



METEOROLOGY PANEL 

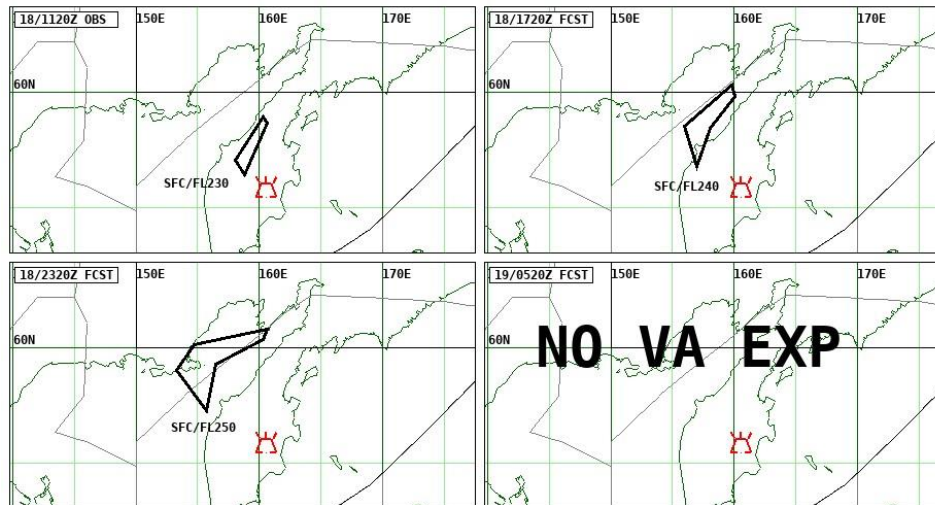
# Introduction of Quantitative Volcanic Ash (QVA) forecasts November 2024





# CURRENT VOLCANIC ASH ADVISORY PRODUCTS

Standard Volcanic Ash Advisory products forecast areas of “Discernible Ash”. This is typically where it has a concentration  $\geq 0.2\text{mg}/\text{m}^3$  or where it can be identified on satellite imagery.



VA ADVISORY  
 DTG: 20231018/1200Z  
 VAAC: TOKYO  
 VOLCANO: BEZMIANNY 300250  
 AREA: RUSSIA  
 SUMMIT ELEV: 2882M  
 ADVISORY NR: 2023/38  
 INFO SOURCE: HIMAMARI-9  
 AVIATION COLOUR CODE: NIL

ERUPTION DETAILS: VA CONTINUOUSLY OBS IN SATELLITE IMAGERY  
 RMR: SOME PART OF VA OBTAINED BY MET CLOUD.  
 VA HEIGHT UPDATED TO FL230 BASED ON SATELLITE DATA.  
 NXT ADVISORY: 20231018/1800Z

FVXX22 KNES 180646  
 VA ADVISORY  
 DTG: 20231018/0646Z  
 VAAC: WASHINGTON  
 VOLCANO: REVENTADOR 352010  
 PSN: S0005 W07739  
 AREA: ECUADOR  
 SUMMIT ELEV: 11686 FT (3562 M)  
 ADVISORY NR: 2023/679  
 INFO SOURCE: GOES-16. NWP MODELS.  
 ERUPTION DETAILS: OCNL EM  
 OBS VA DTG: 18/0620Z  
 OBS VA CLD: SFC/FL150 N0001 W07743 - S0004 W07738  
 - S0006 W07741 - S0002 W07746 - N0001 W07743 MOV  
 NW 10KT  
 FCST VA CLD +6HR: 18/1230Z SFC/FL150 N0004 W07752  
 - S0004 W07738 - S0007 W07740 - S0000 W07755 -  
 N0004 W07752  
 FCST VA CLD +12HR: 18/1830Z SFC/FL150 N0005  
 W07751 - S0004 W07738 - S0006 W07740 - N0001  
 W07754 - N0005 W07751  
 FCST VA CLD +18HR: 19/0030Z SFC/FL150 N0004



# VAAC London and VAAC Toulouse have also been providing additional ash concentration charts for low/medium and high thresholds

