



## INTERNATIONAL CIVIL AVIATION ORGANIZATION

**Sixth Meeting of the APIRG Infrastructure and Information Management Sub-Group  
(IIM/SG6)***(Nairobi, 31 July - 3 August 2023)***Agenda Item 3: Achievements in AIM, CNS and MET****3.5 Other Air Navigation Initiatives****WP3.5C QUANTITATIVE VOLCANIC ASH***(Presented by Karen Shorey, WAFC London and SADIS Manager)***SUMMARY**

This working paper outlines upcoming changes to introduce a new Quantitative Volcanic Ash Forecast provision in November 2024.

Action by the meeting in paragraph 4

**REFERENCE(S):**

- ICAO Global Air Navigation Plan <https://www4.icao.int/ganpportal/>
- ICAO SL.2023.1 - *Proposals for the amendment of Annex 3, the new PANS-MET and consequential amendments to Annexes 6, Parts I, II and III, 10, Vol. II, 11, 15, PANS-ABC, PANS-AIM and PANS-ATM arising from the fifth meeting of the Meteorology Panel (METP/5)*

This working document relates to **ICAO Strategic Objectives:**

- A - Safety

**1. INTRODUCTION**

1.1 In recent years the Volcanic Ash Advisory Centres (VAACs) have been developing their ability to produce probabilistic forecasts from their atmospheric dispersion models, including plumes of volcanic ash. In November 2018 the Meteorological Panel (METP) Working Group on Meteorological Information and Service Development (WG-MISD) Volcanic Ash and Sulphur Dioxide (VASD) Work Stream began defining the requirements for a new quantitative volcanic ash (QVA) information service.

1.2 The MISD working group formulated the functional and performance requirements for QVA provision which included defining the Initial Operating Capability (IOC) for the provision of probabilistic volcanic ash information, as well as drafting provisions for Annex 3 and the new PANS-MET.

1.3 The Meteorological Operations Group (part of the METP) for the International Airways Volcano Watch (IAVW) is now working on the detail needed to implement the new QVA forecasts.

1.4 QVA information offers operators the opportunity to move away from traditional discernible ash criteria and instead use certified engine susceptibility for flight route planning and inflight replanning. The criteria were agreed with a representative of ICCAIA<sup>1</sup> whose members are aerospace manufacturers and service providers.

## 2. DISCUSSION

### Quantitative Volcanic Ash Data Sets

2.1 The following thresholds and ranges were determined for the IOC:

Descriptor	Concentration thresholds and ranges
Very Low	<0.2 mg/m <sup>3</sup>
Low	≥0.2 – <2 mg/m <sup>3</sup>
Medium	≥2 – <5 mg/m <sup>3</sup>
High	≥5 — <10 mg/m <sup>3</sup>
Very high	≥10 mg/m <sup>3</sup>

2.2 The probability of exceeding each of these thresholds will be provided for 5000FT slices of the atmosphere between the surface (FL000) and FL600, for three hourly intervals out to 24 hours. The gridded data output will be at a horizontal resolution of 0.25 degrees. An example of what this output could look like is shown in figure 1 and further examples are included in Appendix A:

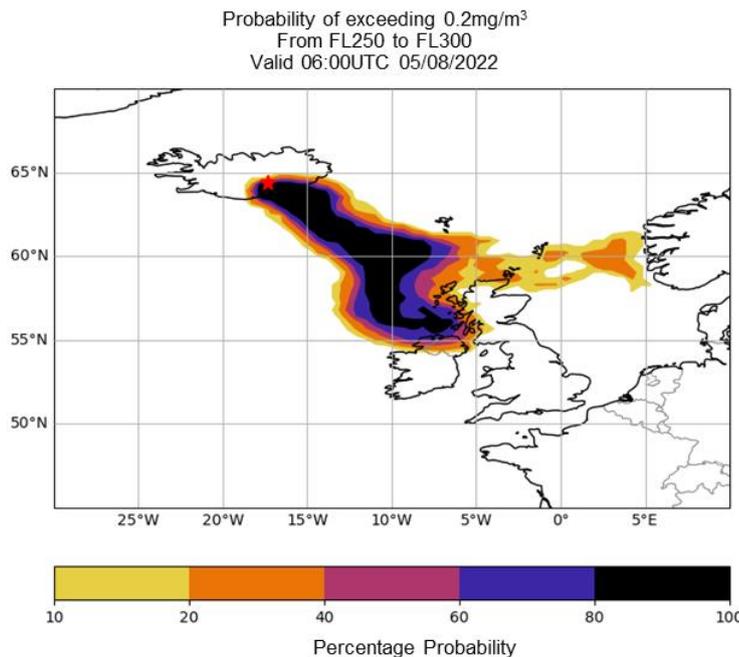


Figure 1 – probability of exceeding a concentration of 0.2 mg/m<sup>3</sup> of ash.

2.3 Forecasts will be updated at least every 6 hours, and it is expected that the first forecast will be produced within 60 minutes of the VAAC being notified of a new eruption.

