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Evolution of the Volcano Observatory Notice to Aviation (VONA): New Requirements for State Volcano Observatories

Paula Acethorp[1] & Dave Schneider[2]

[1] New Zealand Civil Aviation Authority

[2] U.S. Geological Survey, Alaska Volcano Observatory

Meteorological Operations Group Working Group (WG-MOG)

International Airways Volcano Watch (IAVW)

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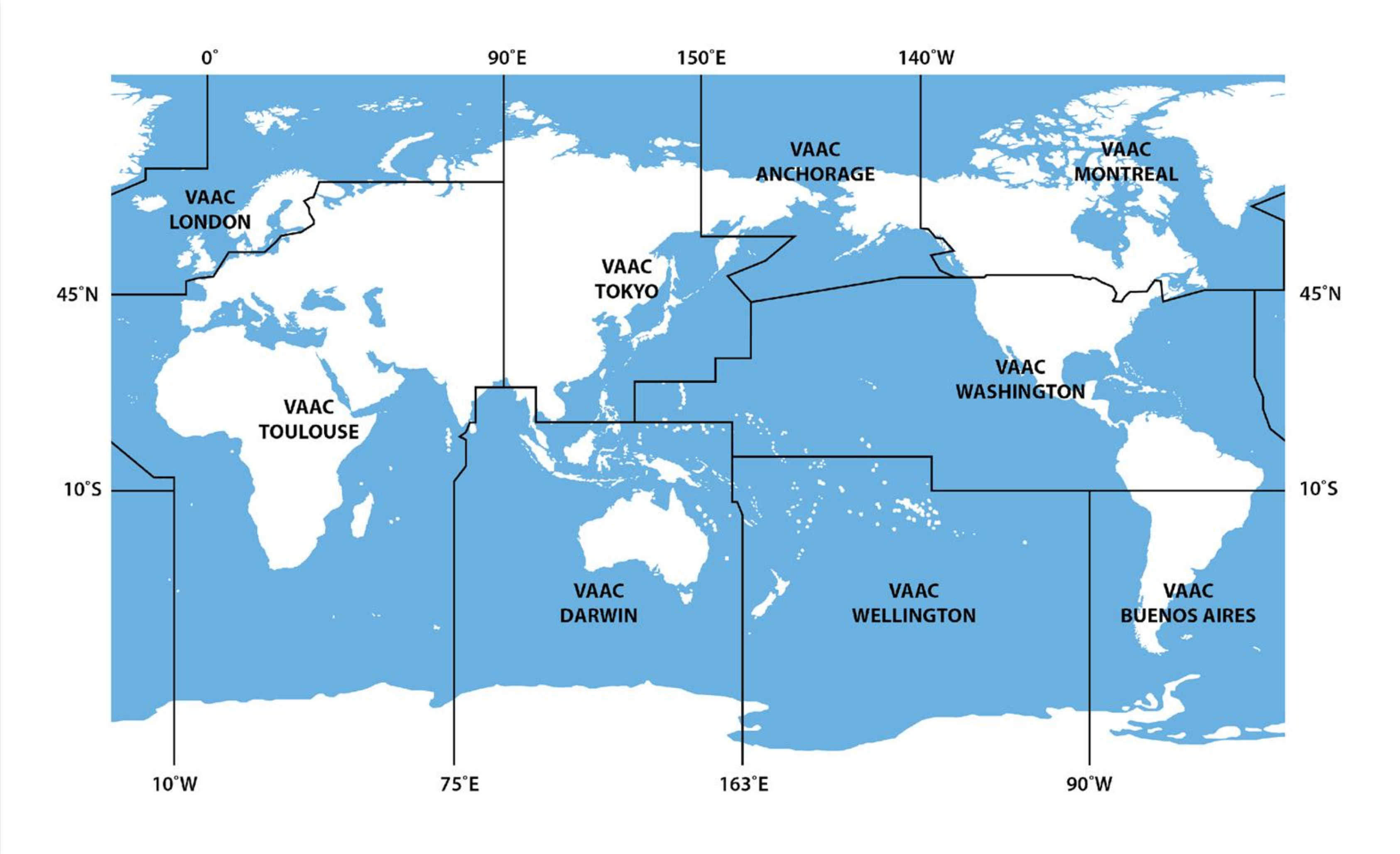
Volcanic Ash Advisory Centres (VAACs)



