



METEOROLOGY PANEL



ICAO Developments in Volcanic Hazard Information Services

Paula Acethorp

WG-MOG IAVW Work Stream Coordinator

Jarrad Denman

Manager, VAAC Darwin

Volcanic Hazard Information

- ▶ Elevation of the Volcano Observatory Notice to Aviation (VONA)
- ▶ Development of a trial sulphur dioxide (SO₂) global information service
- ▶ Development of a quantitative volcanic ash information service



METEOROLOGY PANEL



Elevation of the VONA

- ▶ Annex 3 simply states volcano observatories shall “send information” to ACC/FIC, MWO, VAAC
- ▶ Details of VONA sit in the Handbook on the International Airways Volcano Watch (IAVW) – ICAO Doc 9766
- ▶ Proposed to elevate the VONA to a “recommended practice” in Annex 3 in November 2023.



Elevation of the VONA

Current VONA template:

VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)

Item No	Element	Content
1	Message title	VOLCANO OBSERVATORY NOTICE FOR AVIATION
2	Issued:	20200621/2330Z
3	Volcano:	White Island 241040
4	Current Aviation Color Code:	Green
5	Previous Aviation Color Code:	Yellow
6	Source:	GNS Science, New Zealand
7	Notice Number:	NZ VONA 20/02
8	Volcano Location:	3752S17718E
9	Area:	White Island
10	Summit Elevation:	1053FT
11	Volcanic Activity Summary:	Volcano status now minor volcanic unrest.
12	Volcanic Cloud Height:	NIL
13	Other Volcanic Cloud information:	NIL
14	Remarks:	No further eruptions since 20191209. Key observables are now indicating a lower level of volcanic unrest. Volcanic Alert Level remains at Level 1 (changed 15 June 2020 UTC)
15	Contacts:	Duty Volcanologist, +6473748211ph
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.



METEOROLOGY PANEL



10/2/2020

Elevation of the VONA

ICAO Aviation Colour Code

ICAO Colour Code	Status of activity of volcano
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 underway with significant emission of ash into the atmosphere [specify ash-plume height if possible].



Elevation of the VONA

Simultaneously removing Aviation Colour Code from the VAA

VA ADVISORY

DTG: 20080923/0130Z
VAAC: TOKYO
VOLCANO: KARYMSKY 1000-13
PSN: N5403 E15927
AREA: RUSSIA
SUMMIT ELEV: 1536M
ADVISORY NR: 2008/4
INFO SOURCE: MTSAT-1R KVERT KEMSD
AVIATION COLOUR CODE: RED
ERUPTION DETAILS: ERUPTION AT 20080923/0000Z FL300 REPORTED
OBS VA DTG: 23/0100Z
OBS VA CLD: FL250/300 N5400 E15930 – N5400 E16100 – N5300 E15945 MOV SE 20KT
SFC/FL200 N5130 E16130 – N5130 E16230 – N5230 E16230 – N5230 E16130
MOV SE 15KT



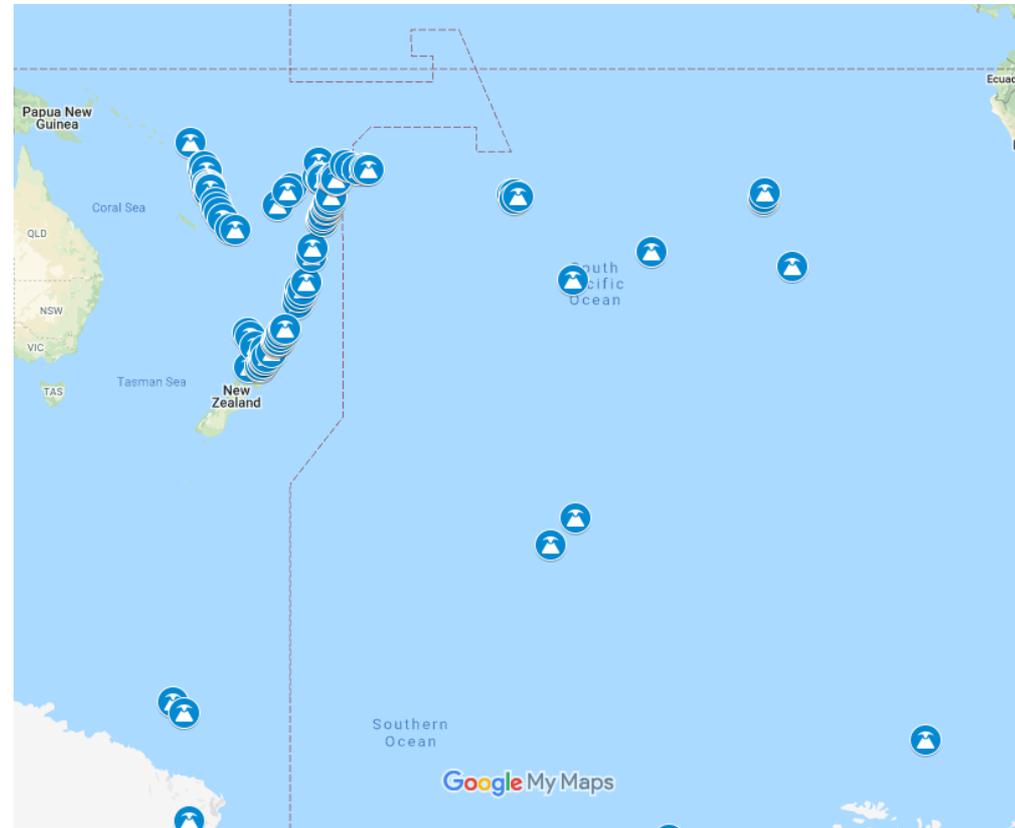
METEOROLOGY PANEL



10/2/2020

Elevation of the VONA

- ▶ GNS Science, MetService and CAA developing a proposal for a south Pacific VONA web portal
- ▶ Will allow volcano observatories to create and issue their VONA, in both text and IWXXM format (once defined)



