GAP
Good Aviation Practice

Flying around volcanoes

CAA
CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

Contents

Cover photo: Mount Taranaki, located in Egmont National Park, is one of the most symmetrical volcanic cones in the world. Photo: iStock.com/natmint

See the CAA website for Civil Aviation Rules, advisory circulars, airworthiness directives, forms, and more safety publications. Visit aviation.govt.nz.

Every effort is made to ensure the information in this booklet is accurate and up-to-date at the time of publishing. But numerous changes can occur with time, especially in regard to airspace and legislation. Readers are reminded to get appropriate up-to-date information.

Introduction

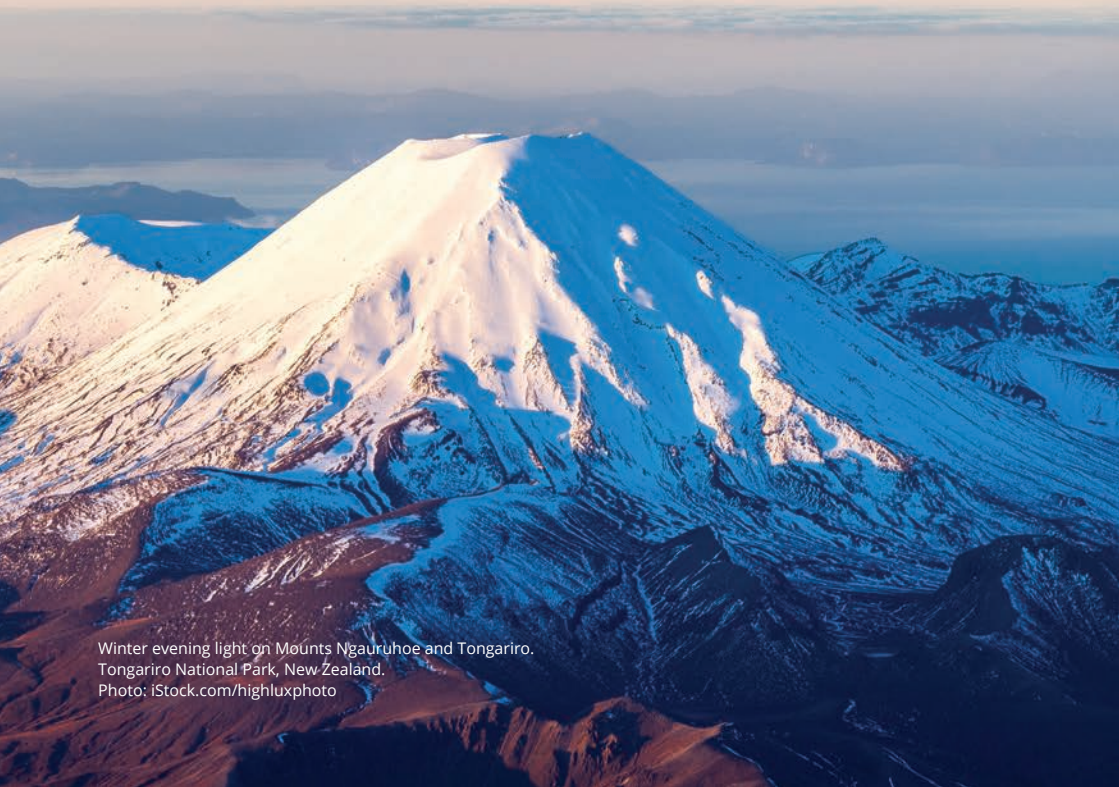
Aotearoa New Zealand is a unique land of dramatic and beautiful landscapes, yet its volcanoes can make it a perilous place at times.

We live astride the crash zone of the Australian and Pacific plates, meaning that, along with tsunami and large damaging earthquakes, volcanic activity is one of the major natural hazards in New Zealand.

Volcanoes pose a hazard to aviation through the violent ejection of steam and rocks, lava flow, emissions of dangerous gases, and of course, the release of volcanic ash into the atmosphere. Some of these things can compromise airports, aircraft systems and lead to aircraft engine power failure.

So, it's important to be aware of the unique characteristics of the volcanic area where you are operating and to know where to access the latest information on volcanic activity.

This GAP booklet will give you an overview of New Zealand's volcanoes, their hazards, and outline where you can find information on their current activity and the applicable aviation rules.



Winter evening light on Mounts Ngauruhoe and Tongariro.
Tongariro National Park, New Zealand.
Photo: iStock.com/highluxphoto

Volcanoes of New Zealand

GNS Science is the designated ICAO State volcano observatory in New Zealand. It monitors New Zealand's active volcanoes, through the GeoNet[1] programme.

Our active volcanoes extend from Taranaki and the Central Plateau all the way to the Kermadec Islands – hundreds of kilometres offshore to the north-northeast of New Zealand.

The majority are considered dormant, rather than extinct, and will probably produce eruptions at some indeterminate time in the future.

Signs of those volcanoes moving into a more active state may develop days (or possibly hours) ahead of an eruption, or there may be months or even years of warning before an event occurs.

There are no active volcanoes in the South Island of New Zealand.

On a geological timescale, the volcanoes of New Zealand are considered frequently active. The cone volcanoes have had recent eruptions:

- Whakaari/White Island (2019)
- Tongariro (2012)
- Ruapehu (2007)
- Ngauruhoe (1970s).

