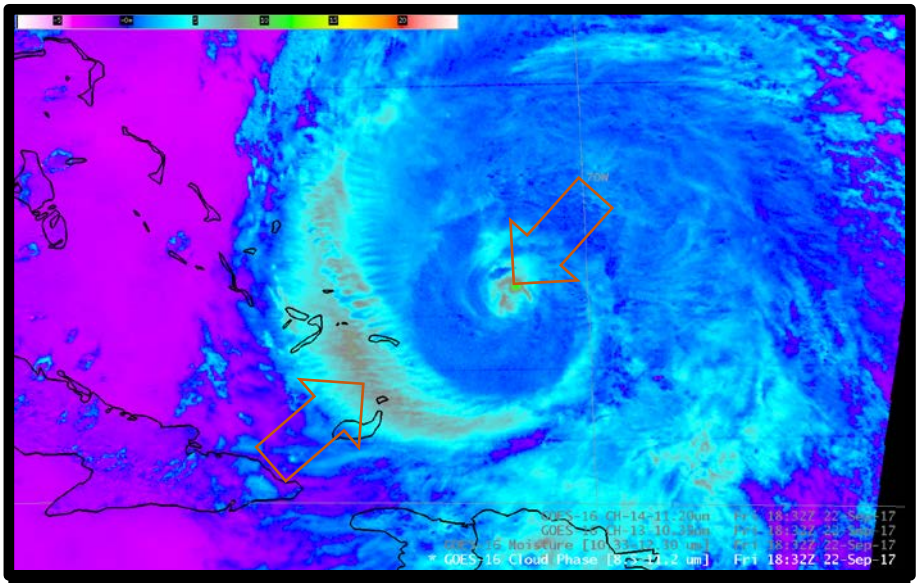
Cloud Phase Difference Quick Guide

Why is the Cloud Phase Difference Important?

Cloud Phase Brightness Temperature Difference (BTD) (8.5 µm – 11.2 µm) is used to differentiate cloud particle sizes. The emissivity of ice particles varies as the emitted radiation wavelength varies, and as the particle size varies. The difference field, then, shows ice particle size. In the figure at right, the smallest ice crystals are in the eye of Irma (brownish) and also curving westward to northward through the eastern Bahamas, as noted by the arrows. Smaller particle sizes are indicated for thin clouds if the BTD is large. This BTD can also detect blowing dust.



Cloud Phase Brightness Temperature Difference (8.5 µm – 11.2 µm) from GOES-16 ABI at 1832 UTC, 22 September 2017 (Showing Hurricane Irma)

What does the Cloud Phase Brightness Temperature Difference show?

Positive or Negative?	Feature detected
Positive	Large Positive: Small Ice Crystals Small Positive: Large Ice Crystals
Negative	Water Droplets

Impact on Operations

Primary Application

Cloud Particle Size: Differentiate between ice particle sizes. The emissivity of ice is related to particle size and the brightness temperature difference exploits that variability. In contrast, clouds made up of water droplets generally exhibit a negative brightness temperature difference

Dust Detection: Identify regions of low-level dust in the atmosphere. This brightness temperature difference is used in both the Ash and Dust RGB Products.

Limitations

Over Land: When clouds are over hot land, there is more transmissivity of upwelling 8.5 µm radiation than 11.2 µm radiation through the cirrus, increasing the brightness temperature difference (BTD). The BTD will be somewhat less over cooler land.

Limitation: Changes in the difference field over land can be affected by changes in surface moisture or changes in temperature – or both.

Limitation : Optically thin cirrus are hard to detect. Supercooled water clouds are difficult to interpret.

