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VALIDATON OF GOES-N IMAGER DATA AND PRODUCTS DURING THE GOES-N SCIENCE TEST

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1. INTRODUCTION

The Geostationary Operational Environmental Satellite (GOES)-I/M series imager instruments have provided quality radiances and derived products for approximately 10 years. In addition to the imagery, a wide variety of Level-2 type products are derived from the GOES imager. These include clear-sky radiances, precipitation estimates, winds, cloud-top properties, land surface temperature, snow cover, solar insolation, fire detection, and aerosol optical depth. The imagery and derived products support numerous Numerical Weather Prediction (NWP), forecasting, and other environmental applications.

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The GOES-N Imager will continue and enhance this NOAA-wide mission. GOES-N is the first satellite in a new series (GOES-N/P) and will be launched in the late fall of 2005 and become operational in mid-2008. The GOES-N/O/P instruments will be similar to the GOES-8/12 instruments, but will be on a new spacecraft bus (Fig. 1). The new spacecraft bus is expected to bring improvements to both the navigation/registration and radiometrics.

The improved registration will provide superior “movie loops” of a number of derived products. With regard to radiometrics, the spectral coverage of the four infrared bands of the GOES-N Imager is plotted in Fig. 2. These are very similar to the spectral band centers and widths of the GOES-12 Imager. The corresponding weighting functions have been calculated for the standard atmosphere and are shown in Fig. 3. Radiances from the GOES-N+ Imagers are expected to be less noisy than the previous imagers as a result of instituting a longer

blackbody dwell time and operating the instrument with a colder patch (detector) temperature. In addition, the GOES-N/O/P series will be capable of providing imagery through the spring and fall "eclipse" or "keep out" periods. These "eclipse" periods occur around the time of the spring and fall equinoxes and can result in an interruption of imagery for as long as two hours centered approximately on 06 and 09 UTC for GOES-East and West, respectively.

As with previous GOES post-launch checkouts, a science test period schedule will be integrated within the National Environmental Satellite Data and Information Service (NESDIS)/National Aeronautics and Space Administration (NASA) Post-Launch Test (PLT) schedule (Hillger et al. 2003; Daniels et al. 2001). During the science test period, the GOES-N imager and sounder (Schmit et al. 2005) will be operated in a special test mode, where the default imager and sounder schedules allow for continuous imaging of the continental United States at 5-min and 30-min intervals, respectively. Numerous other predefined imager and sounder schedules and sectors will be available for use that will allow for the capture of significant weather phenomena of varying scales during the science test period.

During this science test period, numerous groups within NESDIS and its Cooperative Institutes will be involved with validating both the GOES-N measurements and derived products. Several goals to accomplish during this science test period include: 1) Investigate and quantify/characterize the quality of the GOES-N measurements; 2) Generate Level-2 products from these measurements and validate them; and 3) Investigate the utility of nearly continuous rapid scan imager and sounder imagery for improving forecasts of severe weather. Details involving each of these goals are described in the following sections.

2. RADIANCES

The imagery and radiance quality will be monitored and characterized during the NOAA post-launch science test. This will be accomplished by comparing GOES-N radiances to similar radiances from other satellites (Gunshor et al. 2004), performing noise and striping analyses (Hillger and Vonder Haar 1988) and performing comparisons of observed radiances to radiances computed from forward model calculations. Impacts of increasing the imager's scan-mirror's dwell time on the blackbody from 0.2 sec to 2 sec will be assessed. The noise for the long and mid-wave channels is expected to be significantly improved which should bring a significant improvement in the precision of their calibration. At the same time, a reduction in striping is expected which will improve the quality of the imagery and the Level-2 products derived from this imagery.

3. PRODUCTS AND RAPID SCAN IMPACTS

The second goal of the GOES-N PLT will be to generate Level-2 products from the GOES-N imager data stream and validate them. Every product is expected to benefit as a result of improved calibration, reduced channel noise, and better navigation. Products such as atmospheric motion winds that rely on accurate navigation between images may benefit even more. Many of the GOES-N products that are generated will take advantage of the continuous rapid scan imagery, as well as some of the special scanning schedules offered during the GOES-N science test.

Validation of the derived products will be done in a variety of ways. They will be compared to equivalent products generated from other satellites and/or to ground-based observations. Where and when possible, attempts will be made to quantify the impact of the improved attributes of GOES-N on the accuracy and/or utility of the derived products.

4. SUMMARY

The upcoming GOES-N Imager PLT will be an important step in the preparation for operational use of the Imager to produce a number of products. More information on the GOES-N/O/P series can be found on-line at the following web addresses:
http:///www.osd.noaa.gov/GOES/goes_n.htm
http://www.osd.noaa.gov/GOES/GOES_NQBooklet.pdf.

