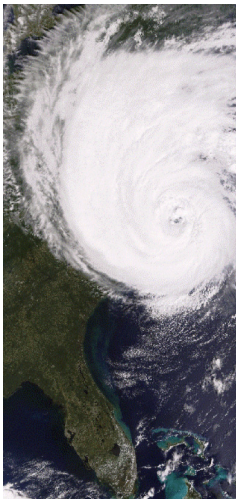
Updated February 2014

GOES-R Imagery
Cloud and Moisture Imagery

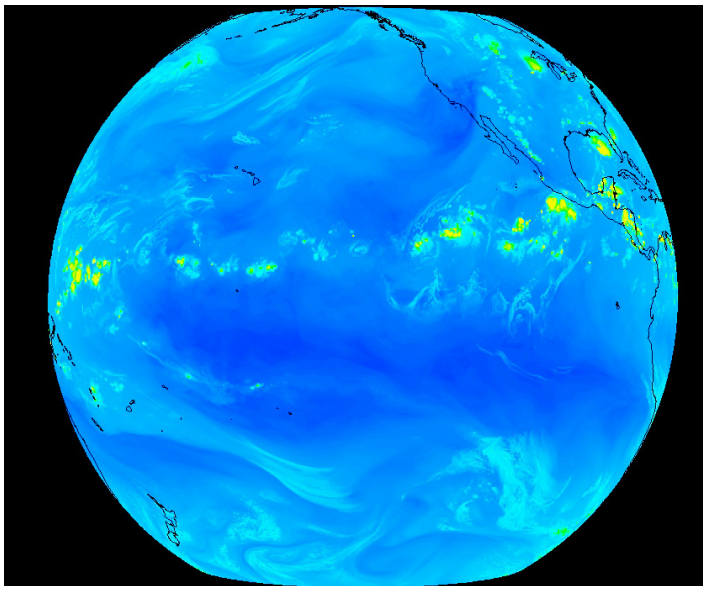


Credit: CIMSS

What is GOES-R?
The Geostationary Operational Environmental Satellite - R Series (GOES-R) is the next generation of National Oceanic and Atmospheric Administration (NOAA) geostationary Earth-observing systems. Superior spacecraft and instrument technology will support expanded detection of environmental phenomena, resulting in more timely and accurate forecasts and warnings. The Advanced Baseline Imager (ABI), a sixteen channel imager with two visible channels, four near-infrared channels and ten infrared channels, will provide three times more spectral information, four times the spatial resolution and more than five times faster coverage than the current system. Other advancements over current GOES capabilities include total lightning detection (in-cloud and cloud-to-ground flashes) and mapping from the Geostationary Lightning Mapper (GLM) and increased dynamic range, resolution and sensitivity in monitoring solar X-ray flux with the Solar Ultraviolet Imager (SUVI). The first satellite in the GOES-R series is scheduled for launch in early 2016.

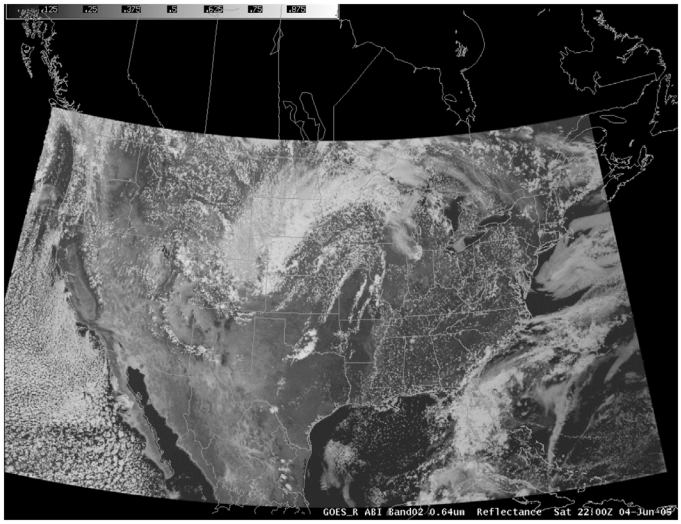
What is cloud and moisture imagery?
Cloud and Moisture Imagery is the satellite imagery that forecasters and the public are accustomed to viewing in weather forecast offices, on the web and in the news. **Cloud and Moisture Imagery** includes digital maps of the observed land, water, and clouds. Reflectance and radiance measurements for visible, near-infrared and infrared bands, respectively, are converted into digital information which can be displayed by a visualization system. **Cloud and Moisture Imagery** of the 16 ABI spectral bands represent the GOES-R system key performance parameter (KPP). A KPP product means the system must provide this capability. The imagery will also be used as input to the various product algorithms such as cloud properties, atmospheric motion vectors, sea surface temperature, etc.

