure 1

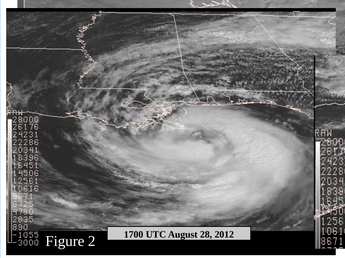

Figure 2

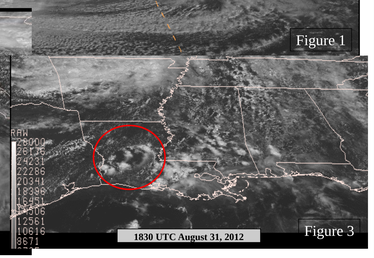

Figure 3

During the 2012 Proving Ground activities, forecasters and analysts were treated to a unique opportunity to observe and evaluate super rapid scan operations (SRSO - 1-minute at 1 km resolution) using GOES-14 (courtesy of hard work by Tim Schmidt – NESDIS/STAR). GOES-14 was still out of storage when Hurricane Sandy formed allowing forecasters and distinguished guests to HPC, OPC, and SAB to observe the complex transition in real-time **(Figure 1)**. When Hurricane Isaac made landfall along the Louisiana coastline **(Figure 2),** the SRSO assisted forecasters at HPC and NHC with monitoring convective trends. One HPC forecaster commented on how the SRSO aided in his QPF decision: "Upon reviewing the standard GOES imagery in 30 minute intervals, I was intrigued by the possibility of a mesohigh over Louisiana (**Figure 3 – red circle)**), which was possibly aiding in the development of a rainband along its periphery. The potential feature was subtle but important. The super rapid scan imagery easily displayed the diminishing cloud shield in the center of the high and the convective elements forming along its flank. This confirmation strengthened my meteorological argument for suggesting that this rain band will continue, along with the potential for the mesohigh to favor the development of additional bands later on." ~ K. James

First Convective Product Demonstrated in HPC/OPC/TAFB/SAB: Overshooting Top Detection (OTD)

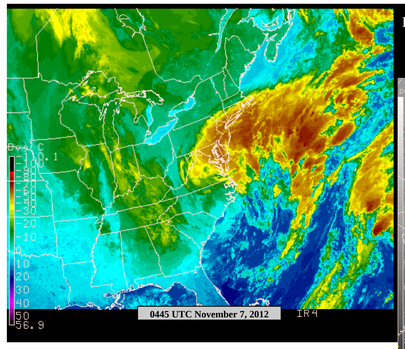

Figure 4

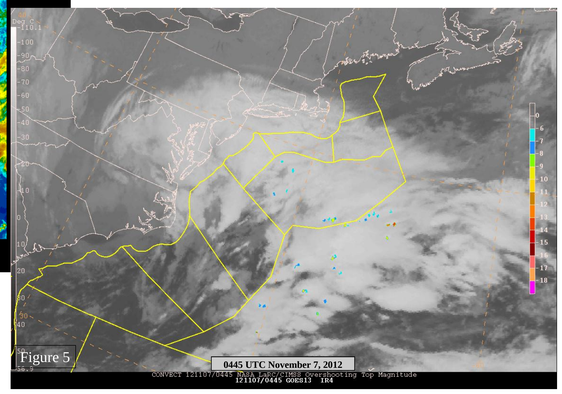

Figure 5

One week after Superstorm Sandy, a strong nor'easter affected the Mid-Atlantic and New England and OPC forecasters were dealing with intense convection in the Offshore zones and High Seas. **Figure 4** shows the 4 km enhanced infrared channel on GOES-13, while **Figure 5** shows the OTD magnitude (Bedka/CIMSS) overlaid on the infrared image. The OTD product performed well in identifying the most intense updrafts associated with supercell thunderstorms in the eastern Offshores zones. The yellow outlines are the OPC offshore zones north of 31N and to the south are the TAFB offshore zones.

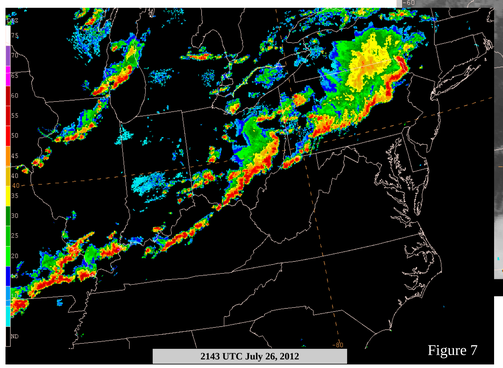

Figure 7

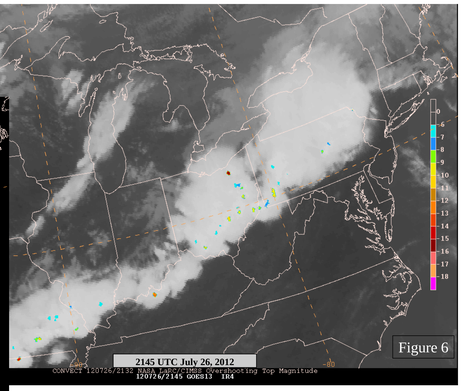

Figure 6

In late July 2012, a strong storm system brought a series of Line Echo Wave Pattern (LEWP) convective elements into the Ohio Valley and Mid-Atlantic. The event was being monitored by HPC and SAB for a possible heavy rain threat due to training convective cells. The OTD did an excellent job of highlighting the most intense updrafts with some exceeding 15K in magnitude **(Figure 6)**. The OTD threshold is 6K, so the cell in northeast OH is particularly robust, but was behind the surface boundary. Therefore, this cell would be monitored for excessive rainfall, while the convective elements within the squall line **(Figure 7)** were being monitored by the Storm Prediction Center for severe weather.

