

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

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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 2013, 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. 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).

IR data from the HES will be used for: 1) providing an accurate, hourly three-dimensional picture of atmospheric temperature and water vapor; 2) tracking atmospheric motions by discriminating more levels of motion and assigning heights more accurately; 3) distinguishing between ice and 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 with improved certainty, including dust, volcanic ash and ozone; and 7) detecting clear-sky low-level atmospheric inversions.

The HES-IR will be able to provide higher spectral resolution observations (on the order of 1 cm^{-1} , compared to 20 cm^{-1} on today's broadband GOES sounder). There are many areas where the HES sounder capabilities and applications offer a distinct advantage over the current filter-wheel GOES Sounders. Two such examples are the improved spatial coverage and the vertical moisture information. Due to a coverage rate 5 times faster than current GOES, the HES will allow much improved spatial coverage. The current GOES sounder only scans the continental U.S. and some surrounding oceans, while GOES-R will be able to cover the land and ocean regions within 62 degrees of satellite sub-point in one hour. Due to its high spectral resolution, the HES will provide an hourly three-dimensional picture of water vapor as never before seen from geostationary orbit.

Improvements mentioned above and additional applications of HES on GOES-R are demonstrated in this talk by using current satellite and aircraft measurements as well as simulated data.

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