

# Volcano observatories: why they matter and how they can help



**Nico Fournier & GeoNet volcano monitoring group**  
GNS Science, New Zealand



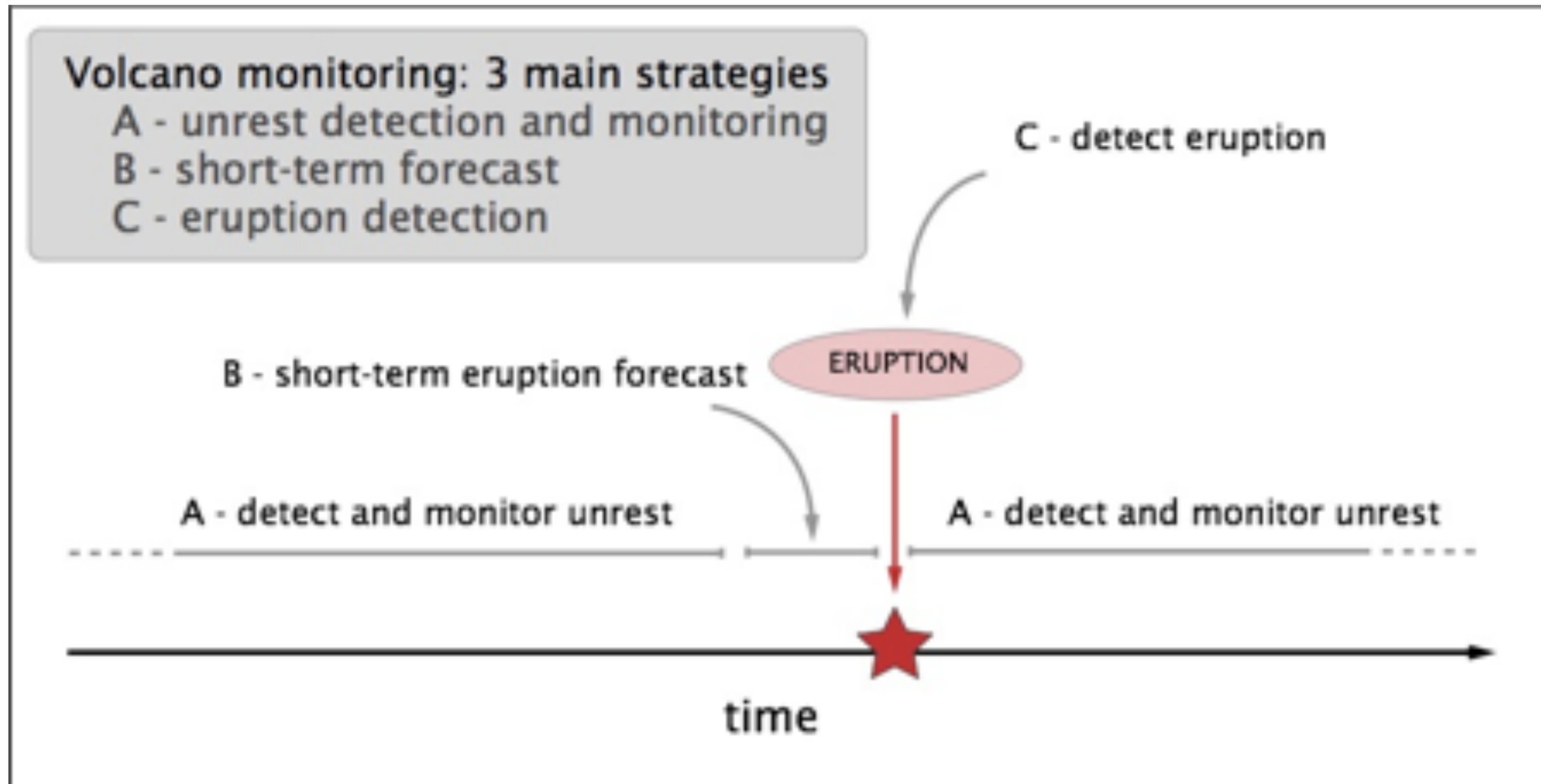
# Volcano observatories primarily focus on acute risk to life safety near volcanoes



Pinatubo, Philippines, June 1991

Alber Garcia

# Volcano observatories primarily focus on acute risk to life safety near volcanoes



Volcanoes can also impact aviation in different ways



# Volcanoes impact aviation on the ground



*5-10 mm of ash*

AFP, 2011

Planes grounded in *Argentina* in June 2011 by the Cordon-Caulle eruption in *Chile*.

