

# Utilization of volcanic ash advisories for safe air traffic management



Volcanic Ash Advisory Centre Tokyo  
Japan Meteorological Agency

# Contents

1. Introduction
2. Outline of Volcanic Ash Advisories provided by VAAC Tokyo
3. Recent experience and necessary efforts
4. Conclusion

# Contents

## 1. Introduction

## 2. Outline of Volcanic Ash Advisories provided by VAAC Tokyo

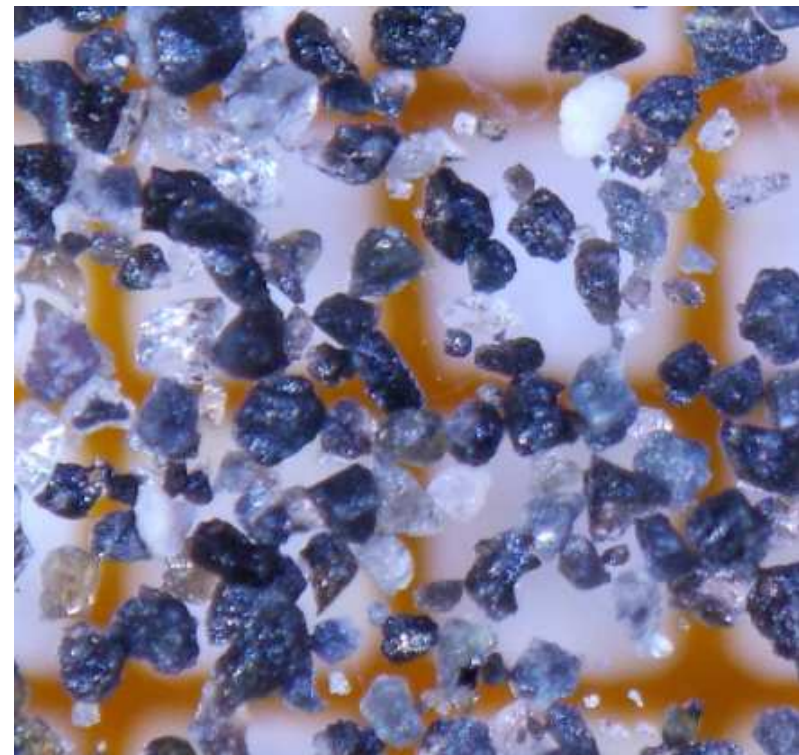
## 3. Recent experience and necessary efforts

## 4. Conclusion

# What is volcanic ash?

- Formed during eruptions:  
rocks or rapidly cooled-down magma, broken into small pieces due to volcanic activity (2 mm or smaller).
- Time required for volcanic ash at FL330 to fall onto the ground:

Diameter	Order of
100 $\mu$ m (0.1 mm)	→ several hours
10 $\mu$ m (0.01 mm)	→ several days
1 $\mu$ m (0.001mm)	→ several years



← 1 mm →

Volcanic ash at the eruption of Sakurajima (Showa Crater) at 13:42 JST on 20 Sep. 2012

