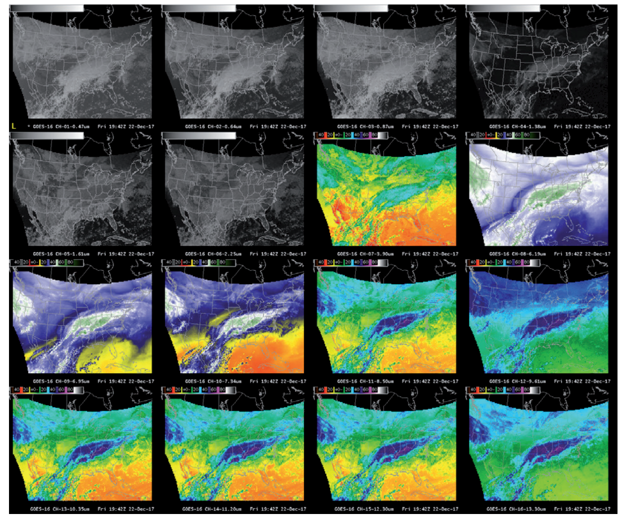
GOES-R Cloud and Moisture Imagery

FACT SHEET

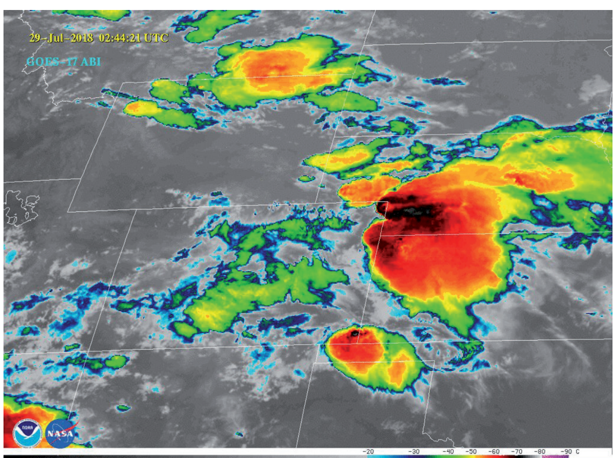
What is cloud and moisture imagery?

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 observed land, water and clouds. The GOES-R Series **Advanced Baseline Imager (ABI)** measures energy at different wavelengths, which is either reflected (visible and near infrared) or emitted (infrared) from Earth's surface. The 16-channel imager has two visible channels (or bands), four near-infrared channels and ten infrared channels that provide three times more spectral information, four times the spatial resolution, and more than five times faster coverage than the previous system. The GOES-R Series ABI cloud and moisture imagery represents the key performance parameter, a capability the system must provide. The imagery is also used as input to various product algorithms such as cloud properties, atmospheric motion vectors, sea surface temperature, and more.



The ABI's 16 spectral bands are shown as a 16-panel panel image of the contiguous United States on December 22, 2017, from GOES-16. The first two bands sense energy in the visible, the following four in the near infrared, and the final ten in the infrared. Credit: NOAA/CIMSS

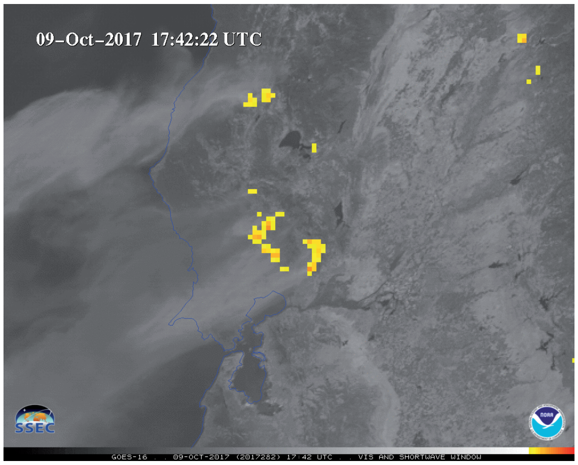
What cloud and moisture imagery is available from the GOES-R Series?



GOES-17 ABI longwave infrared band (11.2 µm) imagery of convective activity in the Western U.S. on July 29, 2018. Credit: NOAA/NASA