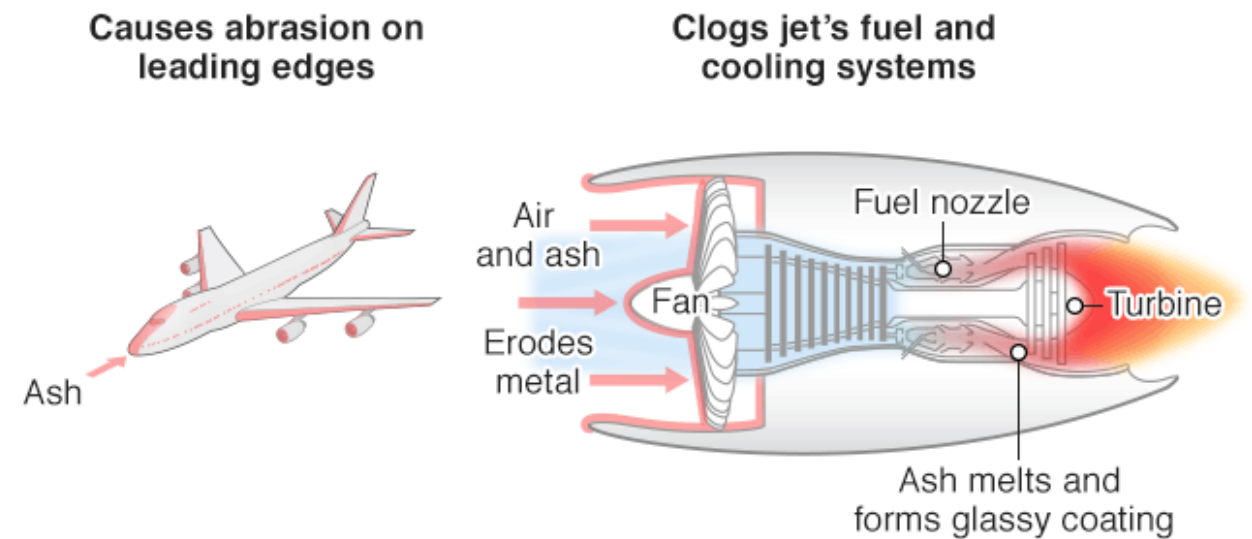
Airport close for 31 days due to the on-going ashfall, remobilisation of ash and cleanup.

# Volcanoes impact aviation in the air



Etienne de Malglaive / Getty Images

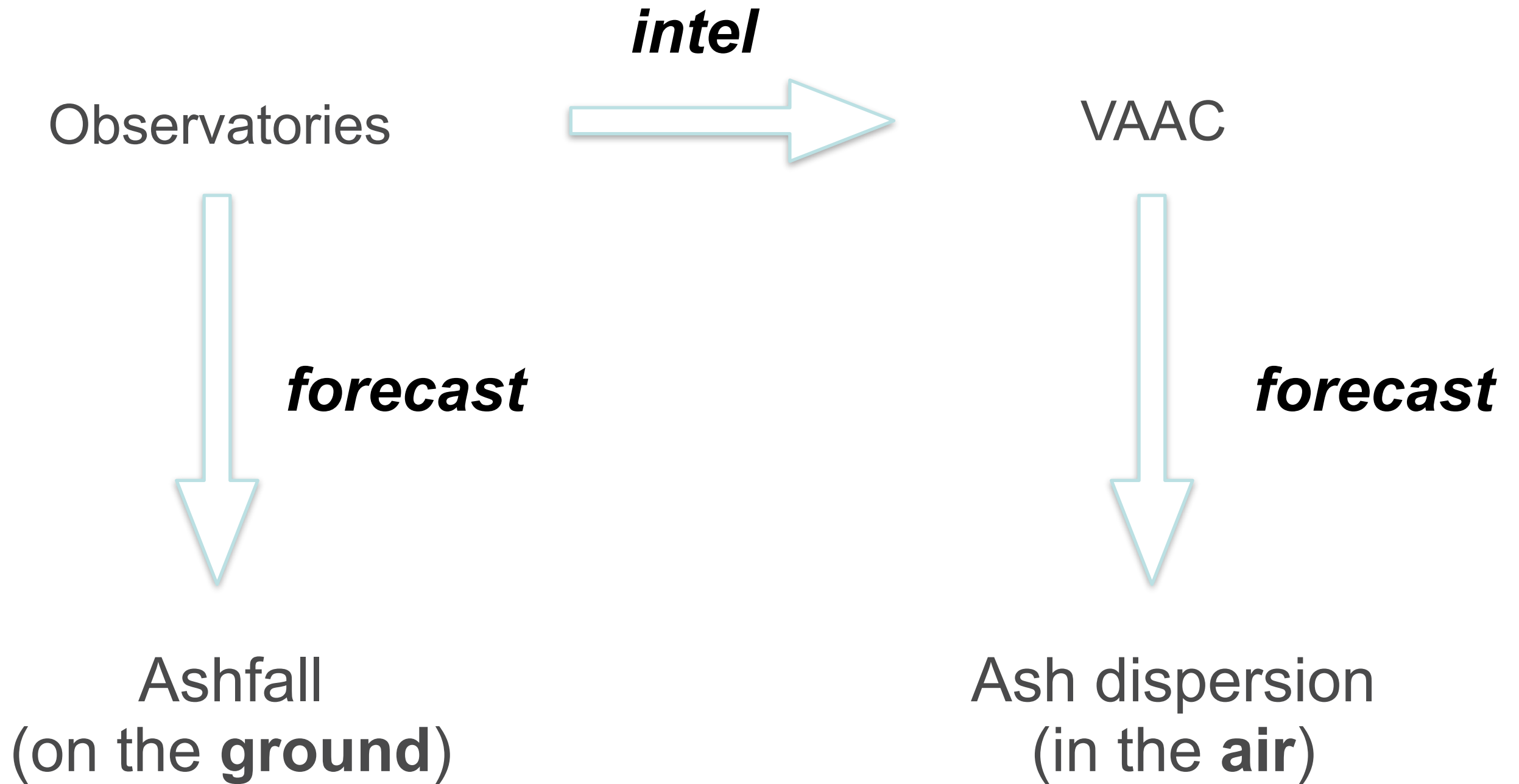
## How volcanic ash can damage a plane in flight



