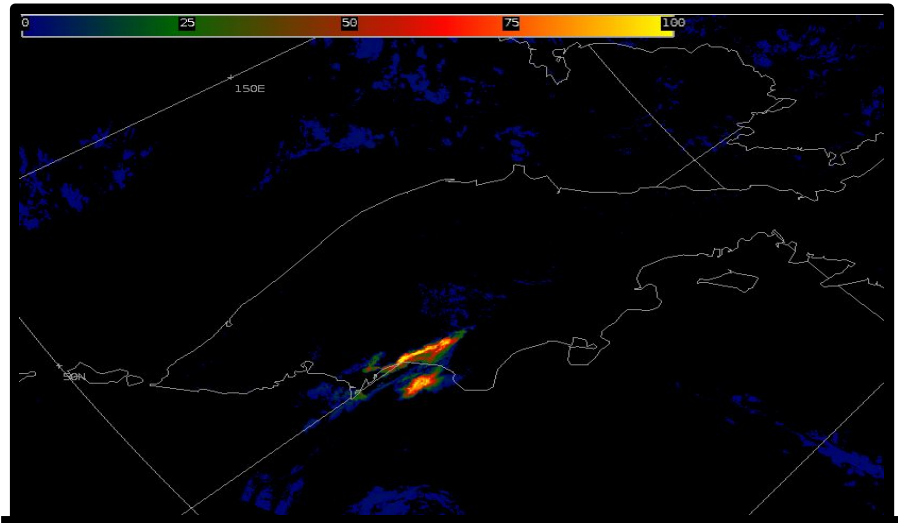


Why is the VIIRS Ash Index Important?

Ash particles erupted from volcanoes pose a serious threat to aviation safety, as the ingestion of ash particles can damage, and even shut down, jet turbine engines. The VIIRS Ash Index is tuned specifically for volcanic ash, reducing the complexity of interpretation that can be a problem with RGB type products. Also, the polar orbit of VIIRS provides frequent coverage of the high latitudes without the parallax and foreshortening inherent to geostationary observations at these latitudes. Direct readout of the Ash Index assures valuable information for mitigating volcanic aviation hazards can be made available in a timely manner.



VIIRS Ash index from the Karymsky eruption on the Kamchatka Peninsula, Russia at 0110 UTC, 20 Apr 2022. Red-Orange-Yellow indicates high ash content. Blue areas are cloud-contaminated.

VIIRS Ash Index Attributes

Parameter	Band / Band Diff. (μm)	Physically Relates to...	Small index values Indicate...	Large Index Values Indicate...
VIIRS Ash Index	m15 (10.8 μm) minus Maximum [m14(8.6 μm), m15(10.8 μm), m16(12.0 μm)]	Ash concentration. Temperature contrast (ΔT) between radiation emissions with and without absorption by ash.	Minor ash content and/or small ΔT . Min = 0	Major ash content and/or large ΔT . Max = 100

Impact on Operations

Aviation Hazard Alerts:

Provides timely updates on the location and spatial extent of potentially hazardous volcanic plumes.

24 Hour Detection: uses mid-longwave thermal radiation bands available day or night.

Specific for Volcanic Ash: tuned to show only volcanic ash plumes, simplifying interpretation.

High Spatial Resolution: 750 m.

Frequent coverage at high latitudes: VIIRS satellites pass near the poles with every orbit.



Limitations

Qualitative: Index represents the strength of absorption due to ash, but absorption is not a unique function of the quantity of ash.

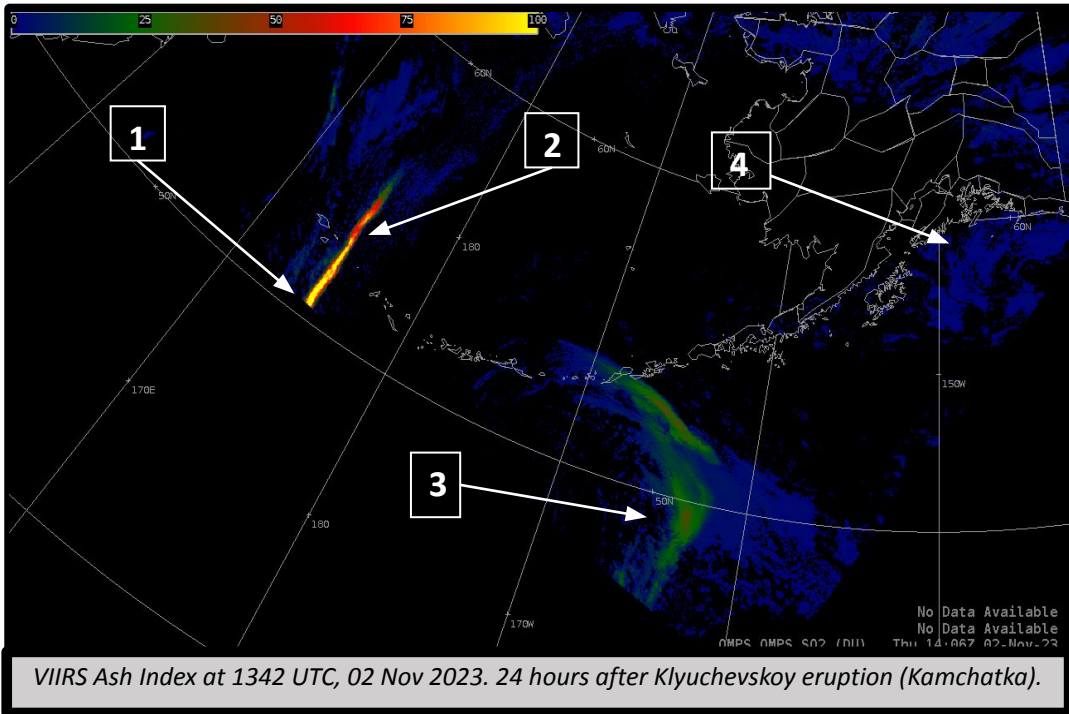
Cloud Artifacts: Weak signatures are often visible due to water-phase (and mixed phase) clouds and water vapor.