At the time of this writing, the GOES-N spacecraft had not been launched. Upon successful launch and execution of GOES-N PLT, the results of analyses involving the imager radiances and derived products will be presented at the conference.

5. ACKNOWLEDGMENTS

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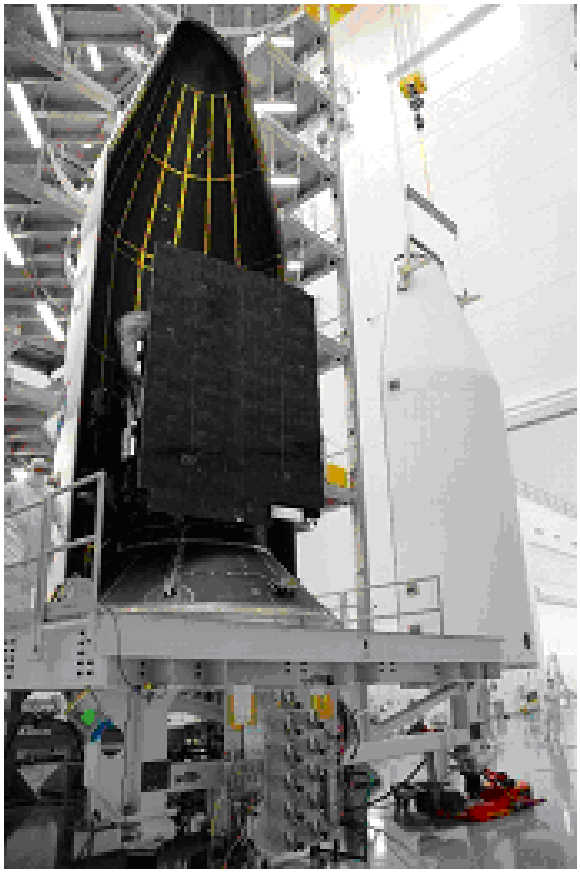

Figure 1. The GOES-N spacecraft. (Courtesy of NASA)