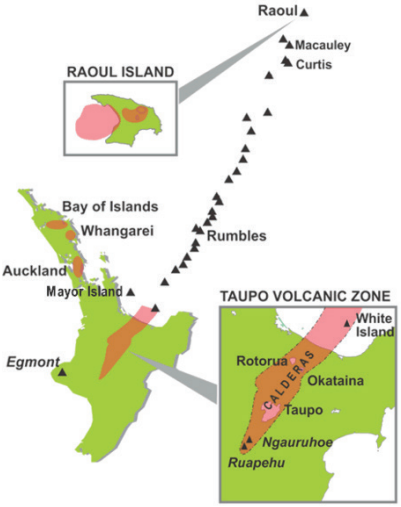
Aerial view of Whakaari / White Island.
Photo: iStock.com/thopson

A little further afield in the Kermadec chain, Raoul Island last erupted in 2006.

Within the wider Auckland Oceanic Flight Information Region, the 'Pacific ring of fire' extends north-northeast from the Kermadec Islands, through the Tongan islands, to the islands of Samoa. Many of these volcanoes are sub-marine – their eruptions sometimes only evident by rafts of pumice floating in the ocean. Occasionally the eruption is violent enough to form a new island – such as the formation of Hunga Tonga-Hunga Ha'apai in Tonga during 2014-2015. This island was then destroyed in an even more violent eruption in 2022.

Volcanoes even further afield can also have an impact on New Zealand airspace, most recently seen in the 2011 Puyhue-Cordon Caulle eruption in Chile. In this event, ash circumvented the globe several times and disrupted flights to and from New Zealand over several weeks.

Active volcanoes in New Zealand



GNS map of active volcanoes in New Zealand. Courtesy of GNS Science.

1 GeoNet is a partnership between the Earthquake Commission, GNS Science, and Land Information New Zealand geonet.org.nz

Volcanic hazards affecting aviation

A volcanic eruption produces multiple hazards, some of which may extend hundreds of kilometres from the active volcano. The main hazard for aviation is airborne volcanic ash.

A volcanic event may build up over weeks to years and it may be relatively difficult to forecast its probable eruption characteristics and timing. However, once volcanic ash is ejected into the atmosphere, it can be tracked by ground and satellite-based observing networks. Its course can also then be predicted using weather and dispersion models. Expected ashfall (such as on airports) can also be modelled, as well as the dispersion of potentially dangerous volcanic gases.

Flexibility is key when planning and operating around volcanoes. How volcanic risks are managed will depend upon the known characteristics of each volcano, the style of ongoing volcanic unrest or activity that may be producing volcanic ash, and the prevailing conditions both during and after any eruptive episode. For instance, eruption duration can vary from seconds to hours to days.

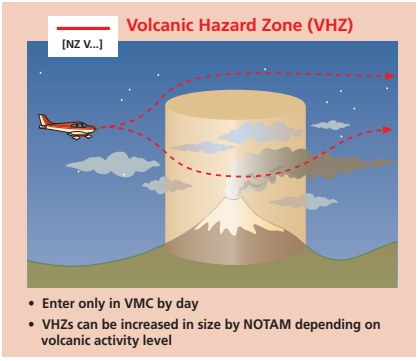
Seen from the International Space Station on June 12, 2009, Sarychev Peak erupts on the Kuril Islands northeast of Japan. Image courtesy of the NASA Earth Observatory.

Volcanic Hazard Zones

A Volcanic Hazard Zone (VHZ) is a type of special use airspace established to provide increased protection to aircraft in an area where volcanic activity may be present. A VHZ is designated for a volcano, using an identifier NZVxxx, under the New Zealand airspace management system.

The airspace is usually permanent and is published in the NZ Aeronautical Information Publication (AIP). Permanent VHZ are in place for Raoul Island, Whaakari/White Island, Tongariro, Ngauruhoe and Ruapehu. Further permanent or temporary VHZ may be designated by the CAA in the future, in the event of other New Zealand volcanoes becoming active.

During an increase in volcanic activity, permanent VHZ may be increased in size in accordance with current volcanic activity. Operation within a VHZ requires pilots to operate in VMC by day, to be able to observe any volcanic ejecta or ash plume. Pilots intending to operate within a VHZ must therefore receive relevant NOTAM and, in the event of ash emission, SIGMET information.