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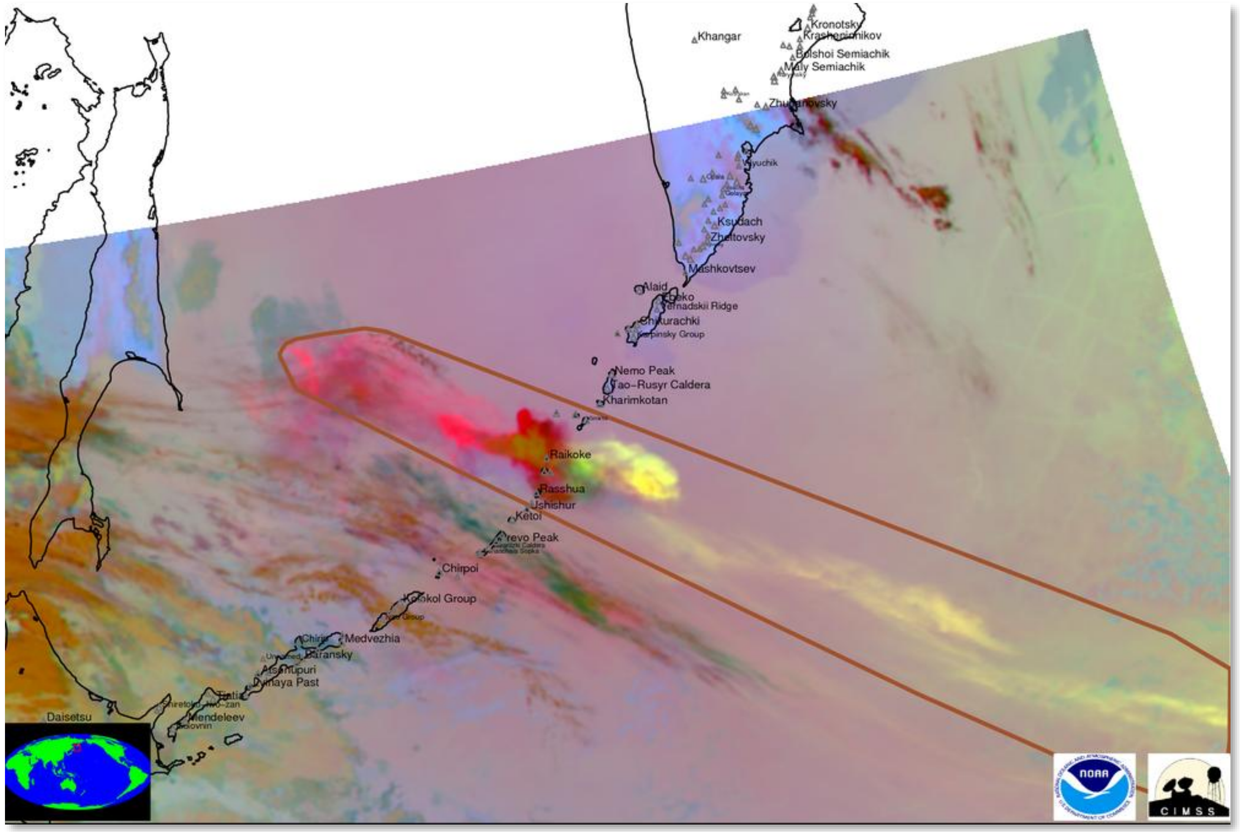
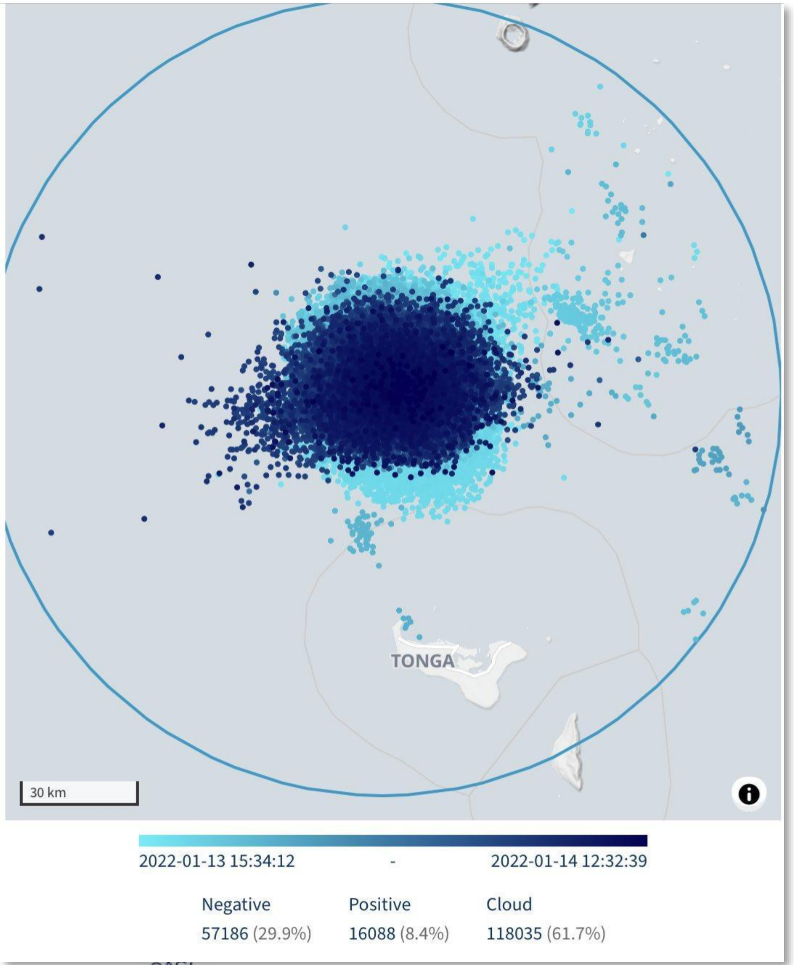
VAAC monitoring tools