Modelled Ash Concentration from FL200 to FL350  
Valid 1600 UTC 14/01/23

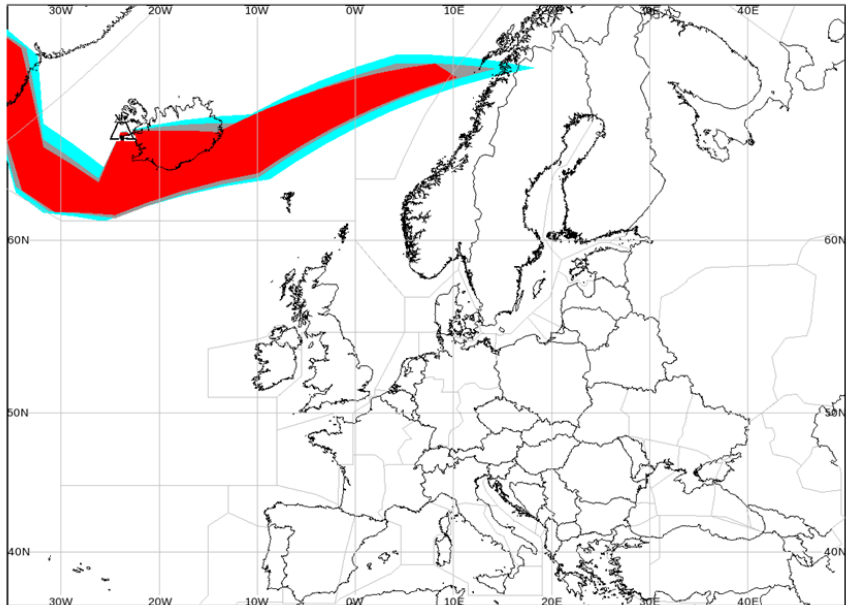
This is a guidance product, supplemental to the official VAAC London Volcanic Ash Advisory and Volcanic Ash Graphic products

Approved by Forecaster.

Issue Time: 1543 UTC 13 JAN 2023

**EXERCISE**

0.2-2 milligrams per cubic metre    2-4 milligrams per cubic metre    >4 milligrams per cubic metre



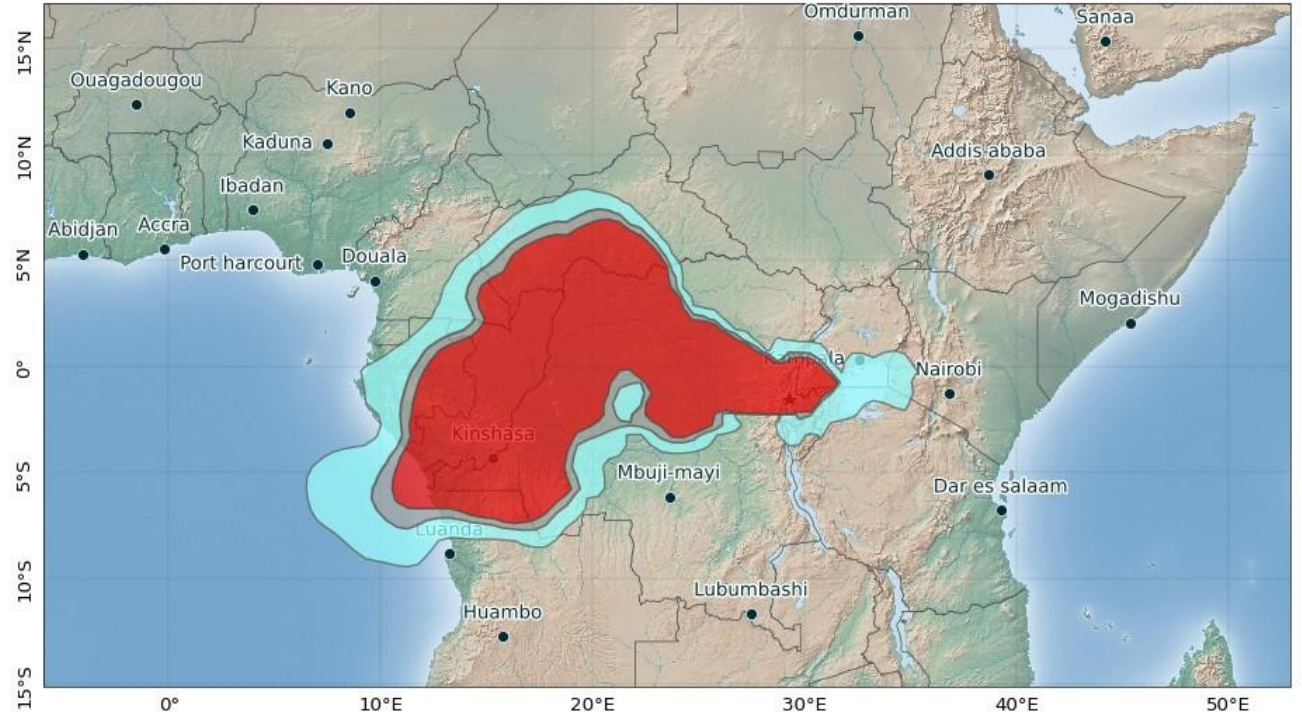
© Crown Copyright 2023 Source: Met Office

**volcafi\_2023 - ash concentration from FL200 to FL350**  
valid at 2023/12/07 12:00 UTC  
**EXERCISE !!! EXERCISE !!! EXERCISE !!!**

This is a guidance product, supplemental to the official VAAC Toulouse Volcanic Ash Advisory and Volcanic Ash Graphic products.  
All concentrations are subject to a level of uncertainty relative to errors in the estimation of the eruption strength.



low    medium    high





## QUANTITATIVE VOLCANIC ASH (QVA)

New QVA provision builds on the concentration charts idea.

