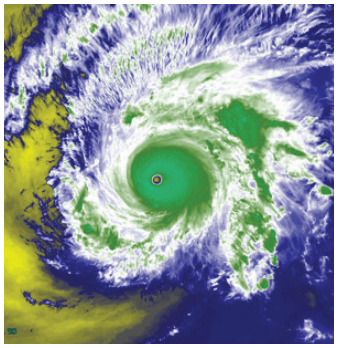
GOES-R ABI Fact Sheet Band 9 ("mid-level water vapor" infrared band)

The "need to know" Advanced Baseline Imager reference guide for the NWS forecaster



The Advanced Himawari Imager (AHI) 6.9 µm for Typhoon Maysak from March 31, 2015, at 06 UTC. Credit: CIMSS and JMA

In a nutshell

GOES-R ABI Band 9 (approximately 6.9 µm central, 6.7 µm to 7.1 µm)

Similar to AHI Band 9

Available on current GOES sounder (Band 11)

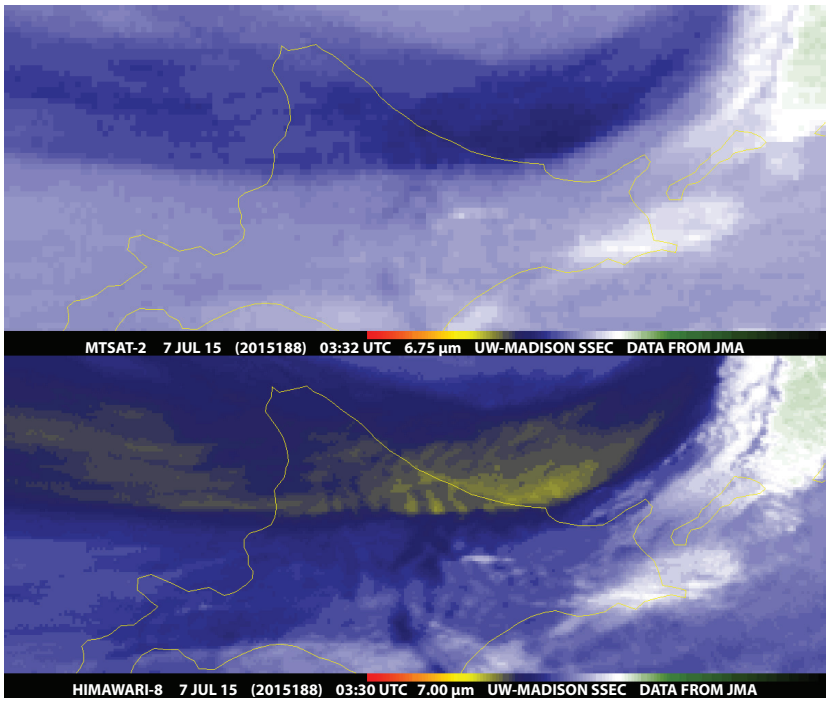
Nickname: "Mid-level water vapor" infrared band

Availability: Both day and night

Primary purpose: Monitor atmospheric water vapor features

Uses similar to: ABI/AHI Bands 8/9

The 6.9 µm band is one of three mid-tropospheric water vapor bands on the ABI. This band will be used for mid and upper-level tropospheric water vapor tracking, jet stream identification, hurricane track forecasting, mid-latitude storm forecasting, severe weather analysis, and mid-level moisture estimation (for legacy vertical moisture profiles). The 6.9 µm band can be used to estimate atmospheric motion vectors. In addition, the radiance from this, and other bands, will be used directly in Numerical Weather Prediction. This water vapor band is similar to a band on the GOES sounders, although those bands are spectrally narrower. The heritage GOES imager water vapor band falls "between" this band and the 6.2 µm band. *Source: Schmit et al., 2005 in BAMS, and the ABI Weather Event Simulator (WES) Guide by CIMSS.*



The top panel shows the MTSAT water vapor band, while the lower panel shows JMA's AHI water vapor band centered at 7.0 µm. There is improved spatial resolution from the AHI, providing evidence of waves over northern Japan that are not evident in the MTSAT image. Both images are from July 7, 2015, at approximately 03:30 UTC, and each are shown in their native projection. This image was made in McIDAS-X. Warmer brightness temperature (K) are denoted as yellow, while the colder values are denoted as white and green. Credit: SSEC and ASPB

Did You Know?

A GOES image is not scanned all at the same exact time, but is constructed over a short time range. A portion of Earth is scanned as a telescope mirror sweeps back and forth. The infrared (IR) imager on GOES-13 to GOES-15 has two detectors building an image; it takes 25 minutes to scan a full disk. The ABI on GOES-R has more than 200 IR detectors monitoring radiation as the detector mirror sweeps across different sectors. It takes only 5 minutes for ABI to scan a full disk in a dedicated full disk mode. In ABI's agile "flex mode," the ABI scans a full disk (every 15 minutes), the Contiguous U.S. (every 5 minutes), and a 1000 km x 1000 km area, at the satellite sub-point, mesoscale sector (every 30 seconds for one regional sector or one minute to capture two geographically separated sectors).

