# Volcanic Ash Detection and Retrieval

Quick Guide

Why is Volcanic Ash Detection Important?

Volcanic ash is hazardous to aviation, air quality and public health. The Volcanic Ash algorithm determines the location, height and mass loading properties for satellite pixels potentially containing volcanic ash. These products help forecasters identify potentially hazardous areas and issue more accurate aviation and public health warnings. Volcanic ash products are also useful for enhancing ash dispersion and trajectory prediction models.

Volcanic Ash Cloud Detection with cloud height shown (~30000 ft)
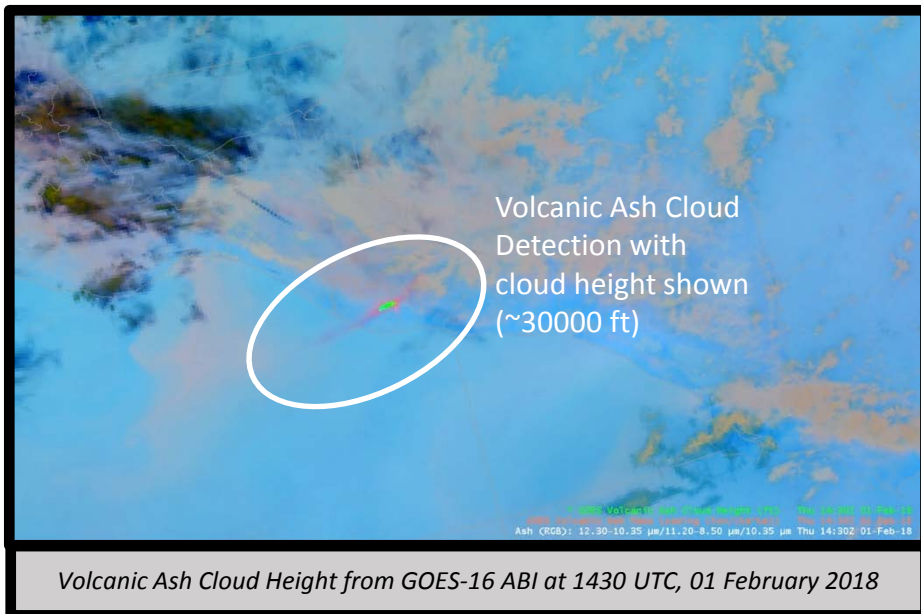
Volcanic Ash Cloud Height from GOES-16 ABI at 1430 UTC, 01 February 2018

How is Volcanic Ash detected and cloud height/mass determined?

ABI Channels	Wavelength	Channel Usage
10	7.3 μm	Ash detection using absorption optical depth ratios
11	8.4 μm	
13	10.3 μm	Ash detection using absorption optical depth ratios; ash height and mass loading using optimal estimation technique; Note: Band 13 replaced Band 14 in the algorithm in 2018.
15	12.3 μm	
16	13.3 μm	Ash height and mass loading using optimal estimation technique

Impact on Operations

Volcanic Ash Detection: Day/night detection of volcanic ash clouds is performed using spectral and spatial testing over full-disk coverage and is regularly updated every 15 minutes.

Volcanic Ash Cloud Height: For satellite pixels determined to possibly contain volcanic ash, an ash cloud top height is determined and displayed in units of feet.

Volcanic Ash Cloud Mass Loading: For satellite pixels determined to possibly contain volcanic ash, column integrated ash mass loading calculation is performed and given in units of tons per square kilometer.

Dispersion Modeling Aid: The volcanic ash algorithm products can also be used for initialization and validation of volcanic ash dispersion models.

Limitations

Imagery/Instrument Sensitivities: Any artifacts or noise within the imagery or instrument and/or unknown spectral shifts in the instrument channels will degrade the algorithm performance.

Ancillary Data Availability: No ancillary data (NWP, land/sea/snow mask, radiative transfer model [RTM], etc.) can be missing.

RTM Clear-sky Radiance Errors: Calculation errors and algorithm inconsistencies can occur near distinct physical boundaries (coastlines, mountains, snow/ice field edges, atmospheric frontal zones, etc.) due to less accurate NWP profiles in these regions, especially where optically thin clouds are present.

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Interpretation

1 **Volcanic Ash Mass Loading –** Provides the column integrated ash mass within a satellite pixel (units are tons/km^2; image is showing 5.2 tons/km^2 for the sampled pixel)

2 **Volcanic Ash Cloud Height –** Helps define the upper extent of a possible ash cloud within a given satellite pixel (units are ft; image is showing 34771 ft for the sampled pixel)

Mass and height retrievals are from an optimal estimation technique. Please reference Pavolonis, et al. (2013), if interested, for more details on the retrieval technique. Data is not corrected for parallax as this is variable on satellite view angle and cloud height estimations.

