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.

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

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 | Band number | 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 |
|------------------------|-------------|-----------------------------|-------------------------|-----------------------|-----------------------|-------------------------|--------------------------|-----------------------------|------------------------|-------------------|---------------------|-----------------------|-------------------------|-------------------|-------------------------------|-----------------------------|-----------------------------|----------------------|--------------------------------|------------------|------------|-------------------|------------------------|----------|
| 6.2                    | 8           | Basesline 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

<table>
<thead>
<tr>
<th>ABI Band</th>
<th>Approximate Central Wavelength (µm)</th>
<th>Band Nickname</th>
<th>Type</th>
<th>Nominal sub satellite pixel spacing (km)</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>6.2</td>
<td>Upper-level water vapor band</td>
<td>IR</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>6.9</td>
<td>Mid-level water vapor band</td>
<td>IR</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>7.3</td>
<td>Low-level water vapor band</td>
<td>IR</td>
<td>2</td>
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</table>

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