# Impact of volcanic ash to aviation operations

## Volcanic ash causes

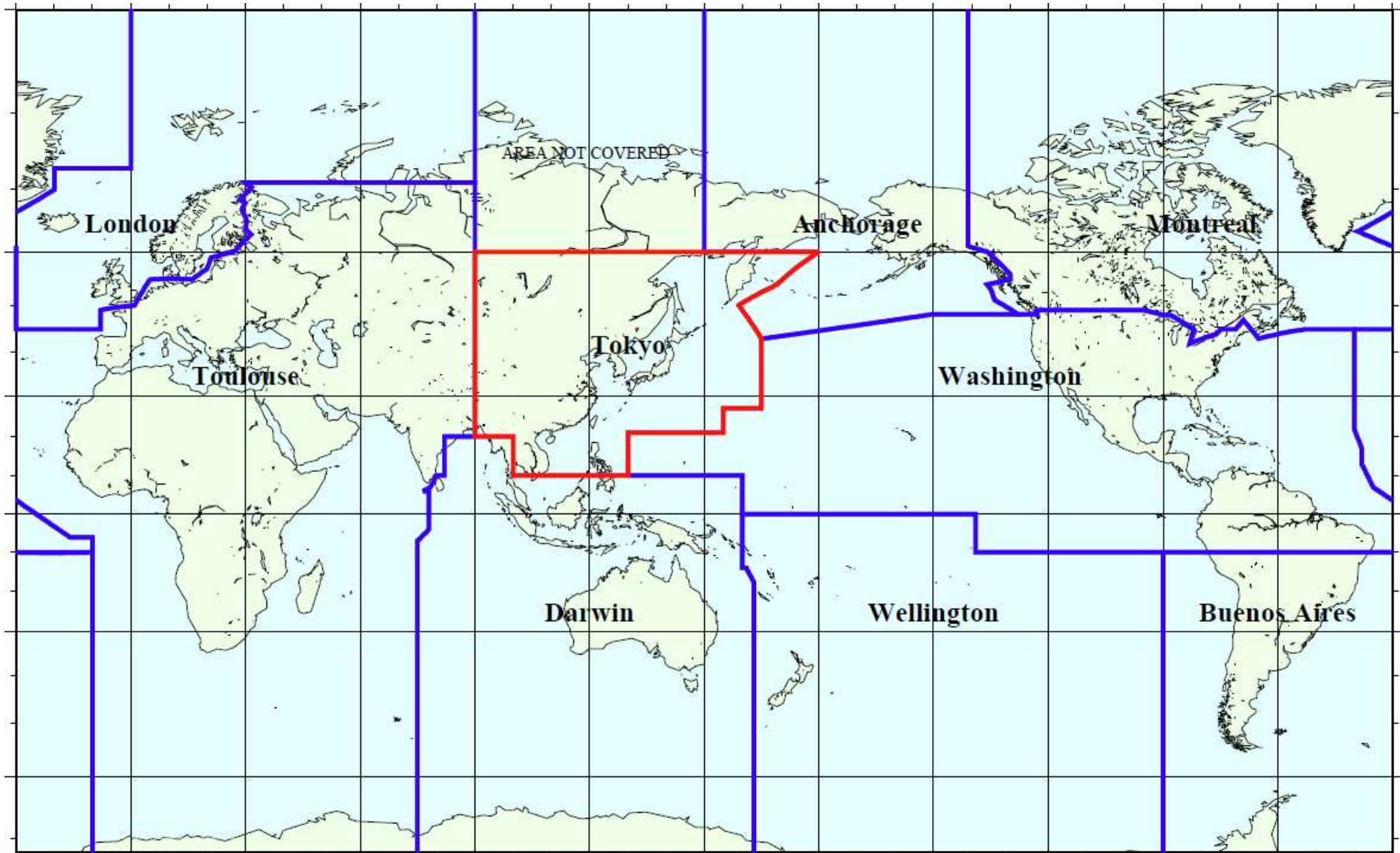
- engine failure
- poor visibility due to ash-related scouring of aircraft windshields
- take-off/landing delays due to ash accumulation at airports

## 207 incidents from 1973 to 1991

(Number of aircrafts affected by eruptions are from USGS)

- 8 aircrafts affected by the eruption of Mt. Saint Helens (U.S.) in 1980
- 5 aircrafts affected by the eruption of Mt. Galunggung (Indonesia) in 1982;  
all engines of British Airways B747 stopped
- 6 aircrafts affected by the eruption of Mt. Redoubt (U.S.) in 1989;  
all engines of KLM B747-400 stopped
- 18 aircrafts affected by the eruption of Mt. Pinatubo (the Philippines)