1. Satellite Data



VAAC monitoring tools

1. Satellite Data
2. Lightning Detection



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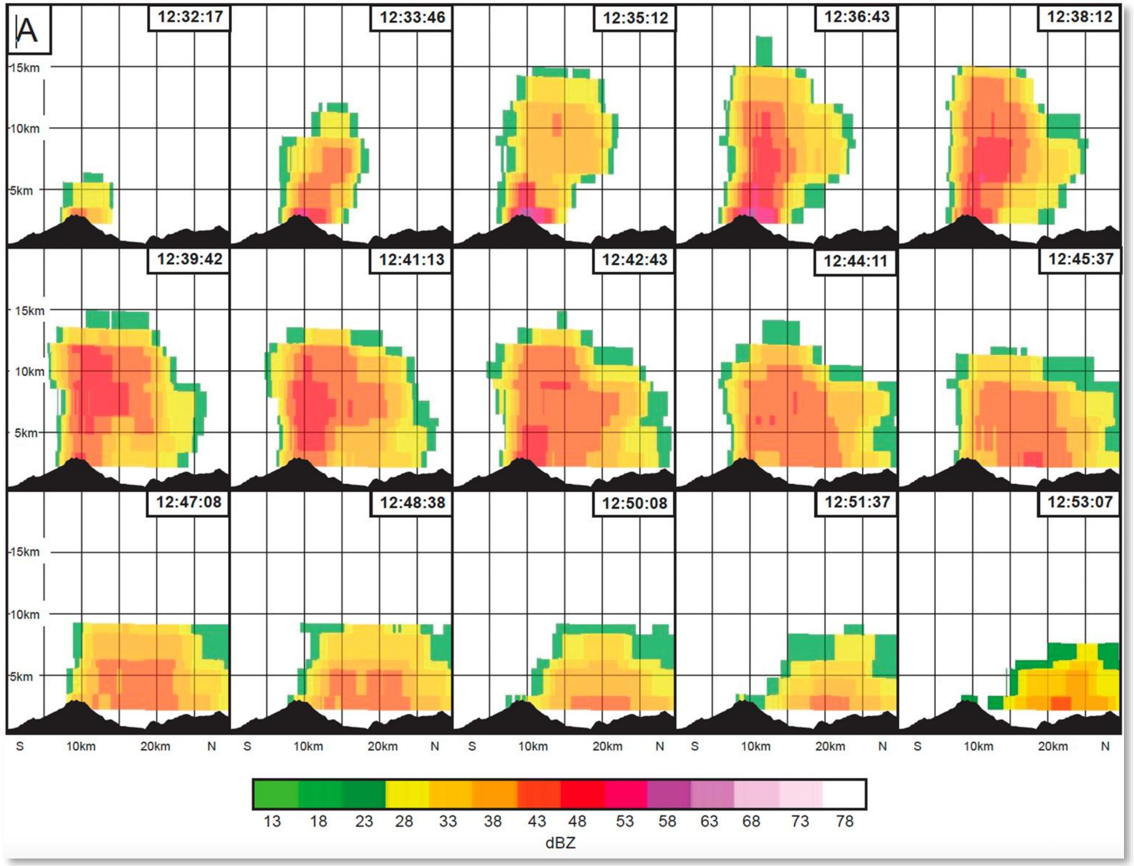
VAAC monitoring tools