Surface Mineral Sensitivity: silicate minerals near the surface can mimic ash absorption and look similar to an ash plume.

Coverage: VIIRS on LEO satellites has less frequent, but more global, coverage than GEO.

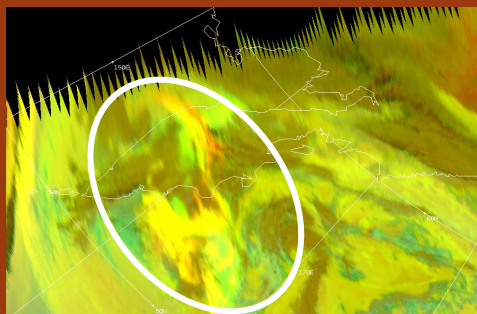
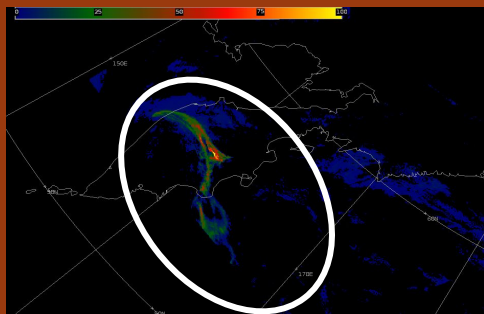
VIIRS Ash Index Interpretation

- 1** Very High Ash Concentrations ($> 80\%$)
- 2** High Ash Concentrations ($> 50\%$)
- 3** Low Ash Concentrations ($\geq 30\%$)
- 4** Water vapor absorption ($< 30\%$)



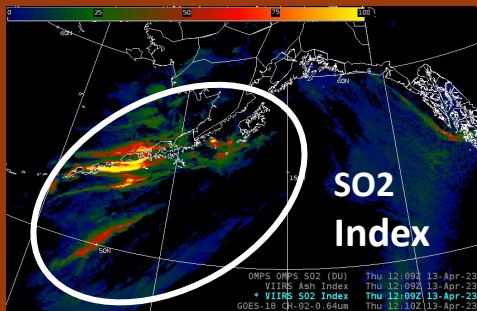
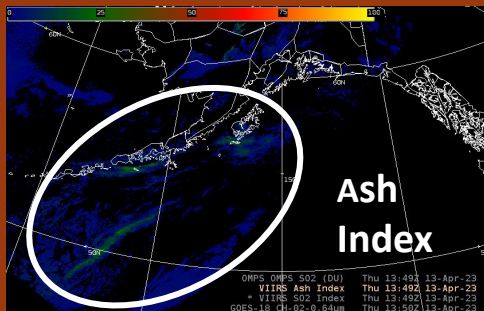
VIIRS Ash Index vs GOES ABI Ash RGB:

VIIRS has higher spatial resolution and less distortion at high latitudes than ABI which has steep viewing angles. The ABI Ash RGB requires subjective interpretation of multiple colors while the VIIRS Ash Index is specific to ash.



VIIRS Ash Index vs VIIRS SO2 Index:

Volcanic ash typically precipitates out more quickly than SO₂ plumes which can linger in the atmosphere for weeks. Comparing the VIIRS Ash index to the VIIRS SO₂ index can provide information about how these plume concentrations evolve.



Resources

[Day-Night Monitoring of Volcanic SO₂ and Ash Clouds for Aviation Avoidance at Northern Latitudes](#)

Prata, F., and Lynch, M. (2016), Passive Earth Observations of Volcanic Clouds in the Atmosphere, 10, 199; doi:10.3390/atmos10040199

Prata, A.J. (2009), Satellite detection of hazardous volcanic clouds and the risk to global air traffic, Natural Hazards, 55, 303-324, doi: 10.1007/s11069-008-9273-z

Real-time Data

<https://www.star.nesdis.noaa.gov/mapper>

<https://proto.gina.alaska.edu/distro/aerosols/>

Hyperlinks not available when viewing material in AIR Tool