METEOROLOGY PANEL



10/2/2020

Development of a trial SO₂ global information service

- ▶ From the International Volcanic Health Hazard Network (www.ivhnn.org):
 - Short-term overexposure causes inflammation and irritation, resulting in burning of the eyes, coughing, difficulty in breathing and a feeling of chest tightness
 - Prolonged or repeated exposure to low concentrations (1–5 ppm) may be dangerous for persons with pre-existing heart and lung diseases.



METEOROLOGY PANEL



Development of a trial SO₂ global information service

- ▶ Based on WHO 10–min exposure threshold (0.175 ppm)
 - Odour is generally perceptible between 0.3 and 1 ppm
- ▶ London VAAC developing the global trial SO₂ forecast capability
- ▶ Looking at “the art of the possible”

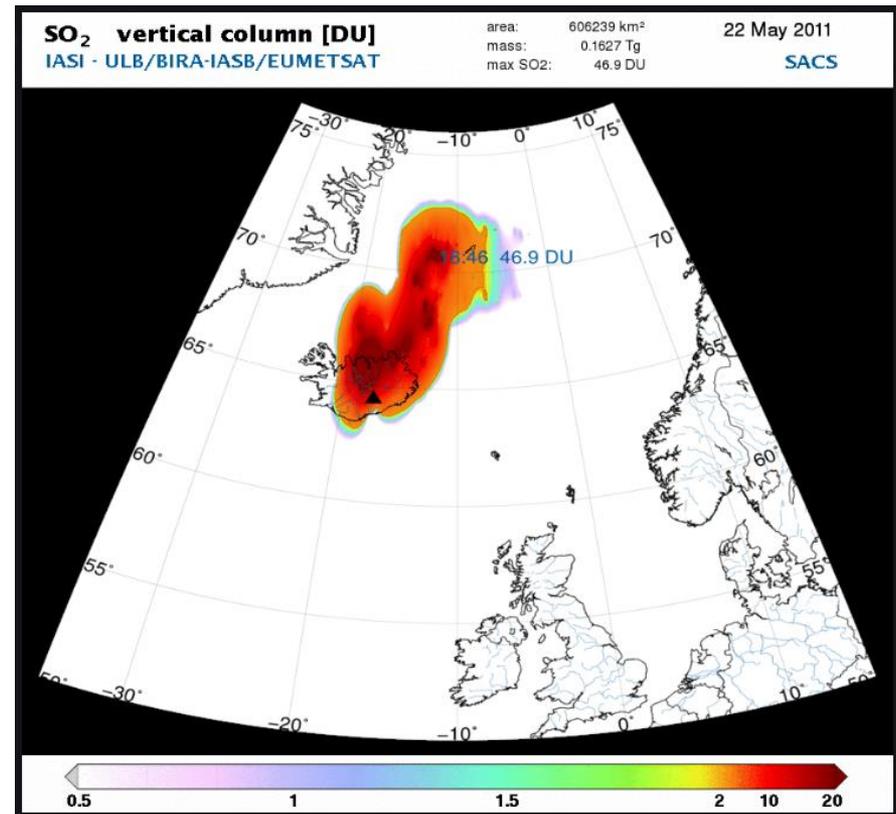


METEOROLOGY PANEL



Development of a trial SO₂ global information service

- ▶ Measurements of sulphur dioxide being carried from the Grímsvötn volcano towards the northeast of Iceland on 22 May 2011.



