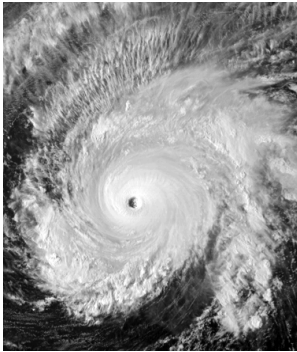




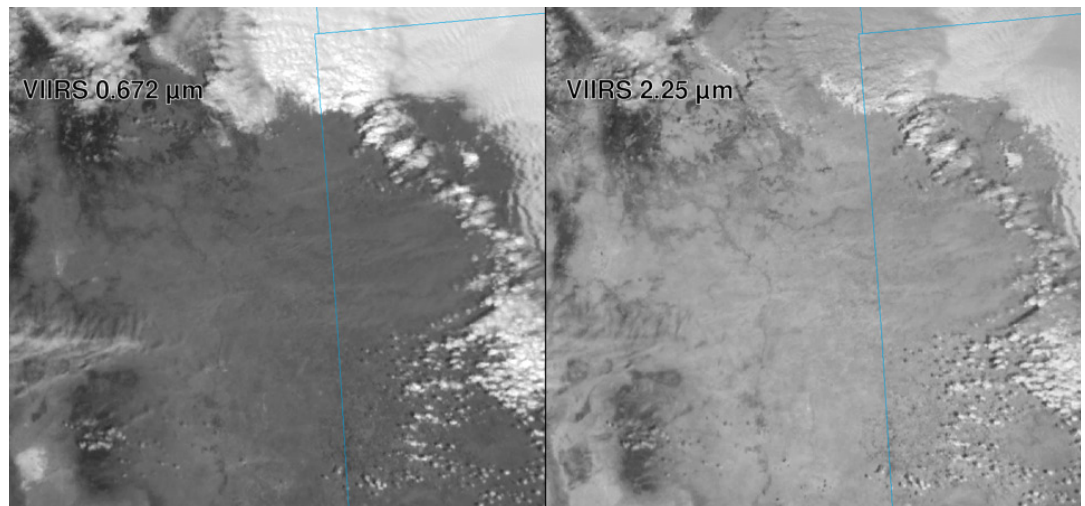
GOES-R ABI Fact Sheet Band 6 (“Cloud Particle Size” near-infrared)

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



Above: The Advanced Himawari Imager (AHI) 1.6 μm image for Typhoon Maysak from March 31, 2015 at 6 UTC. Glaciated clouds appear dark in this band, due to less solar reflection. Credit: JMA/CIMSS

The 2.2 μm band, in conjunction with other bands, will enable cloud particle size estimation. Cloud particle growth is an indication of cloud development and intensity of that development. Other applications of the 2.2 μm band include: use in a multispectral approach for aerosol particle size estimation (by characterizing the aerosol-free background over land), cloud screening, hot-spot detection, and snow detection. The MODIS and VIIRS cloud mask algorithms use a similar band. *Source: Schmit et al., 2005 in BAMS, and the ABI Weather Event Simulator (WES) Guide by CIMSS.*



Suomi NPP VIIRS images from March 23, 2013 at 20:35 UTC of the 0.67 (left) and 2.2 (right) μm bands. Note the darker phenomena in the 2.2 μm band for both ice clouds (near the top of the image) and White Sands, NM (lower left). These images were made in McIDAS-V. Credit: SSEC

In a nutshell

GOES-R ABI Band 6 (approximately 2.24 μm central, 2.22 μm to 2.27 μm)

Also similar Suomi NPP VIIRS Band M11, MODIS Band 7, Landsat Band 7, AHI Band 6

New for GOES-R series, not available on current GOES

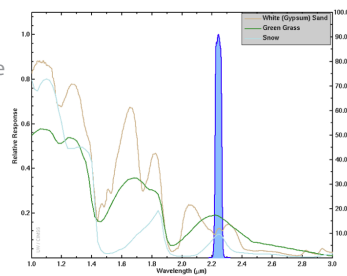
Nickname: “Cloud particle size” near-infrared band