Aviation Colour Codes and the Volcanic Alert Levels

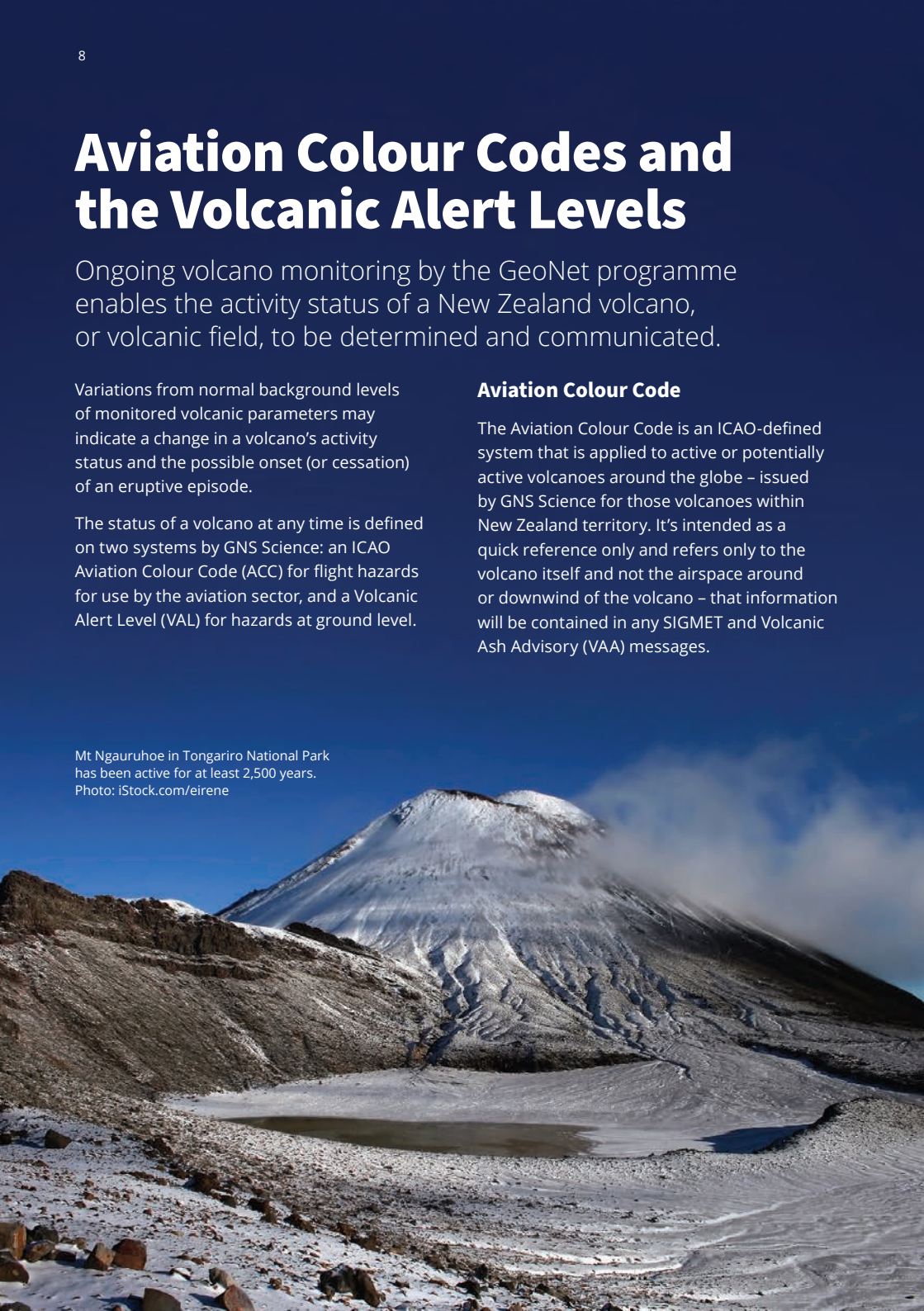
Ongoing volcano monitoring by the GeoNet programme enables the activity status of a New Zealand volcano, or volcanic field, to be determined and communicated.

Variations from normal background levels of monitored volcanic parameters may indicate a change in a volcano's activity status and the possible onset (or cessation) of an eruptive episode.

The status of a volcano at any time is defined on two systems by GNS Science: an ICAO Aviation Colour Code (ACC) for flight hazards for use by the aviation sector, and a Volcanic Alert Level (VAL) for hazards at ground level.

Aviation Colour Code

The Aviation Colour Code is an ICAO-defined system that is applied to active or potentially active volcanoes around the globe – issued by GNS Science for those volcanoes within New Zealand territory. It's intended as a quick reference only and refers only to the volcano itself and not the airspace around or downwind of the volcano – that information will be contained in any SIGMET and Volcanic Ash Advisory (VAA) messages.



Mt Ngauruhoe in Tongariro National Park has been active for at least 2,500 years. Photo: iStock.com/eirene

Status of activity of volcano by ICAO Colour Code

Green

Volcano is in normal, non-eruptive state

or, after a change from a higher alert level:

Volcanic activity considered to have ceased, and volcano reverted to its normal, non-eruptive state.

Yellow

Volcano is experiencing signs of elevated unrest above known background levels

or, after a change from higher alert level:

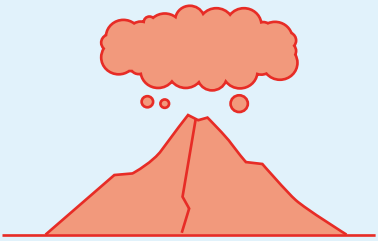
Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.

Orange

Volcano is exhibiting heightened unrest with increased likelihood of eruption

or,

Volcanic eruption is underway with no or minor ash emission *[specify ash-plume height if possible].*



Red

Eruption is forecasted to be imminent with significant emission of ash into the atmosphere likely

or,

Eruption is under way with significant emission of ash into the atmosphere *[specify ash-plume height if possible].*

NZ Volcanic Alert Levels (VAL)

The New Zealand VAL system is defined in the Guide to the National Civil Defence Emergency Management Plan and is a New Zealand-specific system. It's a six-level system, with each level defining a different activity status of the volcano or field. The VAL is assigned by GNS Science and is an important trigger in the issue of a NOTAM.

Levels 1 and 2 suggest different levels of volcanic unrest (but no eruption). Levels 3, 4, and 5 indicate an ongoing eruption (minor, moderate, and major respectively). It's important to note that even at Level 0, volcanic environment hazards may still be present and that an eruption can happen at any time.

Aerial view of New Zealand's Tongariro National Park. Photo: iStock.com/Jef Wodniack