Eumetsat MetOp satellite



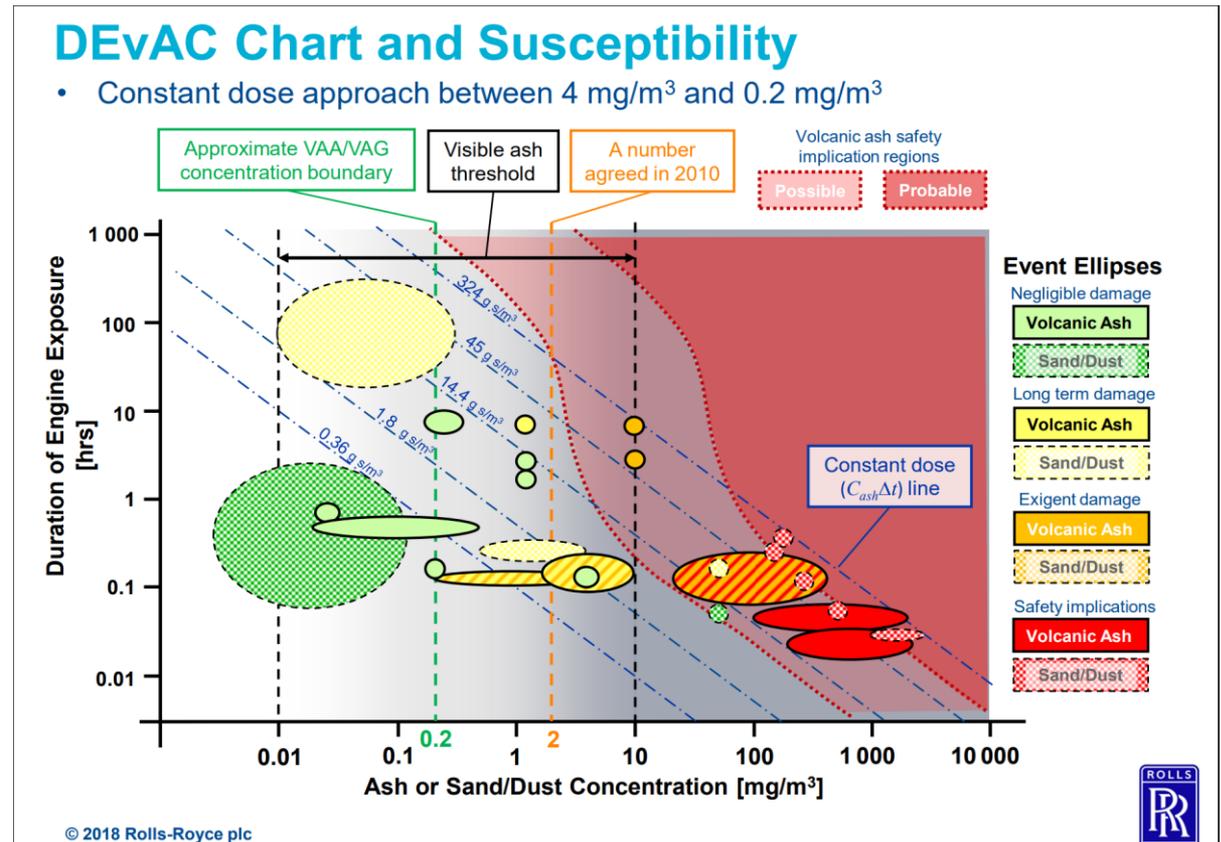
METEOROLOGY PANEL



Development of a quantitative volcanic ash information service

Background:

- ▶ Rolls Royce declared volcanic ash limits for all RB211 and Trent engines “Exposure to a cumulative **volcanic ash dose equivalent** to operating for 120 minutes in an actual ash concentration of 2 mg/m³ (i.e. 14.4 g s/m³), or lower, should not lead to a significant reduction in engine related flight safety margins if all measures are taken to maximise engine operability margins”
- ▶ FAA encouraging other manufacturers to follow suit



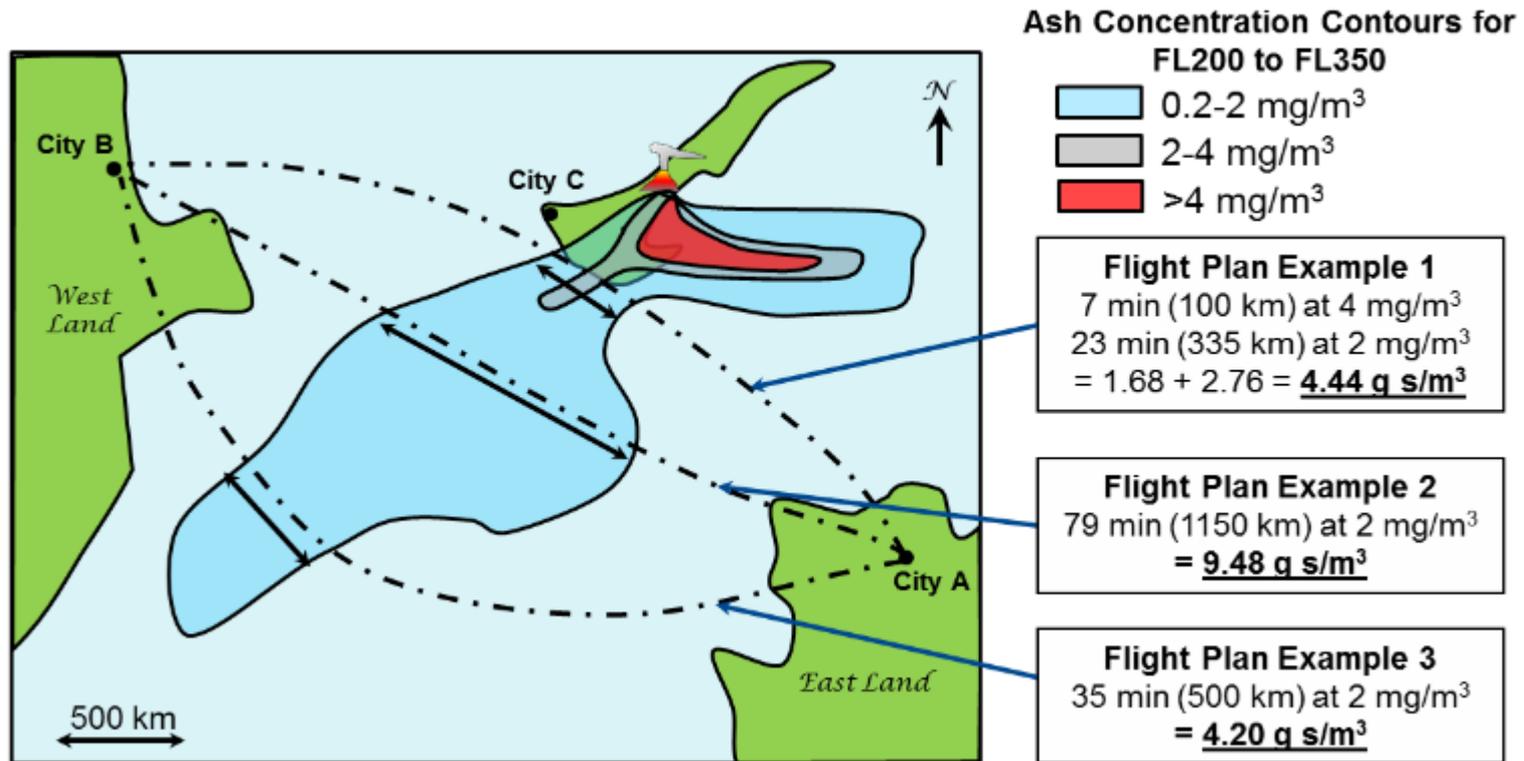
[Maximising Airspace Use During Volcanic Eruptions: Matching Engine Durability against Ash Cloud Occurrence](#)



