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The GOES-N Sounder Data and Products

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1. INTRODUCTION

The Geostationary Operational Environmental Satellite (GOES) Sounders have provided quality hourly radiances and derived products over the continental U.S. and adjacent oceans for approximately 10 years. The products derived include: clear-sky radiances; temperature and moisture profiles; Total Precipitable Water vapor (TPW) and layer PW; atmospheric stability indices such as Convective Available Potential Energy (CAPE) and Lifted Index (LI); cloud-top properties; clear-sky water vapor winds via radiance tracking; and total column ozone (Li et al. 2001, Schreiner et al. 2001, Schmit et al. 2003). These products are used for a number of numerical weather prediction and forecasting applications (Bayler et al. 2001, Dostalek et al. 2001, Schmit et al 2001). The GOES-N Sounder will continue this mission.

GOES-N is the first satellite in a new series 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 through 12 instruments, but will be on a new and improved spacecraft bus (Fig. 1). The new bus will allow improvements both to the navigation and registration, as well as improved radiometrics. The better registration will provide superior "movie loops" of a number of derived products. The improved navigation is due in part to the migration from earth sensors to star trackers (Slafer 2005). The spectral coverage of the eighteen infrared bands of the GOES-N Sounder is plotted in Figure 2. These are very similar to the spectral band centers and widths of the previous GOES Sounders. The corresponding weighting functions have been calculated with the standard atmosphere (Fig. 3). Radiances from the GOES-N+ Sounder will be less noisy, due to a colder patch (detector) temperature. In addition, in contrast to previous GOES satellites, the GOES-N/O/P series will provide data through the spring and fall "eclipse" or "keep out" periods. This is important as observations will be supplied during these times (approximately centered on 06 and 09 UTC for GOES-East and West, respectively) around the equinoxes. For example, the Sounder cloud-top

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pressure Derived Product Image (DPI) in Figure 4 shows the lack of GOES-12 Sounder coverage during the landfall of Hurricane Ivan in 2004.

Similar to previous GOES checkouts following launch, there will be a pre-operational period, during which the instruments are run in various routine schedules to provide radiance measurements to be validated as well as to generate products from the radiances (Daniels et al. 2001, Hillger et al. 2003). These post-launch check-out periods are essential to the subsequent operational use of the satellite assets. A number of groups within NOAA NESDIS and its cooperative institutes take part in these Post-Launch Tests (PLT).

2. RADIANCES

The imagery and radiance quality will be monitored during the NOAA post-launch science test. As with other GOES checkouts, there are three primary goals for the GOES-13 (N) science test. The first goal is to assess the quality of the GOES-13 radiance data. This will be accomplished by comparisons with other satellite measurements, by investigation of the consistency of the radiances compared with forward model calculations, and by calculation of the signal-to-noise ratio.

The GOES-N long and mid-wave channels show Noise Equivalent delta Radiances (NEdN)'s that are approximately 2/3 those of the GOES-12 ground test. The position of the boom allows for colder detectors and hence less instrument noise (Fig. 5).

To minimize data outages, GOES-N/O/P will supply data through the eclipse periods. Batteries have been added to the GOES-N series spacecraft batteries are designed to be large enough to run through eclipse. Also, shields have been added to the secondary mirror spiders. Outages due to Keep Out Zones (KOZ) will be minimized. If the PLT period occurs during the eclipse season, data during these previously unavailable times will be investigated.

3. PRODUCTS

The second goal of the PLT will be to generate products from the GOES-13 (N) Sounder data stream and compare them to products produced from other satellites, as well as other ground-based observations. The Sounder products that will be produced include: clear-sky radiances, temperature/moisture retrievals, Total Precipitable Water, layer PW, Lifted Index, cloud-top parameters, and possibly ozone. The third goal is to investigate and measure the impact of the new satellite bus on instrument performance and product quality, manifested through the expected improvements in navigation, calibration, and data availability.

4. SUMMARY

The upcoming GOES-N Sounder PLT will be an important step in preparing for operational use of the Sounder to produce a number of products (clouds, retrievals, DPI, ozone, etc). The new GOES-N/O/P bus means there will be virtually no spring and fall eclipse outages, much reduced Keep Out Zone outages and better calibration (colder detectors). Plus, there will be improved navigation and registration.

