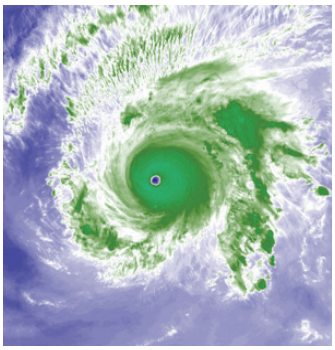
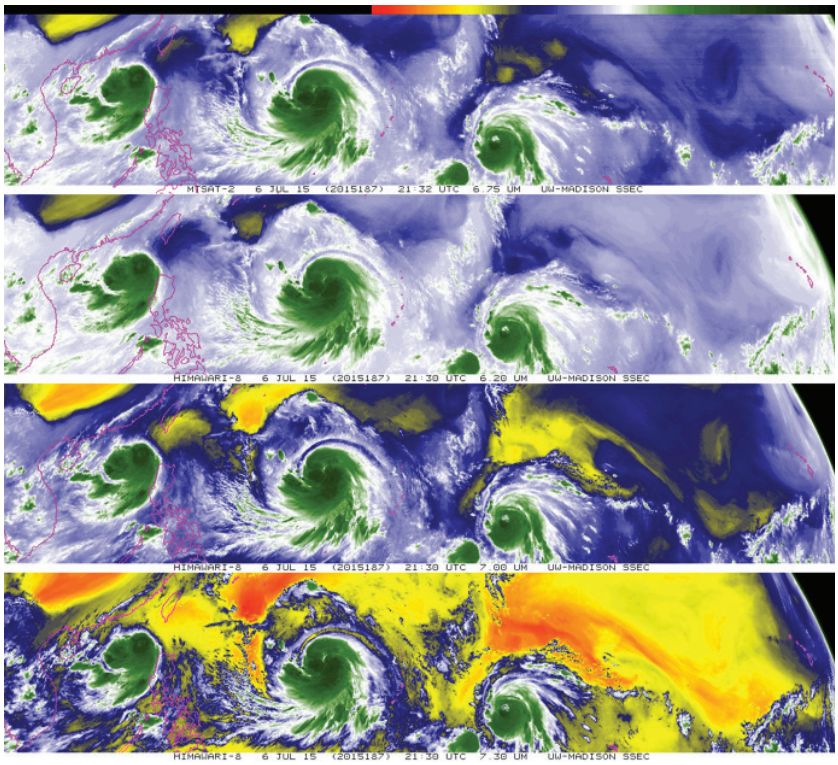
GOES-R ABI Fact Sheet Band 8 ("Upper-level water vapor" infrared)

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



The Advanced Himawari Imager (AHI) 6.2 µm for Typhoon Maysak from March 31, 2015, at 06 UTC. Credit: CIMSS and JMA.

There are three mid-level water vapor bands on the ABI. The 6.2 µm "water vapor" band will be used for upper-level tropospheric water vapor tracking, jet stream identification, hurricane track forecasting, mid-latitude storm forecasting, severe weather analysis, upper mid-level moisture estimation (for legacy vertical moisture profiles) and turbulence detection. This band can be used to estimate atmospheric motion vectors. In addition, the radiances from this and other bands will be used directly in Numerical Weather Prediction models. This water vapor band is most similar to those on heritage GOES imagers, although the current GOES water vapor band centered at 6.5 µm falls between ABI bands 6.2 and 7.0 µm. *Source: Schmit et al., 2005 in BAMS, and the ABI Weather Event Simulator (WES) Guide by CIMSS.*



The three lower panels show the three water vapor bands of JMA's AHI: 6.2, 7.0, and 7.3 µm, respectively from top to bottom. Similar brightness temperatures are observed in cloudy regions (cold or green colors), while the three levels can be seen in the clear sky, with the 7.3 µm reporting the warmest temperatures. Similar to the ABI, each of these water vapor bands are 2 km spatial resolution (at the sub-point). The top panel shows the corresponding 6.75µm, 4 km spatial resolution water vapor image from MTSAT. These images are from July 6, 2015, at approximately 21:30 UTC and each satellite is shown in its native projection. This image was made in McIDAS-X. Credit: SSEC and ASPB

In a nutshell

GOES-R ABI Band 8 (approximately 6.2 µm central, 5.8 µm to 6.6 µm)

Similar to MODIS Band 27, SEVIRI Band 5, MTSAT Band 4, AHI Band 8

Available on current GOES (imager and sounder)

Nickname: "Upper-level water vapor" infrared band

Availability: Both day and night

Primary purpose: Atmospheric feature detection

Uses similar to: ABI/AHI Bands 9/10

Did You Know?

