

### Why is the CO<sub>2</sub> Band Important?

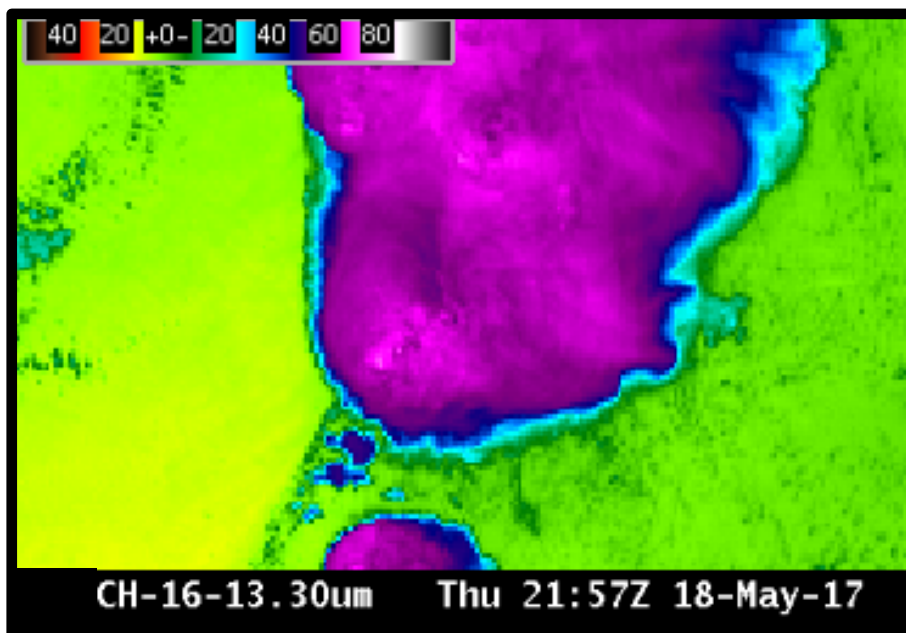
Products derived using the infrared 13.3  $\mu\text{m}$  "Carbon Dioxide" band can be used to delineate the tropopause, to estimate cloud-top heights, to discern the level of Derived Motion Winds, to supplement Automated Surface Observing System (ASOS) sky observations and to identify Volcanic Ash. The 13.3  $\mu\text{m}$  band is vital for Baseline Products; that is demonstrated by its presence on heritage GOES Imagers and Sounders. Despite its importance in products, the CO<sub>2</sub> channel is typically not used for visual interpretation of weather events.

### Impact on Operations

**Primary Application:** The 13.3  $\mu\text{m}$  band on the ABI is used in many GOES-16 Baseline Products. These products include cloud mask, cloud-top height, pressure, and temperature. This band is an input to the legacy moisture and temperature profiles, and hence is used for the products derived from the profiles, such as total precipitable water and stability indices. This band is also used in the quantitative volcanic ash detection and height algorithm

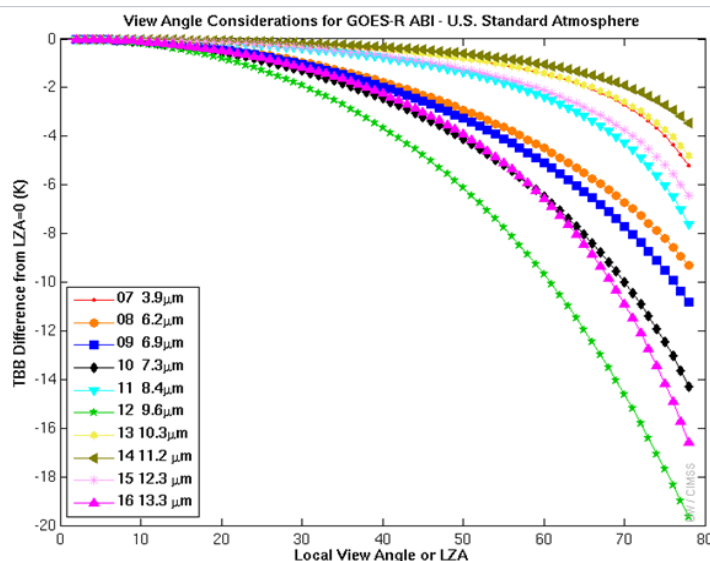
Because the CO<sub>2</sub> band has a muted view of surface features, it can be used to create RGBs that highlight features at upper levels.

The figure at right shows cooling as a function of zenith angle for clear skies. Cooling effects are strongest for the Ozone Band (9.6  $\mu\text{m}$ , green stars), just a bit stronger than those for the CO<sub>2</sub> band (13.3  $\mu\text{m}$ , magenta triangles)



### Limitations

**This is a "dirty" window:** Cooling in this band is associated with the ubiquitous nature of carbon dioxide (CO<sub>2</sub>) in the atmosphere. That cooling is especially noticeable near the limb, more so than almost any other ABI channel (see below). Earth's surface is apparent in clear skies, but strong cooling from CO<sub>2</sub> means 13.3  $\mu\text{m}$  brightness temperatures are much cooler than in other window channels at the limb.