More information on the GOES-N/O/P series can be found on-line at the following Web address: http://www.osd.noaa.gov/GOES/GOES_NQBooklet.pdf. Other information is also available via COMET's VISITview program.

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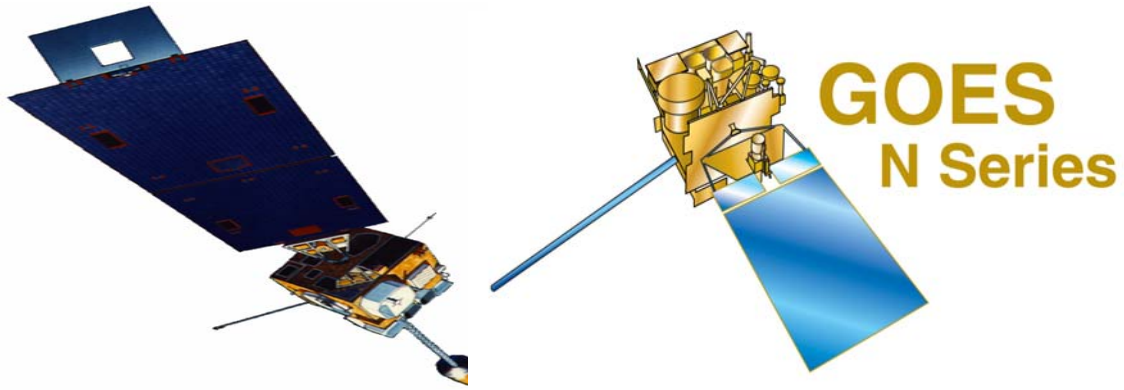

Fig. 1. GOES-8 through 12 (left) and GOES-N/O/P (right) spacecraft diagram. Figures courtesy of NASA.

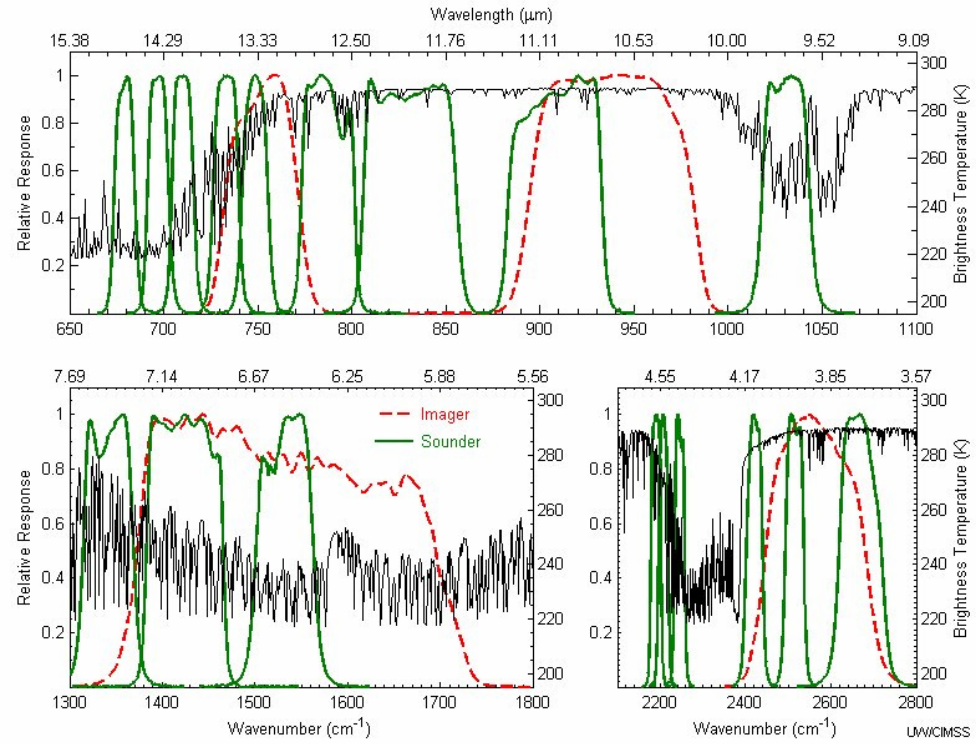

Fig. 2. The spectral coverage of the eighteen GOES-N Sounder (and four Imager--dashed) IR bands plotted with the earth-emitted spectra calculated from the U.S. Standard Atmosphere.

