

## Volcanic Activity and MSI

Submitted by NAVAREA and METAREA XIV

### SUMMARY

Executive Summary: This document discusses the potential hazards to marine navigation posed by volcanic activity, the sources of available information, notes that these sources are mostly aviation oriented, considers whether intelligence rather than just information, or at least marine-specific information should be provided to the mariner, notes the work underway in the Southwest Pacific region and suggests that closer collaboration between local and international aviation and maritime sectors could benefit both.

Action to be taken: 7

Related documents: MSC.1/Circ.1310/Rev.1 *Joint IMO/IHO/WMO Manual on Maritime Safety Information*

## 1 Background

1.1 MSC.1/Circ.1310/Rev.1, paragraph 4.2.3 provides a list of subjects that are considered suitable for broadcast as NAVAREA warnings. 4.2.3.16 includes “tsunamis and other natural phenomena...”. Most examples relate to tsunamis, with only one example for volcanic activity.

## 2 Volcanic Activity – Is it a hazard to ships?

2.1 While the impacts of volcanic activity to aircraft are well documented, there is less data available on the impacts to ships.

2.2 Hazards to aircraft are mostly confined to the effects from airborne ash and sulphur dioxide gas, to not only the aircraft itself but also the people on board.

2.3 Volcanic activity can have a significant impact on land and sea environments, as recently evidenced during the catastrophic 2022 Hunga Tonga–Hunga Ha'apai eruption and tsunami. As such, it stands to reason that ships are potentially affected by volcanic hazards, but what are the specific hazards to ships? There are useful references from the United States Geological Survey (USGS)<sup>1</sup>, and a presentation provided by a professional seafarer to the recent 11<sup>th</sup> Cities on Volcanoes conference<sup>2</sup>. From these sources, the table below lists some of the potential hazards:

<sup>1</sup> USGS - [https://volcanoes.usgs.gov/volcanic\\_ash/marine\\_transportation.html](https://volcanoes.usgs.gov/volcanic_ash/marine_transportation.html)

<sup>2</sup> Cragg P, *What are the Volcanic hazards to Ships : How can you Risk Assess if you don't know?*

Volcanic Activity	Hazard to Ships
Pumice rafts	Blocks seawater cooling systems, overheating engines
Gas emissions (sub-sea)	Impact to instruments on the ship's hull. E.g. Echo sounders, speed logs
Explosive surtseyan (shallow water) eruption	Physical damage to, or destruction of ship
Pyroclastic flows (speeds of hundreds KM/h, temperatures hundreds of degrees C)	Heat and impact damage, ship stability
Tephra (from ash to larger objects)	Loss of stability, navigational data, engines, abrasion/corrosion damage Loss of visibility Hazardous to people
Sulphur dioxide	Potential corrosion Hazardous to people
Tsunami	Dependent on depth of water. Loss of stability, etc.

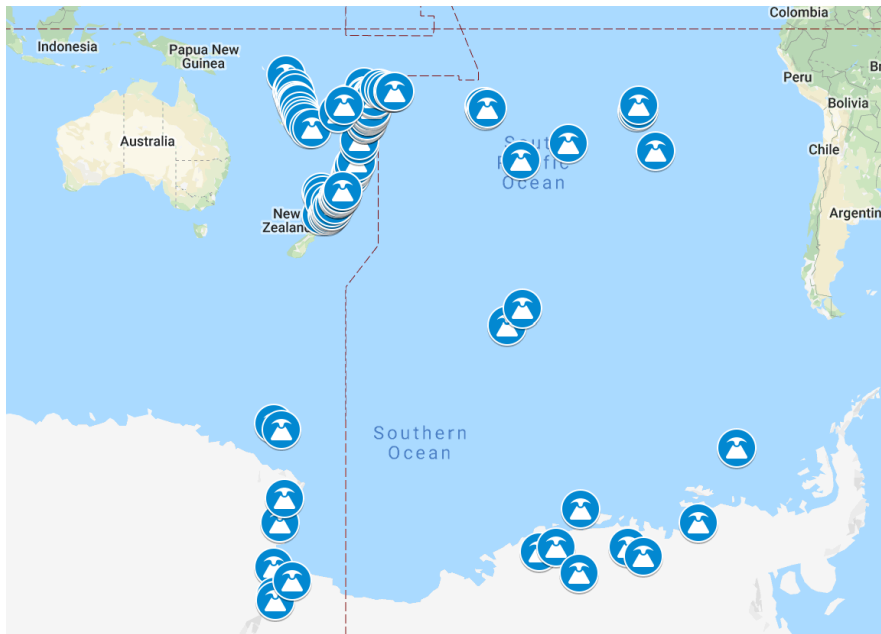
### 3 What sources of information on volcanic activity are available to MSI providers?

3.1 The aviation sector has a mature and regulated volcanic hazard information system. The International Civil Aviation Organization (ICAO) coordinates the International Airways Volcano Watch (IAVW), in cooperation with the WMO. The IAVW incorporates the activities of the nine Volcanic Ash Advisory Centres (VAAC) around the world, along with observations of volcanic activity by State volcano observatories, with the aim of safe and efficient aviation navigation during volcanic unrest periods.

