



Applications of the GOES-R HES (Hyperspectral Environmental Suite) Infrared measurements



Timothy J. Schmit

NOAA/NESDIS/ORA (Office of Research and Applications)
Advanced Satellite Products Team (ASPT)
Madison, WI USA
E-mail: Tim.J.Schmit@noaa.gov
Web page: <http://cimss.ssec.wisc.edu/goes/hes/>

Jun Li

Cooperative Institute for Meteorological Satellite Studies
(CIMSS)

W. P. Menzel

NOAA/NESDIS/ORA (Office of Research and Applications)

Mathew M. Gunshor

Cooperative Institute for Meteorological Satellite Studies
(CIMSS)

James J. Gurka

NOAA/NESDIS/OSD (Office of Systems Development)



IR data from the HES will be used for (in part):

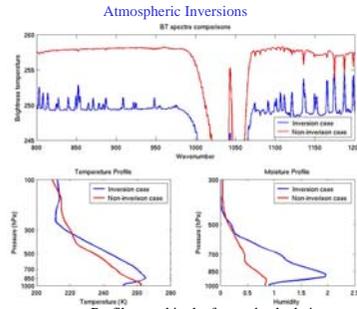
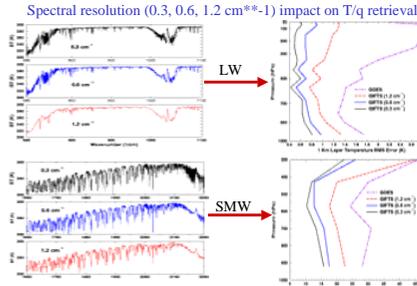
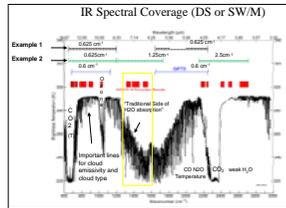
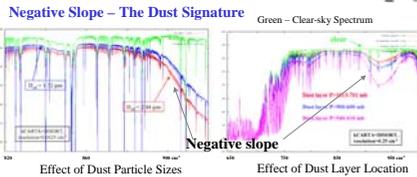
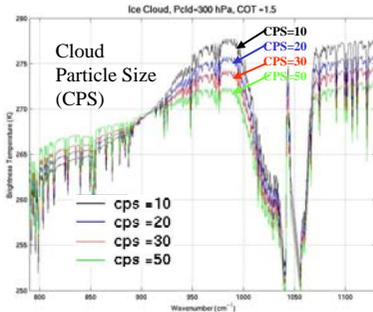
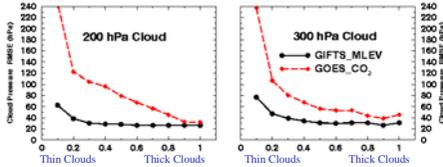
- 1) providing hourly three-dimensional picture of atmospheric temperature and water vapor;
- 2) tracking atmospheric motions and assigning heights more accurately;
- 3) distinguishing between ice/water cloud and identifying cloud microphysical properties;
- 4) providing a 4 km field of view (FOV) for better viewing between clouds and cloud edges;
- 5) providing accurate land and sea surface temperatures and IR surface emissivities;
- 6) distinguishing atmospheric constituents, including dust, volcanic ash and ozone;
- 7) the high-spectral resolution measurements can also be used for satellite comparisons;
- 8) calculating OLR (Outing Longwave Radiation) for climate applications and
- 9) detecting clear-sky low-level atmospheric inversions.