1. Satellite Data
2. Lightning Detection
3. Weather Radar (in conjunction with SVOs or met agencies)



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VAAC monitoring tools

1. Satellite Data
2. Lightning Detection
3. Weather Radar
4. Pilot Reports

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VAAC monitoring tools

1. Satellite Data
2. Lightning Detection
3. Weather Radar
4. Pilot Reports
5. Web cameras

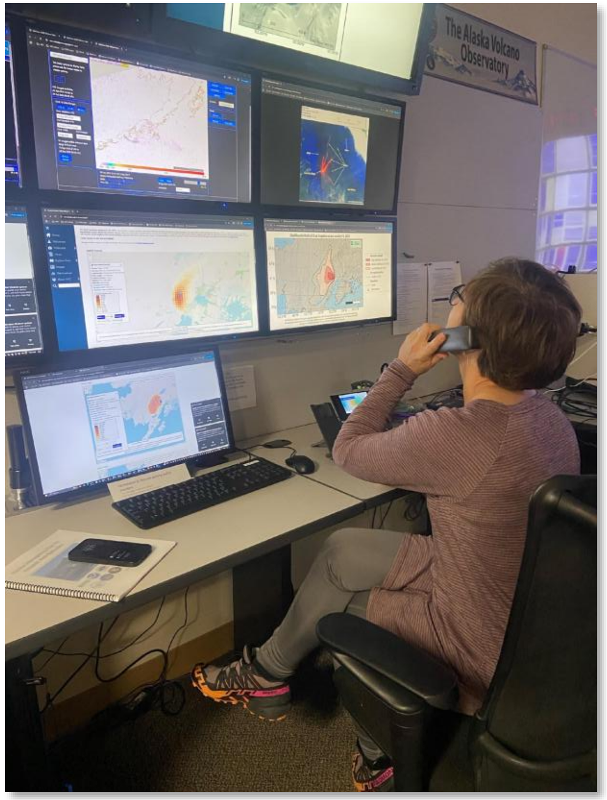
VAAC monitoring tools

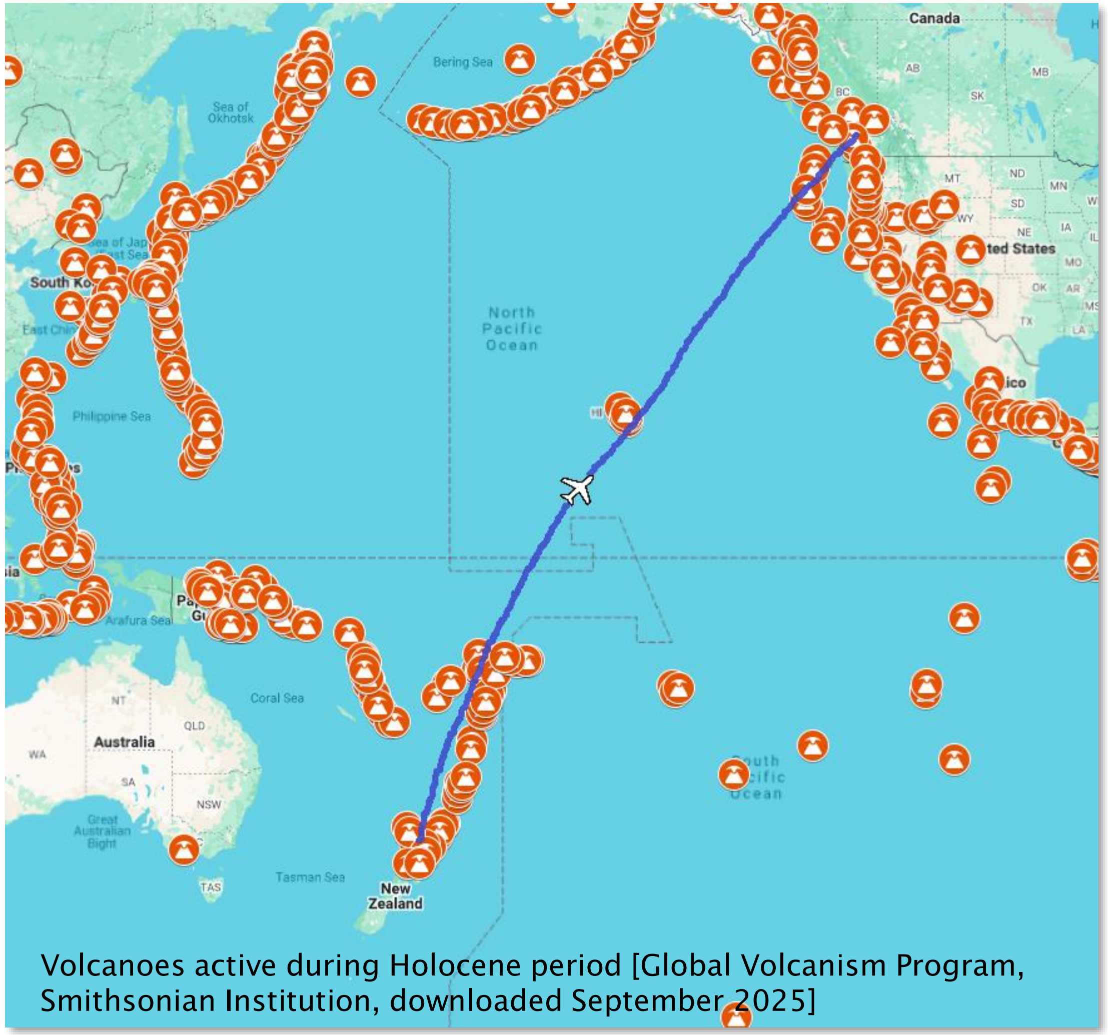
1. Satellite Data
2. Lightning Detection
3. Weather Radar
4. Pilot Reports
5. Web cameras
6. <u>Information from SVOs</u>

VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)

Item No	Element	Content
1	Message title	VOLCANO OBSERVATORY NOTICE FOR AVIATION
2	Issued:	20190626/0600Z
3	Volcano:	White Island 241040
4	Current Aviation Color Code:	Yellow
5	Previous Aviation Color Code:	Green
6	Source:	GNS Science, New Zealand
7	Notice Number:	NZ VONA 01/19
8	Volcano Location:	3752S17718E
9	Area:	White Island
10	Summit Elevation:	1053FT
11	Volcanic Activity Summary:	Moderate to heightened volcanic unrest with second highest SO2 flux of past 20 years
12	Volcanic Cloud Height:	NIL
13	Other Volcanic Cloud information:	NIL
14	Remarks:	ACC changed from Green to Yellow
15	Contacts:	Duty Volcanologist, +6472761784ph,+6473748199fax
16	Next Notice:	Will be issued if there is a change in aviation color code or when a significant volcanic event happens within the current color code.

Old VONA Format