- The Volcanic Ash Advisory Centres have been developing their capability to produce probabilistic forecasts from their atmospheric dispersion models.
- A work stream under the ICAO Met panel has been defining the requirements the new QVA information service.
- 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.



## QUANTITATIVE VOLCANIC ASH (QVA)

- All changes relate to Amendment 82 to ICAO Annex 3, due for implementation in November 2025, however.....  
..... **VAAC London and VAAC Toulouse will be introducing the new QVA provision 1 year early at the end of 2024 to meet a European regulation.**
- It is expected that all nine VAAC's will provide QVA new data by November 2025
- Each VAAC will be responsible for issuing QVA forecasts for the erupting volcanoes in its area of responsibility if they are "Significant eruptions"



## QVA INITIAL OPERATING CAPABILITY

QVA forecasts will be provided for “Significant” volcanic ash clouds

Exact definition still being determined by the VAAC’s but may include:

- an ash cloud with a certain vertical extent
- an ash cloud within (or expected to move within) a certain distance of an airport
- Impact of ash on aviation operations



## QVA INITIAL OPERATING CAPABILITY

An Initial Operating Capability for QVA has been defined. It will consist of three data sets:

- Gridded deterministic data set
  - Gridded probabilistic data set
  - An object/feature data set
- 
- The new forecasts will be provided alongside the traditional Volcanic Ash Advisory messages and graphics, at least for the first few years.



## QVA INITIAL OPERATING CAPABILITY

- The probability of exceeding each of the thresholds will be provided for 5000ft slices of the atmosphere between the surface and FL600 (12 levels)

Descriptor	Concentration thresholds and ranges
Very Low	$<0.2 \text{ mg/m}^3$
Low	$\geq 0.2 \text{ to } <2 \text{ mg/m}^3$
Medium	$\geq 2 \text{ to } <5 \text{ mg/m}^3$
High	$\geq 5 \text{ to } <10 \text{ mg/m}^3$
Very high	$\geq 10 \text{ mg/m}^3$

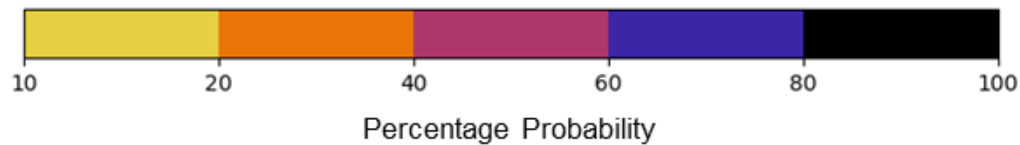
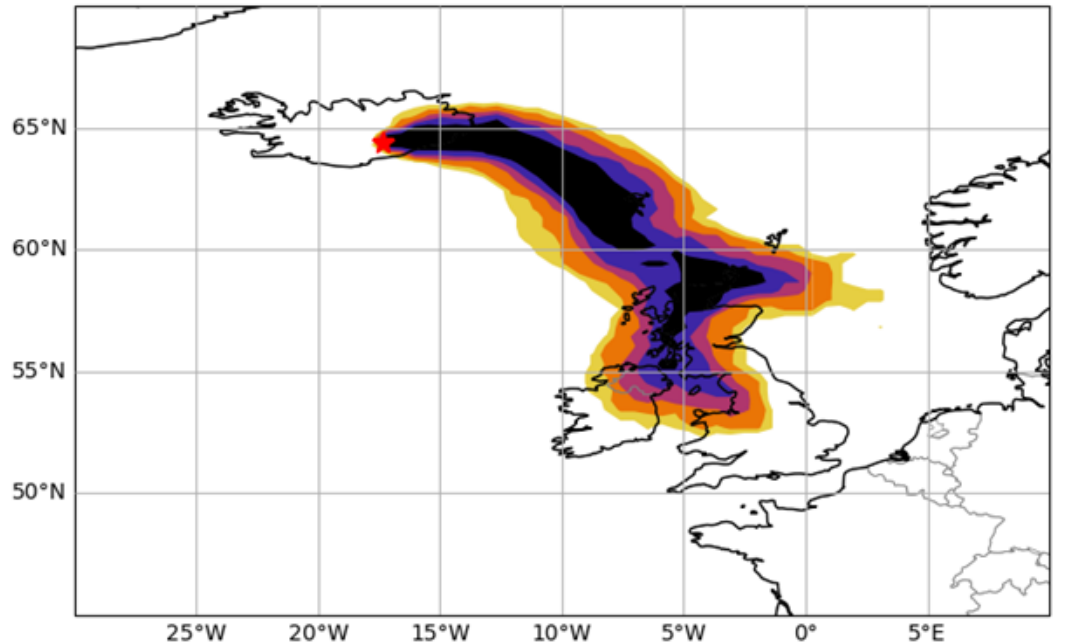
- This gridded data will be provided at a 0.25-degree horizontal resolution, for 3 hourly intervals out to 24 hours.