# Area of responsibility of 9 Volcanic Ash Advisory Centers(VAACCs)



# Responsibility of VAAC Tokyo

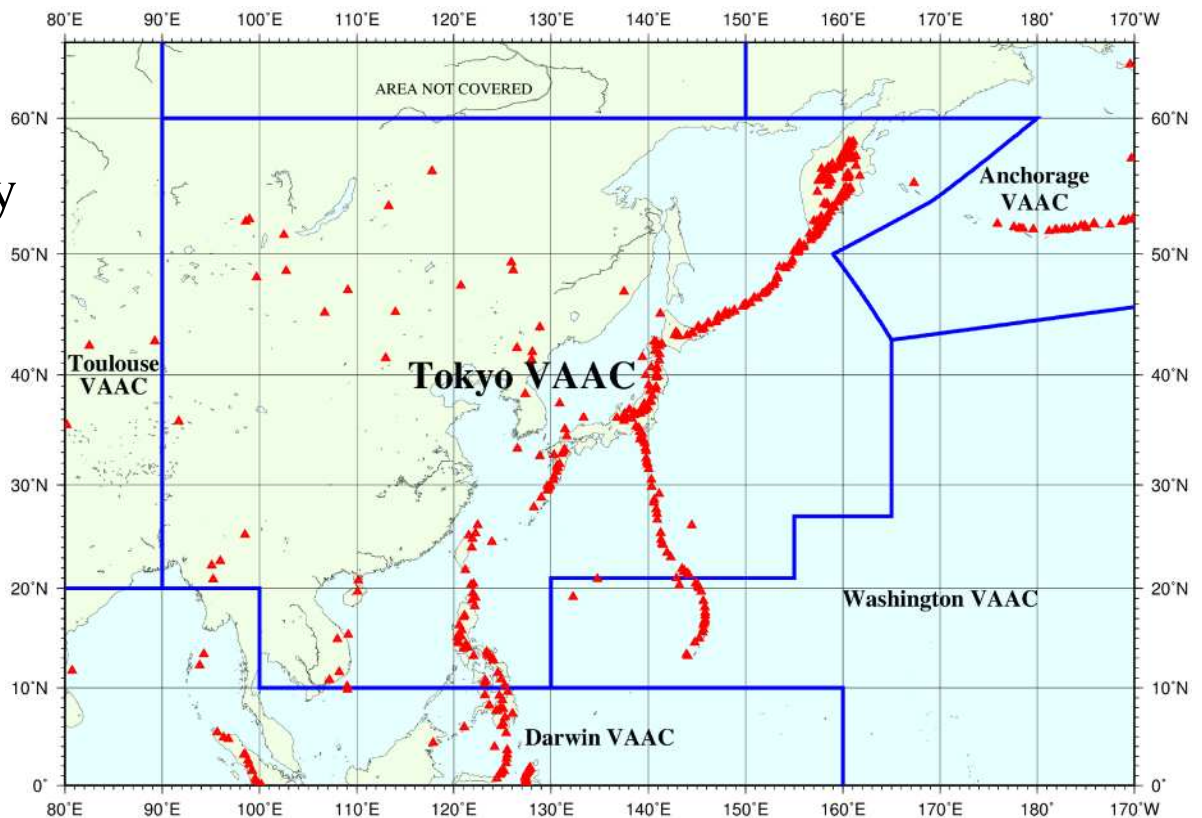
## - Area of Responsibility

area with any active volcanoes such as Kamchatka, Japan and the Philippines

## - Duty

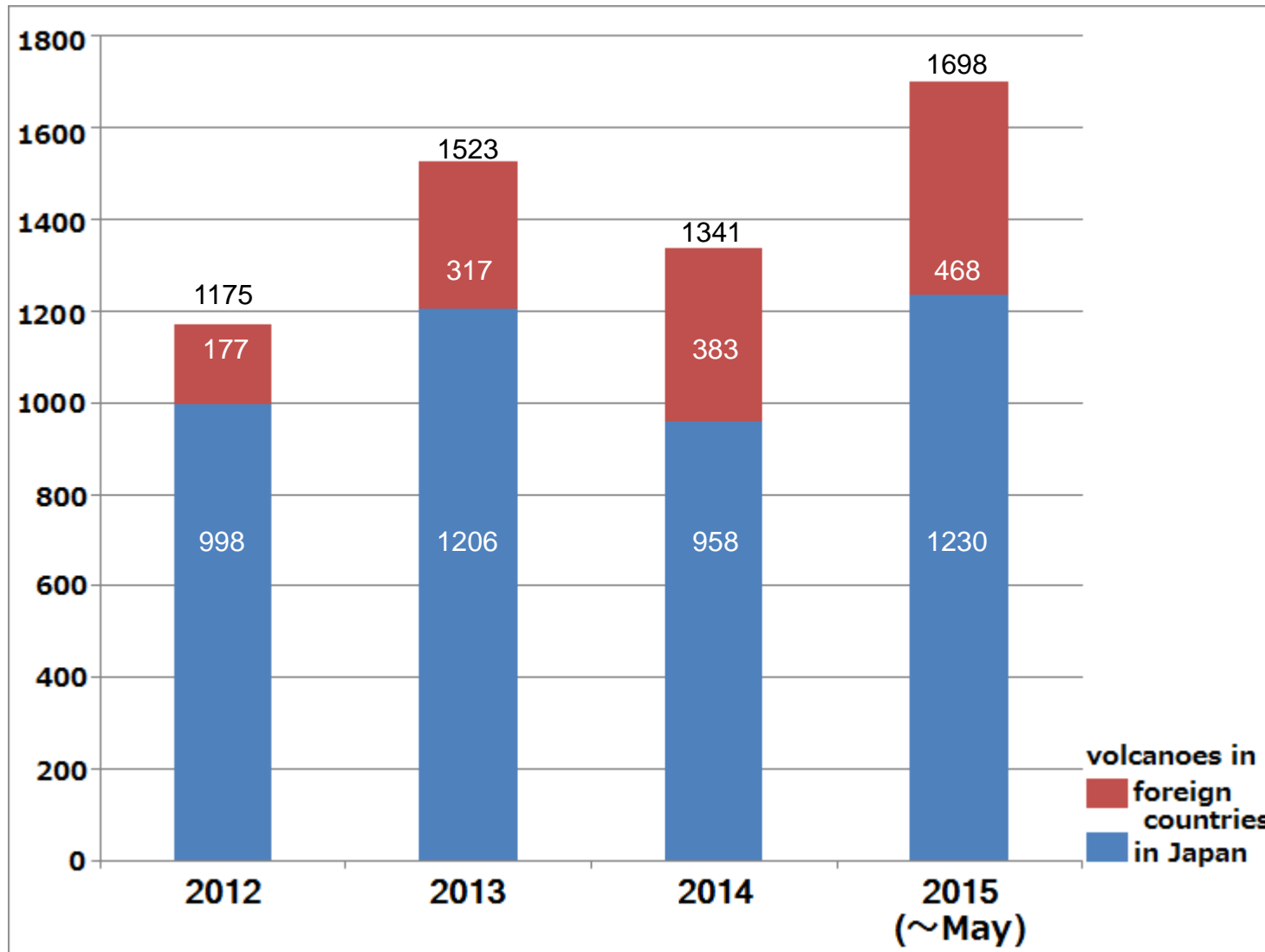
for the area of responsibility