Volcanoes active during Holocene period [Global Volcanism Program, Smithsonian Institution, downloaded September 2025]

Consider a flight from Auckland to Vancouver

Flight planners consider weather and hazards along flight route, adjusting the route accordingly.

Local volcanic activity is of global aviation interest. Activity often only known about once eruption occurs.

SVOs are super important to the aviation system!

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ICAO requirements

UNCHANGED States with **active or potentially active volcanoes** shall arrange State volcano observatories (SVOs) to:

- **monitor** these volcanoes
- send information on volcanic activity as **quickly as practicable** to specified aviation organisations when observing:
  - Significant pre-eruption volcanic activity
  - Volcanic eruption or significant change in eruptive activity; and/or
  - Volcanic ash in the atmosphere.

NEW **Recommendation.**— Information on volcanic activity and/or volcanic ash in the atmosphere should be issued by a SVO as a VONA.

- Includes new requirements as to **how** and **when** VONA issued.

Where to find requirements

Annex 3 - *Meteorological Service for International Air Navigation*

- Contains the requirements for States (what has to be done)

Procedures for Air Navigation Services – Meteorology (PANS-MET, Doc 10157)

- Contains the means of compliance (how to do the things that need to be done – e.g. templates)

Available from ICAO Store or talk to your national aviation authority.

