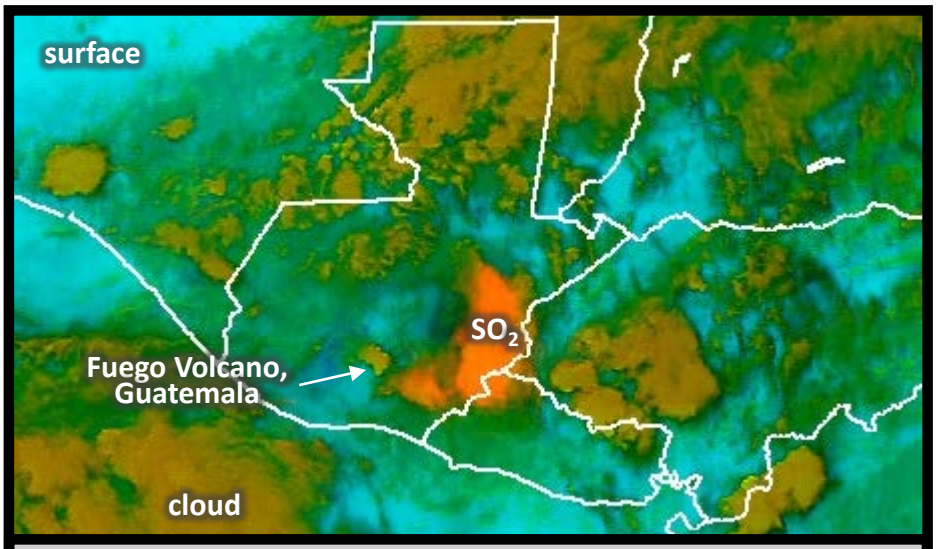
SO_2 RGB

*interpretation still under investigation

Quick Guide

Why is the SO_2 RGB Important?

Sulfur dioxide (SO_2) is a gas commonly released into the atmosphere during volcanic eruptions. In high concentrations it is toxic to humans and has considerable environmental effects, including volcanic smog, acid rain, and is harmful to vegetation downwind of the eruption. The SO_2 RGB product can be used to detect and monitor large sulfur dioxide emissions from volcanoes, as well industrial facilities such as power plants.



SO_2 RGB from GOES-16 ABI at 2200 UTC, 3 June 2018

SO_2 RGB Recipe

Color	Band / Band Diff. (µm)	Min to Max Gamma	Physically Relates to…	Small contribution to pixel indicates…	Large Contribution to pixel indicates…
Red	6.95 – 7.34 Ch 9 – Ch 10	-4.0 to 2.0 °C 1	Vertical water vapor difference, presence of SO_2	Low-levels, relatively drier atmosphere	SO_2 is present in mid- and high-levels of the atmosphere
Green	10.35 – 8.50 Ch 13 – Ch 11	-4.0 to 5.0 °C 1	Moisture, stability, particle size and phase, presence of ash and SO_2	Small crystal ice cloud	Low- and mid-level cloud, volcanic ash and/or SO_2
Blue	10.35 Ch 13	-30.1 to 29.8 °C 1	Cloud top or surface temperature	Mid- and high-levels in the atmosphere	Surface or low-levels in the atmosphere

Impact on Operations

Primary Application

Detection of sulfur dioxide: Stronger absorption of SO_2 is found in Band 10 (7.34 µm, a Water Vapor channel) and weaker SO_2 absorption is found in Band 11 (8.50 µm, an Infrared channel). These bands are differenced with similar water vapor and infrared channels in the red and green components respectively to highlight the presence of SO_2.

Limitations

Distinguishing SO_2 from ash and water vapor: Volcanic eruptions are often composed of ash and a mixture of gases, including water vapor and SO_2. Distinguishing the components can be a challenge, and water vapor can mask the ash and aerosol signals.

Low-level clouds: In the RGB, the light green color of low-level SO_2 is a similar color to that of low-level cloud.

Upper-level clouds: Thick opaque upper-level clouds can mask the SO_2 signal below.