METEOROLOGY PANEL



Development of a quantitative volcanic ash information service



[Maximising Airspace Use During Volcanic Eruptions: Matching Engine Durability against Ash Cloud Occurrence](#)



METEOROLOGY PANEL

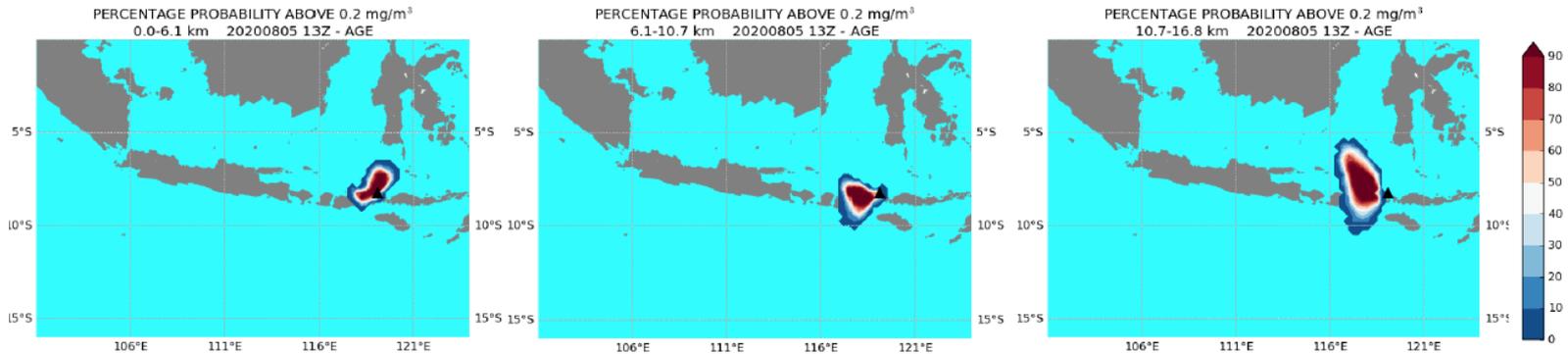


Development of a quantitative volcanic ash information service

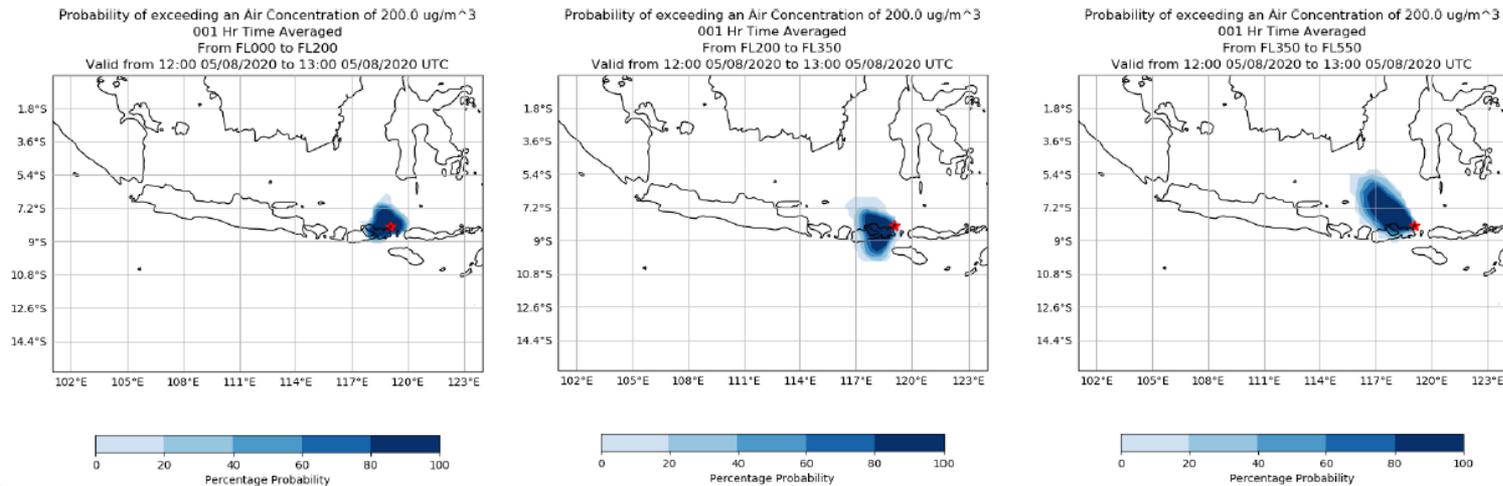
- ▶ VAACs Darwin and London host agencies (BoM Australia and UKMO) have created examples for a hypothetical eruption – showing the **probability of exceeding a certain threshold of ash concentration**
- ▶ Based on 18 member ensemble forecasts, the “probability” is the percentage of ensemble members with ash above the stated threshold (so not true probability as does not encompass uncertainty in eruption parameters)
- ▶ Data shows the instantaneous (top charts) or pseudo-instantaneous (lower charts) results at the time stamp
- ▶ These are for 3 “deep” altitude layers: SFC–F200 (shown in next slides); FL200–FL350 and FL350–FL550