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How are SVOs designated?

- Every ICAO region has an Air Navigation Plan (ANP), outlining services in the region.
  - **Volume I contains Table MET I-1 *State Volcano Observatories***
- Only **designated SVOs** should issue VONA – reduces risk of conflicting information, promotes single ‘source of truth’.
  - Also, for volcanoes located on borders, SVOs should coordinate on any VONA being issued.
- Usually, designation in the ANP is coordinated by the national aviation authority.

States with Designated SVOs

For reference, as at 18 Nov 2025…

United States	French Antilles (France)	Peru	Papua New Guinea	Cape Verde
Argentina	Guatemala	Trinidad and Tobago	Iceland	Comoros
Chile	Guyana	China	Portugal	Democratic Rep. of Congo/RDC
Colombia	Mexico	Japan	Italy	Eritrea
Costa Rica	Montserrat (U.K.)	India	Russian Fed.	Ethiopia
Ecuador	Nicaragua	Indonesia	Spain	France (Réunion)
El Salvador	Panama	New Zealand	Cameroon	Kenya

Americas	Asia-Pacific	North Atlantic	Europe	Africa-Indian Ocean

ANP, Vol I, Table MET I-1. Note - ICAO updating website, Americas link broken. No Middle East SVOs designated.

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What's a "potentially active" volcano?

- Smithsonian Global Volcanism Program (GVP) categorises **Holocene volcanoes** as being active or potentially active.
- Threat posed to aviation is the combination of the **volcanic hazard** (eruption style and frequency) and **the exposure** (people and infrastructure at risk).
- When prioritising how volcano monitoring resources are allocated, **SVOs should consider the threat that is posed to aviation** as part of their deliberative process.

VONA – *wider group of users*

Using the VONA template becomes a "**Recommended Practice**" for SVOs.

- VONA to be **provided to operators** in the same way as any other aviation meteorological warning.
- Globally harmonised, can be ingested into flight planning software, information decision making tools.
- **Vitally important** to follow the template precisely so that the VONA can be machine readable.

New Format

WMAK01 PAVO
VONA
DTG: 20231003/1412Z
VOLCANO: SHISHALDIN 311360
PSN: N5445 W16358
AREA: ALEUTIANS
SOURCE ELEV: 9373FT AMSL
NOTICE NR: 2023/50
CURRENT COLOUR CODE: RED
PREVIOUS COLOUR CODE: ORANGE
SVO: ALASKA VOLCANO OBSERVATORY
ACT STS: ERUPTION OCCURRED
ONSET: 20231003/1350Z
DUR: ONGOING CONS
VA CLD HGT: 40000FT AMSL
HGT SOURCE: SATELLITE
MOV: S
CTC: ALASKA VOLCANO OBSERVATORY DUTY SCIENTIST, TEL +1-907-786-7497
RMK: SIG VA EM OBS IN SATELLITE AT 20231003/1350Z. VA EM EXP TO BE CONS FOR SEVERAL HR.
NXT NOTICE: A NEW VONA WILL BE ISSUED IF COND CHANGE SIGNIFICANTLY OR IF THE COLOUR CODE CHANGES

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VONA – *enhanced information*

- Where possible, SVOs encouraged to include **ranges** for eruption source parameters in the remarks sections.
  - This could include variation in eruption cloud height or other factors like coarse-grained tephra, or significant water content. Supports modelling by the VAACs and issuance of **probabilistic** quantitative volcanic ash concentration information.
  - SVOs are encouraged to work with their VAACs outside of the VONA process on eruption source parameters.
- SVOs encouraged to issue **test VONA** when upgrading systems or processes
  - 'Status indicator' can be used for test or exercise messages – tells users they are not for operational use, but still disseminated the same way.
- To be provided in both traditional alphanumeric code (TAC) and IWXXM (ICAO XML) format, for **greater utility in aviation systems.**
  - SVOs encouraged to work with associated MET service, Air Navigation Service Provider or VAAC to create/issue IWXXM format.

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VONA – *modified colour code*

New UNASSIGNED colour code for poorly monitored volcanoes (e.g., no geophysical monitoring, undersea volcanoes, remote volcanoes) – for when an SVO can't be sure of the volcano's normal background status.