- collect information on eruption/volcanic activity
- monitor volcanic ash from satellite imagery
- forecast ash extent
- issue Volcanic Ash Advisories (VAAs)



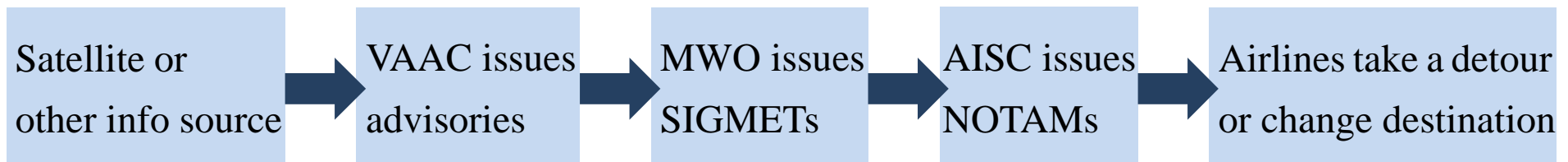
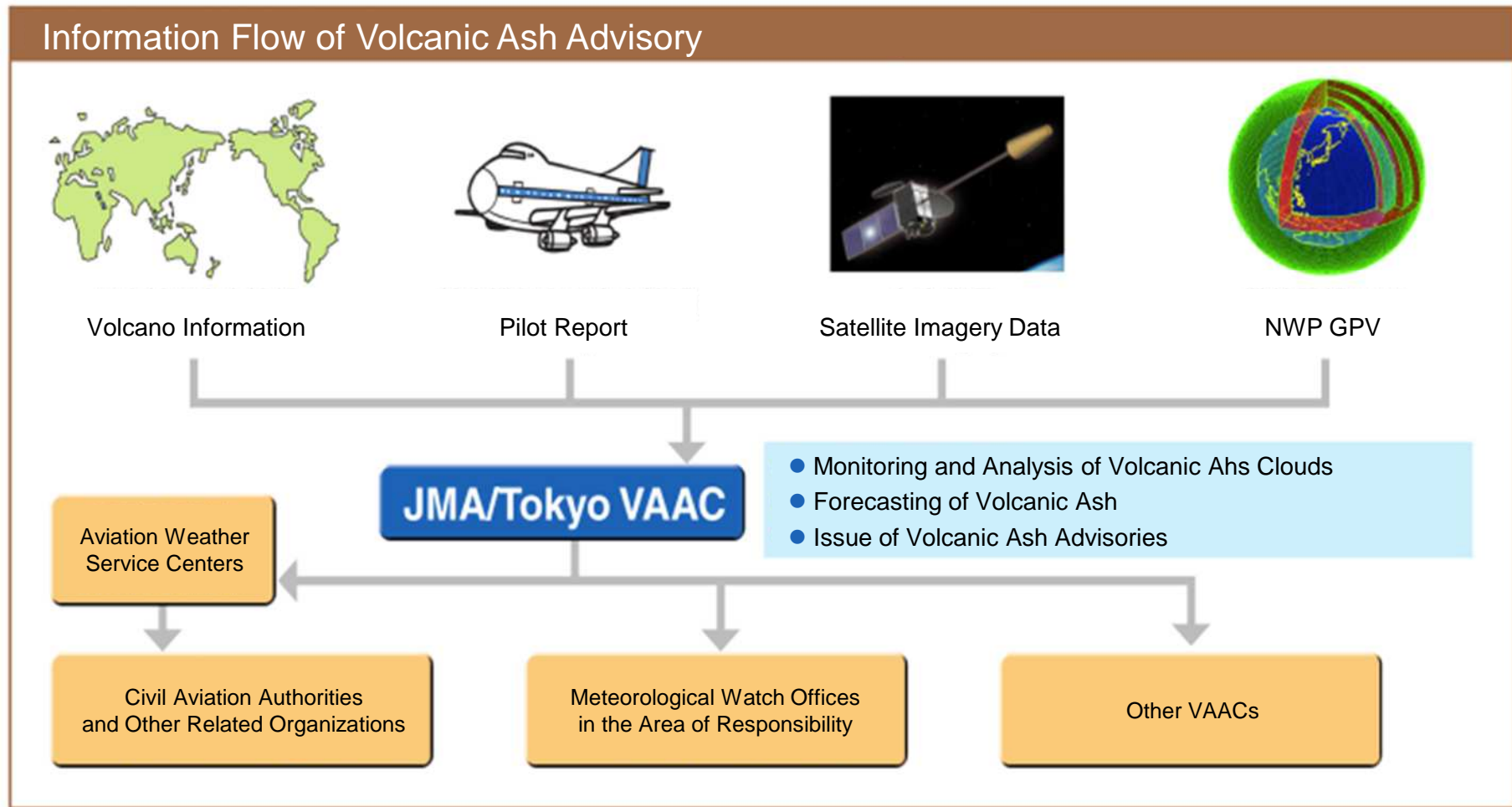
— : boundary of area of responsibility  
▲ : active volcano