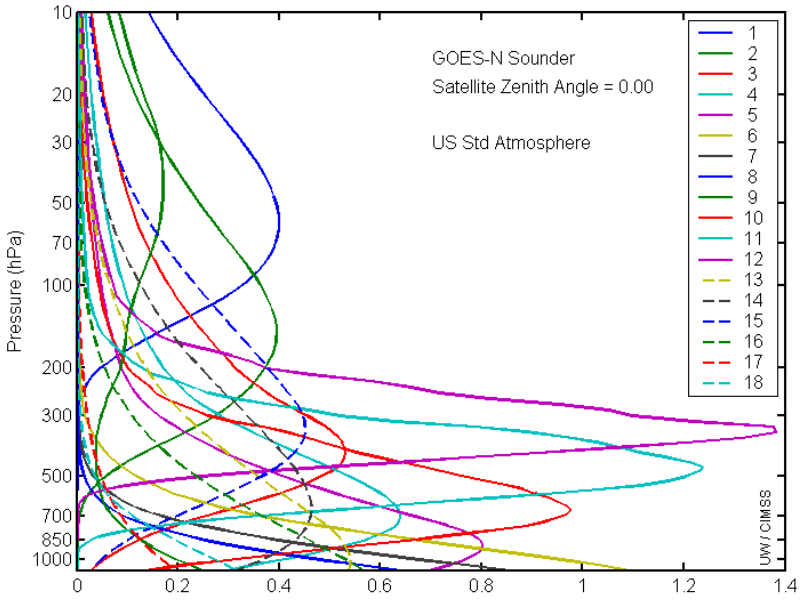

Fig. 3. The weighting functions of the eighteen GOES-N Sounder infrared bands.