Volcanic Ash Mass Loading (with Ash Cloud Height readout) from GOES-16 ABI at 1600 UTC, 01 February 2018.
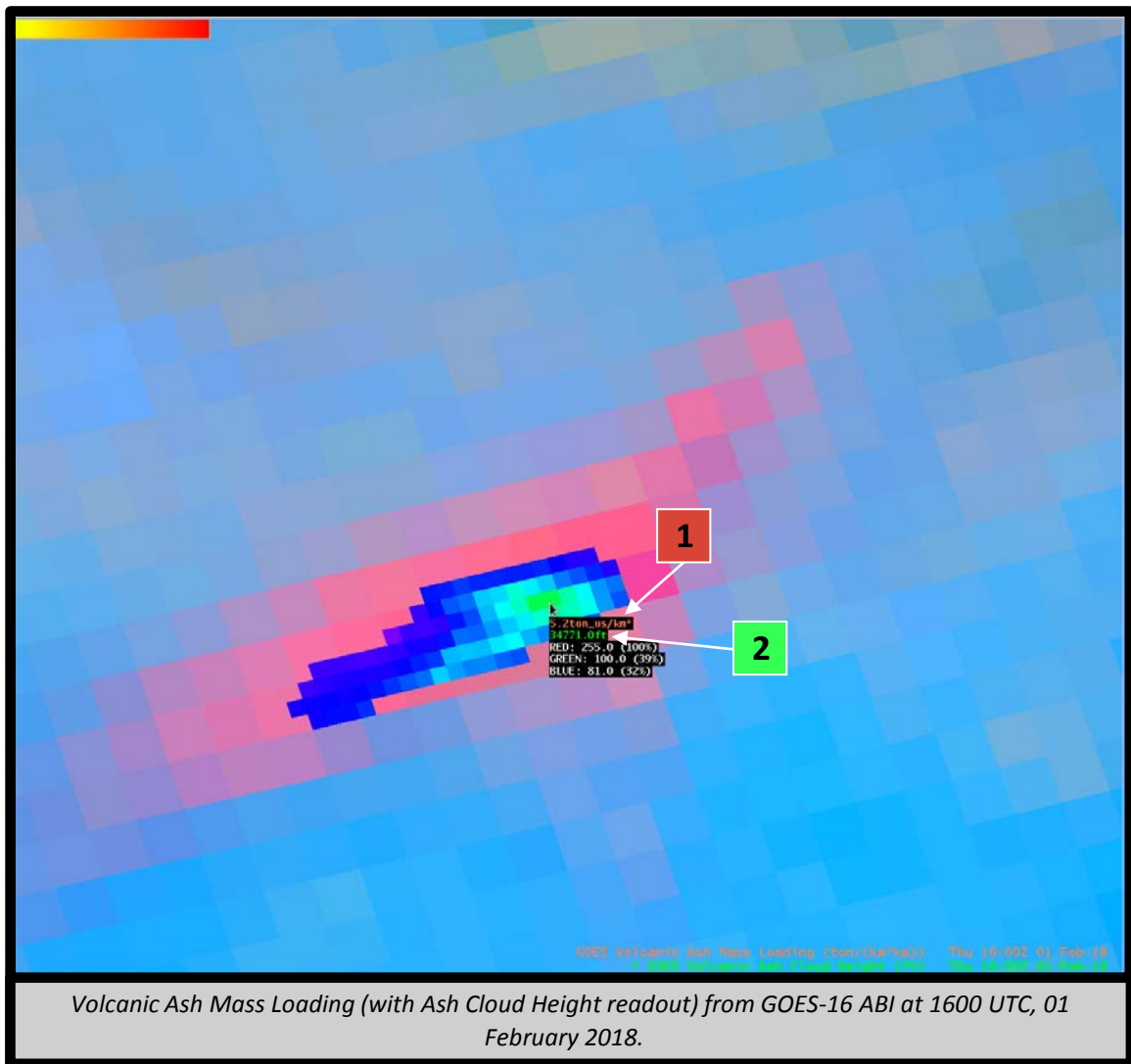
Volcanic Ash Products enhance the basic location information that can be taken from Ash RGB imagery (below)

Mexico

Volcanic Ash Cloud

Guatemala

Volcán de Fuego
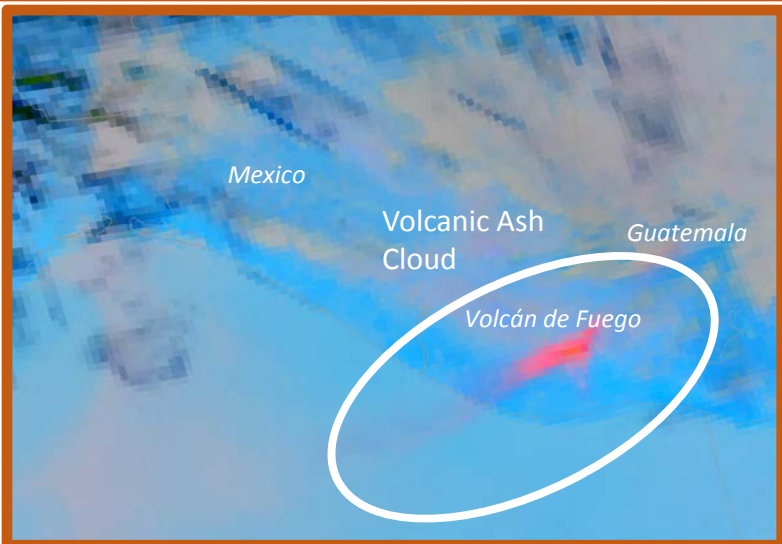
Resources

Algorithm Theoretical Basis Document
Volcanic Ash Detection and Height

Algorithm Product Information
Volcanic Ash Detection Fact Sheet

Volcanic Ash/Mass Retrieval Technique Pavolonis et al., 2013, Journal of Geophysical Research

Hyperlinks will not work in AWIPS, but will work in VLab