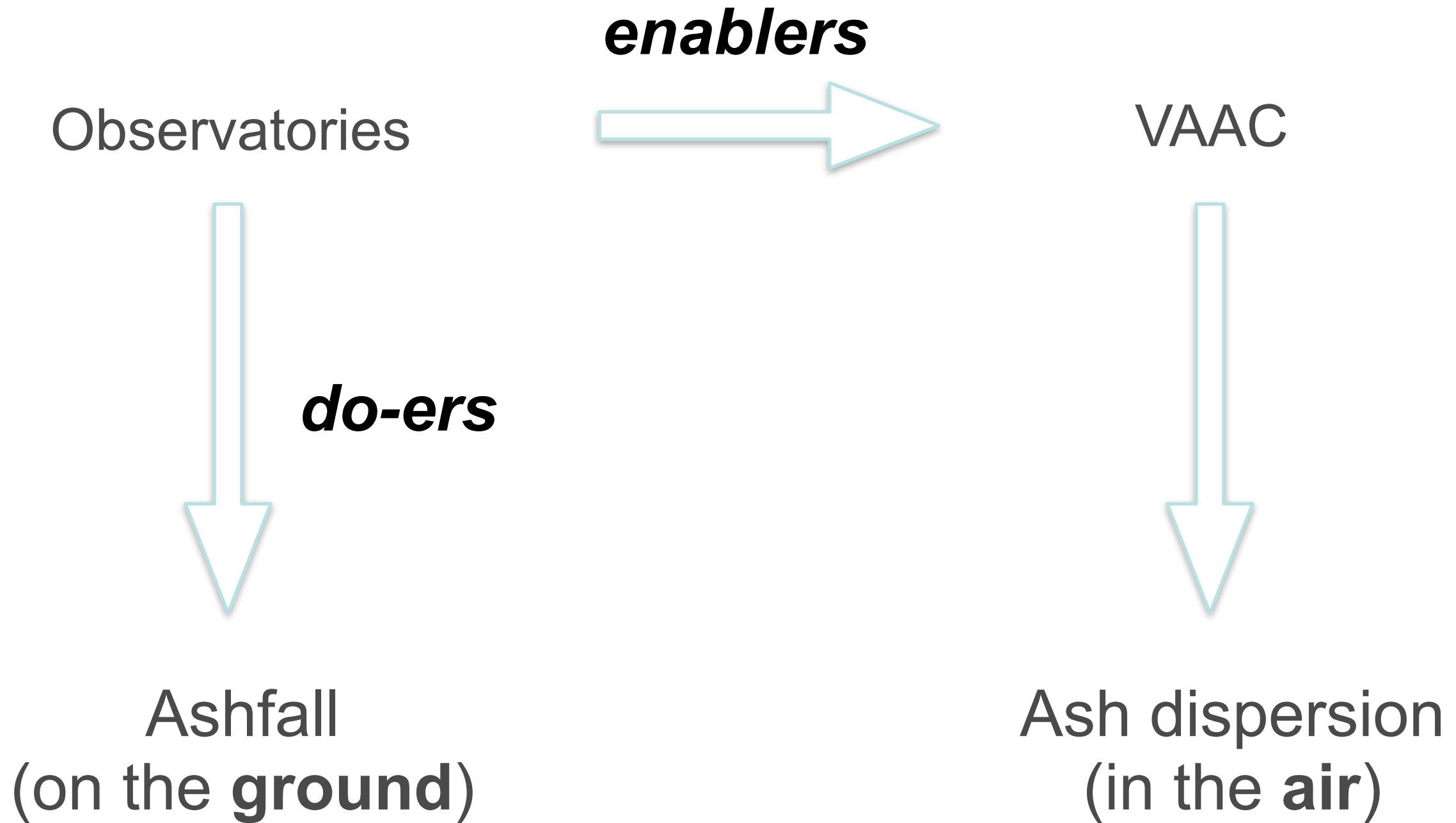
Eyjafjallajokull eruption in Iceland (2010) caused airspace mayhem in Europe.