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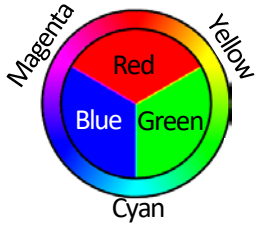
RGB Interpretation

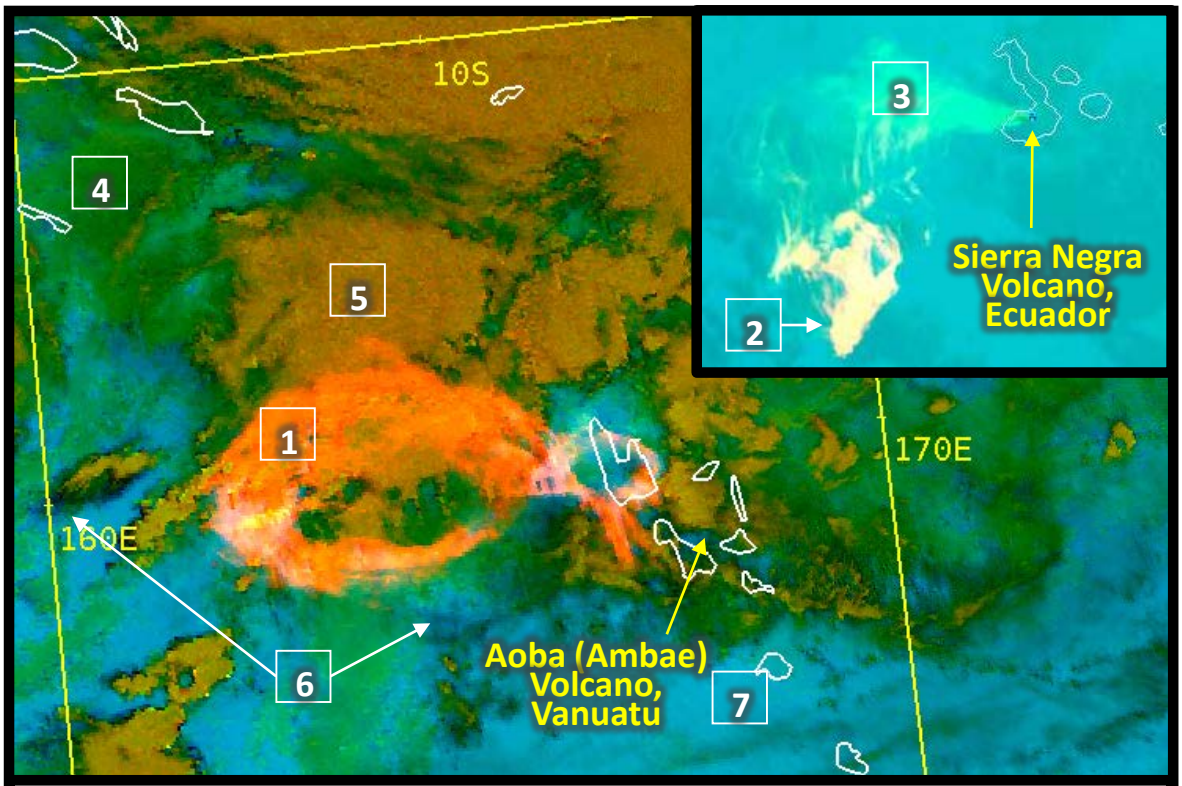
1. Upper-level SO_2, cold background *(orange)*
2. Upper-level SO_2, warm background *(light yellow)*
3. Low-level SO_2, *(light green)*
4. Low- and mid-level cloud *(green)*
5. Convective clouds *(tan)*
6. Thin, high level cloud *(dark blue)*
7. Ocean/land surface *(light blue)*

Note: colors may vary diurnally, seasonally, and latitudinally

This RGB composite was developed by the Japan Meteorological Agency (JMA) for Himawari-8. Interpretation is still under investigation.

RGB Color Guide





SO_2 RGB from Himawari-8 AHI at 2100 UTC, 5 April 2018
SO_2 RGB from GOES-16 ABI at 0130 UTC, 27 June 2018 (inset, upper right)

Comparison to Ash RGB and 10.35 µm Infrared:

The SO_2 RGB is a modified version of the Ash RGB recipe, tuned to better detect sulfur dioxide emissions. For the RED component, in place of the longwave difference in the Ash RGB, band 10 is differenced to take advantage of the strong SO_2 absorption region near 7.34 µm. For the GREEN component, similar channels are used in both RGBs but with different ranges, to take advantage of the lesser SO_2 absorption region near 8.50 µm. The BLUE component is the same for both RGBs.

The three images below are from the eruption of the Aoba Volcano shown above, but a few hours later at 0250 UTC, 6 April 2018. In the SO_2 RGB, SO_2 over (cold) cloud is orange, while SO_2 over (warm) ocean is white; in the Ash RGB, SO_2 is aqua green over ocean; in the IR 10.35 µm imagery, SO_2 is not discernable.