Availability: Daytime for snow and cloud applications; nighttime for fire applications

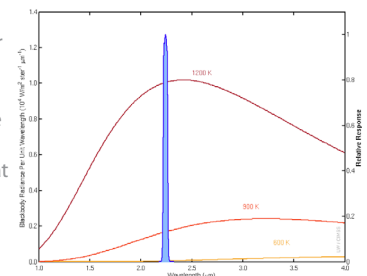
Primary purpose: Cloud particle size, snow, cloud phase

Uses similar to: 1.6 μm for fire detection and cloud properties

The ABI (blue shaded curve) spectral response function for the ABI 2.2 μm Band 6, along with three high-spectral resolution curves. The plot of white gypsum sand (brown solid line) demonstrates how the 2.2 μm band is highly absorbing compared to the shorter wavelength bands. Credit: CIMSS, ASTER spectral library



Planck curve showing the radiance for increasing wavelengths for three temperatures. Note how there is more energy from a fire at 2.2 μm , compared to 1.6 μm at these temperatures. Fires are not the only contributor to the reflectance value for a given pixel, so the satellite value observed may be less than the theoretical maximums shown in this plot. Credit: CIMSS



Did You Know?

Similar to the 1.6 μm band, the 2.2 μm band can be useful in determining hot spots. In fact, the 2.2 μm band is spectrally located closer to the maximum emitting temperature. While the 2.2 μm band can be used for cloud-top applications, it can also be thought of as the “fire and ice” band, with applications related to hot spots and snow detection.

Baseline Products by Band

Wavelength Micrometers	2.24
Band number	6
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



One of the frustrations that meteorologists sometimes face with satellite imagery is discriminating land features from clouds. Using the 2.2 μm band, forecasters will find that snow, green grass, and certain white sands are all not particularly reflective, in contrast to water clouds. The challenge, however, is that ice cloud is also not very reflective in the 2.2 μm band, making it appear relatively dark in the imagery. Ice cloud is more reflective than what is evident using the 1.6 μm band, though. Outside of New Mexico (and shall we say, "Black Sands"), we anticipate that most forecasters will use the 1.6 μm band and its better spatial resolution in lieu of the 2.2 μm band. That does not suggest that the 2.2 μm band is not without specialized applications, particularly for certain cloud algorithms and "hot spot" detection when fires have an emission temperature of greater than 600 K.

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

Tim's Topics



The near-infrared bands on the ABI are key for determining cloud properties. According to Andi Walther, in the GOES-R AWG Daytime Cloud Optical and Microphysical Properties ATBD, "The main information content for Cloud Optical Depth (COD) lies in the conservative-scattering channel at about 0.64 μm . The absorption channel at 2.2 μm provides additional information on Cloud effective Particle Size (CPS) and helps in directly estimating COD by adjusting the differences in the phase function due to particle size. Liquid and ice water path are calculated subsequently from COD and CPS." Hence, when one uses the liquid or ice water path, one is using, in part, the 2.2 μm information. Now, for forecasting applications, it might make sense to view the derived quantitative product, such as liquid or ice water path, and not just the one ABI band.

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

ABI Band	Approximate Central Wavelength (μm)	Band Nickname	Type	Nominal sub satellite pixel spacing (km)
1	0.47	"Blue" band	Visible	1
2	0.64	"Red" band	Visible	0.5
3	0.86	"Veggie" band	Near-IR	1
4	1.37	"Cirrus" band	Near-IR	2
5	1.6	"Snow/Ice" band	Near-IR	1
6	2.2	"Cloud Particle Size" band	Near-IR	2

Further reading

ABI Bands Quick Information Guides: <http://www.goes-r.gov/education/ABI-bands-quick-info.html>

VIIRS example (fader): http://cimss.ssec.wisc.edu/goes/abi/viirs_clouds.html

Landsat bands: http://landsat.gsfc.nasa.gov/?page_id=5377

GOES-R COMET training: <http://www.goes-r.gov/users/training/comet.html>

GOES-R acronyms: <http://www.goes-r.gov/resources/acronyms.html>