Mount Agung in Bali (2017) disrupted the local economy

# Observatories provide essential *forecast* and *intel*



# Observatories provide essential *forecast* and *intel*

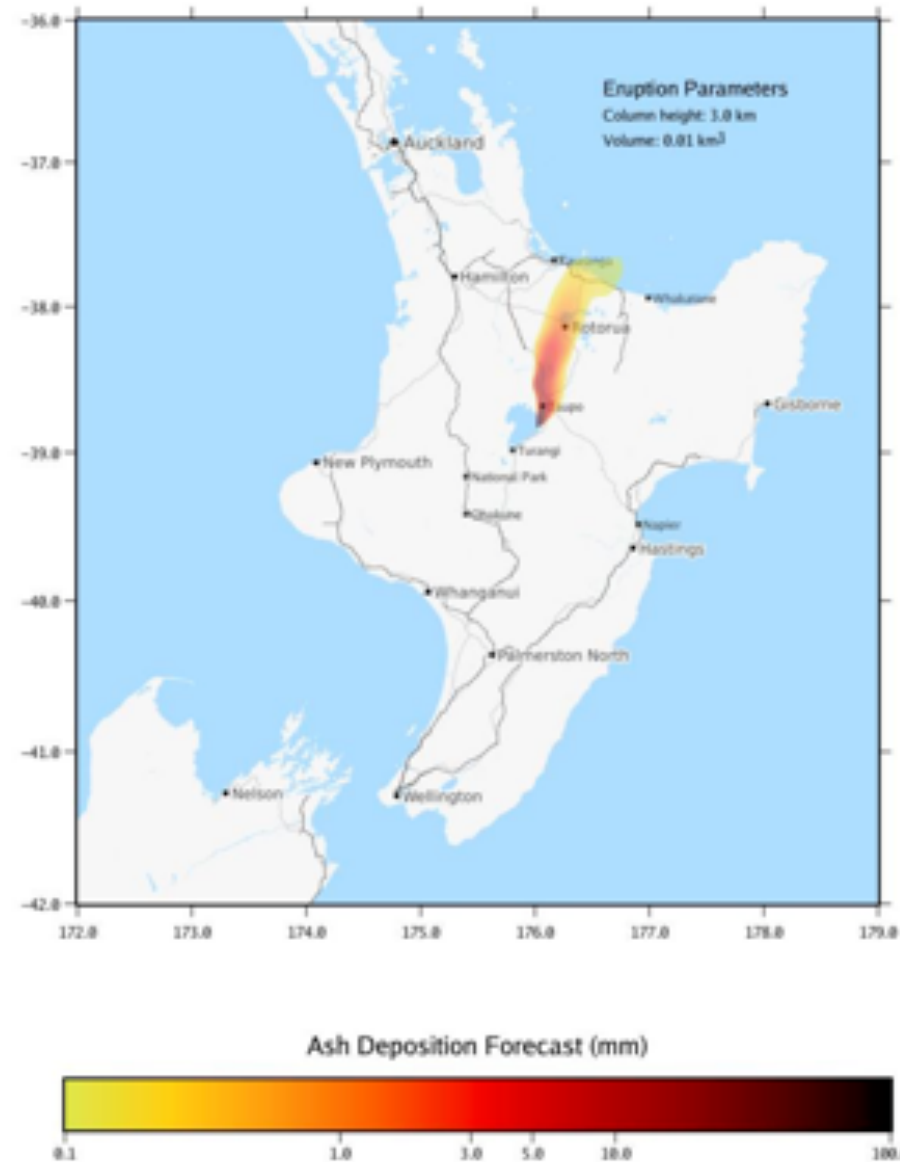


# Observatories provide essential *forecast* and *intel*



**New Zealand**  
**Volcanic Ashfall Forecast**  
Wednesday October 30, 2019 12:00 NZDT

## Taupo – 12 h Ash deposition forecast





# Observatories provide essential *forecast* and *intel*

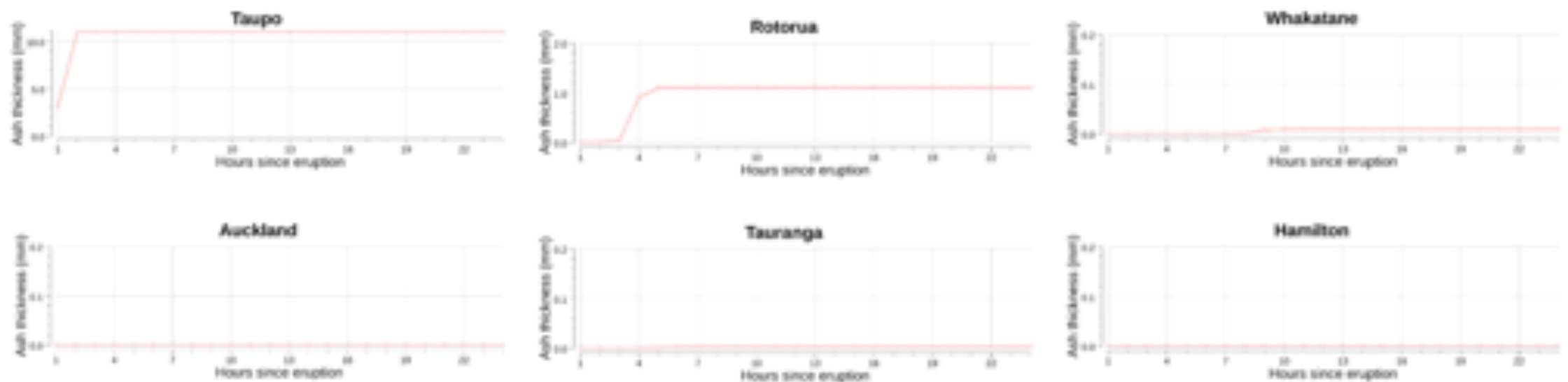


## New Zealand Volcanic Ashfall Forecast Wednesday October 30, 2019 12:00 NZDT



Eruption source:	Taupo
Eruption time:	30 October 2019 10:10 NZDT
Forecast duration (24 hours):	Ends at 31 October 2019 10:10 NZDT

Cumulative ashfall at selected points of interest for the forecast duration:



# When there aren't volcano observatories...

Is there an eruption?

Is it big?

Where???

How high is the ash going?

Is it still going on ?

VAAC may be able to provide intel with Satellite imagery, but it can be difficult, especially with cloud cover

VAAC has to rely on unverified (at best), or unreliable (at worst) reports



# Tonga 2014-2015



# VA Advisory

FVPS01 NZKL 112251~

VA ADVISORY

DTG: 20150111/2251Z

VAAC: WELLINGTON

VOLCANO: HUNGA TONGA-HUNGA HAAPAI 243040

PSN: S2034 W17522

AREA: TONGA

SUMMIT ELEV: 149M

ADVISORY NR: 2015/23

INFO SOURCE: PILOT OBSERVATION.