Where to find the current Aviation Colour Code and Volcanic Alert Levels

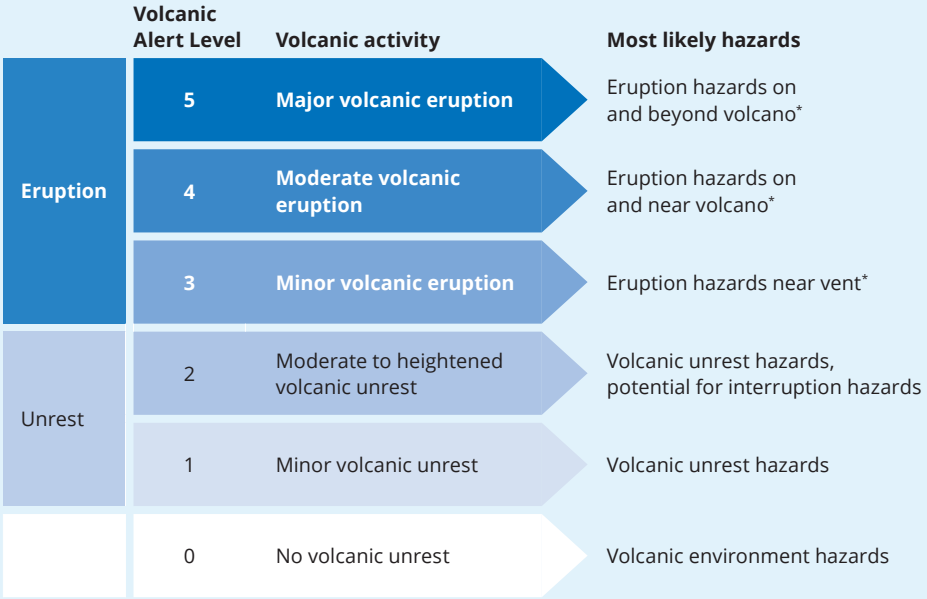
When information from the GeoNet volcano monitoring programme indicates a change in a volcano's status (either up or down), GNS Science will adjust the ACC and the VAL, and issue a Volcanic Activity Bulletin (VAB) – all available at geonet.org.nz/volcano. These can also be obtained directly by email from GeoNet on request.

If the VAL changes to, or from, at least level 2, a NOTAM will be issued to describe the size of the VHZ applicable to that volcano, along with the current VAL assigned. When the VAL is at 0 or 1, no NOTAM will be issued.

While an increase in VAL to 1 or 2 can reflect an increase in probability of an eruption, it does not necessarily signal an eruption is imminent. Historically, seismic and deformation episodes have occurred at volcanoes like Taupo, Okataina, and Raoul Island, which would have resulted in an adjustment to VAL 1 or 2, yet no eruption occurred. Conversely, while rare, eruptions can also occur with little to no useful warning at VAL 0 or 1.

Information on both pre-eruptive and eruption activity – including ACC – is also disseminated in the Volcano Observatory Notice to Aviation (VONA) and is sent to air traffic control and meteorological service providers. The VONA format is expected to become a recommended ICAO product to be issued by State volcano observatories from late 2024 and will be available to all aviation operators through the usual aviation meteorological briefing tools or websites from then.

New Zealand Volcanic Alert Level System



An eruption may occur at any level, and levels may not move in sequence as activity can change rapidly.

Eruption hazards depend on the volcano and eruption style, and may include explosions, ballistics (flying rocks), pyroclastic density currents (fast-moving hot ash clouds), lava flows, lava domes, landslides, ash, volcanic gases, lightning, lahars (mudflows), tsunami, and/or earthquakes.

Volcanic unrest hazards occur on and near the volcano, and may include steam eruptions, volcanic gases, earthquakes, landslides, uplift, subsidence, changes to hot springs, and/or lahars (mudflows).

Volcanic environment hazards may include hydrothermal activity, earthquakes, landslides, volcanic gases, and/or lahars (mudflows).

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* Ash, lava flow, and lahar (mudflow) hazards may impact areas distant from the volcano.

This system applies to all of New Zealand's volcanoes. The Volcanic Alert Level is set by GNS Science, based on the level of volcanic activity. See geonet.org.nz/volcano for alert levels and current volcanic activity, gns.cri.nz/volcano for volcanic hazards, and getthru.govt.nz for what to do before, during and after volcanic activity. Version 3.0, 2014.

Content above from GNS Science's Volcanic Alert Levels webpage – geonet.org.nz/about/volcano/val

What happens when there's volcanic activity?

OK, now a volcano is becoming more active... What happens next depends on how much activity has been observed, and the subsequent actions can involve the whole aviation sector!

Smoke and ash emitting from Mount Etna on the island of Sicily, Italy.
Photo: iStock.com/NORRIE3699

> If the volcano is emitting volcanic ash into the atmosphere then MetService will issue a volcanic ash SIGMET.

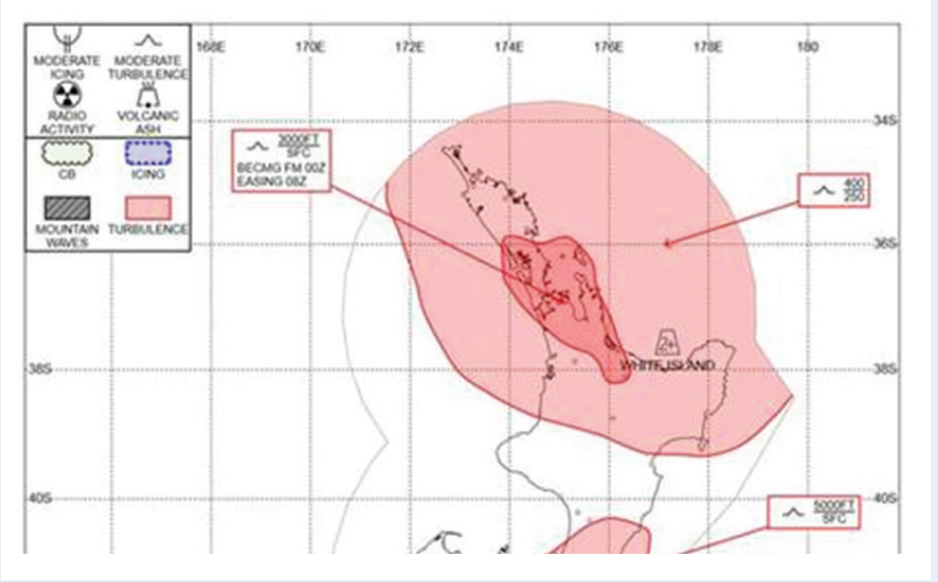
When GNS Science issues a Volcanic Activity Bulletin – or officially advises MetService of a change in volcanic activity – the New Zealand Volcanic Ash Advisory System[2] is set into motion.