In order to meet user requirements, several instruments have been designated for the GOES-R notional baseline:

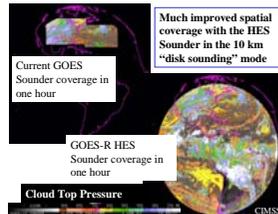
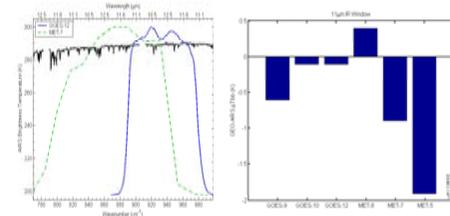
- Payload key:**
- HES** Hyperspectral Environmental Suite
Sounder (IR) and
Coastal Waters (visible/near-IR)
 - ABI** Advanced Baseline Imager
 - GLM** Geostationary Lightning Mapper
 - SIS** Solar Imaging Suite
 - SEISS** Space Environment In-Situ Suite
 - MAG** Magnetometer
 - AUX** Auxiliary Services
LRT--Low Rate Information transmission
EMWIN--Emergency Managers Wx Information Network
DCS--Data Collection System
SAR-- Search and Rescue

The increased spectral, temporal and spatial resolutions of the Hyperspectral Environmental Suite (HES) on the Geostationary Operational Environmental Satellite (GOES)-R and beyond will provide a substantial increase in the quantity and quality of the products. The GOES-R, slated for launch in 2012, will offer improved data from an advanced operational, geostationary sounder HES. The HES will be a multi- or high-spectral imager and hyperspectral sounder instrument suite with three threshold tasks. HES will provide high-spectral resolution Hemispheric Disk Soundings (DS), Severe Weather Mesoscale (SW/M) soundings, and Coastal Waters (CW) imaging (in the visible/near-IR spectral regions).

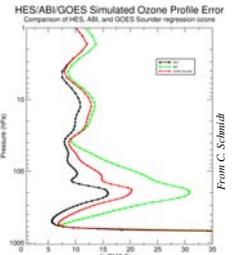
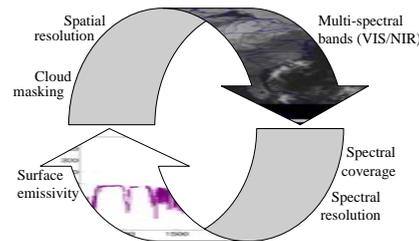
HES DS will provide better than 10 km spatial resolution from 3.7 μm to 15.4 μm with a one-hour refresh rate of the full disk, 62° local zenith angle. SW/M will cover a 1000 x 1000 km square in 4 minutes, at 4 km spatial resolution for the infrared (IR) bands. The GOES-R HES will be a very flexible instrument that can provide hourly coverage of the near full disk, or provide more frequent coverage of smaller areas (1000 x 1000 km in 4 minutes) with 4 km horizontal resolution. The latter will be used when there is the potential for explosive development of severe thunderstorms, hurricanes, or severe winter storms. It can also be used in areas where the numerical forecast models have low confidence (targeted observations).



Hyperspectral Reference for Inter-calibration of Broadband Sensors



Best products will be realized from combinations of ABI and HES (Hyperspectral Environmental Suite) data (IR and Visible/near IR on the HES-Coastal Water)!



Simulations of ozone at nadir show the accuracy of high-spectral resolution data, the current GOES sounder and the ABI band.

The great amount of information from IR HES measurements on the GOES-R series will both offer a continuation of current product and services, but also allow for improved or new capabilities. These products will cover a wide range of phenomena. The data will be used in **Regional Models** (much greater positive impact due to increased vertical resolution, surface emissivity and cloud improvements and better definition of low level moisture), **Global Models** (hourly data assimilation and increased spatial resolution), **Forecast Offices and National Centers** (improved severe weather forecasting due to low-level moisture fields and rapid scan capability and improved cloud/moisture products to influence hourly roundups and flash flood projections), **Tropical Prediction Center** (high vertical resolution water vapor wind profiles to improve tropical storm track/intensity forecasts), **Aviation Weather Center** (improved depiction of clouds and volcanic ash due to hyperspectral detection), and **Synergy** (several ABI products will be improved with co-located HES data).