Development of a quantitative volcanic ash information service



T+0, Members exceeding 0.2mg/m³

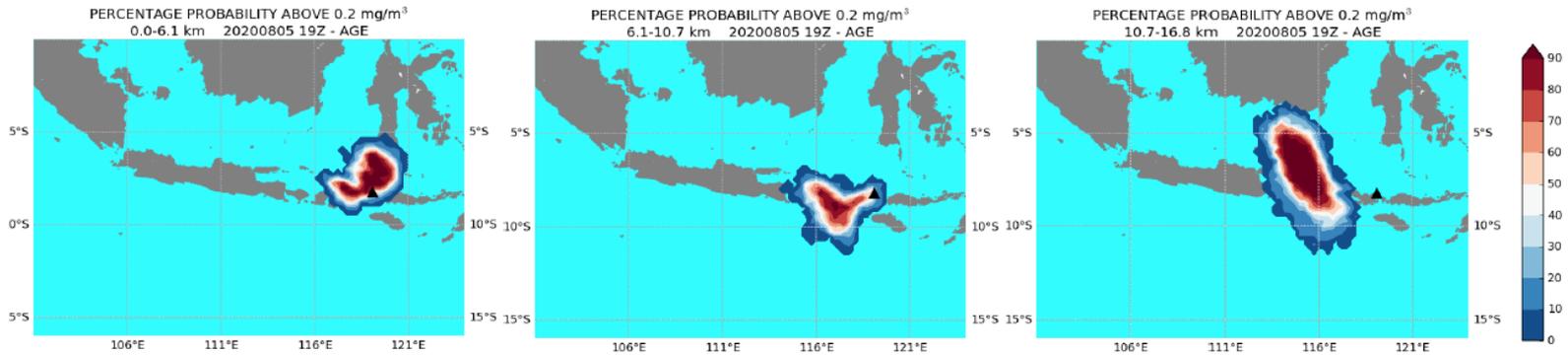


METEOROLOGY PANEL

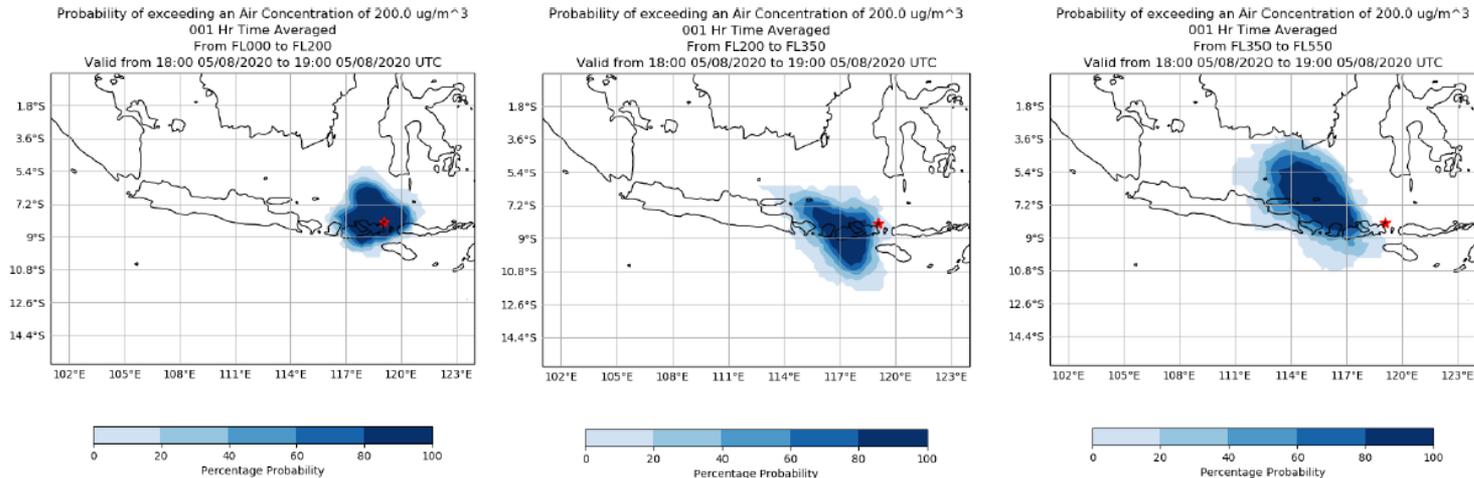


10/2/2020

Development of a quantitative volcanic ash information service



T+6, Members exceeding 0.2mg/m³