If the VAL moves from 0 or 1 up to 2, MetService will request Airways NZ to issue a NOTAM advising of the VHZ change in height and diameter. The NOTAM will also direct users to the GeoNet website to access the latest VAB. This will outline details of the volcanic hazards.

If the volcanic activity does not include volcanic ash emission, MetService will include a volcano symbol showing "2+" on the Graphical New Zealand SIGWX chart at the location of the volcano. See image on page 14.

If the volcano is emitting volcanic ash into the atmosphere, MetService will issue a volcanic ash SIGMET and, acting as the Wellington Volcanic Activity Advisory Centre (VAAC), it will issue a Volcanic Ash Advisory (VAA) and accompanying Volcanic Ash Graphic (VAG).

2 www.aviation.govt.nz/assets/licensing-and-certification/meteorology/living-with-volcanic-ash.pdf



Graphical NZ SIGWX indicating a Volcanic Alert Level of at least 2 at Whakaari/White Island (no volcanic ash SIGMET in force at this stage).

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WVNZ21 NZKL 200100
NZZC SIGMET 1 VALID 200105/200705
NZKL-
NZZC NEW ZEALAND FIR VA ERUPTION
MT OKATAINA S3807 E17630 VA CLD
OBS SFC/FL060 STNR NC=
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The very first volcanic ash SIGMET and VAA issued will simply contain information that an eruption has occurred and may or may not include a polygon describing the observed ash height and location.

An updated SIGMET and VAA will be issued on the completion of the volcanic ash dispersion computer model run, allowing a forecast of the volcanic ash movement to be provided.

The symbol on the Graphical NZ SIGWX chart will be updated to show a volcano shape with lines coming out from the top of the volcano shape – indicating ash emission.

The Graphical SIGMET Monitor will not display the observed and forecast ash polygons, but simply refer users to the text SIGMET, VAA, and VAG.[3]

3 Available (when issued) on MetFlight, MetJet, IFIS and at vaac.metservice.com

> It's worth noting that at any VAL, pilots operating near the volcano are requested to report any unusual volcanic activity to Airways NZ.

For a change to VAL 2 or higher, Airways NZ will issue a NOTAM advising of the VHZ dimension change, and directing users to the latest VAB issued by GNS Science – which describes the volcanic activity and hazards observed. Airways NZ may also issue a further NOTAM advising of any routes affected by the volcanic ash.

It's worth noting that at any VAL, pilots operating near the volcano are requested to report any unusual volcanic activity to Airways NZ, who will then forward the report to both GNS Science and MetService to assist in their assessment of the volcanic activity. Further, when observing or encountering a volcanic ash cloud, pilots should complete a Volcanic Activity Report (VAR) after landing, and send the form to MetService. See the resources section on page 24 for a link to the VAR form on the CAA website.

Mount Ruapehu eruption in June 1996.
Photo courtesy of GNS Science. Photography by Lloyd Homer. VML 3561.

Example of a NOTAM given a change to volcanic activity from VAL 1-2 at Ruapehu, and with regard to CAR Part 71 where a VHZ is designated (NZV314 in this case).

This NOTAM indicates to users that the VHZ around Ruapehu has been redefined due to increased volcanic activity. The radius of the cylinder centred on the volcano is now eight nautical miles and it extends from the ground to FL150. Users are requested to report the location of any volcanic ash or any volcanic activity observed and they are directed to the GeoNet website to read the VAB which will provide information on the observed and likely volcanic hazards.

B7142/20 FROM: 20 DEC 2020 22:45 TO: 20 JAN 2021 22:45 EST

VOLCANIC HAZARD ZONE NZV314 MT RUAPEHU IS REDEFINED AS FLW DUE TO INCREASED VOLCANIC ACT, VOLCANIC ALERT LEVEL NOW 2:
ALL THAT AIRSPACE BOUNDED BY A CIRCLE RADIUS 8NM CENTRED ON 39 17 22.4 S 175 33 45.6 E MT RUAPEHU.
PILOTS ARE REQ TO REP LOCATION OF VA AND ANY VOLCANIC ACT OBS.
PRESCRIBED PURSUANT TO CIVIL AVIATION RULE PART 71 UNDER A DELEGATED AUTHORITY ISSUED BY THE DIRECTOR OF CIVIL AVIATION.
SEE GEONET.ORG.NZ FOR VOLCANIC ACTIVITY BULLETIN DETAILING VOLCANIC HAZARDS
LOWER: SFC UPPER: FL150

Mount Ruapehu in New Zealand's Tongariro National Park.
Photo: iStock.com/vlapaev

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VA ADVISORY
DTG: 20160913/0128Z
VAAC: WELLINGTON
VOLCANO: WHITE ISLAND 241040
PSN: S3731 E17711
AREA: NEW ZEALAND
SUMMIT ELEV: 321M
ADVISORY NR: 2016/1
INFO SOURCE: GNS, WEBCAM, HIMAWARI-8
AVIATION COLOUR CODE: ORANGE
ERUPTION DETAILS: ERUPTION AT 13/0045
OBS VA DTG: 13/0050Z
OBS VA CLD: SFC/FL020 S3730 E17715 -
S3730 E17900 - S3715 E17900 - S3730
E17715 MOV E 15KT
FCST VA CLD +6 HR: 13/0650Z SFC/FL020
S3730 E17915 - S3715 E17915 - S3730
E17715
FCST VA CLD +12 HR: 13/1250Z SFC/FL020
S3715 E17915 - S3700 E17915 - S3730
E17715
FCST VA CLD +18 HR: 13/1850Z NO VA EXP
RMK: REPORT FROM GNS SCIENCE OF MINOR
ERUPTION OF VA TO 2000FT, CONFIRMED ON
WEBCAM AND ASH CLEARLY IDENTIFIABLE
ON HIMAWARI SATELLITE IMAGERY.
NXT ADVISORY: NO LATER THAN
20160913/0728Z
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This VAA issued by VAAC Wellington on 0128 UTC 13 September 2016 is for the White Island volcano with Global Volcanism Program[4] volcano identity number 241040. The next few lines include details of the volcano, then a unique advisory number which tells the user it's the first advisory issued for White Island in 2016.