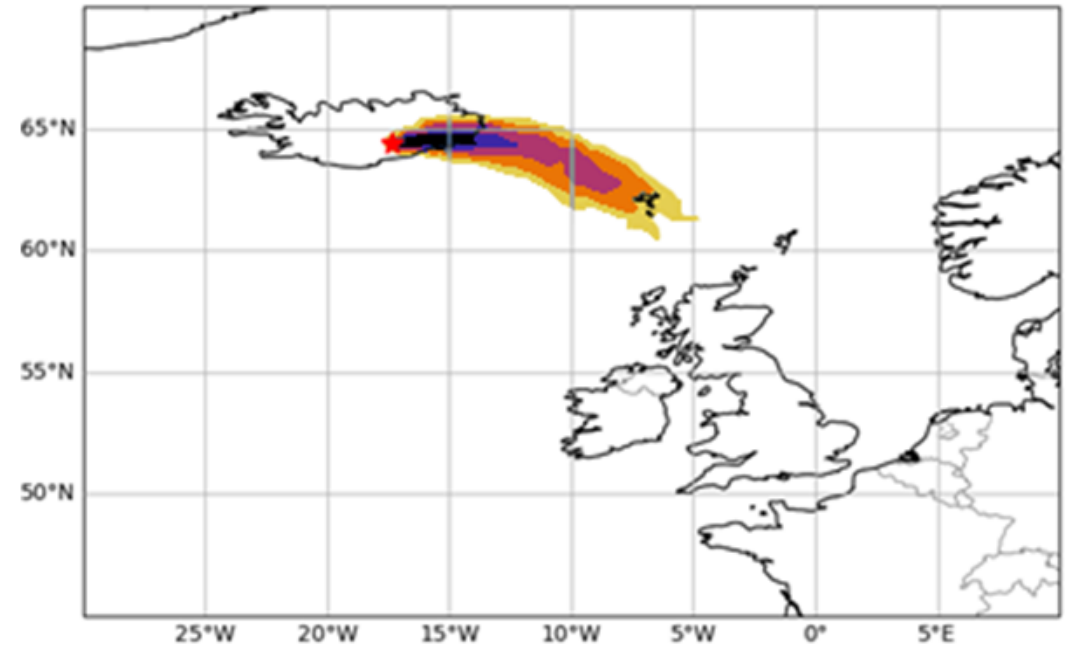


The probability of exceeding  $0.2 \text{ mg/m}^3$  and  $2.0 \text{ mg/m}^3$  for the FL250-FL300 level.

Probability of exceeding  $0.2 \text{ mg/m}^3$   
From FL250 to FL300  
Valid 18:00UTC 05/08/2022

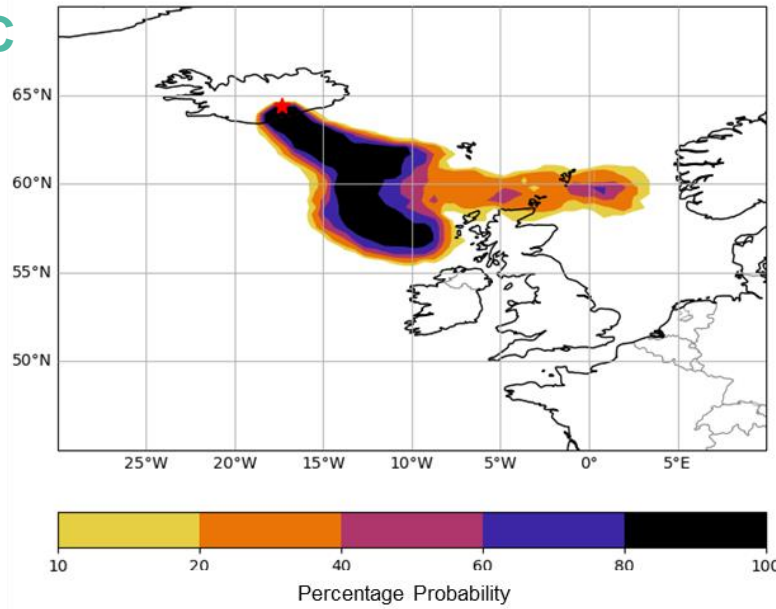


Probability of exceeding  $2 \text{ mg/m}^3$   
From FL250 to FL300  
Valid 18:00UTC 05/08/2022