AVIATION COLOUR CODE: UNKNOWN

ERUPTION DETAILS: **OBS VA TO FL160 AT 11/2036Z**

OBS VA DTG: 11/2300Z

EST VA CLD: SFC/FL160 S2045 W17600 - S2045 W17330 - S2145

W17345 - S2115 W17600 - S2045 W17600 FL160/600

NO VA EXP

FCST VA CLD+6 HR: 12/0500Z SFC/FL160 S2030 W17600 - S2100 W17215

- S2215 W17230 - S2200 W17600 - S2030 W17600

FL160/600 NO VA EXP

FCST VA CLD+12 HR: 12/1100Z SFC/FL160 S2030 W17600 - S2015 W17330

- S2100 W17030 - S2230 W17115 - S2215 W17300 -

S2245 W17600 - S2030 W17600 FL160/600 NO VA EXP

FCST VA CLD+18 HR: 12/1700Z SFC/FL160 S2015 W17545 - S2000 W17245

- S2130 W16945 - S2300 W16930 - S2315 W17145 -

S2300 W17400 - S2300 W17530 - S2245 W17615 -

S2015 W17545 FL160/600 NO VA EXP

RMK: **VOLCANO OBSCURED BY CLOUD. PILOT REPORT OF**

**DARK VA CLOUD UP TO FL160 AND APPROX 10NM**

**AROUND THE ISLAND. CONTINUOUS ERUPTION.**

NXT ADVISORY: NO LATER THAN 20150112/0500Z=







Reports of ash at high elevation, leading to cancellation of regional and international flights for several days

Lack of flights began to create a serious economic threat



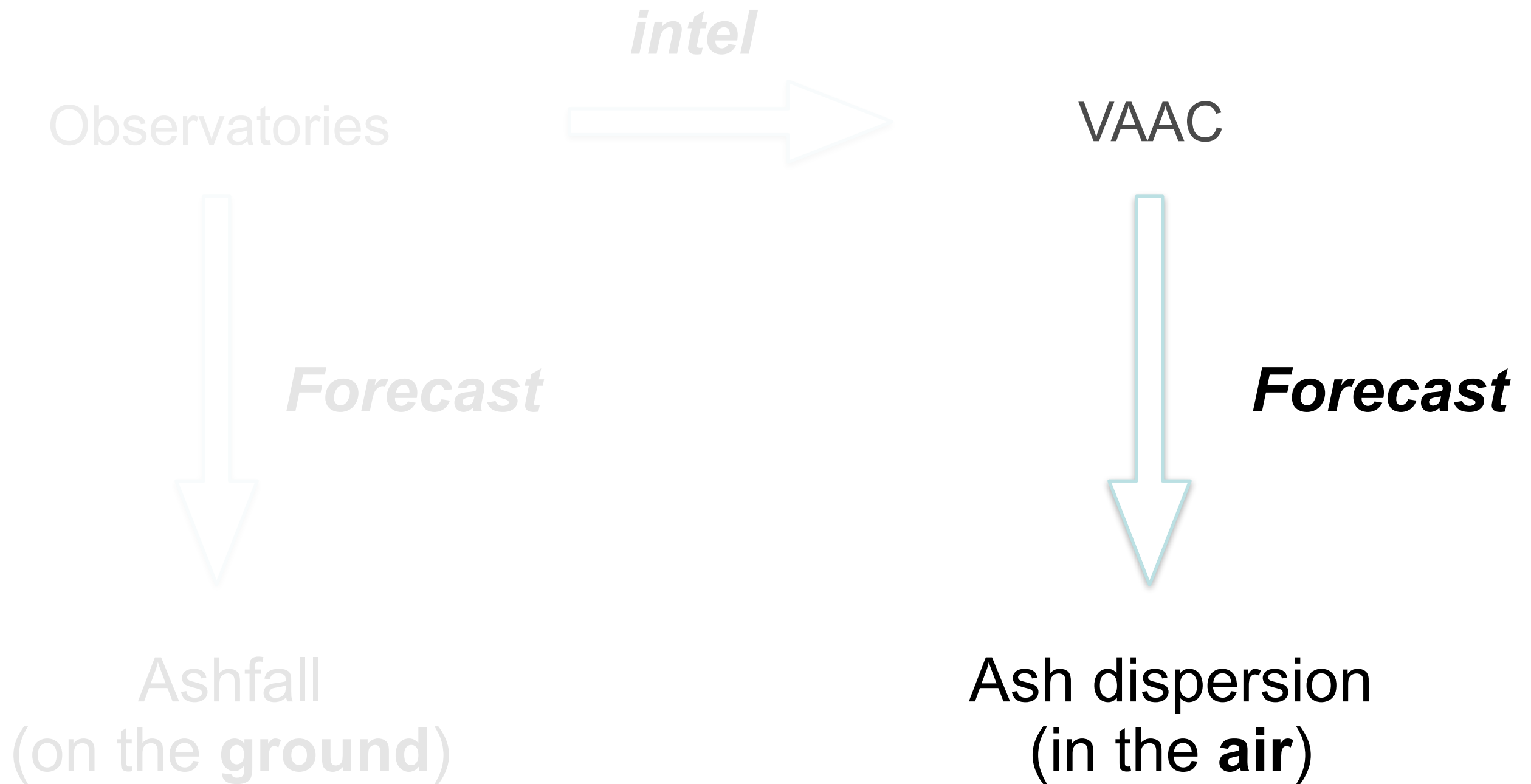
# Meet Hunga Tonga Hunga Ha'apai



# Significant presence of ash at *low elevations only*



# Difficulties in providing *intel* to VAAC





# “Plumometer”



PVC pipe + elbow + trigonometry = “plumometer”!