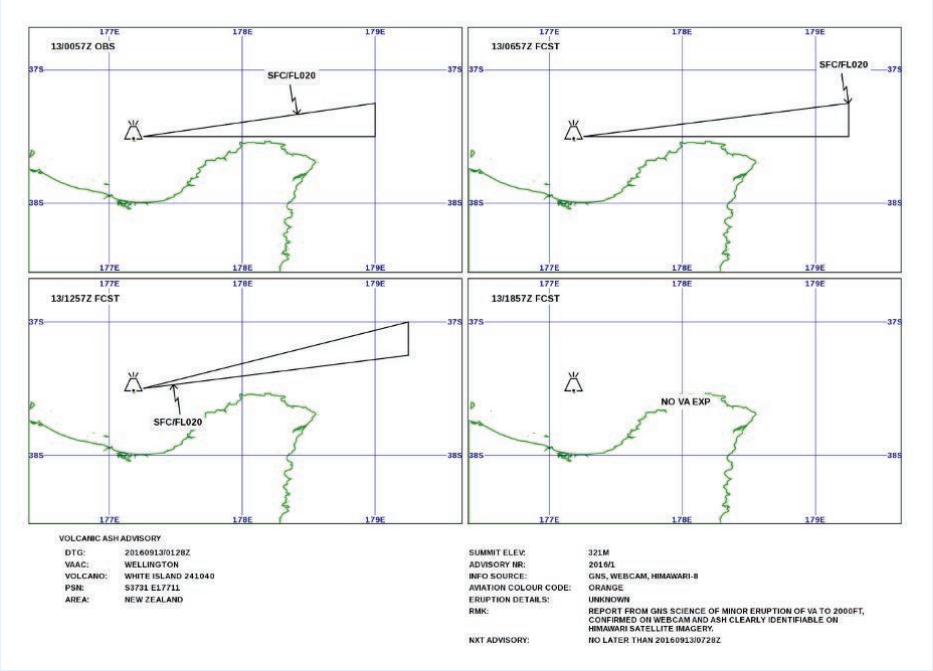
The 'info source' section describes the observation sources the VAAC has used, while the Aviation Colour Code is provided by GNS Science.

The 'OBS VA DTG' is the date and time the volcanic ash observation was made by the VAAC, followed by a description of the vertical and horizontal extent of the observed ash – in this case the ash is expected to extend from the surface to FL020 (or 2000ft). The subsequent polygons describe the expected evolution of the volcanic ash cloud in six-hour blocks, up until 18 hours from the observed time.

Finally, the 'RMK' section includes any further information of relevance that the VAAC forecaster is able to provide on the observation – and expected movement – of the volcanic ash cloud.

Understandably, it's not easy for the user to visualise where the volcanic ash polygons are located, so users can access the accompanying Volcanic Ash Graphic from the VAAC Wellington website at vaac.metservice.com.

4 Smithsonian Institute Global Volcanism Program www.volcano.si.edu



Example of a Volcanic Ash Graphic supplied by the Wellington VAAC.

The volcanic ash SIGMET issued by MetService contains the name and location of the emitting volcano and the coordinates of the observed and six-hour forecast volcanic ash polygon (describing the same areas as the VAA).

The Graphical SIGMET Monitor will display a volcano symbol at the location of the volcano, with an information box directing users to the text SIGMET or VAA and VAG. If the volcano emitting the ash is located outside the area of the graphic, then an information box containing the same information will still be included.

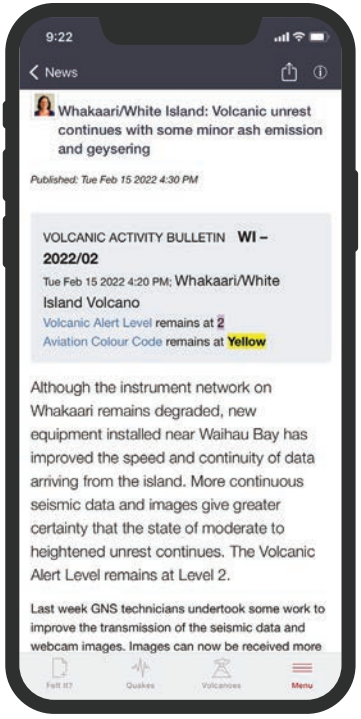
Maintaining your situational awareness

New Zealand is sometimes known as the 'shaky isles', with a relatively young and active set of volcanoes. Being aware of the latest volcanic hazard information is key to safe operations around volcanic regions.

If you're planning a flight near a volcano, visit the GeoNet website (geonet.org.nz) as part of your planning checklist. Check what the latest VAB is telling you and make it part of your everyday risk assessment process. Have a look at the available GeoNet webcams – a great way to help build a picture of the weather you'll fly in. Use these in conjunction with current forecasts and observations. And as always, ensure you check current NOTAMs, the Graphical NZ SIGWX chart, and any SIGMETs and VAA in force as part of your flight planning process.

Aerial view of Rangitoto Island, New Zealand.
Photo: iStock.com/NataliaCatalina

Mount Ruapehu eruption, at sunrise, in June 1996.
Photo courtesy of GNS Science. Photography by Lloyd Homer. VML 12100.