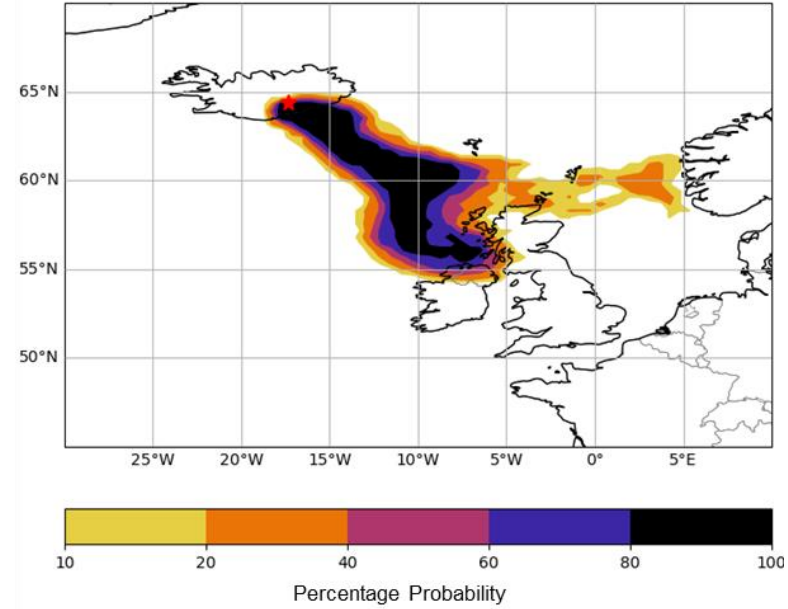
Probability of exceeding 0.2mg/m<sup>3</sup>  
From FL250 to FL300  
Valid 00:00UTC 05/08/2022

00UTC



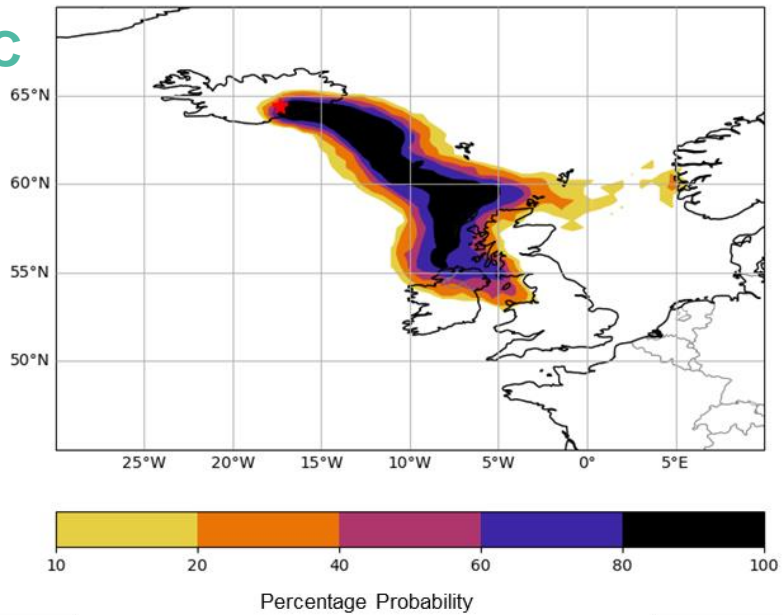
Probability of exceeding 0.2mg/m<sup>3</sup>  
From FL250 to FL300  
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06UTC



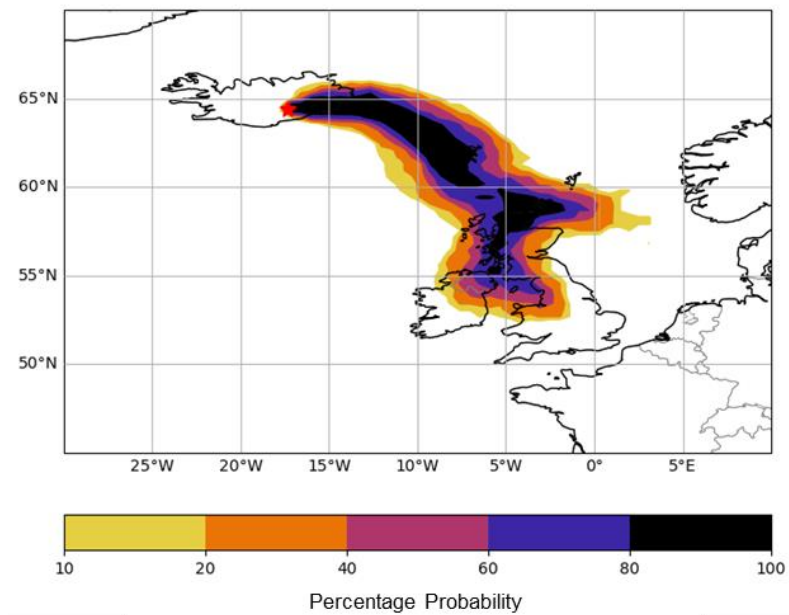
Probability of exceeding 0.2mg/m<sup>3</sup>  
From FL250 to FL300  
Valid 12:00UTC 05/08/2022