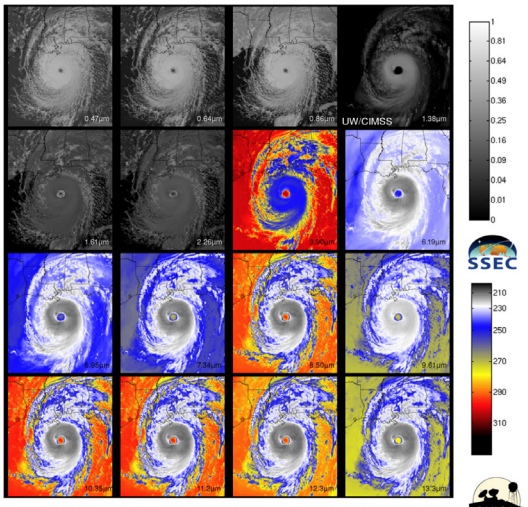
How is cloud and moisture imagery used?
The imagery from the GOES-R ABI will not only be used directly, by National Weather Service and other forecasters, as part of broadcast media, and on the Internet, but also indirectly via derived products or in numerical weather prediction models to better define the initial state. Data from ABI will have a wide-range of uses and multiple societal benefits in areas such as severe weather, energy, transportation and commerce.



Simulated ABI band 10 (7.34 µm) for 26 June 2008 at 21:00 UTC over the Pacific. The image is displayed using Man computer Interactive Data Access System (McIDAS)-V.

Six of the ABI bands are similar to the current GOES imagery. The 0.6 µm is used in part for daytime clouds fog, insolation and winds. The 3.9 µm has been demonstrated to be useful in many applications, including fog/low cloud identification at night, fire/hot-spot identification, volcanic eruption and ash detection, and daytime snow and ice detection. This band is also useful for studying urban heat islands. The 6.2 µm monitors midtropospheric water vapor and the 12.3 µm band, the long wavelength part of the "split window," is similar to bands on both the earlier imagers and the current sounders. This band is used for low-level moisture determinations, volcanic ash identification, dust, sea surface temperature measurements, and cloud particle size estimates. The 13.3 µm band continues measurements from the current sounders and later imagers for cloud detection, cloudtop height assignments of cloud-drift motion vectors,





ABI band data for 2005 August 28 22:00 UTC

Left: Simulated ABI band 2 (0.64 µm) for 4 June 2005. Right: Simulated images of the 16 ABI bands for Hurricane Katrina. These images were simulated via a combination of high spatial resolution numerical model runs and advanced 'forward' radiative transfer models.

high-cloud products supplementing surface-based observations, tropopause delineation and estimation of cloud opacity. The current GOES imagers offer only the 12 or 13.3 µm channels. ABI will provide both bands, allowing for enhanced products.

Ten of the ABI bands are new to GOES-R, allowing new products that are currently not available. The additional bands on ABI are 0.47 µm for aerosol detection and visibility estimation; 0.865 µm for aerosol detection and estimation of vegetation health; 1.378 µm to detect very thin cirrus clouds; 1.6 µm for snow/cloud discrimination; 2.25 µm for aerosol and cloud particle size estimation, vegetation health, cloud properties/screening, hot-spot detection, moisture determination and snow detection; an additional two bands at 7.0 and 7.34 µm for midtropospheric water vapor detection and tracking and upper-level sulfur dioxide (SO_2) detection; 8.5 µm for detection of volcanic dust clouds containing sulfuric acid aerosols and estimation of cloud phase; 9.6 µm for monitoring atmospheric total column ozone and upper-level dynamics; and 10.35 µm for deriving low-level moisture and cloud particle size. Each of these bands is often used in conjunction with other bands (such as the 11.2 µm) in a multi-spectral approach for product generation, such as the clear sky mask or aviation-related products.

Research and Development Partners for Cloud and Moisture Imagery Products

- Cooperative Institute for Meteorological Satellite Studies (CIMSS) at the University of Wisconsin
- NOAA National Environmental Satellite, Data, and Information Service, Center for Satellite Applications and Research (NESDIS/STAR)
- Cooperative Institute for Research in the Atmosphere (CIRA)

On the Web

http://cimss.ssec.wisc.edu/abi/
http://cimss.ssec.wisc.edu/goes_r/proving-ground.html
http://www.economics.noaa.gov/?goal=weather&file=obs/satellite/goes&view=benefits

For More Information, Contact:

GOES-R Program Office
Code 410
NASA Goddard Space Flight Center
Greenbelt, MD 20771
301-286-1355

Jim Gurka, james.gurka@noaa.gov
Steve Goodman, steve.goodman@noaa.gov

What are the benefits?

ABI addresses the needs of many users of geostationary data by increasing spatial resolution (to better monitor small-scale features), scanning faster (to improve temporal sampling and to scan additional regions) and adding spectral bands (to enable new and improved products for a wide range of phenomena). Every product from the current GOES imager will be improved due to data from ABI. In addition, several new products, such as vegetative health and atmospheric visibility, will be possible and exploit the improved spectral, temporal and spatial resolutions. An independent study determined that the incremental monetary benefits from the GOES-R series of just five of the societal application sectors (aviation, energy, irrigated agriculture, recreational boating and tropical cyclones) were estimated to be at least $4.6B over that of the current system.

Contributors: Timothy J. Schmit – NOAA/NESDIS/STAR, M. Gunshor, K. Bah, J. Otkin, J. Feltz, C. Schmidt, J. Sieglaff, William Straka - CIMSS and the Cloud and Moisture Imagery Applications Team.