GeoNet app

Consider downloading the GeoNet app to your mobile phone – it can send you an alert when a new VAB is issued, so you always have the latest information to hand.

Make sure you have the volcanic bulletins option turned on under Menu > Notification rules.

When you're airborne over or near a volcano, use your eyes and your nose! Is there any unusual activity visible – something different to what you would normally see? Can you smell sulphur gases? A good rule of thumb is to, where possible, keep upwind of any active volcanoes. Avoid flying into steam clouds as, along with the water vapour, there may also be dangerous sulphur and chlorine-based gases present.

Some volcanoes emit gases continuously with no ash-producing eruption occurring. However, it's possible that the smell of sulphur gases while airborne may indicate volcanic activity that has not yet been reported, and possible entry into an ash-bearing cloud could occur. In some cases when sulphur odours are detected after an eruption, there may be little ash remaining in the cloud owing to earlier ash fallout, or due to separation of the ash and gas components of the cloud as dispersion progresses.

Sulphur dioxide gas produces a sharp pungent aroma like that emitted when setting off fireworks or striking a match. It's noticeable to most people at 0.3 to 1 part per million (ppm) – this means between 0.3 to 1 part of the gas in 1 million parts of air. Asthmatics are especially sensitive to sulphur dioxide and may be affected by concentrations as low as 0.2-0.5 ppm. The World Health Organization air quality guidelines recommend a 10-minute exposure of no more than 0.175 ppm[5] for sulphur dioxide, while in New Zealand WorkSafe's Workplace Exposure Standards and Biological Indices[6] has a short-term exposure limit (average over 15 minutes) of 0.25 ppm.

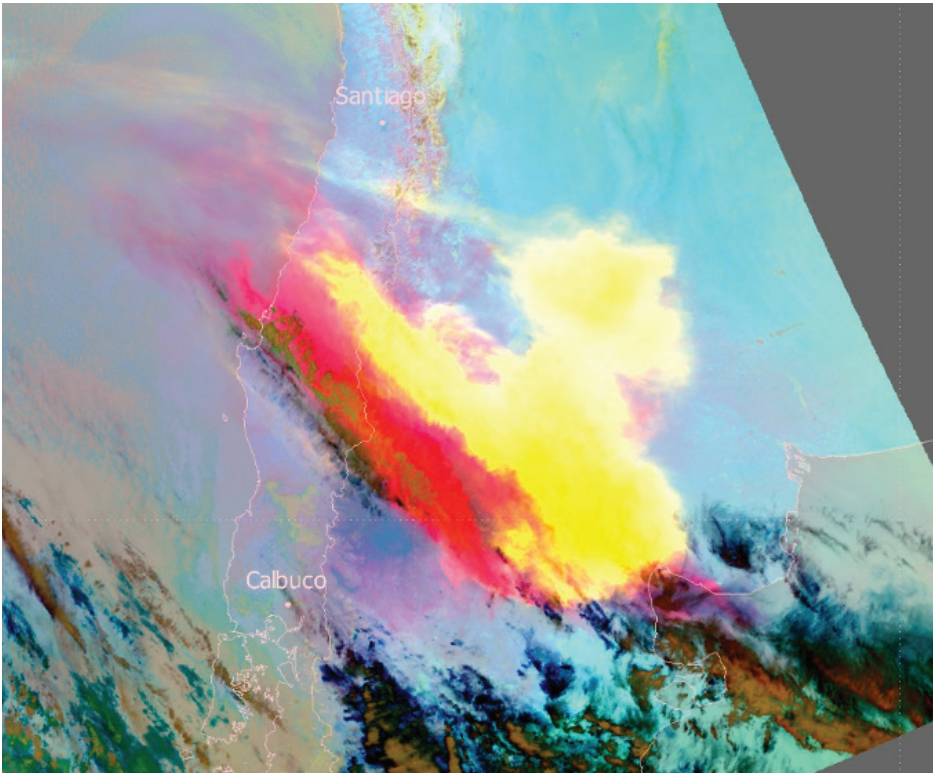
So, if you think you can smell sulphur dioxide, the best course of action is to vacate the area – move across the wind flow until you are clear.

5 www.who.int/health-topics/air-pollution
6 www.worksafe.govt.nz/topic-and-industry/monitoring/exposure-standards-and-biological-exposure-indices

The enhanced satellite image below of the Calbuco volcanic cloud, shows the cloud stretching from the west to the east coast of southern South America. Most of the cloud, which is getting thinner as it moves away from the Calbuco volcano, is shown in this enhancement as yellowish (ash and sulphur dioxide mixed), but there is also a larger reddish area ('pure' ash cloud) and a small cyan-green band close to Santiago ('pure' sulphur dioxide cloud with some remaining ash particles).

> If you think you can smell sulphur dioxide, the best course of action is to vacate the area – move across the wind flow until you are clear.

A daytime view of the Calbuco volcanic cloud, provided by the VIIRS instrument on the Suomi-NPP satellite on 23 April 2015. Image courtesy of NOAA/JPSS.



Maintenance of your aircraft

Flying into dense volcanic ash can be catastrophic for your aircraft. However, even low concentrations of volcanic ash and gas can cause issues in the long term, without effective maintenance.

Volcanic ash consists mainly of sharp-edged, hard, glass particles and pulverised rock. It's highly abrasive and has a melting temperature below the operating temperature of typical turbine engines at cruise power. A volcanic ash cloud may be accompanied by sulphur dioxide and chlorine gases, which can combine with water to create acid. Volcanic ash in the atmosphere poses a serious hazard, not only to the aircraft, but also to the health of passengers. Clearly, aircraft should avoid volcanic ash encounters where possible.

