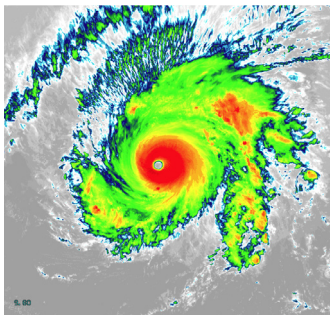
GOES-R ABI Fact Sheet Band 12 ("ozone" infrared band)

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



The Advanced Himawari Imager (AHI) 9.6 µm ozone band image for Typhoon Maysak from March 31, 2015 at 06 UTC. Credit: CIMSS and JMA

In a nutshell

GOES-R ABI Band 12 (approximately 9.6 µm central, 9.4 µm to 9.8 µm)

Similar to MODIS Band 30, SEVIRI Band 8, AHI Band 12

Available on current GOES sounder

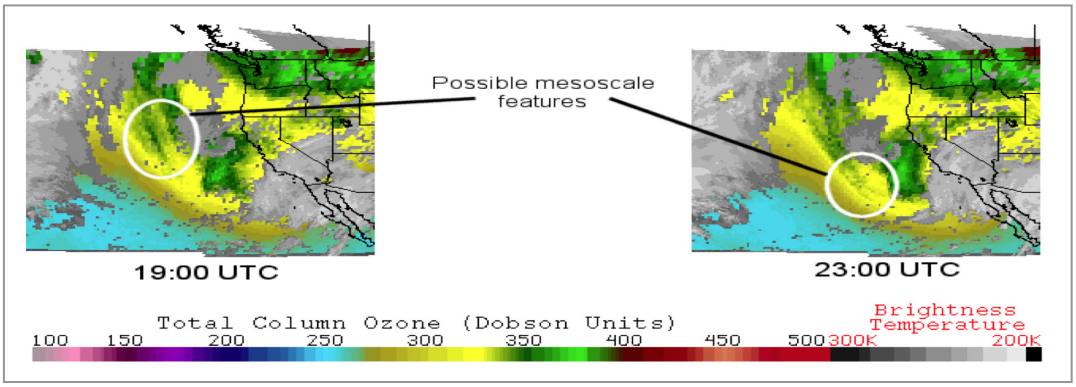
Nickname: "Ozone" infrared band

Availability: Both day and night

Primary purpose: Total column ozone

Uses similar to: None

The "ozone" band at 9.6 µm will provide information both day and night about the dynamics of the atmosphere near the tropopause with high spatial and temporal resolutions. For clear (cloud-free) scenes of view, this band is cooler than the IR window bands because of absorption due to ozone. In general, larger amounts of ozone cause more cooling relative to the the nominal surface emission. A high temporal and spatial ozone product derived from the 9.6 µm band may give some indications to clear-air turbulence in certain situations associated with tropopause folding. A similar band is available on today's geostationary sounders. In fact, similar ozone-sensitive bands are on many geostationary imagers around the globe. Product generation will be key for estimating the ozone signature; stated another way, this band alone does not provide total column ozone, but must be computed using other spectral bands. More information can be found in the AWG ATBD on Total Ozone. This band/product can also be compared to upper-level potential vorticity. Band 12 is part of the "air mass" red-green-blue (RGB) composite and the non-baseline total column ozone product. *Source: Schmit et al., 2005 in BAMS, and the ABI Weather Event Simulator (WES) Guide by CIMSS.*



The GOES sounder Total Column Ozone product depicted mesoscale ozone features on February 25, 2001. Small changes in ozone gradient (from yellow to green) were visible on the western edge of a developing cyclone, which propagated eastward with the cyclone. A Pacific Landfalling Jets Experiment flight encountered severe turbulence while passing though the fine features highlighted in the ozone images. These gradients are not visible in Band 12 images. Credit: CIMSS

Did You Know?