12UTC



Probability of exceeding 0.2mg/m<sup>3</sup>  
From FL250 to FL300  
Valid 18:00UTC 05/08/2022

18UTC



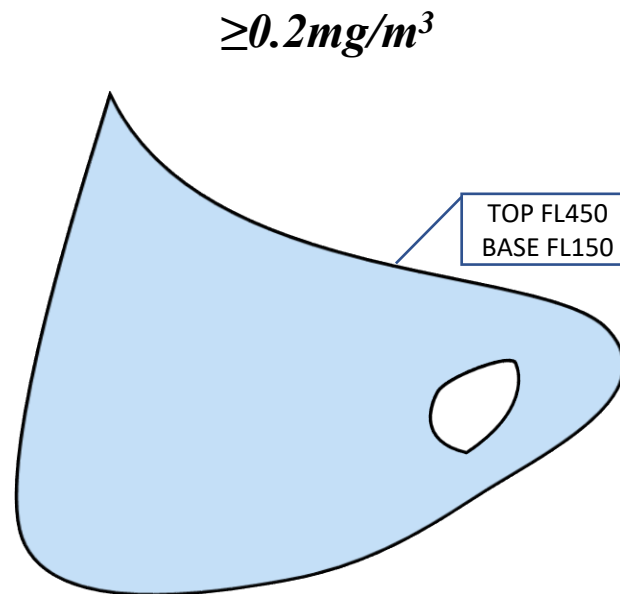
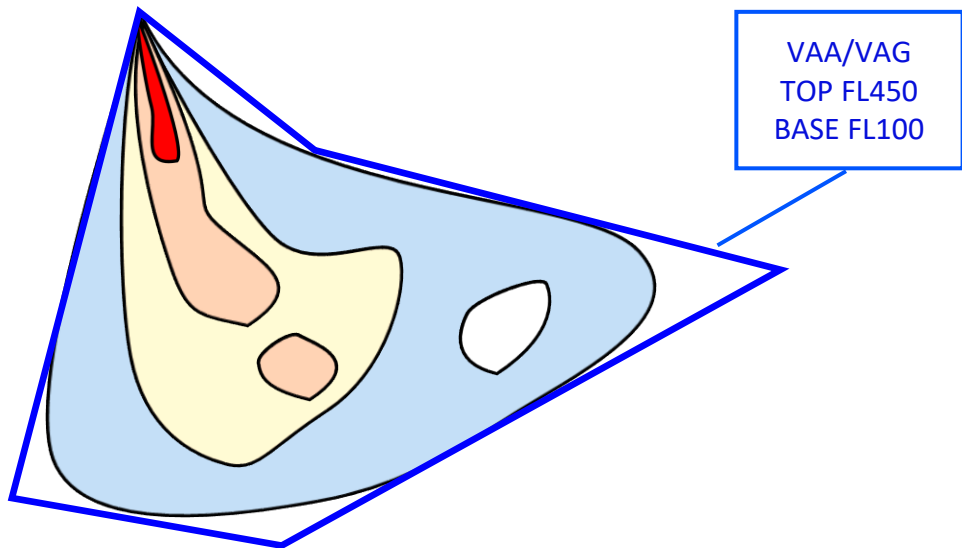


## QVA INITIAL OPERATING CAPABILITY

- A deterministic gridded QVA data set will also be provided which shows the expected ash concentration for each grid box.
- The gridded data will be in NetCDF format.
- Polygons/features will be created from the deterministic data, and these are intended to be used for situational awareness
- This will be provided in IWXXM format, using a specially created schema.