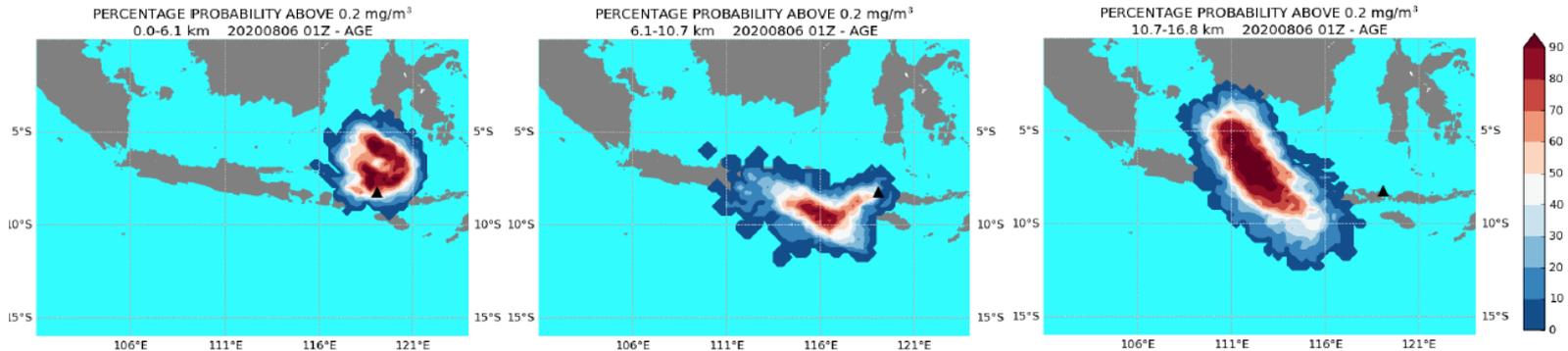


METEOROLOGY PANEL

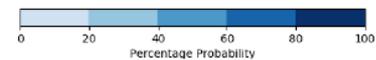
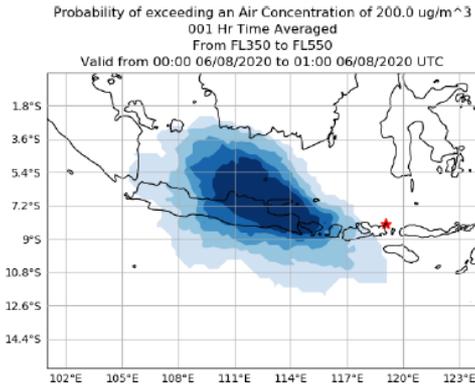
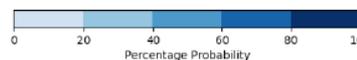
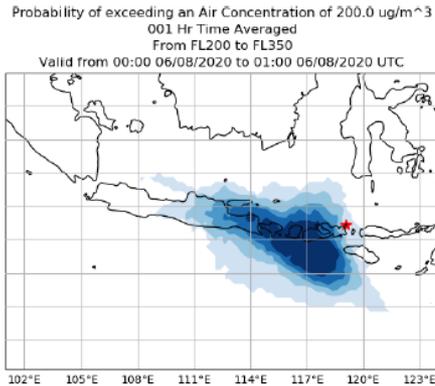
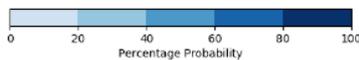
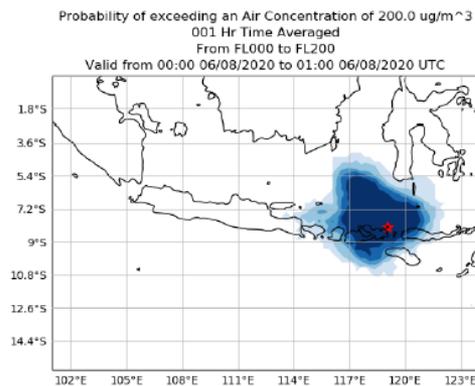