<sup>1</sup> International Coordinating Council of Aerospace Industries Associations.

- 2.4 A definition of what constitutes a “significant volcanic ash cloud” has been agreed to ensure that QVA forecasts are provided for ash clouds that pose a widespread impact to aircraft operations and air navigation.
- 2.5 In addition to the probability fields, a deterministic field will be provided which gives the expected ash concentration each grid point.
- 2.6 The deterministic data will also be turned into polygons/features in which everything inside of each one will exceed the specified concentration threshold. Each polygon/feature will also have attributes which indicate the base and top that it applies to. These are intended to allow users a simple way to visualize the key information about the volcanic plume, and has similarities to the way turbulence is presented in the World Area Forecast System SIGWX forecasts.
- 2.7 The diagram in Appendix B shows how polygons/features for each of the four threshold values could be stacked to produce the final visualization, as well as how they might relate to the traditional volcanic ash advisory products.
- 2.8 The polygons/features will be provided in a new IWXXM format, and the schema for this is already largely developed by the WMO Task Team on Data (who developed all the other IWXXM schemas).
- 2.9 The current volcanic ash advisories (VAA) and volcanic ash graphics (VAG) will continue to be produced for a number of years until the new QVA service is fully established.

### **QVA Data Distribution**

- 2.10 SWIM compliant services will be developed to distribute the QVA data, and it is hoped that all VAACs can provide a service with the same capabilities and features.
- 2.11 VAAC London will adhere to the Eurocontrol SWIM yellow profile <https://www.eurocontrol.int/concept/system-wide-information-management>, and publish it in the SWIM registry <https://eur-registry.swim.aero/services>. It is expected that VAAC Toulouse will do the same.
- 2.12 It is likely that a “publish subscribe” type of service will be used, which notifies subscribers that new forecast data is available whenever it is created by the VAAC. This suits the irregular nature of volcanic eruptions. The details of what this will look like is still being determined.

### **3. CONCLUSION**

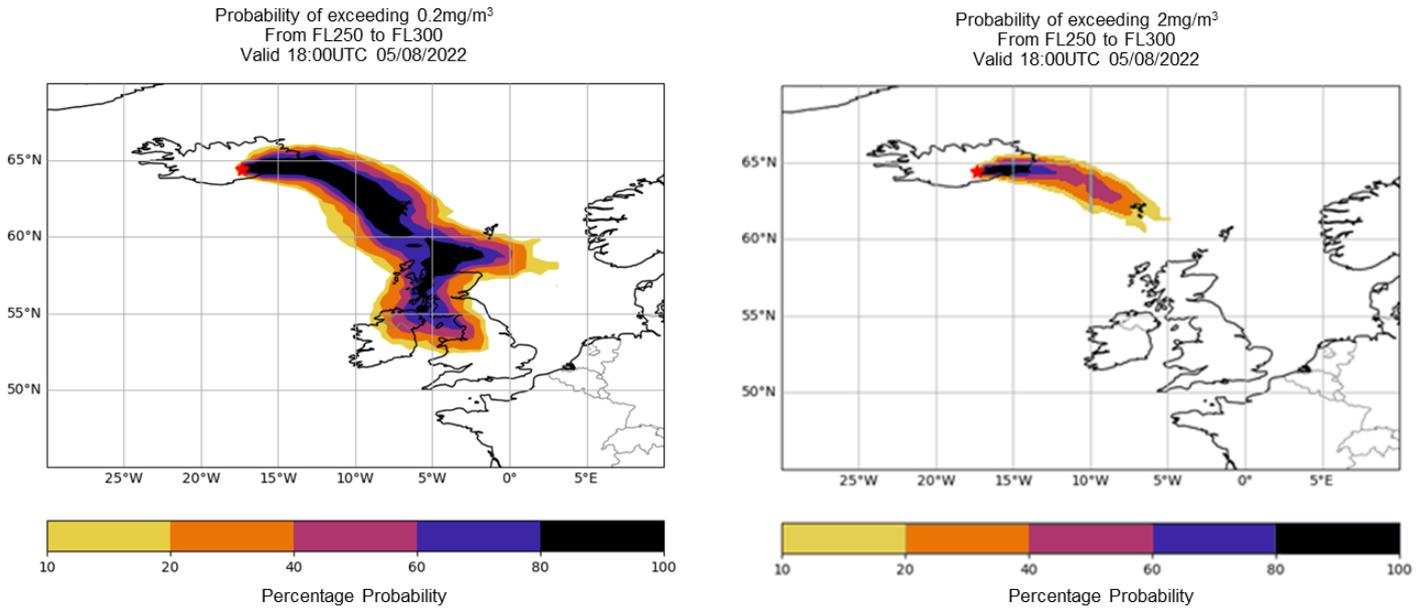
- 3.1 Development activities for the new Quantitative Volcanic Ash Information Services will take place over the next 18 months or so. All VAACs should have the IOC QVA service operational by November 2025, however those VAACs in a position to do so, like VAAC London, will commence this service in November 2024.
- 3.2 Attachment A is an information flyer on QVA which can be shared.

