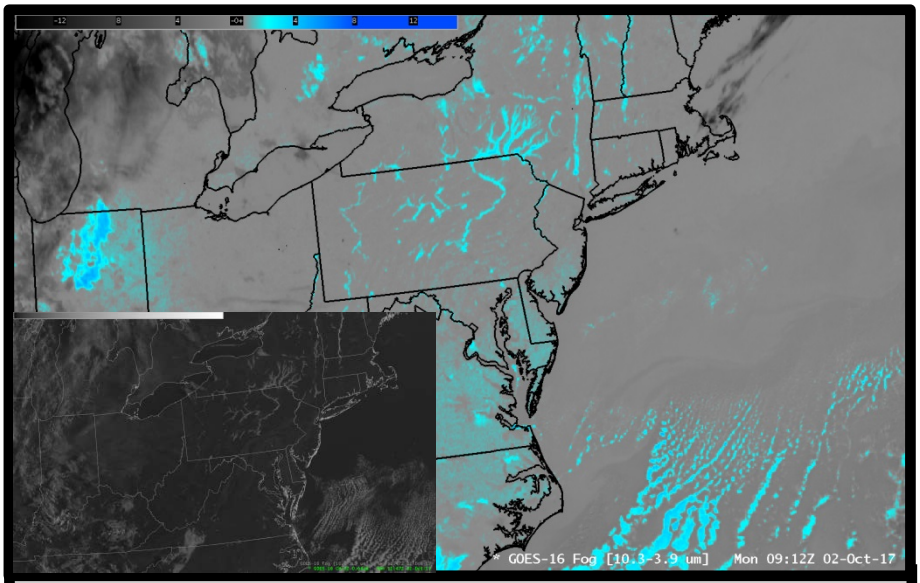
Night Fog Difference (10.3 μm – 3.9 μm)

Quick Guide

Why is the Fog Brightness Temperature Difference Important?

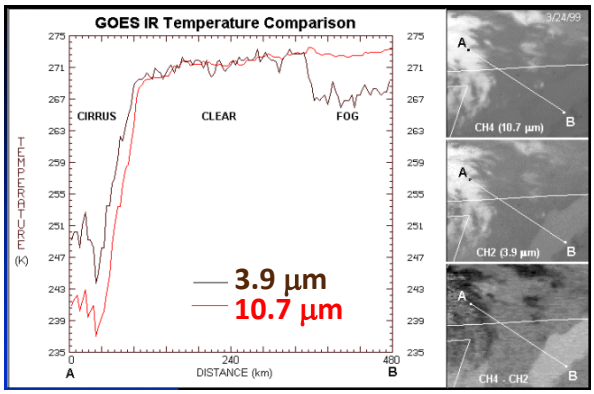
This Brightness Temperature Difference (BTD) is used at night to identify clouds made up of water droplets. Such clouds do not emit 3.9 μm radiation as a blackbody might, but they do emit 10.3 μm radiation nearly as a blackbody. Thus, stratus clouds at night have a positive BTD, colored blue in the image at right on a morning with dense fog over the River Valleys of the mid-Atlantic and northeast. GOES-16 has sufficient resolution to detect the fog in these small valleys.



GOES-16 Channel Difference (10.3 μm – 3.9 μm) ABI at 0912 UTC, 02 October 2017; Inset: Visible Image (0.64 μm) at 1247 UTC , 02 October 2017

What does the 10.3 μm – 3.9 μm Brightness Temperature Difference Tell you?

Day or Night	Sign of BTD	Feature Identified	What controls the Sign
Night	Positive	Clouds made up of water droplets	Emissivity
	Negative	Clouds made up of ice crystals	
Day	Negative	Particle size	Small ice or water particles, strong updrafts



Impact on Operations

Primary Application: At night, identify clouds that are made up of small water droplets, based on differences in cloud water droplet emissivity at 3.9 μm and at 10.3 μm. Thus, low stratus decks stand out very well.

Application: Identify strong convective updrafts. During daytime, small ice crystals are more highly reflective than larger ice crystals, so the BTD will give information about particle size.

Limitations

Nighttime application: This is the BTD is usually called the 'Fog' Product, a misnomer – it's really the 'Stratus Product'. The satellite sees only the top of the cloud and gives no specific information about the cloud base.

Limitation: The default AWIPS enhancement used at night must be changed to give useful information during the day.

Limitation : Low clouds cannot be identified if high clouds are present in the scene. The satellite views the top-most cloud deck.