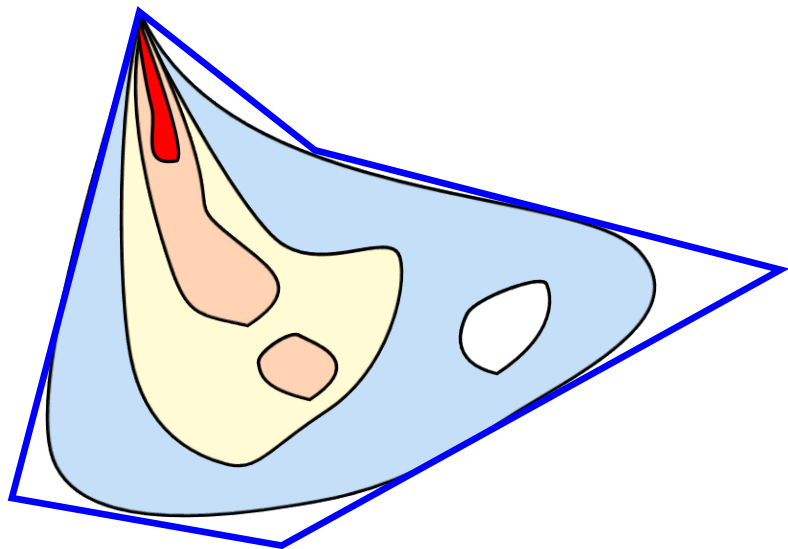


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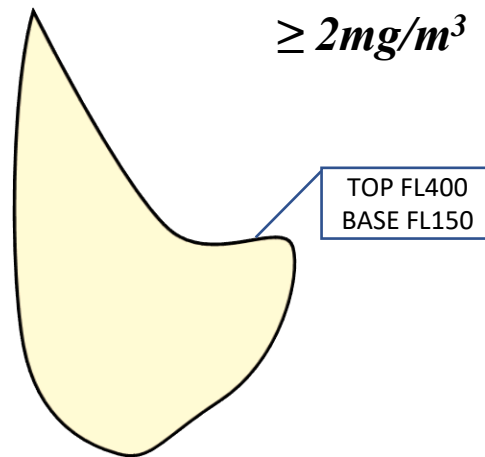




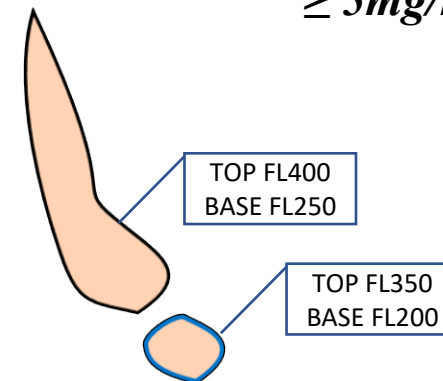
# METEOROLOGY PANEL



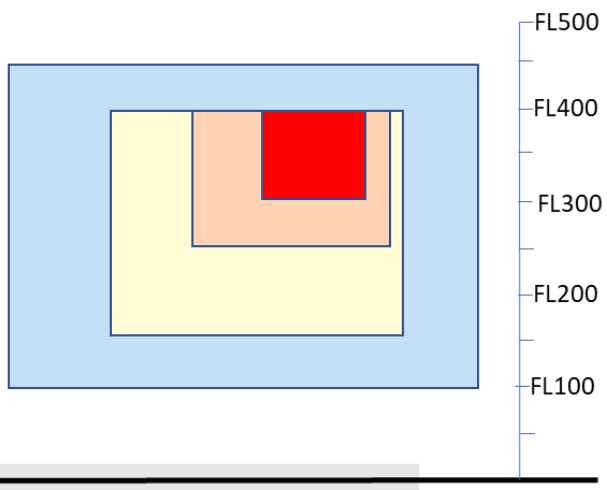
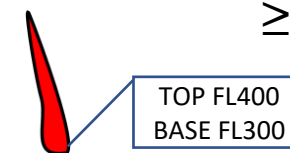
$\geq 2\text{mg/m}^3$