While the future capability product is called total column ozone, there is very limited sensitivity to surface levels of ozone, especially when using a spectrally broad band. When the ABI was first designed, there was a high-spectral resolution infrared sensor (the ABS: Advanced Baseline Sounder) on the GOES-R series. The advanced geostationary sounder, later called the Hyperspectral Environmental Suite (HES) was removed in 2006, predominately because of budgetary issues. High spectral resolution infrared observations allow for improved vertical resolution of retrieved quantities such as temperature and moisture profiles. In addition, these IR observations allow for estimating other traces gases, such as SO_2 from volcanoes.

Baseline Products by Band

Wavelength Micrometers	9.6
Band number	12
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	√

Tim's Topics

The ozone band on the ABI was added in the early formulation stages, suggested by those in both NOAA and NASA. The thermal infrared ozone channel on ABI can provide information about turbulence and wind shear near the tropopause which is important to aviation. In 2003, Art Neuendorffer, then of NOAA NESDIS, noted the "channel [spectral width] allows for a strong quasi-linear signal over a broad range of ozone values (and secant angles) while being relatively insensitive to variations in filter function." This band was based on Europe's Meteosat Second Generation (MSG) SEVIRI and the current GOES sounders, first launched in 2002 and 1994, respectively.

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

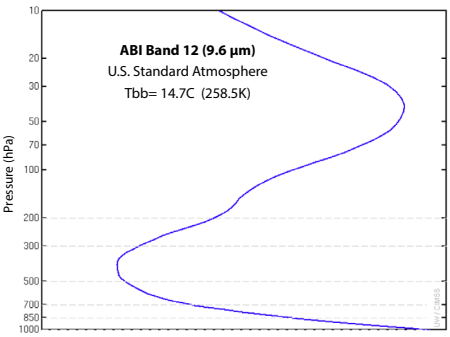
Carven's Corner

Beyond ozone, water vapor absorption also occurs in this band. This makes Band 12 somewhat complicated to use, because the horizontal distribution of ozone and water vapor varies across the globe (there is an ozone hole in the southern hemisphere). The brightness temperature will generally increase with less water vapor, less ozone, or an increase in air temperature in the layer where water vapor or ozone resides.

Compared to other bands, Band 12 will show cloud top temperatures at the tropopause in tropical environments with temperatures somewhat higher than other bands. This is because temperatures increase with height in the stratosphere, where the majority of ozone resides. This ozone partially obscures the cloud (and entire troposphere) in this spectral range.

In lieu of Band 12, a difference between two water vapor channels, Band 8 and Band 10, is effective at locating stratospheric intrusions that may better depict the evolution of extratropical cyclones.

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



The weighting function (or contribution function) represents the layer(s) of the atmosphere where the radiation sensed by the instrument originated. The plot above shows the weighting function of the ozone band on the ABI. The clear-sky calculated brightness temperature does not include the presence of clouds. The weighting function peaks both in the stratosphere and near the surface. Credit: CIMSS

ABI Band	Approximate Central Wavelength (µm)	Band Nickname	Type	Nominal sub satellite pixel spacing (km)
12	9.6	Ozone	IR	2

Further reading

ABI Bands Quick Information Guides: http://www.goes-r.gov/education/ABI-bands-quick-info.html
GOES Sounder Total Column Ozone: http://cimss.ssec.wisc.edu/goes/rt/viewdata.php?product=o3_us
CIMSS Satellite Blog post: http://cimss.ssec.wisc.edu/goes/blog/archives/16395
CIMSS Satellite Blog post: http://cimss.ssec.wisc.edu/goes/blog/archives/15047
Total Ozone ATBD: http://www.goes-r.gov/products/ATBDs/option2/AAA_Ozone_V2.0_no_color.pdf
EUMETSAT: http://oiswww.eumetsat.org/IPPS/html/MSG/RGB/AIRMASS/
GOES-R COMET training: http://www.goes-r.gov/users/training/comet.html
AHI Weighting Functions: http://cimss.ssec.wisc.edu/goes/wf/AHI/
GOES-R acronyms: http://www.goes-r.gov/resources/acronyms.html