### **4. ACTIONS BY THE MEETING**

- 4.1 The meeting is invited to:
  - a) Note the information in this paper
  - b) Talk to their technical team or software provider about the upcoming changes and start to prepare for them.

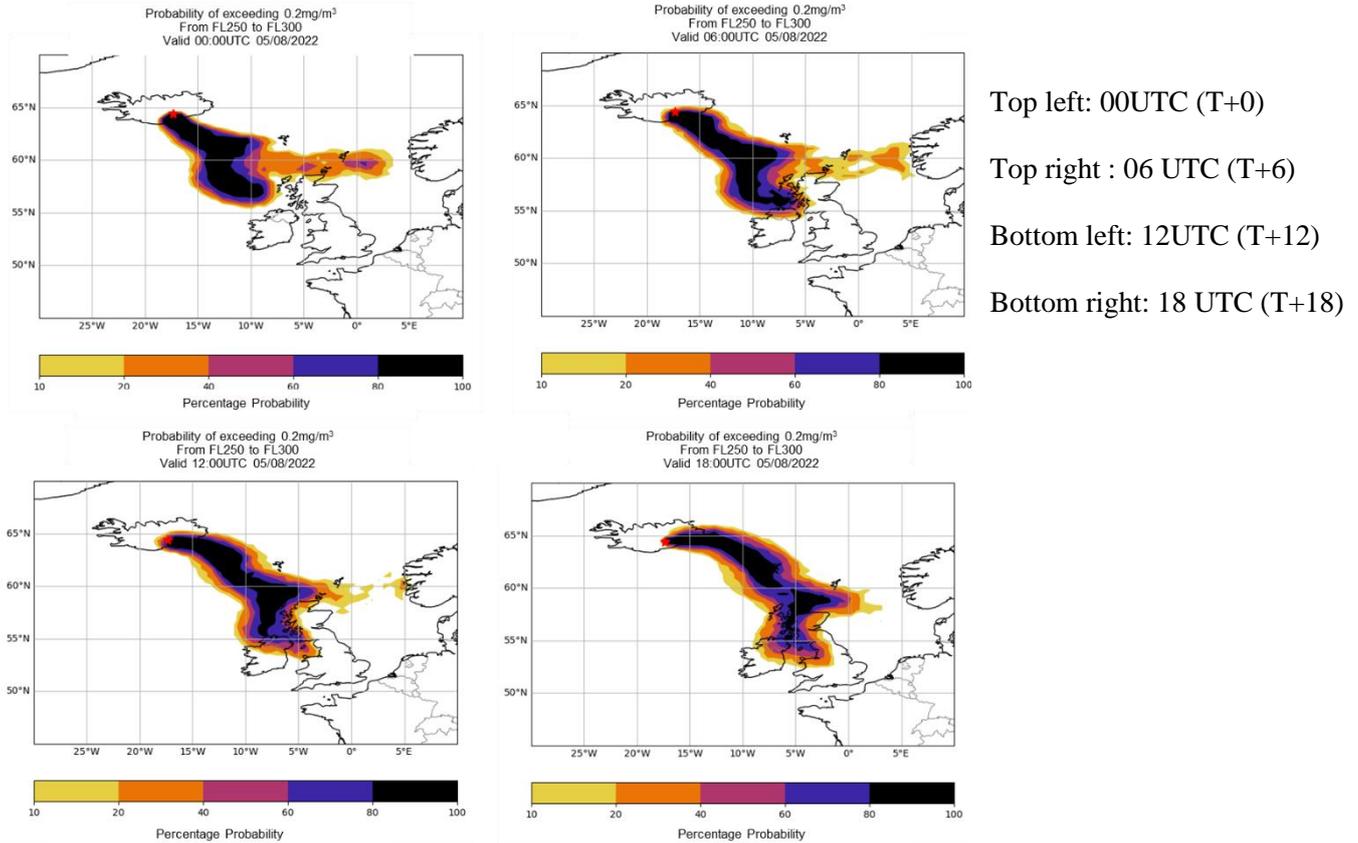
----- END -----

## Appendix A – Example QVA probabilistic data



Plots of this type can be created from the probabilistic QVA data sets. The plot on the left shows the probability of the ash concentration exceeding 0.2mg/m<sup>3</sup> whilst the plot on the right shows the probability of the ash concentration exceeding 2mg/m<sup>3</sup>

In example time series for the plume exceeding 0.2mg/m<sup>3</sup> is shown below.



## Appendix B – QVA polygons/features

Top left: this shows a top-down view of each polygon/feature, including the area that would be described in the traditional volcanic ash advisory.

Right: This shows individual polygons/features for each of the threshold criteria. The area inside of each polygon/feature (shown in colour) is where that threshold is exceeded. A base and top attribute is also provided to indicate the vertical extent.

Bottom left: shows a simple cross section of the plume along the line A-B

