## Monitoring volcanic activity with satellite remote sensing to reduce aviation hazard and mitigate the risk: application to the North Pacific







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**Detection of volcanic ash clouds and plumes** 

Emails and text messages sent based on BTD signals.

in Sector n15.08221.1641 - 08 Aug 2008 16:41 UTC

Alert system analysis of brightness temperature difference (BTD) data

Can detect large volcanic events (Kasatochi 2008), small scale clouds (Cleveland 2012)

Features such as temperature inversion and re-suspension of ash can be seen as new volcanic event

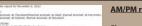
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# **Operational System** Satellite data collected in real-time Make use of Geo- and Polar data Data for a 24 hour period Users carrying out report

## Thermal alerts Triggered ASTER requests Manual observations AM/PM reports are made of obserations for use by Alaska Volcano Observatory AM/PM report



Observers analyze satellite data for ground-based thermal signals and ash clouds and plumes

Record cloud cover for alert volcanoes and all sectors No activity recorded+cloudy = clouds could obscure activity No activity recorded +clear = satellite data shows no activity

Record thermal signals, ash clouds/plumes

Use observation database tool to complete report

System will automatically send report out

#### Weekly report

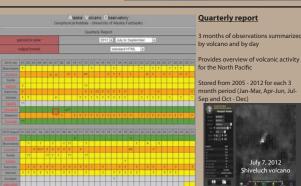
Summarises activity from past week

Shows AM/PM reports with thermal signals

Emphasizes all volcanoes where observations

Observer can select the relevant T or P and ump to the 40 x 40 zoomed in region around the volcano for that reported data set





### Web Tools Geophysical Institute - University of Ataska Fairbank Observation Database Data Center image Flipper 40x40 Hotspot Viewer AVO RS Wiki Hotspot Report Puff Monitoring Tools Auto Data Query Pass Report Observation Data Query Satellite Latency Grapher "Ash Band" Statistics AVHRR Ash Composites Volcano Locations OMI SO<sub>2</sub> Images

## Integration (webcam, TIR BTD, seismic/air waves and ash modeling)

Webcam - 22:30 UTC

Satellite - 23:43 UTC (now detached)

Nikolski broadband seismic station

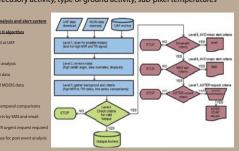
Both a seismic and a ground-coupled air wave were recorded Air wave arriving about 200 s after the seismic wave. The seismic wave gives an origin time of about 22:03:30 UTC.

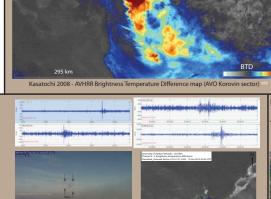
VATD model - says 7 km ASL (used seismic/infrasound for start time)

#### Thermal alerting system for All North Pacific volcanoes

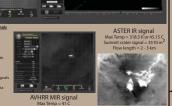
Mid- and thermal infrared data used in real-time from MODIS, AVHRR, GOES and

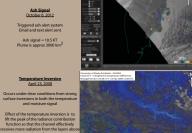
Examine precusory activity, type of ground activity, sub-pixel temperatures

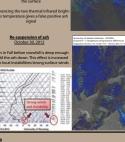










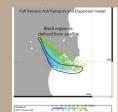








Link satellite retrievals to volcanic ash model simulations Satellite ash masses in real time within defined sectors Generate ash model simualtions to fit AVO sectors Use satellite data to update ash simulations in real-time



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