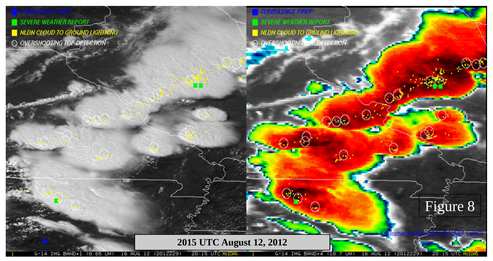

Figure 8

Since GOES-14 was out of storage for the experimental SRSO, Kris Bedka (SSAI) put together the image in **Figure 8** that includes the SRSO in visible and infrared, lightning detection (CG), OTD, severe weather reports, and pireps. Using the OTD algorithm in this way would assist OPC and TAFB forecasters in identifying the most intense convection sooner, especially in poor radar coverage areas.

Future Product Demonstrations at HPC/OPC/TAFB/SAB: Lightning Density (proxy to GLM) and Convective Initiation

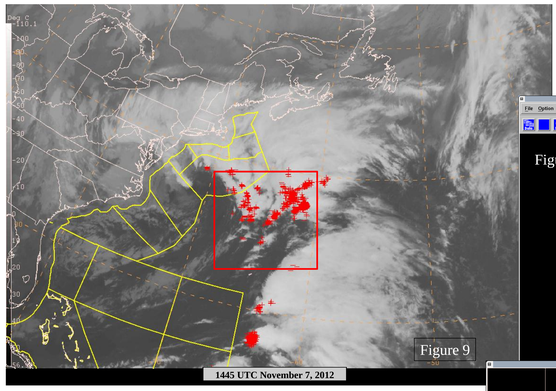

Figure 9

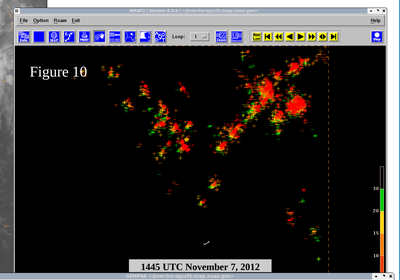

Figure 10

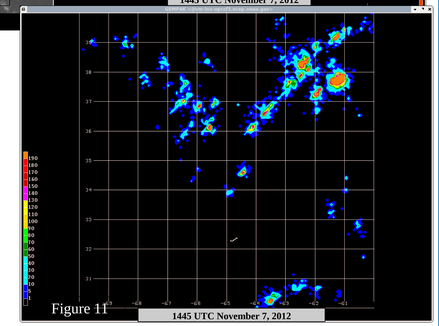

Figure 11

A collaborative effort among OPC, CICS-MD, and NESDIS-STAR started in early Fall 2012 that would investigate a way to create lightning density plots using the Vaisala GLD-360 lighting feed that is ingested at the HPC/OPC. The GLD is used as a partial proxy for GLM as the GLD shows existence and location of CG strikes relevant to the GLM on GOES-R. Greg McFadden (OPC/OAB) started programming code that will take individual lightning strikes and bin them into groups specified by the group. In **Figure 9**, the nor'easter from 11/07/12 was producing excessive lightning in the High Seas zones of OPC. A smaller sample in **Figure 10** gives a more representative picture of how concentrated the lightning strikes were in the red box seen in **Figure 9**. The code written by Greg creates a contoured density plot of the lightning strikes as seen in **Figure 11**. Since OPC and TAFB forecasters don't have radar, lightning serves as a proxy for locating the most intense storms that could affect mariners. The product is expected to be ready in early 2013.

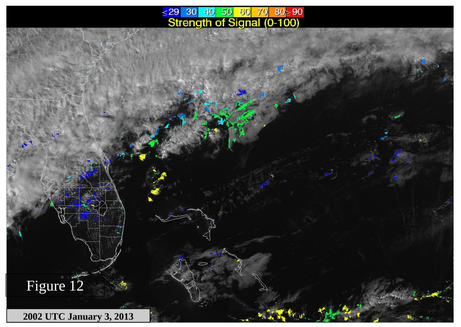

Figure 12

The final convective product that will be introduced to the Proving Ground in 2013 is the UAH Convective Initiation algorithm. The example shown in **Figure 12** was captured on 01/03/13 during a tranquil period. The yellow coloring indicates cumulus clouds that show a 60% chance of developing further, while the cooler colors indicates much lower probabilities. With the higher temporal resolution of GOES-R, this product will serve a valuable purpose in OPC and TAFB operations as it will help determine where the highest convective threats exist for mariners.

2012 Lessons Learned and 2013 Training Plans

- Although the GOES-14 SRSO experiment has completed, the forecasters at HPC, OPC, and SAB continue to inquire on when it will return. HPC in particular found an interesting use for the SRSO to identify a meso-high associated with the outer rainbands of Tropical Depression Isaac.
- Training on the OTD product started in mid-October 2012 and the first round of evaluations ended on 12/31/12. A second evaluation will begin in mid-February 2013 and run through mid-June 2013 to capture the Spring convective season on land and in the Atlantic offshore zones.
- Work continues on the lightning density product being developed at OPC with a target of early 2013 for it to go into operations as an experimental product. Training will be developed and should coincide with the next OTD demonstration.
- The Convective Initiation products will continue to be evaluated in the Proving Ground. Work continues on this algorithm to make it more NWP based. Training will commence around mid-April and the evaluation lasting from 04/15/13 – 07/15/13.