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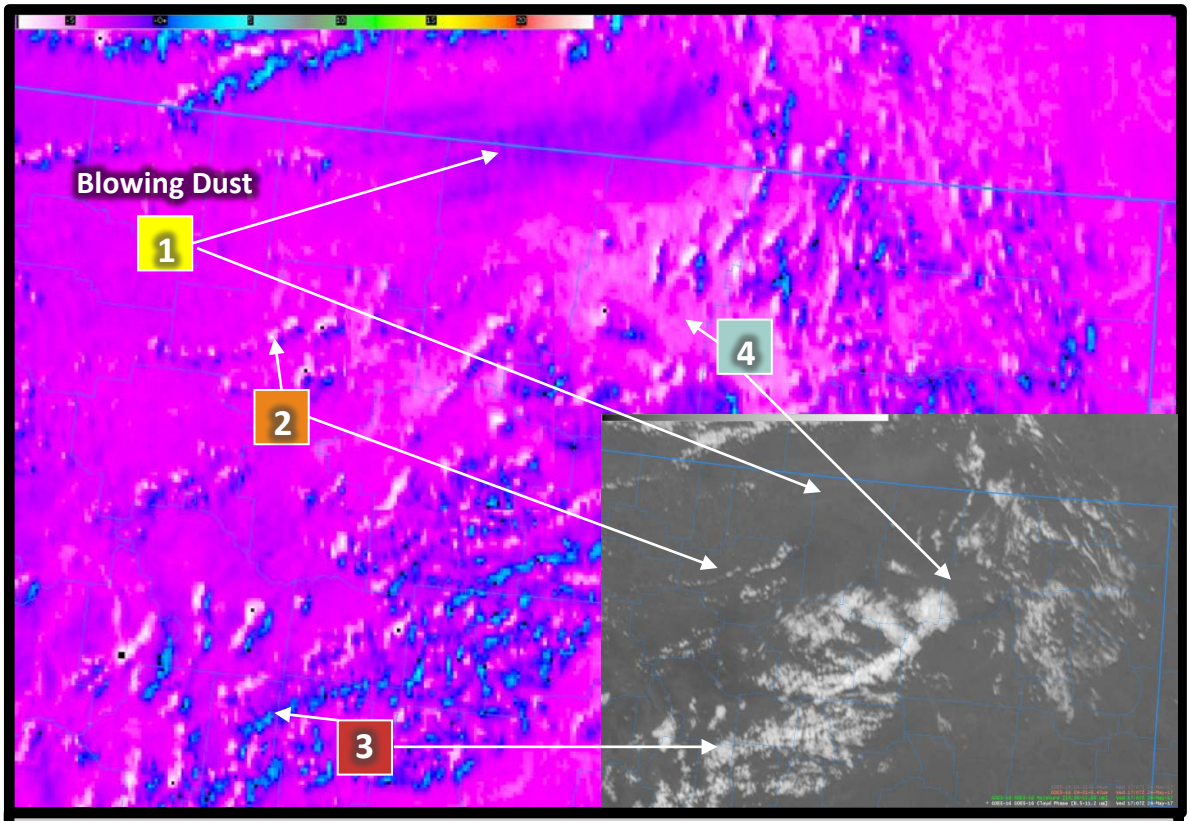
Image Interpretation

1. Blowing Dust shows up with small positive values near the Montana/ Saskatchewan border

2. Cumulus clouds are made up of water droplets and will have negative values.

3. Ice clouds will have positive values

4. Land surface emissivity can vary depending on, for example, drought conditions or vegetation. This will cause a different signal in the Brightness Temperature Difference in regions of clear skies. Such features typically are stationary



Cloud Phase Brightness Temperature Difference (8.5 μm – 11.2 μm), 1707 UTC, 24 May 2017 ; Inset: Visible Imagery (0.64 μm) at the same time

Because this product is used to estimate Cloud Particle Size, it is used in Baseline Products; compare this to the Baseline Estimates of Cloud Phase, or Cloud Particle Size. Additionally, you can compare this to visible, infrared, and cirrus channel scenes to make a better description of the scene being viewed.

Resources

Journal of Appl. Met Article on Cloud Phase Brightness Temperature Difference
Cloud Properties Inferred from 8-12 *μm* data

Documentation
ATBD on Cloud particle Size Distribution at http://www.goes-r.gov

Hyperlinks do not work in AWIPS but they do in VLab