# “Plumometer”

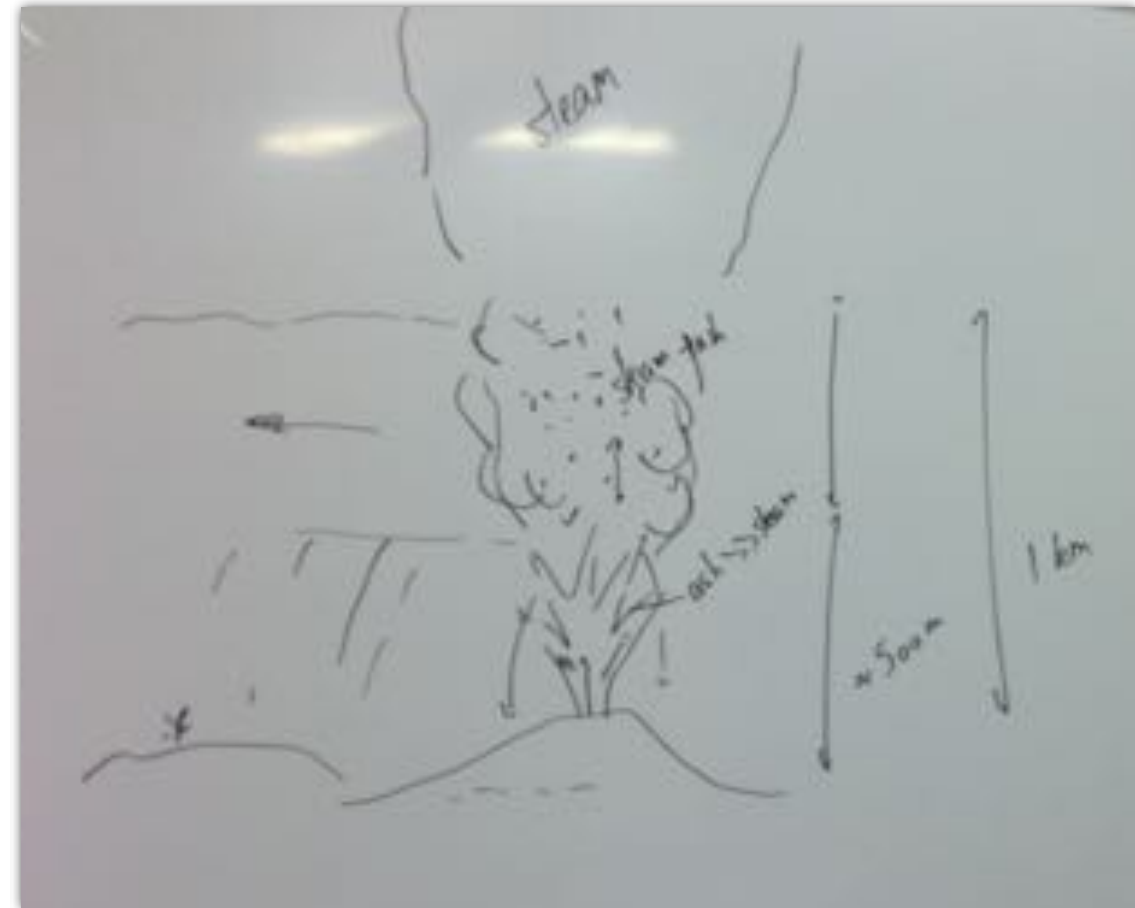




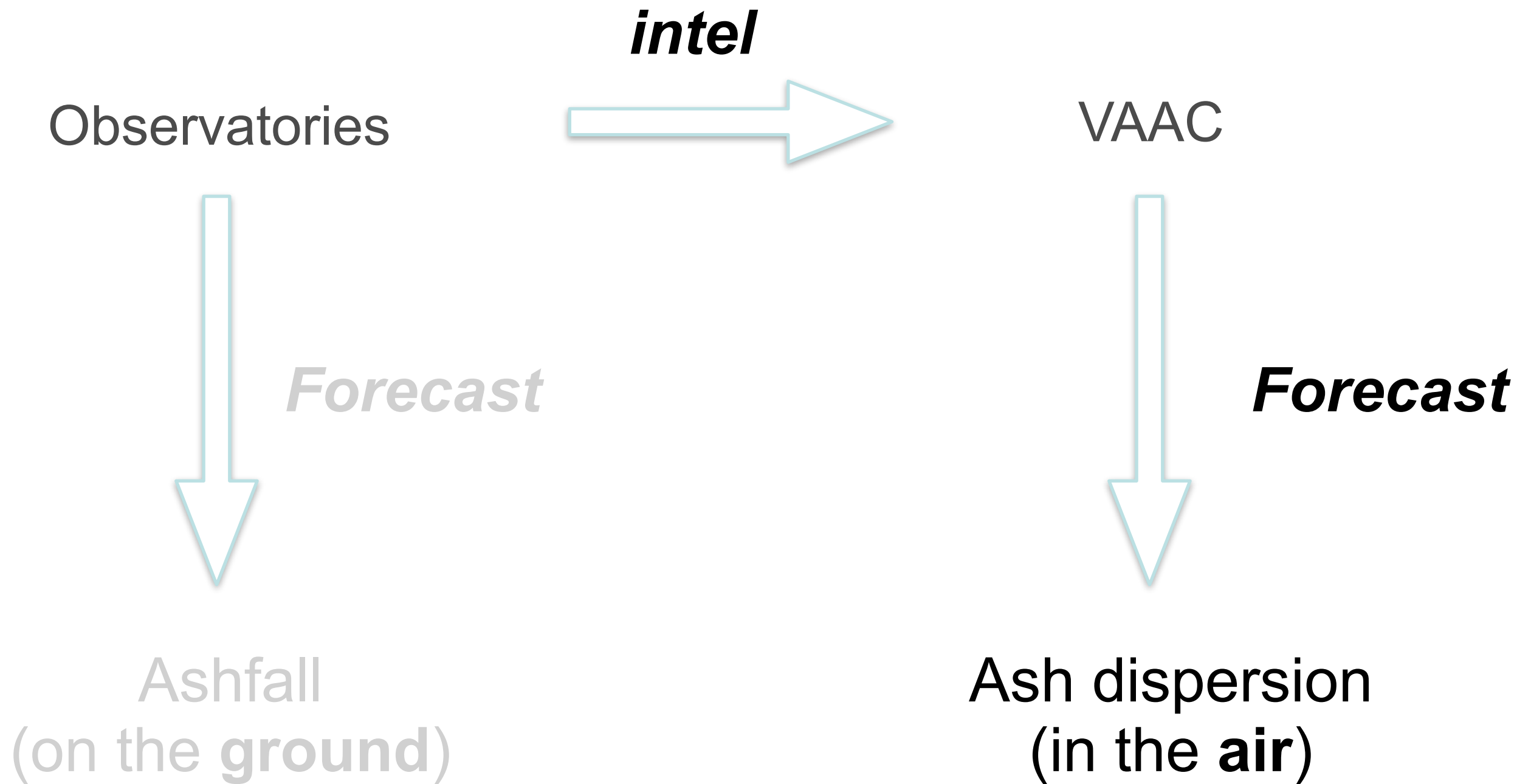
# Report relevant information



# Distinguish *ash* vs *steam* plume in reports to VAAC



# Increased ability to provide *intel* to VAAC & aviation



# **Observatories are do-ers and enablers *prior, during and after* an eruption**

*Before* the eruption: when possible, provide an indication that an eruption is more likely

**During/immediately after an eruption: information about the eruption (height, size, type - e.g., steam vs ash, duration)**

*After* the eruption: confirmation of end of eruption, likelihood of further eruption



# Some resources for ash impact - posters

<https://www.gns.cri.nz/Home/Learning/Science-Topics/Volcanoes/Eruption-What-to-do/Ash-Impact-Posters/>

(accessed 1/10/20)

Volcanic ash fall advice in HTML poster versions for:

- [Advice for waste water-managers](#)
- [Advice for water supply managers](#)
- [Advice for roading managers](#)
- [Advice for airport operators](#)
- [Advice for power transmission and distribution system operators](#)
- [Advice for power plant operators](#)
- [Advice for facilities managers: buildings](#)
- [Advice for all facilities managers: gensets and HVAC](#)
- [Advice for facilities managers: computers and electronics](#)
- [Advice for urban clean-up operations](#)

[Back home <<](#)