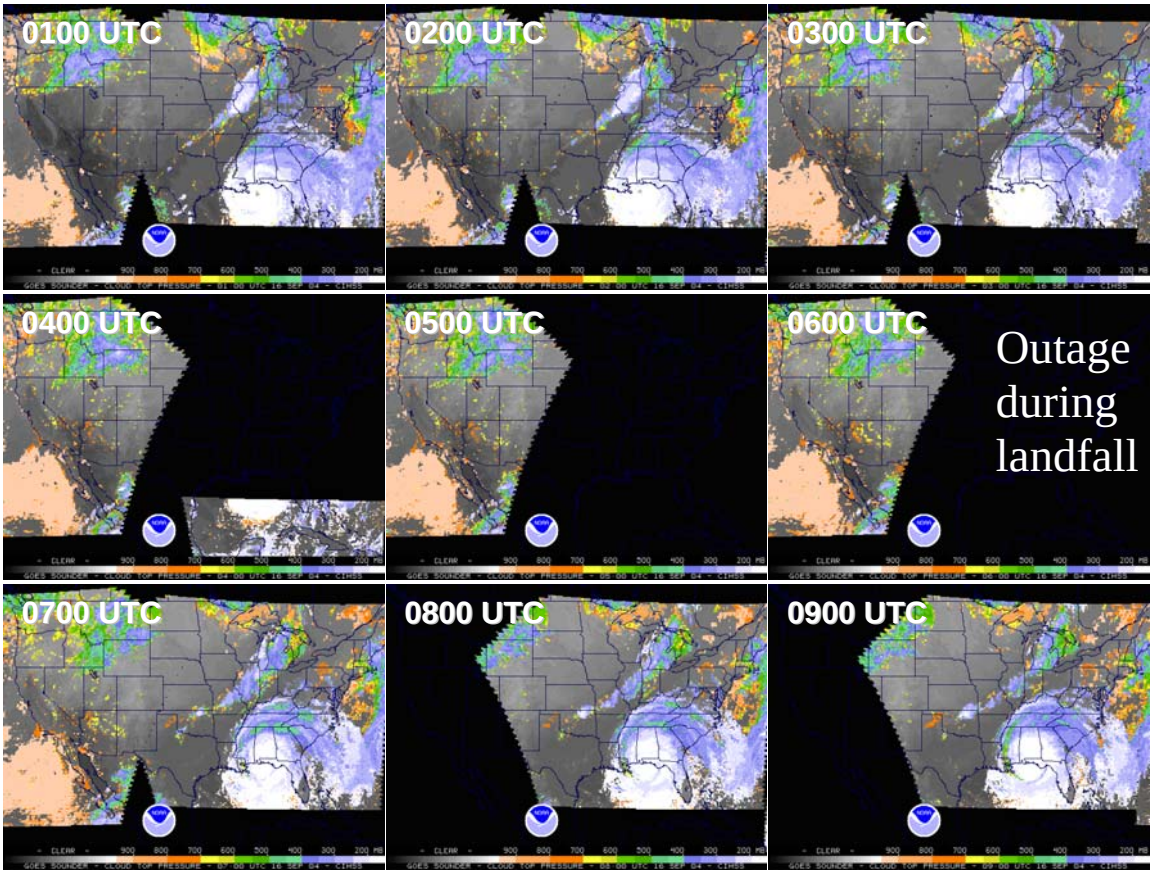

Fig. 4. GOES-10 & -12 Sounder Cloud Top Pressure Coverage during the landfall of Hurricane Ivan: 16 September 2004.

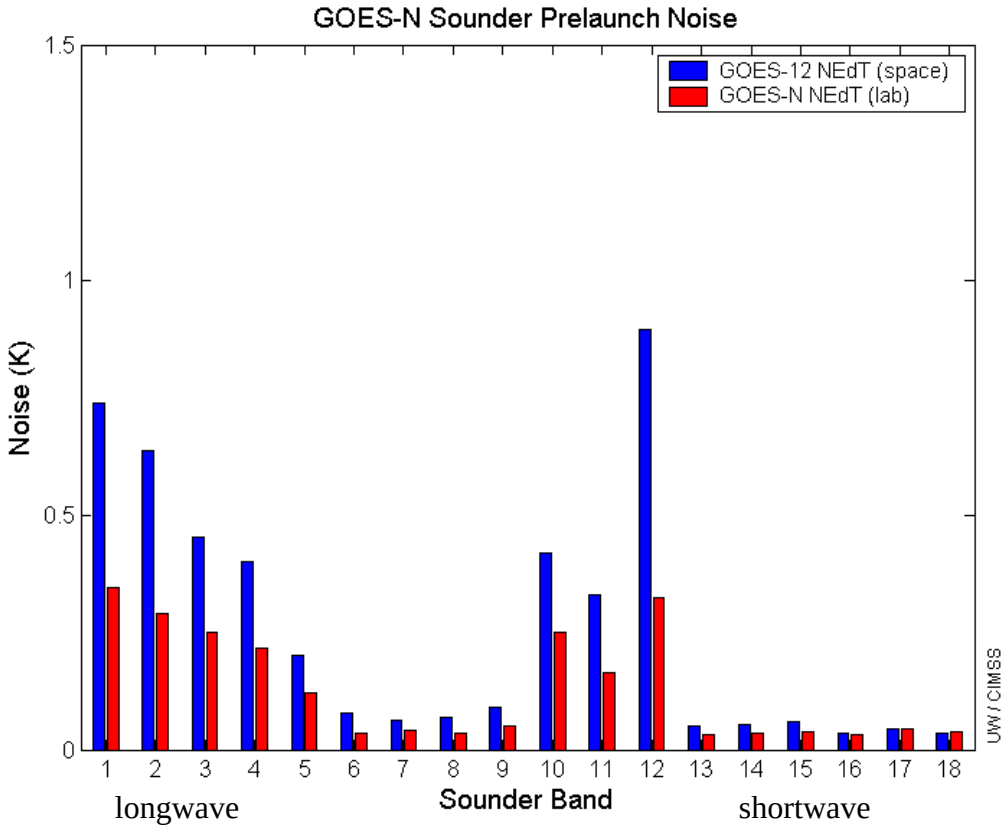

Fig. 5. The GOES-N Sounder estimated noise is expected to be an improvement over the current series.