

GOES-16 ABI L2+ Volcanic Ash (VAA) Release
Provisional Data Quality
July 21, 2018
Read-Me for Data Users

The GOES-R Peer/Stakeholder Product Validation Review (PS-PVR) for ABI L2+ Volcanic Ash (VAA) Provisional Maturity was held on July 20, 2018. At the review, the PS-PVR panel recommended that the ABI Volcanic Ash products be declared Provisional. This was accomplished at approximately 1615 UTC on July 20, 2018.

The ABI L2+ volcanic ash product determines for each earth-navigated pixel the likelihood the pixel contains volcanic ash using confidence categories. The confidence categories, while not a requirement or official product, are used to determine which pixels to perform volcanic ash height and mass loading retrievals, which are the official volcanic ash products. The volcanic ash height retrievals have units of km and volcanic ash mass loading retrievals have units of tons / km² (numerically equivalent to g/m²). The ash height retrievals are for the highest ash cloud layer, although multiple layers may be present. The mass loading is a column-integrated quantity. The volcanic ash algorithm uses only infrared channels. The volcanic ash products are generated for every ABI Full Disk (FD) of the Earth—as dictated by the ABI requirements—volcanic ash products are NOT generated for the CONUS or Mesoscale domains.

A full description and format of the VAA product can be found in the Product Definition and User's Guide (PUG) document (<http://www.goes-r.gov/products/docs/PUG-L2+-vol5.pdf>). The algorithm used to derive the VAA products from GOES-16 ABI observations is described in detail in the "GOES-R Advanced Baseline Imager (ABI) Algorithm Theoretical Basis Document for Volcanic Ash (Detection and Height)" (https://www.goes-r.gov/products/ATBDs/baseline/Aviation_VolAsh_v2.0_no_color.pdf).

Provisional maturity, by definition, means that:

- Validation activities are ongoing and the general research community is now encouraged to participate;
- Incremental product improvements may still be occurring;
- Product performance has been demonstrated through analysis of a small number of independent measurements obtained from select locations, periods, and associated ground truth or field campaign efforts;
- Product analysis is sufficient to communicate product performance to users relative to expectations (Performance Baseline);
- Documentation of product performance exists that includes recommended remediation strategies for all anomalies and weaknesses. Any algorithm changes associated with severe anomalies have been documented, implemented, tested, and shared with the user community;
- Testing has been fully documented; and
- Product is ready for operational use and for use in comprehensive cal/val activities and product optimization.

Provisional users bear all responsibility for inspecting the data prior to use and for the manner in which the data are utilized. Persons desiring to use the GOES-16 ABI Provisional maturity Volcanic Ash products for any reason, including but not limited to scientific and technical investigations, are

encouraged to consult the NOAA algorithm working group (AWG) scientists for feasibility of the planned applications. This product is sensitive to upstream processing, such as calibration and navigation.

Known issues at the Provisional validation stage include:

1. Missing values may be present due to upstream L1b issues.
2. The GOES-16 volcanic ash products are not required to accurately flag pixels that contain volcanic ash. The ash cloud height and mass loading products are generated for all pixels that have a multi-spectral infrared signal that is reasonably consistent with volcanic ash. As such, many pixels that do not contain ash will have valid ash height and loading values, especially in stratus regions and under clear sky conditions over land. It is up to users to filter out non-ash pixels with valid height and loading values. While the ash confidence flag is sometimes helpful for filtering the ash height and loading products, there is no single confidence level threshold that works consistently well.
3. The validation analysis has been significantly limited by a lack of volcanic clouds observed by GOES-16 that are coincident with “truth” data sets such as lidars. Lessons learned so far indicate that the ash cloud height is biased low and the ash mass loading is biased high, especially in well-dispersed ash clouds.
4. The GOES-16 volcanic ash products are not designed to detect optically thick umbrella clouds produced by explosive events (e.g. 3 June 2018 Fuego event). Thus, the ash height and mass loading products will often be missing in volcanic umbrella clouds, especially in the early stages of development.
5. The baseline GOES-R ABI volcanic ash algorithm was finalized in 2010 and does not represent the latest state of the science. The science has evolved significantly since 2010, so users are cautioned that the baseline GOES-R volcanic ash products were not designed for advanced applications such as eruption alerting and integration with dispersion models. Users interested in more advanced products are referred to the VOLcanic Cloud Analysis Toolkit (VOLCAT) (<https://volcano.ssec.wisc.edu>), which generates more advanced products using a variety of satellites, including GOES-16. However, the VOLCAT products are currently non-operational and are supported on a best effort basis.

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