2010 National Hurricane Center (NHC) GOES-R Proving Ground
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Background Information

The 2010 NHC GOES-R Proving Ground is running from Aug. 1, 2010 through Nov. 30, 2010 to provide feedback on GOES-R products generated from proxy data. Table 1 lists the products being evaluated. This report summarizes progress and feedback as of Sept 9, 2010. M. DeMaria (NESDIS/STAR/RAMMB) visited NHC on Sept. 8 and 9th, 2010 and met informally with several forecasters from the Tropical Analysis and Forecast Branch (TAFB) and the Hurricane Specialist Unit (HSU). On the afternoon of Sept. 9th, he observed the preparation of the 21 UTC advisory package for Tropical Storm (TS) Igor and met with HSU forecasters Michael Brennan and Jack Beven and TAFB forecaster Dan Mundell.

Table 1. GOES-R Products in the NHC Proving Ground.

Product	Proxy Data Sources
1. Hurricane Intensity Estimate	SEVIRI Imagery for ABI
2. RGB Air Mass Product	SEVIRI Imagery for ABI
3. RGB Dust Product	SEVIRI Imagery for ABI
4. RGB Saharan Air Layer Product	SEVIRI Imagery for ABI
5. Super Rapid Scan Operations Imagery	GOES-15 imagery for ABI
6. Lightning-based Rapid Intensity Index (RII)	Vaisala GLD-360 lightning network for GLM GOES-east and –west for ABI

Advisory Package Preparation

This process began with at the satellite classification desk of TAFB. Marshall Huffman did position and Dvorak intensity estimates for TS Igor in the far east Atlantic and an invest system in the eastern Caribbean. TS Igor was in range of the Meteosat imagery and he showed how the GOES-R Hurricane

Intensity Estimate (HIE) was utilized. TAFB provides an independent intensity estimate using the subjective Dvorak method, but the HIE is consulted for consistency, and is also provided to the hurricane forecasters. The HIE for Igor was also compared with the operational ADT, version 8.1.1 . The maximum wind estimate for the Igor case from HIE was a little higher than from the ADT. Marshall also pointed out that the HIE minimum sea level pressures tend to have a low bias compared to the operational ADT and subjective Dvorak methods, and this was the case for TS Igor.

After the satellite classification was completed, John Cangialosi described the advisory preparation for TS Igor as it was being prepared. This storm was still in its formative stage and occurred shortly after TS Gaston, which formed in a somewhat similar location, but never developed beyond a marginal tropical storm, probably due to interaction with a very dry and stable air mass. The GOES-R RGB air mass product was viewed for Igor, and it showed that the cyclone was fairly far removed from the dry sub-tropical air to its north, although it was not completely separated from this air mass. This analysis provided some supporting evidence that Igor would intensity, as was being indicated by all of the tropical cyclone intensity guidance models, rather than dissipating like Gaston did. From that point on, the track, intensity and wind radii forecasts were created, as well as the advisory products. The lightning data for Igor showed little activity and, because Igor was just declared a storm that same morning, the time series of lightning data was very short, and provided little insight into Igor's intensity forecast.

<u>GOES-R Feedback Meeting</u>

After the completion of the 21 UTC advisory package, M. DeMaria met for about 1 hour with Michael Brennan, Jack Beven and Dan Mundell to obtain additional feedback and suggestions. Below is the summary of that discussion.

1. HIE product

Most of the feedback on the HIE came during the observation of the satellite intensity estimates during the advisory preparation. The HIE is routinely being consulted for storms east of about 50^{o}W, and is being compared to the ADT values and the TAFB subjective values. Items requiring feedback are listed below.

a. The HIE and ADT maximum wind estimates are generally comparable, but the minimum sea level pressures of the HIE can be unrealistically low at times.

2. RGB Air Mass Product

This product is a useful complement to the dust product, and in some ways, better separates the dry and moist air regions. This may also be helpful later in the season if an extratropical transition occurs in the view of Meteosat. Some items that require follow-up are as follows.

a. The delivery method by Google Earth is okay, but requires full reloading of the loop whenever changes are made to the time interval of the loop. This comment applies to all the Google Earth Products. Mark and Mike will follow up with Kevin Micke from CIRA on this issue. Also, these products should be transitioned to AWIPS as soon as technically feasible.
b. Sometimes the product indicates polar air at very low latitudes. This cause of this is not clear.
c. There are limb effects that perhaps could be corrected as function of zenith angle.

3. Dust Product

This product was generally considered very useful and it complements the use of visible imagery to detect dust. The product was mostly viewed by the HSU but should eventually have some TAFB applications as well. Several tropical systems have had large dust outbreaks to their north this year. Feedback items are listed below.

a. Similar to the air mass product, the Google Earth delivery method could be improved.
b. There may be some cloud contamination problems near stratocumulus fields
c. There may be some false alarms in very low latitudes.

4. SAL Product

The forecasters have been using a similar product for several years, but found the animated version to be an improvement over the static images used previously. Feedback items are listed below.

a. Improve the delivery method.
b. There may be some contamination near stratocumulus fields.

5. SRSO data

Two SRSO cases have been collected during the 2010 GOES-15 Science Test, one during Hurricane Danielle, and one during Hurricane Earl. NHC was able to modify their N-AWIPS system to view some of these images in real time. Additional study in the post-season will be needed to determine the utility of the high temporal resolution images. The goals of obtaining SRSO data during a hurricane landfall has not been achieved, although the Earl case came close.

6. Lightning-Based RII

The forecasters have had less time to look at the lighting based RII product, but their initial impression is that the lightning data tends to have only a moderate impact on the RII probabilities. M. DeMaria showed time series of the inner core and rainband lightning from Alex, Danielle, Earl and Fiona and showed how the evolution of these two parameters can be used qualitatively. When the rainband lightning activity exceeds the core lightning activity, intensification is favored. When there is no lightning

activity at all, rapid intensification is not likely. Mike and Jack indicated that they would look at the lightning time series product later in the season. Below are items that required feedback.

a. A quantitative evaluation of all cases from the 2010 season should be performed to see if the lighting input improves the probabilities of RII, using standard probabilistic verification metrics (Brier score, threat score, ROC score, etc). CIRA will perform this evaluation at the end of the season and present the results to NHC for feedback.
b. The lightning time series plots should be made available for all storm cases after the season for additional evaluation.

Future Plans

Below are some suggests for future NHC Proving Ground activities

1. The RGB products are fairly new and will take several seasons to gain familiarity
2. More experience is needed to determine the value of the lightning input both for the quantitative RII product and for qualitative use for intensity prediction
3. An RGB product developed specifically to aid in TC center fixing might be of use
4. After preliminary research, the overshooting tops algorithm might be evaluated in the 2011 season
5. A product to discriminate between thin and thick cirrus over tropical cyclones would be useful. There are AWG products for that, so proxy versions of those might be considered for the 2011 season