Europe was the first to put a water vapor band on a geostationary imager, in 1977. It was soon followed by the Visible-Infrared Spin-Scan Radiometer (VISSR) on GOES-4 in 1980. The spatial resolution of this VISSR band was approximately 14 km, meaning the GOES-R ABI water vapor bands improve spatial resolution by almost 50 times. Of course there have been other improvements with the ABI as well, such as images at least every 5 minutes (over the Contiguous U.S.), compared to 30-minute images with GOES-4.

Baseline Products by Band

Wavelength Micrometers	6.2
Band number	8
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	√

Carven's Corner

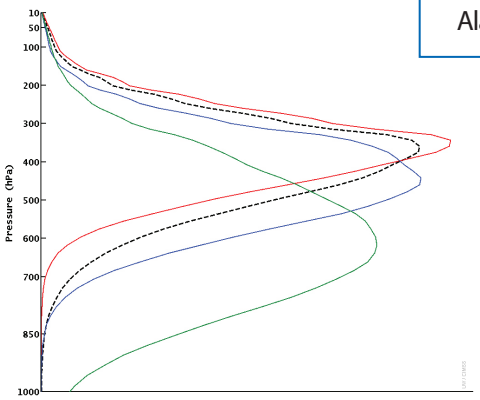
Meteorologists know that an accurate three-dimensional representation of the atmosphere is necessary to produce the best forecast. The GOES-R ABI offers added value to the field in this area. Unlike the GOES-13-15 imagers, there are multiple water vapor channels on the ABI. These water vapor channels will provide an opportunity to track atmospheric features on layers that depend on the temperature and concentration of water vapor in the troposphere. That brightness temperature is not solely representative of any one level, but instead a weighted mean across several adjacent "levels." A hyperspectral sounder, a possibility for the future, may be able to provide a depiction of water vapor in the lower levels of the atmosphere – near or within the boundary layer.

Carven Scott is the ESSD Chief in NWS Alaska Region and a former SOO.

Tim's Topics

The current GOES imager has an infrared band centered at 6.5 µm, while earlier generations of GOES imagers had a spectral band centered at 6.7 µm (which was spectrally narrower). Due to the strong absorption of water vapor at this wavelength, this and similar bands in the spectral region are rightly called water vapor bands. Yet, the bands also have a strong temperature dependence. Ideally, these bands would be called "infrared bands with dependencies on both temperature and water vapor," but this is too long for a "nickname." It is important to remember that a time tendency of warming for a given water vapor image pixel may be indicative of drier air, warmer air, or a combination of both.

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



The weighting function (or contribution function) represents the layer of the atmosphere where the radiation sensed by the ABI originated. The image to the left demonstrates the one mid-level water vapor on today's GOES imagers (dashed line) and the three mid-level water vapor bands on the ABI (solid lines). These are clear-sky calculated brightness temperature and hence do not include the presence of clouds. For the U.S. standard atmosphere, the three ABI water vapor bands have a level of peak contribution of approximately 340, 440 and 620 hPa, respectively. This corresponds to 360 hPa for the current imager's water vapor band. Credit: CIMSS

ABI Band	Approximate Central Wavelength (µm)	Band Nickname	Type	Nominal sub satellite pixel spacing (km)
8	6.2	Upper-level water vapor band	IR	2
9	6.9	Mid-level water vapor band	IR	2
10	7.3	Low-level water vapor band	IR	2

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/17893
GOES-R COMET training: http://www.goes-r.gov/users/training/comet.html
GOES-R acronyms: http://www.goes-r.gov/resources/acronyms.html