The screenshot shows the GNS Science website interface. At the top, there is a navigation menu with links: Home, About Us, Our Science, Services, Products, Learning, News and Events, Careers, Contact Us, Search. Below this is a secondary menu: GeoCamp, Find it on a map, Science Topics, Videos, Interactive, Lesson Plans, Downloads, Glossary. The main content area is titled 'Home / Learning / Science Topics / Volcanoes / Eruption: What to do / Ash Impact Posters'. On the left, a sidebar lists 'Volcanoes' and 'Ash Impact Posters' with sub-links. The main content area has a heading 'Ash Impact Posters' and a paragraph explaining the purpose of the posters. Below this, it says 'Volcanic ash fall advice in PDF poster versions for:' followed by a list of PDF links and file sizes. A small image of a poster titled 'VOLCANIC ASH FALL' is shown on the right.

**Ash Impact Posters**

Volcanic ash is the most widespread hazard of explosive volcanic eruptions and the most likely to affect towns, cities and farmland in the North Island of New Zealand. Ash fall can cause considerable disruption, which in some cases continue long after the volcanic eruption is over. Below are a series of posters, commissioned by the Auckland Lifelines Group (ALG), providing concise best practice information for critical infrastructure managers to effectively prepare for, respond to, and recover from ash-producing volcanic eruptions. Content is based on the latest international research and informed by observations from around the world. We are proud that New Zealand is at the forefront of volcanic ash impacts research, focussing in particular on impacts on critical infrastructure such as water and electricity supplies and transport networks, and thank the ALG for making these posters available.