$\geq 5\text{mg/m}^3$



$\geq 10\text{mg/m}^3$





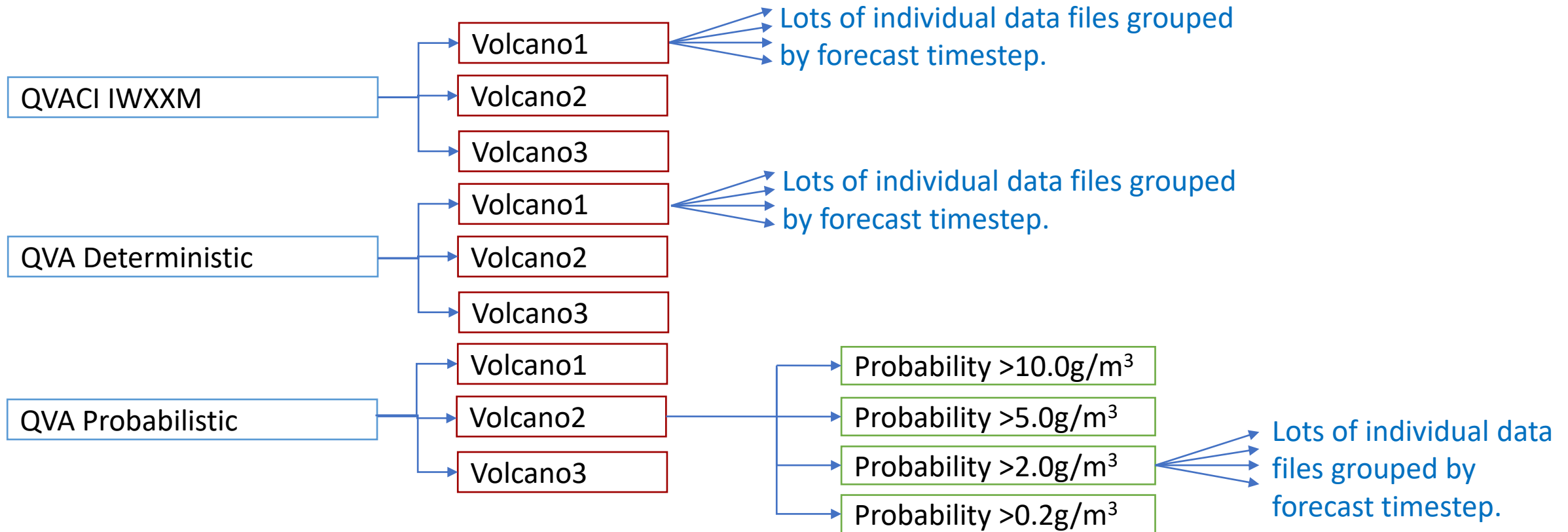
## QVA DATA DISTRIBUTION

- VAAC's will provide a SWIM compliant API to allow access to the data.
- VAAC London and VAAC Toulouse API's will adhere to the EUROCONTROL SWIM yellow profile requirements and will be published in the SWIM registry.
- It is hoped that the QVA service from each VAAC will offer the same capabilities and features. Like SADIS API, data will be organised into collections.



## QVA API

Data will be organised into “collections”, and “locations” which represent individual erupting volcanoes





## QVA DATA DISTRIBUTION

- As eruptions are irregular there will also be a “notification service” which can be listened to. When the notification is issued it will provide information on what has been updated in the API.





## QVA TIMELINE

**End of 2024** - QVA information services from VAAC Toulouse and VAAC London available

**Nov 2025** – other VAAC's start providing QVA, Annex 3 updated to include QVA as a recommended practice

**Nov 2026** – all VAAC's should be providing QVA forecasts the same way

**Nov 2030** – QVA expected to become a Standard in Annex 3. With QVA as a Standard VAA and VAG may only be issued for those volcanic ash clouds that don't meet the criteria for a significant volcanic ash cloud

**After 2030** (no date set yet) VAA and VAG will be retired.



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## QVA TIMELINE

During 2025 national met services, airlines, flight planning organisation and others should start downloading and integrating the new QVA data into their systems.

State or regional airspace operating procedures in relation to the QVA data will need to be decided, ideally prior to November 2025.



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A flyer is available that describes the QVA information service.

METP WG-MOG/20 IAVW – SN/04 Appendix



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## Quantitative Volcanic Ash (QVA) Concentration Information

First edition – 13 September 2022 (corrected 15 December 2022)

### 1 Introduction

This document describes the quantitative volcanic ash (QVA) concentration information (hereafter referred to as 'QVA information') that is planned to be provided by volcanic ash advisory centres (VAAC) as part of the International Civil Aviation Organization's (ICAO) International Airways Volcano Watch (IAVW). It is the first in a series of information "flyers" on QVA information.

Over the past two decades there were many requests by representatives of the IAVW, through various ICAO and World Meteorological Organization fora, for aircraft and engine manufacturers to provide information on the susceptibility of aircraft and their engines to volcanic ash. The specific desire was for ash concentration thresholds to be identified that did not pose a safety concern but could improve route efficiency. This need has led to the development of QVA information.

QVA information offers operators the opportunity to move away from traditional discernible/visible ash criteria and instead use certified engine susceptibility for flight route planning and inflight replanning. Visible ash is what an observer or flight crew member sees with their eyes. The lower limit of visible ash ranges from approximately 0.01 mg/m<sup>3</sup> to 10 mg/m<sup>3</sup>, depending on many factors such as time of day, sky background, position of the sun to the observer (pilot) as well as the angle the ash cloud is viewed (e.g., viewed from the side). Discernible ash is what a satellite or other remote sensing instrument detects. Discernible ash from satellites has been used by the VAACs to define the observed area in the volcanic ash advisories (VAA) in both text and graphic form (VAG) over the past two decades. The lower limit of discernible ash from satellites is approximately 0.1 mg/m<sup>3</sup> to 0.2 mg/m<sup>3</sup>, depending on the satellite and other factors.

QVA information will begin with an initial operating capability (IOC) that is planned to be implemented in three phases in the mid-2020s.

### 2 Initial operating capability (IOC)

The IOC for QVA will provide forecasts of ash concentration in two data formats for significant eruptions.

#### 2.1 Format

QVA information will be provided in two file formats. Objects will be provided in ICAO's Meteorological Information Exchange Model (IWXXM) format. Gridded data will be provided in a file format which has yet to be determined but will probably be a binary format. The IWXXM format contains a subset of the entire gridded data file set.