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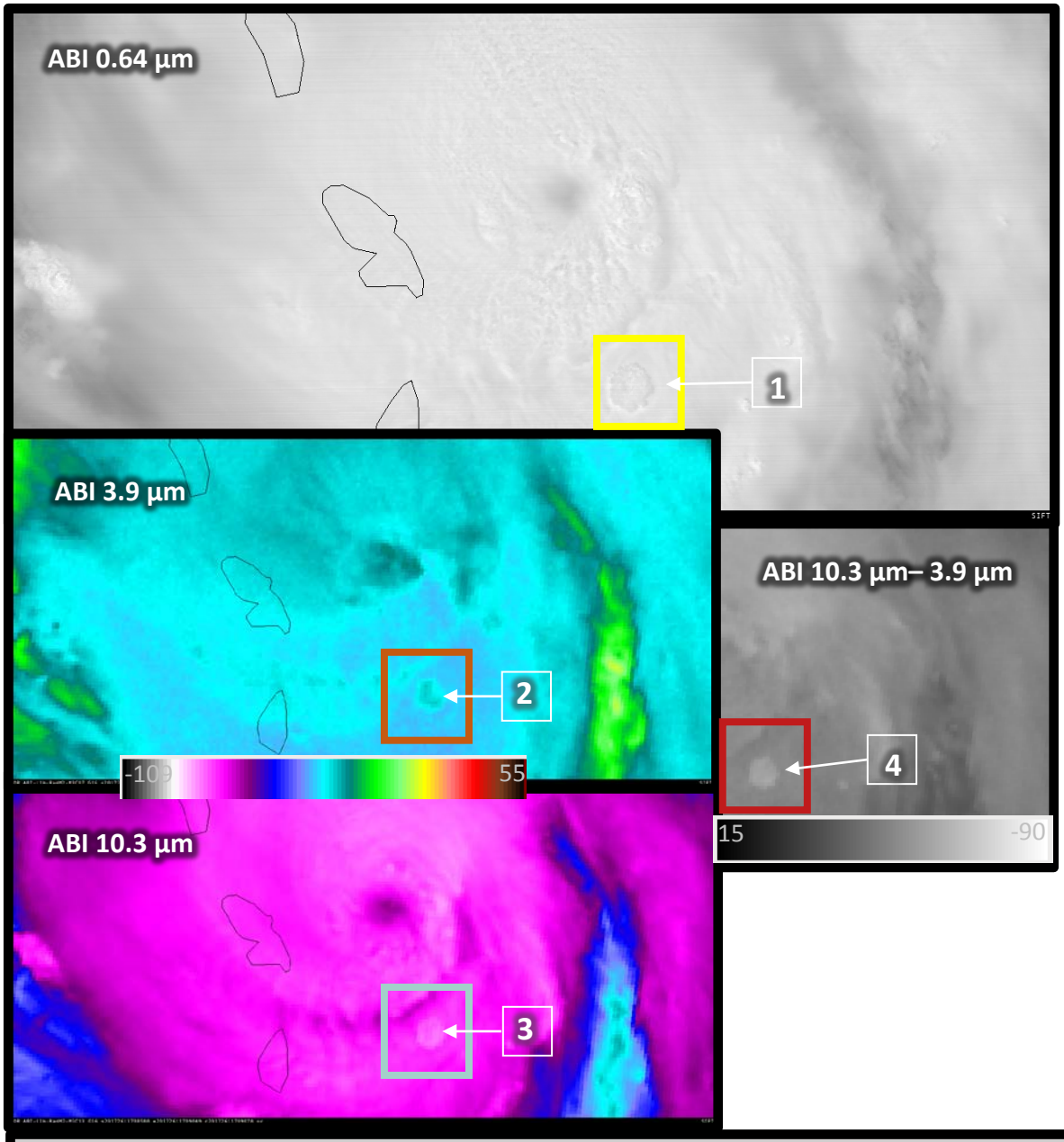
Image Interpretation

1 A convective tower is apparent southeast of the eye of Hurricane Maria in the visible imagery.

2 In the Shortwave Infrared Window (3.9 µm), the convective tower is (about 10 C) warmer than its surroundings because the small ice crystals at the top of the updraft strongly reflect solar radiation

3 In the Clean Infrared Window (10.3 µm), this convective tower is (about 5 C) colder than its surroundings because it extends higher into the troposphere.

4 The Brightness Temperature Difference field has a minimum over the strong updraft.



GOES-16 ABI Red Visible (0.64 µm, Upper Left), Shortwave Infrared (3.9 µm, Middle Left), Clean Window Infrared (10.3 µm, Lower Left), 1709 UTC on 18 September 2017. Center Right: Brightness Temperature Difference (10.3 µm – 3.9 µm)

The 10.3 – 3.9 Brightness Temperature Difference is a component of some RGBs, such as the NightTime Microphysics RGB.

Resources

Blog Post comparing Brightness Temperature Difference and Nighttime Microphysics RGB

Hyperlinks do not work in AWIPS but they do in VLab