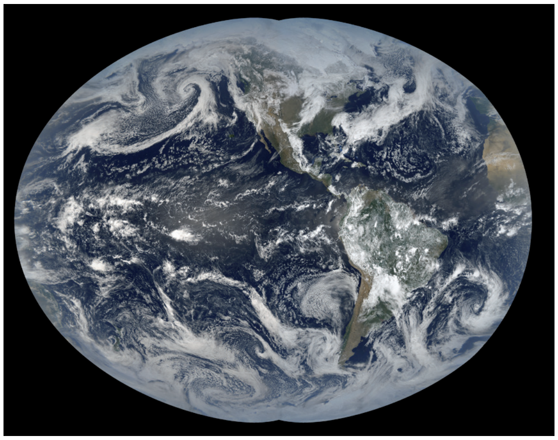
Six of the ABI channels are similar to previous GOES imagery. The **0.64 µm ("red")** visible band is used primarily for daytime detection and analysis of clouds and weather systems and is especially useful for diagnosing rapidly changing phenomena. The **3.9 µm ("shortwave")** near-infrared band is 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 ("upper-level tropospheric water vapor")** infrared band is used for atmospheric feature identification such as jet streams, troughs/ridges, and signatures of potential turbulence. The **longwave infrared 11.2 µm** band enables operational meteorologists to diagnose discrete clouds and organized features for general weather forecasting, analysis, and broadcasting applications. Observations from this channel can characterize atmospheric processes associated with extratropical cyclones and also in single thunderstorms and convective complexes. The **12.3 µm ("dirty" longwave)** infrared band is used for low-level moisture determinations, volcanic ash identification, dust, sea surface temperature measurements, and cloud particle size estimates. Cloud detection, cloud top height, pressure and temperature, total precipitable water, and volcanic ash detection are applications from the **13.3 µm ("carbon dioxide" longwave)** infrared band. The previous GOES imagers offered only the 12 or 13.3 µm channels. ABI provides both bands, allowing for enhanced products.

Ten of the ABI bands are new to GOES-R, allowing for new products that were not available from previous GOES. The additional bands on ABI include the **0.47 µm ("blue")** visible for aerosol detection and visibility estimation, **0.86 µm ("veggie")** near infrared for aerosol detection and estimation of vegetation health, **1.37 µm** to detect very thin cirrus clouds, **1.6 µm** near infrared for snow/cloud discrimination, and **2.2 µm ("cloud particle size")** near infrared for aerosol and cloud particle size estimation, vegetation health, cloud properties, hot spot detection, moisture determination, and snow detection. An additional two infrared bands at **6.9 and 7.3 µm** are used for midtropospheric water vapor detection and tracking and upper-level sulfur dioxide (SO_2) detection. The **8.4 µm "cloud top phase"** infrared band is used for detection of volcanic dust clouds containing sulfuric acid aerosols and estimation of cloud phase. The ozone band at **9.6 µm** monitors atmospheric total column ozone and upper-level dynamics, and the **10.3 µm "clean" longwave** infrared band derives low-level moisture and cloud particle size. Each of these bands is often used in conjunction with other bands in a multi-spectral approach for product generation, such as the clear sky mask or aviation-related products.



GOES-16 visible imagery with infrared fire hot spot (3.9 µm ABI band) pixels overlaid showing a fire in north central California on October 9, 2017. The fire pixels are shown in yellow, orange and red, with red being the hottest pixels. The 3.9 band is uniquely sensitive to temperatures so it is especially useful for fire detection. Credit: NOAA/CIMSS

Multiple ABI bands can be combined to create **"true" color imagery**, which approximates what you would see from space. It uses the "red" visible band, "blue" visible band, and approximates green (the ABI does not have a "green" band), using some of the signal from the "veggie" near-infrared band, which mimics the reflectivity that is present in a true green band. True color imagery makes surface features like clouds, snow cover, blowing dust, smoke and vegetation readily apparent.


This true color view of the Western Hemisphere combines many full disk "local noon" images from GOES-16 and GOES-17 in a Mollweide map projection during the Vernal Equinox on March 20-21, 2019. Credit: NOAA/CIMSS

What are the benefits of ABI cloud and moisture imagery?

On-orbit ABI data has been shown to be at least 100 times better than the previous GOES imager. Imagery from ABI is not only used directly, by the 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. Data from ABI has a wide range of uses and societal benefits in areas such as severe weather, energy, transportation, and commerce.

ABI addresses the needs of many users of geostationary data by increasing spatial resolution (to better monitor small-scale features), providing faster coverage (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). ABI improves every data product from the previous GOES imager and provides a wide range of new products. ABI provides advanced measurements of atmospheric and surface conditions such as sea and land surface temperatures, vegetation, clouds, aerosols, hurricanes, winds, water vapor, rainfall, snow and ice cover, fire locations, smoke plumes, volcanic ash and gas, atmospheric temperature and moisture, and ozone. ABI significantly improves the detection and observation of environmental phenomena that directly affect public safety, protection of property, and our nation's economic health and prosperity.

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Related links:
NOAA STAR GOES image viewer: https://go.usa.gov/xmVXz
CMI product info: https://go.usa.gov/xmVXS
CMI validation and data access: https://go.usa.gov/xmV5a
GOES-R quick guides: http://bit.ly/2LLgVHL
Applications of the 16 Spectral Bands on the Advanced Baseline Imager: http://bit.ly/2HrfQzz