While many of the effects of flying through volcanic ash are felt immediately – abraded windscreens for example – exposure to low concentrations of ash and volcanic gases may cause longer-term issues which are less obvious. Corrosion, filter blockages, pitot static sensor issues, and increased component wear may all result from long-term exposure to low levels of volcanic emissions. It's therefore important that an aircraft which is to be operated in the proximity of volcanic emissions be subject to a maintenance programme which addresses these environmental issues.

In some cases, aircraft and engine manufacturers will include recommended procedures in their maintenance manuals for operators who fly in proximity to active volcanoes. Aircraft operators should familiarise themselves with this documentation and make an assessment as to which of the recommendations they follow to ensure continuing airworthiness.

Photo: CAA/Pen Mackay

More information and resources

See below for more information and resources about volcanoes from the CAA, New Zealand, and overseas.

CAA

Volcanic Activity Report (VAR) form

Standard ICAO form available on the website: aviation.govt.nz > forms > CA010

Meteorology resources

aviation.govt.nz > airspace and aerodromes > meteorology

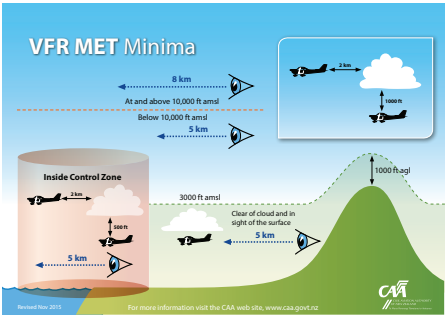
Volcanic hazards

aviation.govt.nz > airspace and aerodromes > meteorology > met developments > volcanic hazards

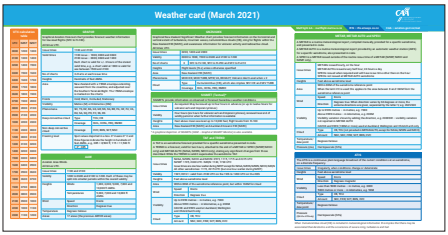
Other MET resources from the CAA

See aviation.govt.nz > safety > safety advice for these and other educational publications from the CAA. Request your own copies by emailing publications@caa.govt.nz

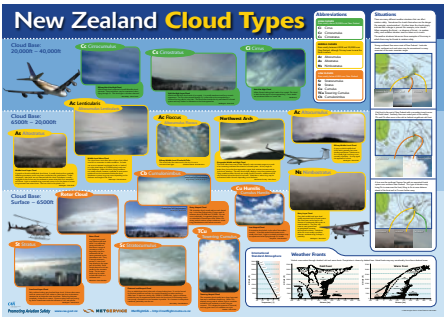
VFR MET Minima card



Weather card

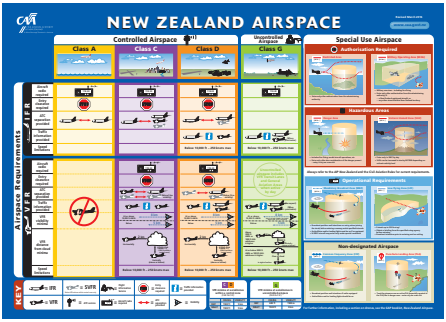


New Zealand cloud types poster



VFR MET Good Aviation Practice (GAP) booklet

NZ airspace poster



New Zealand

GeoNet

geonet.org.nz > volcano

GNS Science

gns.cri.nz > our science > natural hazards and risks > volcanoes

gns.cri.nz > learning > science topics > volcanoes

National Civil Defence Plan

civildefence.govt.nz > cdem sector > plans and strategies

Wellington Volcanic Ash Advisory Center

vaac.metservice.com

International

International Civil Aviation Organization (ICAO) documents

- Annex 3 – Meteorological Service for International Air Navigation, Chapters 3, 4, 7 and 9 and Appendices (available from store.icao.int > shop by areas > meteorology)
- Flight Safety and Volcanic Ash (Doc 9974) (search '9974' on icao.int)
- Handbook on the IAVW – Operational Procedures and Contact List (Doc 9766) (search '9766' on icao.int)
- Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds (Doc 9691) (available from store.icao.int > shop by areas > meteorology)

International Volcanic Health Hazards Network resources

iivhhn.org > public information

Volcanic Ash Impacts and Mitigation – Aviation

volcanoes.usgs.gov/volcanic_ash/aviation.html

Abbreviations

Below are some of the meteorological and volcanic-related abbreviations commonly used in aviation.

ACC	Aviation Colour Code
CAR	Civil Aviation Rule
DTG	Date-time group
FL	Flight level
GVP	Global Volcanism Program – hosted by the Smithsonian Institute
ICAO	International Civil Aviation Organization
NOTAM	Notice to airmen
NZ AIP	New Zealand Aeronautical Information Publication (www.aip.net.nz)
NZ VAAS	New Zealand Volcanic Ash Advisory System
OBS	Observed
PPM	Parts per million
RMK	Remark
SIGMET	Significant meteorological information
SIGWX	Significant weather
SVO	State volcano observatory
VA	Volcanic ash
VAA	Volcanic Ash Advisory
VAAC	Volcanic Ash Advisory Center
VAB	Volcanic Activity Bulletin
VAG	Volcanic Ash Graphic
VAL	Volcanic Alert Level
VAR	Volcanic Activity Report
VHZ	Volcanic Hazard Zone
VMC	Visual meteorological conditions
VONA	Volcano Observatory Notice for Aviation
WHO	World Health Organization
WMO	World Meteorological Organization

GAP
Good Aviation Practice

CIVIL AVIATION AUTHORITY
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See the CAA website for Civil Aviation Rules, advisory circulars, airworthiness directives, forms, and more safety publications.

To request publications such as GAPs and posters email: publications@caa.govt.nz.

aviation.govt.nz

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