10/2/2020

Development of a quantitative volcanic ash information service



T+12, Members exceeding 0.2mg/m³



METEOROLOGY PANEL

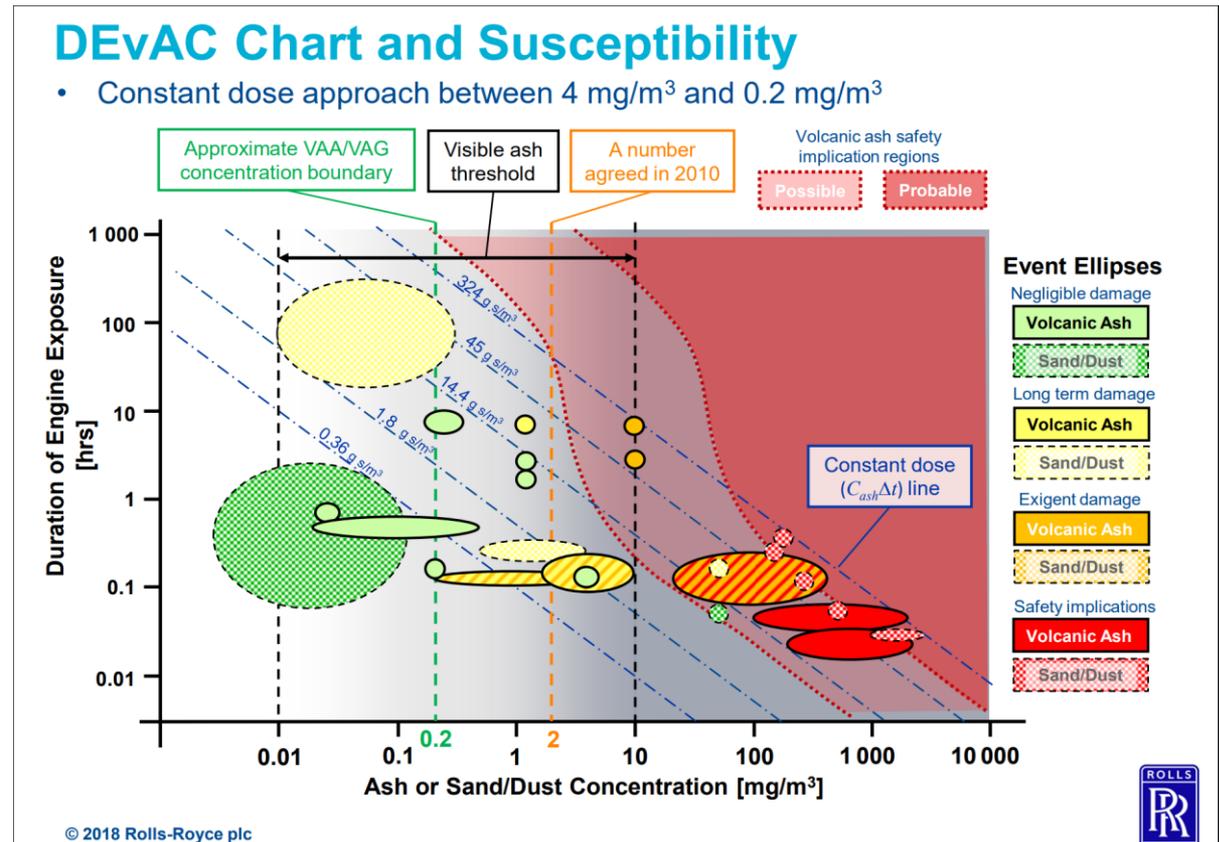


10/2/2020

Development of a quantitative volcanic ash information service

Background:

- ▶ Rolls Royce declared volcanic ash limits for all RB211 and Trent engines “Exposure to a cumulative **volcanic ash dose equivalent** to operating for 120 minutes in an actual ash concentration of 2 mg/m³ (i.e. 14.4 g s/m³), or lower, should not lead to a significant reduction in engine related flight safety margins if all measures are taken to maximise engine operability margins”
- ▶ FAA encouraging other manufacturers to follow suit



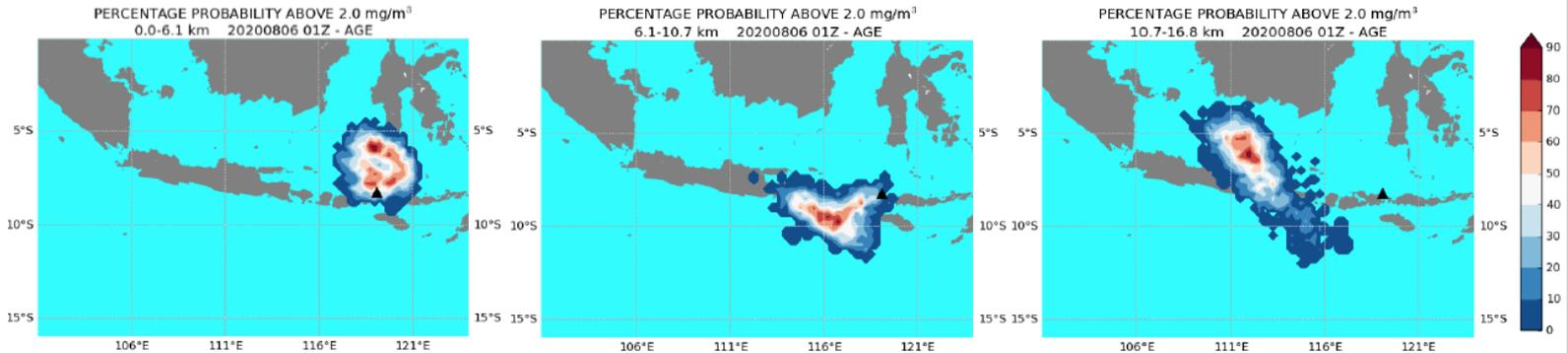
Maximising Airspace Use During Volcanic Eruptions: Matching Engine Durability against Ash Cloud Occurrence