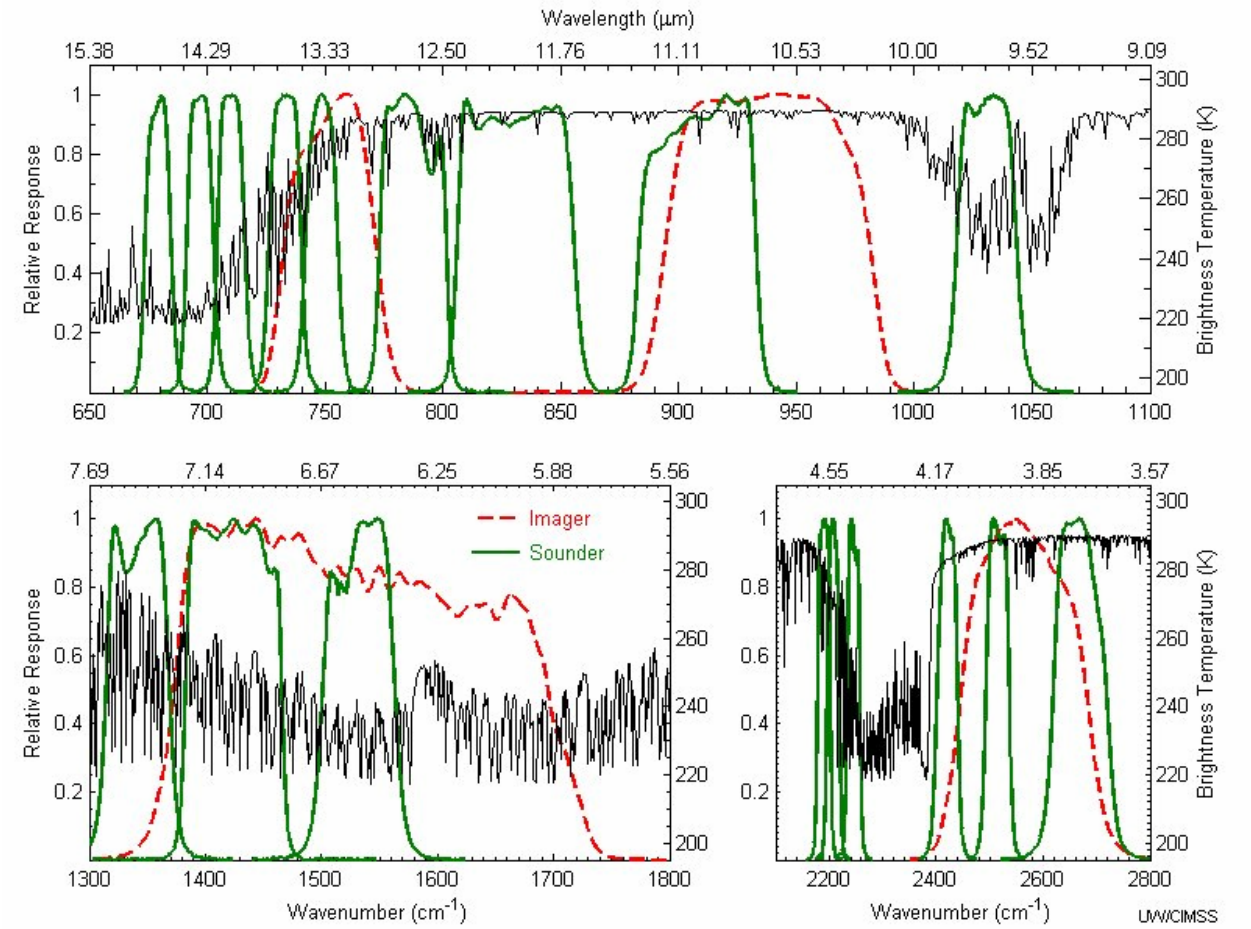

Figure 2. The spectral coverage of the four Imager (dashed lines) and the eighteen GOES-N Sounder (solid lines) IR bands plotted with the earth-emitted spectra calculated from the U.S. Standard Atmosphere.

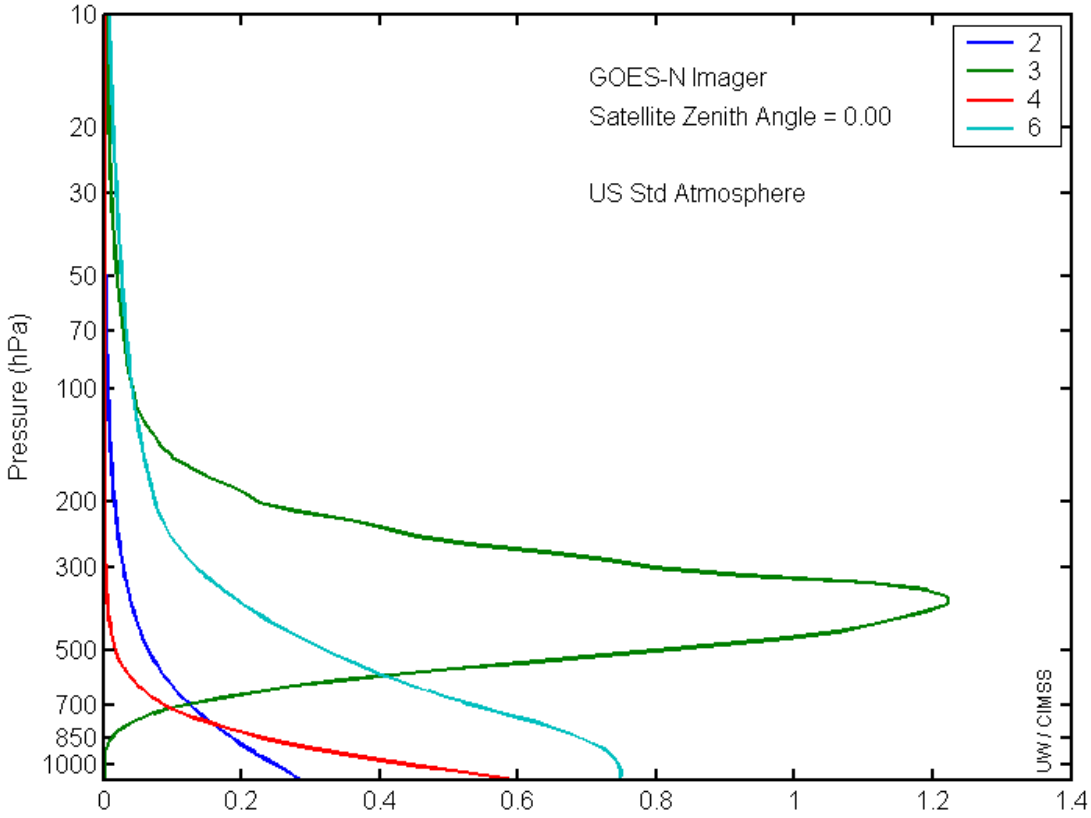

Figure 3. The weighting functions of the four GOES-N Imager infrared bands.