ICAO Colour code	Status of activity of volcano
GREEN	The volcano is in a normal, non-eruptive state; or, volcanic activity is considered to have ceased, and the volcano has reverted to its normal, non-eruptive state.
YELLOW	The volcano is experiencing signs of elevated unrest above known background levels; or, volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase;.
ORANGE	The volcano is exhibiting heightened unrest with increased likelihood of an eruption; or a volcanic eruption is underway but with no or minor volcanic ash emission.
RED	A volcanic eruption is expected to be imminent with significant emission of volcanic ash into the atmosphere likely; or, a volcanic eruption is underway with significant emission of volcanic ash into the atmosphere.
UNASSIGNED	There is insufficient information available to assess the current status of the volcano or volcanic activity.

VONA – *new frequency of issue*

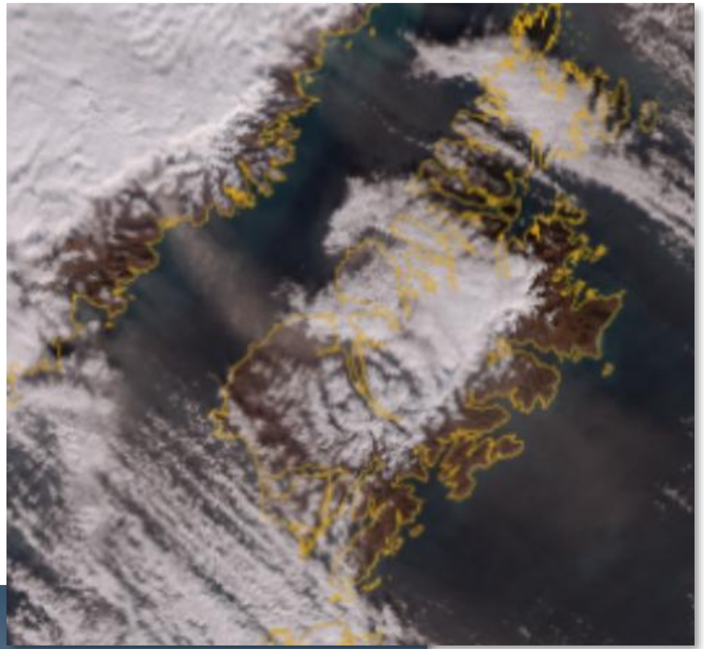
VONAs **shall** be updated):

a) whenever there is a change in the aviation colour code; or
b) at least once every 24 hours whenever the aviation colour code is unchanged at red; or
c) at least once every seven days whenever the aviation colour code is unchanged at orange; or
d) at least twice per month whenever the aviation colour code is unchanged at yellow.

SVOs **should** use the colour code in VONAs. If they don’t they'll need to work out an equivalent update schedule with their National aviation authority that meets the intent of the PANS.

VONA for resuspended ash

- Where capability exists, SVOs can use the VONA to report known resuspended ash.
- The aviation color code SHOULD NOT be changed if ash resuspension is due to <u>meteorological </u>conditions (not due eruptive activity).



Where to find guidance

The upcoming new version of the *Handbook on the International Airways Volcano Watch* (Doc 9766) contains lots of information for SVOs.

- Expected to be published here very soon… (And it's free!)
- Updated information on issuing and disseminating VONA. Includes updated Appendix G *Cost Recovery For Issuance Of VONA.*
- Also includes Appendix A *Sample Letter Of Agreement Between the Air Traffic Services Authority, MET Service Provider and SVO.*
- Guidance developed in coordination with WMO Standing Committee on Services for Aviation (SC-AVI) Advisory Group on Volcanic Science for Applications (AG-VSA).
- **Feedback from SVOs is hugely appreciated, so we can continue to improve the contents.**