Volcanic ash fall advice in PDF poster versions for:

- Wastewater Managers [YISGPoster\\_WastewaterManagers\\_v3.pdf](#) (1.83 MB)
- Water Supply Managers [YISGPoster\\_WaterSupplyManagers\\_v3.pdf](#) (1.48 MB)
- Roading Managers [YISGPoster\\_RoadNetworkOperators\\_v3.pdf](#) (1.88 MB)
- Airport operators [Advice\\_for\\_Airport\\_Operators.pdf](#) (243.23 kB)
- Power Transmission and Distribution System Operators [Advice\\_for\\_Power\\_Systems\\_Operators.pdf](#) (210.30 MB)
- Power Plant Operators [Advice\\_for\\_Power\\_Plant\\_Operators.pdf](#) (187.06 kB)
- Facilities Managers: Buildings [YISGPoster\\_FacilitiesManagersBuildings\\_v2.pdf](#) (1.43 MB)
- Facilities Managers: Gensets and HVAC [Advice\\_for\\_Facilities\\_Man\\_GenSets\\_HVAC.pdf](#) (242.52 kB)
- Facilities Managers: Computers and Electronics [Advice\\_for\\_Facilities\\_Man\\_Comp\\_and\\_Electronics\\_.pdf](#) (260.50 kB)
- Urban Clean-up Operations [Advice\\_for\\_Urban\\_Cleanup.pdf](#) (1.58 MB)



# Some resources for ash impact - Airport operators

VOLCANIC ASHFALL

## ADVICE FOR AIRPORT OPERATORS

VOLCANIC ASH IS: HARD, HIGHLY ABRASIVE, MILDLY CORROSIVE AND CONDUCTIVE WHEN WET.

### ASH IMPACTS TO AIRPORTS

**ASH IS HAZARDOUS TO AIRCRAFT.**

- It can cause engine failure and severe abrasion to exposed surfaces

**ASHFALL MAY REQUIRE AIRPORTS TO CLOSE. TYPICAL IMPACTS INCLUDE:**

- Difficult landing conditions due to reduced runway friction, especially when ash is wet.
- Loss of local visibility when ash on the ground is disturbed by engine exhausts during takeoff and landing.
- Ingestion of remobilised ash into jet engines during taxi-ing, takeoff and landing.
- Deposition of ash on hangars and parked aircraft, with structural loading considerably worsened if ash becomes wet.
- Contaminated ground-support systems.

**ASH ACCUMULATIONS OF LESS THAN 1 MILLIMETRE MAY BE SUFFICIENT TO TEMPORARILY CLOSE SOME AIRPORTS.**

Cleaning up airports after an ashfall is a time-consuming, costly and resource intensive operation. The complexity and immensity of this task should not be underestimated.


**ASH IN AIRSPACE IN THE VICINITY OF AIRPORTS MAY ALSO CAUSE DISRUPTIONS TO AIRPORTS EVEN IF IT DOES NOT ACCUMULATE ON THE GROUND.**



Check GeoNet for latest volcanic alert levels (<http://www.geonet.org.nz>)



3-5 mm of ash fall at Mariscal Sucre International Airport in Quito, Ecuador, following the 3 November 2002 eruption of Reventador volcano. The airport closed for 8 days due to the ash deposition on aircraft and runways.



5-10 mm of ash fall at San Carlos de Bariloche International Airport in Bariloche, Argentina, following the June 2011 eruption of Peayhue Cordón-Caulle volcano in Chile. The airport closed for 31 days due to the on-going ash falls, remobilisation of ash and cleanup.



Volcanic ash particle

### WARNING INFORMATION

**WHERE TO FIND WARNING INFORMATION**

- ASH CLOUD FORECAST** (ash suspended in atmosphere): The Wellington Volcanic Ash Advisory Centre (VAAC) will issue Volcanic Ash Advisories (VAA) and Graphics (VAG) forecasts on suspended ash in the atmosphere affecting aviation. See: <http://vaac.metservice.com/>
- ASHFALL FORECAST** (ash falling to ground): GeoNet (GNS Science) will provide ashfall forecasts in the event of an explosive eruption (see: [geonet.org.nz](http://geonet.org.nz)).
- AVIATION COLOUR & VOLCANO ALERT LEVEL** (ash falling to ground): GeoNet (GNS Science) sets the Aviation Colour Codes and Volcano Alert Level for New Zealand's volcanoes (see: [geonet.org.nz](http://geonet.org.nz)).

### RECOMMENDED ACTIONS

**HOW TO PREPARE**

At-risk airports should develop comprehensive operational plans for ashfall events (including cleanup – see companion “Advice for Urban Clean-Up Operations” poster). These plans should, where possible, be integrated with airline plans.

A more comprehensive summary of ashfall consequences to airports and detailed planning guidelines are available from:

- ICAO: [www.paris.icao.int/news/pdf/9691.pdf](http://www.paris.icao.int/news/pdf/9691.pdf)

The ICAO resource provides guidance on:

- a) standing arrangements prior to volcanic eruptions;
- b) responses during an eruption
- c) post-eruption cleanup and re-opening of the airport.

**FURTHER INFORMATION ON DEALING WITH VOLCANIC ASH MAY BE FOUND IN THE FOLLOWING LOCATIONS:**

<http://www.geonet.org.nz>  
<http://www.ivhnm.org>  
<http://volcanoes.usgs.gov/ash/trans/index.php#airports>  
<http://www.caa.govt.nz/>

DRAFTED BY TOM WILSON AND CAROL STEWART.  
7 February 2013



(accessed 1/10/20)

# Thanks

More info:

[geonet.org.nz](http://geonet.org.nz)

[gns.cri.nz](http://gns.cri.nz)

Twitter:

@geonet

@gnsscience

@nicovolc