### Satellite Image Interpretation

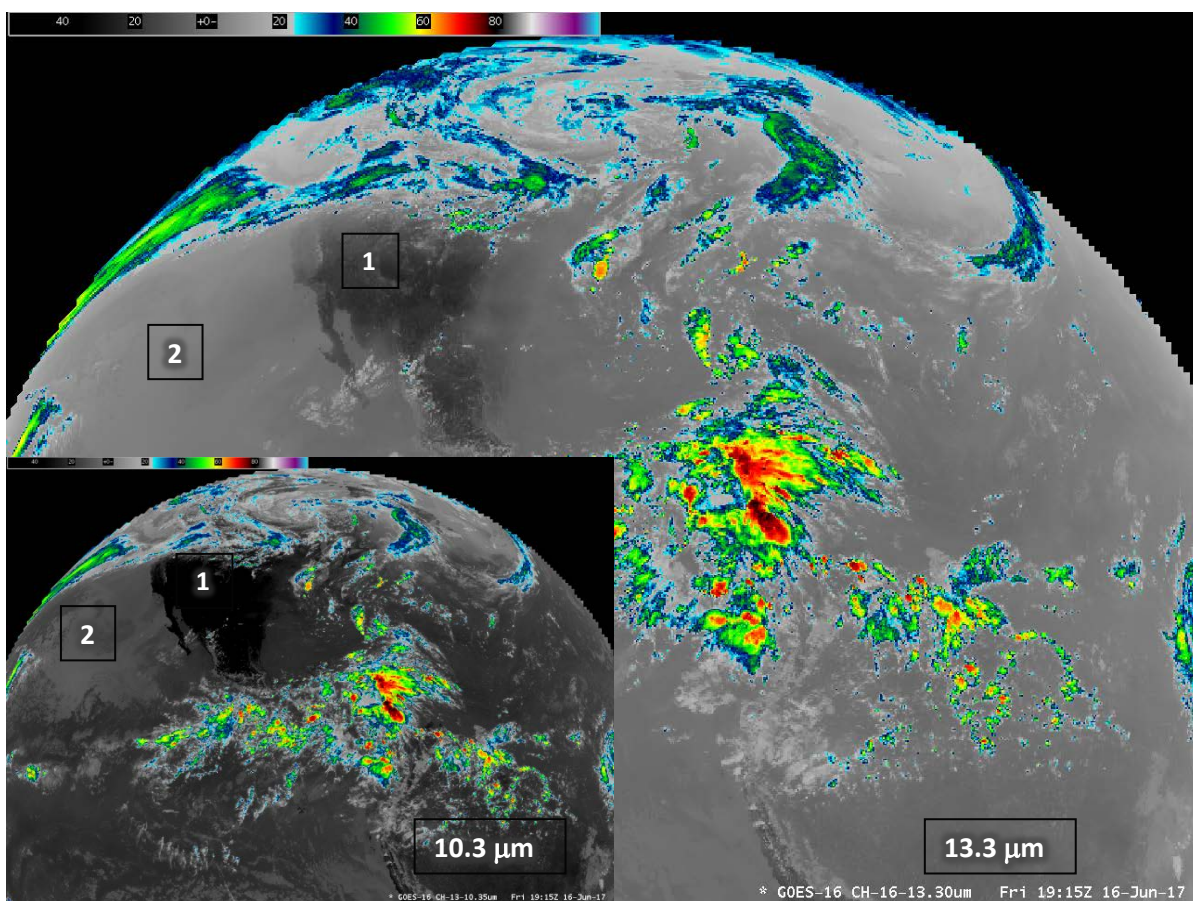
1

The CO<sub>2</sub> channel is a window channel, meaning surface features can be apparent in clear air. Features over the ocean can also be apparent.

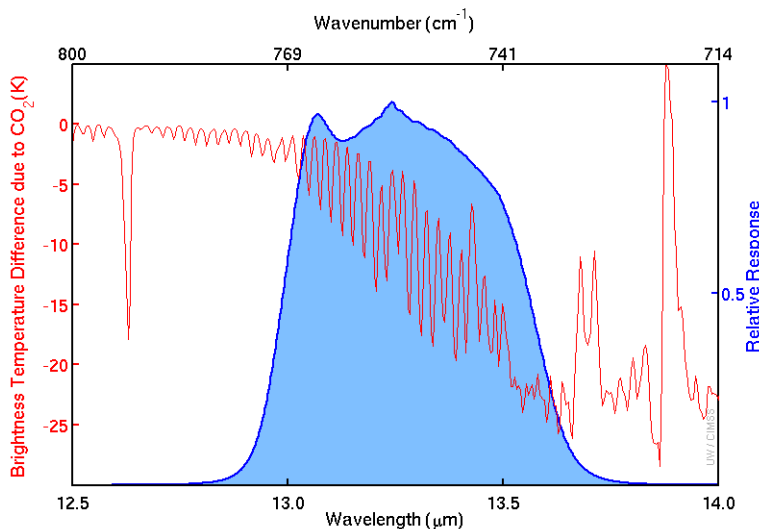
2

However, Brightness Temperatures in clear air from the CO<sub>2</sub> channel are uniformly cooler than temperatures in the window channel (10.3  $\mu\text{m}$ ) because of cooling due to absorption (and re-emission) of atmospheric energy with a wavelength of 13.3  $\mu\text{m}$  by CO<sub>2</sub> molecules.

The spectral response function for the 13.3  $\mu\text{m}$  CO<sub>2</sub> channel, in blue at right, occupies the “shoulder” of a CO<sub>2</sub> absorption band between 13  $\mu\text{m}$  and 14  $\mu\text{m}$ . The cooling effect of CO<sub>2</sub> absorption is shown with the red line.



GOES-16 13.3  $\mu\text{m}$  (CO<sub>2</sub>), 16 June 2017 at 1915 UTC. Inset: 10.3  $\mu\text{m}$  imagery for the same time



### Resources

BAMS Article

[Schmit et al. 2017](#)

GOES-R.GOV

[Band 16 Fact Sheet](#)

**Hyperlinks do not work in  
AWIPS but they do in VLab**