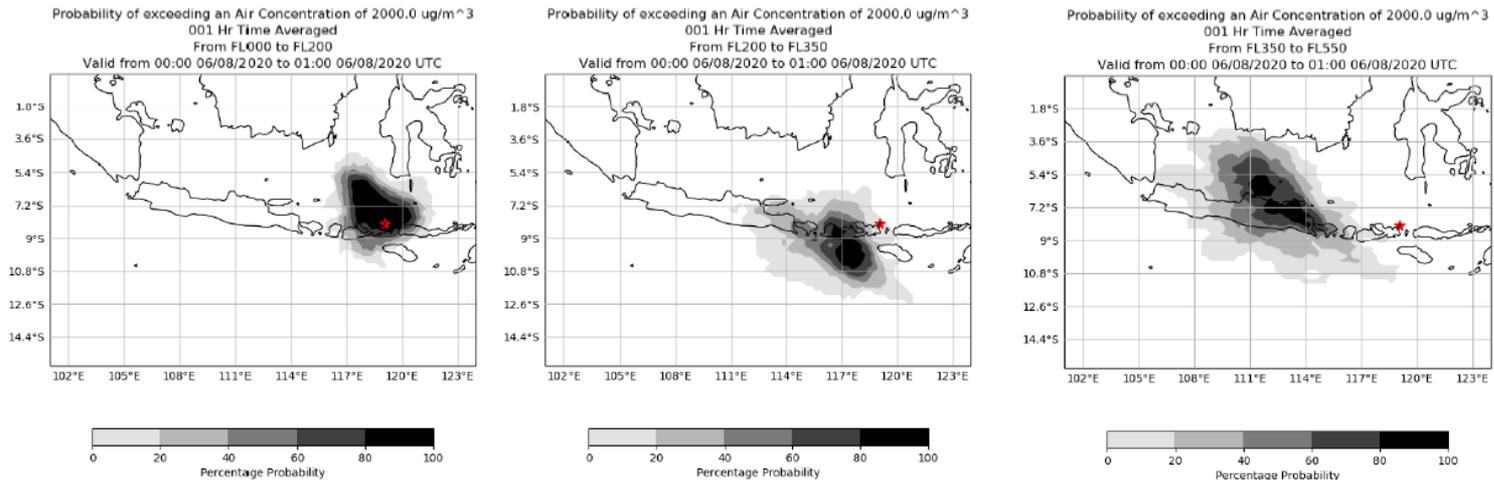
METEOROLOGY PANEL



Development of a quantitative volcanic ash information service



T+12, Members exceeding 2mg/m³

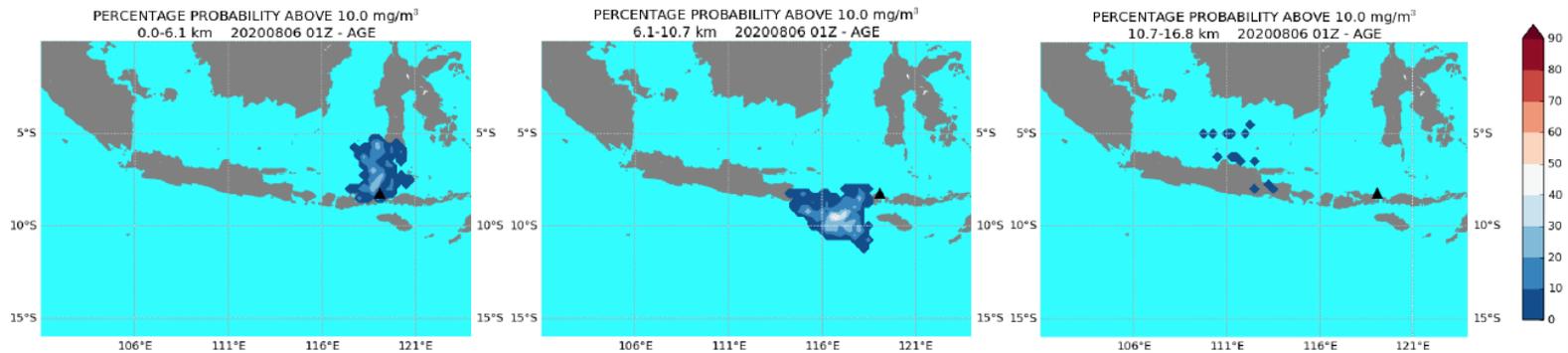


METEOROLOGY PANEL

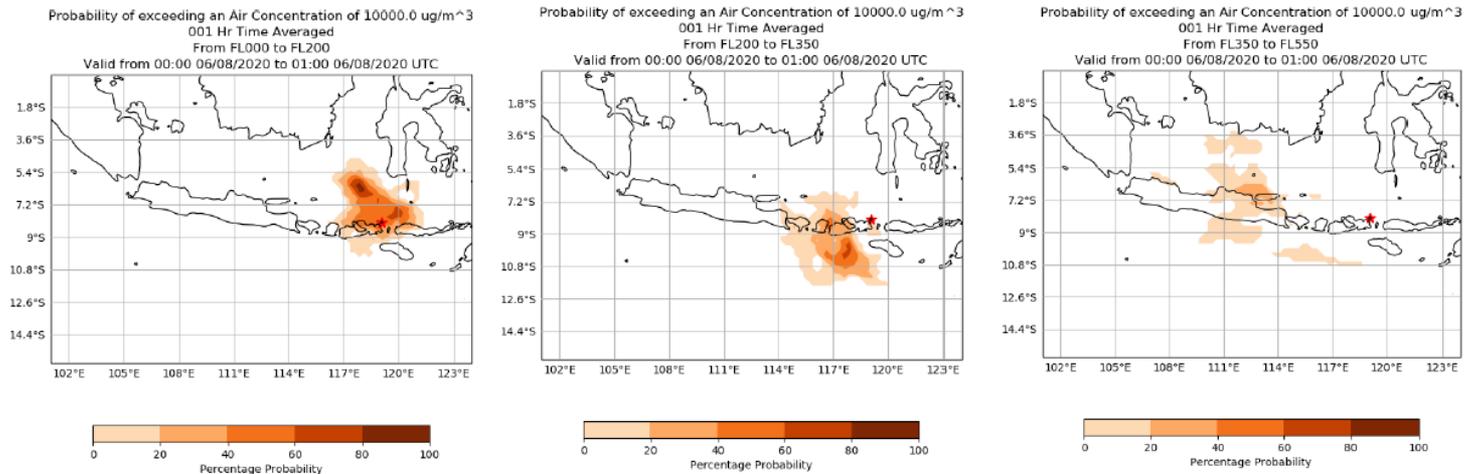


10/2/2020

Development of a quantitative volcanic ash information service



T+12, Members exceeding 10mg/m³



METEOROLOGY PANEL



10/2/2020

Development of a quantitative volcanic ash information service

- ▶ Currently planned to be a recommended practice initially (alongside VAAs) – likely implemented November 2023.
 - Will include “volcanic objects” in IWXXM format – similar to a VAA polygon, likely based on a contour line in the data
- ▶ Will become a standard practice likely the following Annex cycle (eg 2026), probably with VAAs discontinued
- ▶ How would you use such a data set?
 - Are they self-explanatory?
 - How would you use them in your operations?
 - Any suggested improvements?
 - Is the uncertainty around the products obvious?
 - What time steps would be useful? How often should they be generated?
 - How useful are the vertical layers? How many should there be?