Baseline Products by Band

Wavelength Micrometers	6.9
Band number	9
Baseline Products	
Aerosol Detection	
Aerosol Optical Depth	
Clear Sky Masks	√
Cloud & Moisture Imagery	√
Cloud Optical Depth	
Cloud Particle Size Distribution	
Cloud Top Phase	
Cloud Top Height	
Cloud Top Pressure	
Cloud Top Temperature	
Hurricane Intensity	
Rainfall Rate/QPE	
Legacy Vertical Moisture Profile	√
Legacy Vertical Temp Profile	√
Derived Stability Indices	√
Total Precipitable Water	√
Downward Shortwave Radiation: Surface	
Reflected Shortwave Radiation: TOA	
Derived Motion Winds	√
Fire Hot Spot Characterization	
Land Surface Temperature	
Snow Cover	
Sea Surface Temperature	
Volcanic Ash: Detection/Height	
Radiances	√

Ward's Words

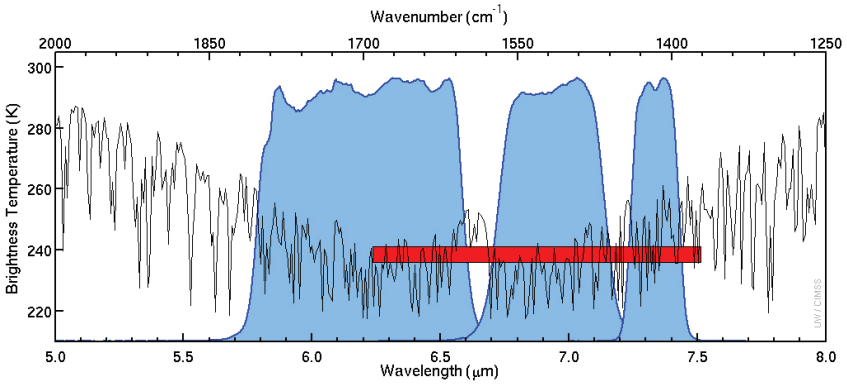
For meteorologists who may be monitoring features in water vapor imagery emerging from the edge of the full disk, consider the differences between this band and Band 8. The brightness temperatures of Band 9 will increase significantly as a constant feature moves from the limb toward the center portion of the image – more so than Band 8, though the behavior is similar. This difference also suggests that for dry tropospheres (in terms of specific humidity), Band 9 is a better choice for seeing lower and mid-level features than Band 8, despite similarities over the tropics and in warm and moist environments.

Bill "Hima-Ward-i" Ward is the ESSD Chief in NWS Pacific Region and a former Guam forecaster.

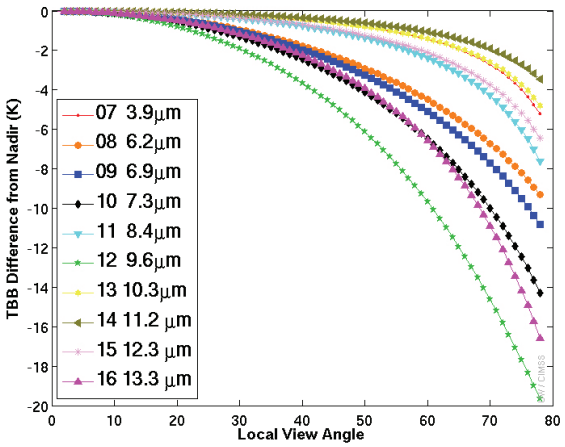
Tim's Topics

The improved spatial resolution on water vapor bands of the AHI and ABI and other advanced imagers are not only better to monitor features that we observe with today's imager, but also to depict finer scale features, such as waves. These waves might be due to flow over mountains or convection. The additional spectral bands, with the finer (nominally 2km) spatial resolutions allow for monitoring either mountain waves or clear air turbulence. While the satellite cannot "see" turbulence, it can monitor "interest fields" that may be associated.

Tim Schmit is a research meteorologist with NOAA NESDIS in Madison, Wisconsin.



The solid blue curves represent the instrument response functions for the three ABI water vapor bands (8, 9 and 10), while the red box represents the main spectral region of the GOES-15 imager water vapor band. The black line represents a high spectral resolution Earth-emitted spectra. There is cooling due to water vapor absorption. Credit: ASPB and CIMSS



As the zenith (or view) angle increases away from nadir, in general the observed brightness temperature decreases, due to the increased path length. All ABI IR bands are shown. Note the ozone band (9.6 μm), followed by the CO_2 band (13.3 μm) cools the most, followed by the water vapor bands. The U.S. standard atmosphere was used for these clear-sky calculations. Credit: CIMSS

Further reading

ABI Bands Quick Information Guides: http://www.goes-r.gov/education/ABI-bands-quick-info.html
ABI Weighting Function page: http://cimss.ssec.wisc.edu/goes/wf/ABI/
CIMSS Satellite Blog: http://cimss.ssec.wisc.edu/goes/blog/archives/category/himawari-8
Mountain Wave turbulence: http://journals.ametsoc.org/doi/abs/10.1175/2008WAF2222127.1
VISIT on GOES sounder: http://cimss.ssec.wisc.edu/goes/visit/sounder.html
GOES-R COMET training: http://www.goes-r.gov/users/training/comet.html
GOES-R acronyms: http://www.goes-r.gov/resources/acronyms.html