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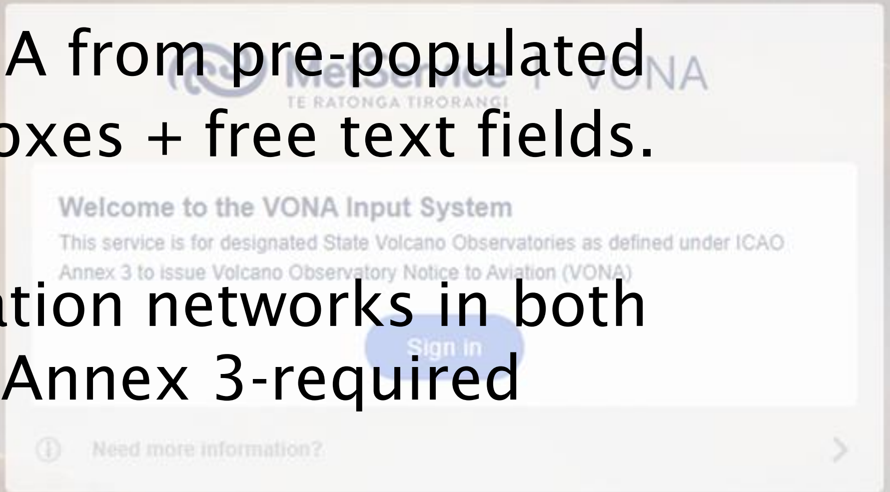
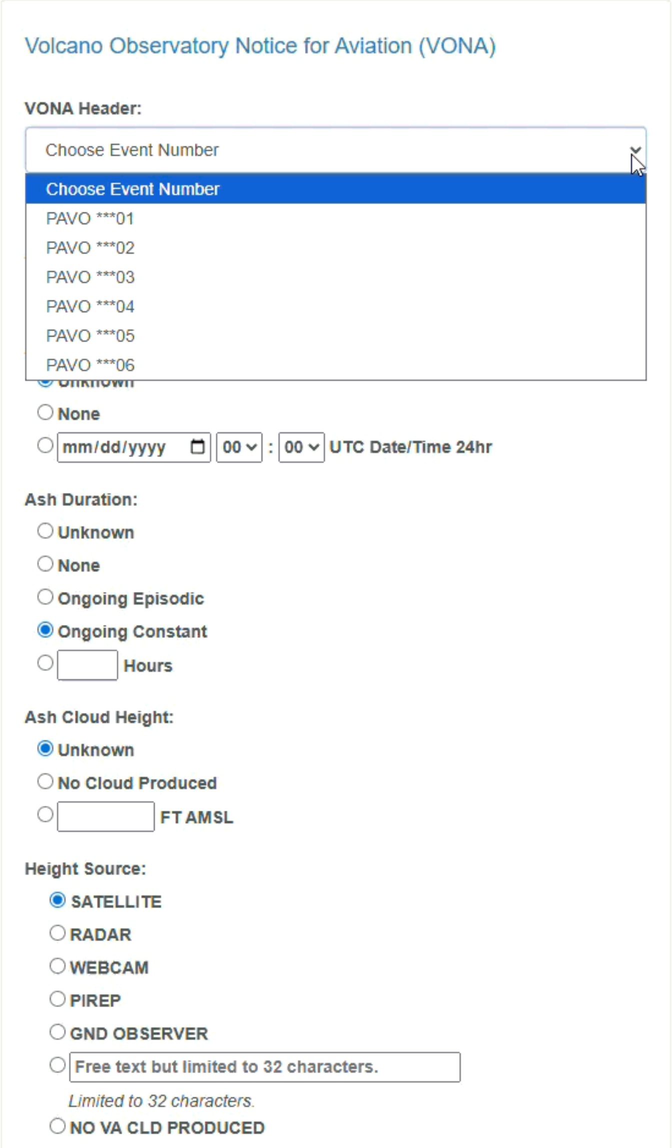
NZ VONA Plans

- MetService NZ (VAAC Wellington) developed VONA Input System
  - SVOs log in to web tool, create and send VONA from pre-populated volcano list, using dropdown text selection boxes + free text fields.
  - Previous VONA may be selected and updated.
  - Once finalized, VONA is disseminated via aviation networks in both traditional alphanumeric + IWXXM formats to Annex 3-required recipients.
  - Can also be emailed to SVO defined address list.
  - To be used by **designated** Pacific SVOs (including NZ SVO). Other SVOs may be considered on case-by-case basis.



USA VONA Plans

- The USGS Volcano Science Center has modified their software to produce the new format in TAC and IWXXM formats, and is working to train observatory staff on the new process.
- Obtained WMO headers to their VOs to cover the broad geographic extent of the 169 historically active volcanoes in the US.
- Entered into agreements with the National Weather Service and the Federal Aviation Administration to distribute the VONA into the aviation communication system.



Thanks!
Questions?
Challenges for your SVO?

Paula.Acethorp@caa.govt.nz

djschneider@usgs.gov