3.2 In New Zealand, MetService operates the Wellington VAAC, which provides observations and forecasts to the aviation system, of the expected movement of airborne volcanic ash, in the form of Volcanic Ash Advisories for an area of responsibility covering most of the South Pacific.

3.3 Information on volcanic eruptions is provided by State volcano observatories and quickly shared across the various aviation networks and portals, to ensure timely information is provided to both the aviation community and to the VAACs, to inform their volcanic ash advisories. Information provided by State volcano observatories on significant pre-eruptive activity also allows for airlines to risk assess their planned routes, potentially avoiding volcanoes at higher risk of eruption.

3.4 The VAACs work closely with the State volcano observatories during both active and quieter periods, providing opportunity for collaboration, capacity building and ensuring application of relevant standards, to support the safety and efficiency of aviation operations.



Volcanoes in the Wellington Volcanic Ash Advisory Centre area of responsibility (that have erupted in the previous 10,000 years). Source: CAA New Zealand

3.5 In the absence of a similar service to mariners, NAVAREA Coordinators should consider engaging with their associated METAREA Coordinators for access to information on volcanic activity. Collaboration between METAREA and NAVAREA Coordinators could also inform the sharing of eruption activity and sea and airborne contaminants, to the benefit of both aviation and maritime sectors. Ships, for example, may be the first source of information on pumice rafts, which in turn may be an early indicator of sub-sea volcanic activity. Ships may also observe ash fall, which is valuable information for volcanic ash dispersion modelling for both VAACs and volcano observatories. On receiving this information, NAVAREA Coordinators could inform the relevant VAAC and volcano observatory.

#### **4 Volcano Observatory Notice to Aviation (VONA) Portal – New Zealand initiative to improve information availability from Southwest Pacific source events**

4.1 Notwithstanding the information currently available through the VAAC system, there is a joint effort underway by the Civil Aviation Authority of New Zealand (CAA NZ), the Institute of Geological and Nuclear Sciences Limited (GNS Science) and MetService New Zealand to outline a simple and cost-effective solution for efficient dissemination of volcanic activity observations. This would support Southwest Pacific countries to produce and disseminate the ICAO required information about volcanic activity into the aviation system, via a New Zealand-based web portal. The information will be in the form of a Volcano Observatory Notice to Aviation or VONA.

4.2 The VONA is a globally consistent format of communicating significant volcanic activity information between volcano observatories and their associated meteorological and air traffic management service providers. It is a critical piece of information to support the timely advice of pre-eruptive activity to aviation, supporting informed risk management of flights in the region of the volcano. More often, it serves as the first piece of advice of new eruption to air traffic control and to the Volcanic Ash Advisory Centres (VAAC), prompting the issuance of warning information to aviation on the presence and expected evolution of the resulting volcanic ash clouds.

4.3 It is planned that new ICAO provisions will require State volcano observatories to disseminate VONA in both plain language format and in digital format by November 2024.

If funding can be secured for development, the VONA Portal will provide an easy to access tool for Southwest Pacific countries to issue their VONA through the aviation networks in the required formats. Further, the VONA portal will have the ability to issue non-aviation specific email versions of the volcanic activity information for use in local emergency management information sharing, if a country would find that useful. This information could also be shared with maritime organisations.

4.4 Further, ICAO is also planning to introduce (in late 2024) a quantitative volcanic ash information service, whereby VAACs will provide detailed probabilistic information on volcanic ash concentrations in gridded data and digital formats, as well as a sulphur dioxide information service detailing the location and movement of significant volcanic sulphur dioxide clouds. While this information is focusing on airborne volcanic ash and sulphur dioxide clouds, future provisions may also consider the impact on aerodromes – e.g. ash fall onto runways.

## **5 Tailored messages for Mariners?**

5.1 In the case of tsunamis, New Zealand receives information from the relevant tsunami warning centre. Standard NAVAREA warning templates have been prepared, under guidance from tsunami experts at the New Zealand National Emergency Management Agency (NEMA), to select for inclusion in navigational warnings, only that information from the tsunami messages that is relevant to mariners. In the case of coastal (navigation) warnings, this information has been assessed by the subject matter experts and translated into guidance to mariners on assessing the risk.

5.2 At WNWNS 10, the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO) presented document [WWNWS10/7/1](#). This provided “details of an initial proposal for the format, content, and dissemination of messages with tsunami guidance specifically for ships on the high seas from the Tsunami Service Providers (TSPs) of the four Tsunami Warning Systems operated by the IOC of UNESCO”. While work on this proposal has not progressed, a similar work stream related to volcanic activity could be considered.

## **6 S-124 Compatibility**

6.1 NAVAREA Coordinators need to consider the future format of all MSI to ensure compatibility with S-124, including navigational warnings for volcanic activity.

## **7 Recommendations/actions requested**

7.1 The Sub-Committee is invited to:

- a. Note the information provided;
- b. Consider collaborating with WWMIWS on access to volcanic activity information;
- c. Discuss the benefits of developing standard navigational warning text, specific to volcanic activity;
- d. Note the work underway in the Southwest Pacific region on an information portal and consider the benefits of engaging in this work; and
- e. Take any other action as appropriate.