# Number of VAAs from VAAC Tokyo





# Information flow



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# Example of VAA (text)

FVFE01 RJTD 140602  
VA ADVISORY  
DTG: 20150414/0602Z  
VAAC: TOKYO

Volcano data, info source, eruption information

VOLCANO: SHEVELUCH 300270  
PSN: N5639 E16122  
AREA: RUSSIA  
SUMMIT ELEV: 3283M  
ADVISORY NR: 2015/164  
INFO SOURCE: MTSAT-2  
AVIATION COLOUR CODE: NIL  
ERUPTION DETAILS: VA CONTINUOUSLY OBS ON SATELLITE IMAGERY

Observed time of volcanic ash from satellite imagery and observed volcanic ash extent

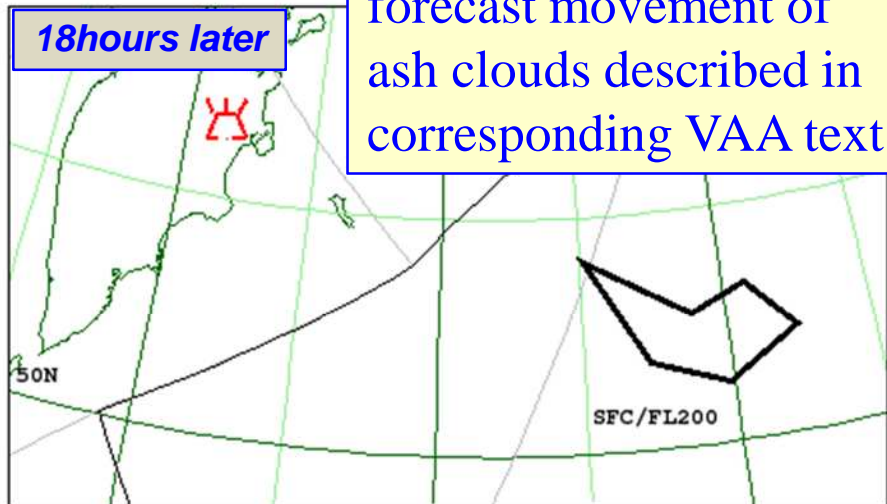
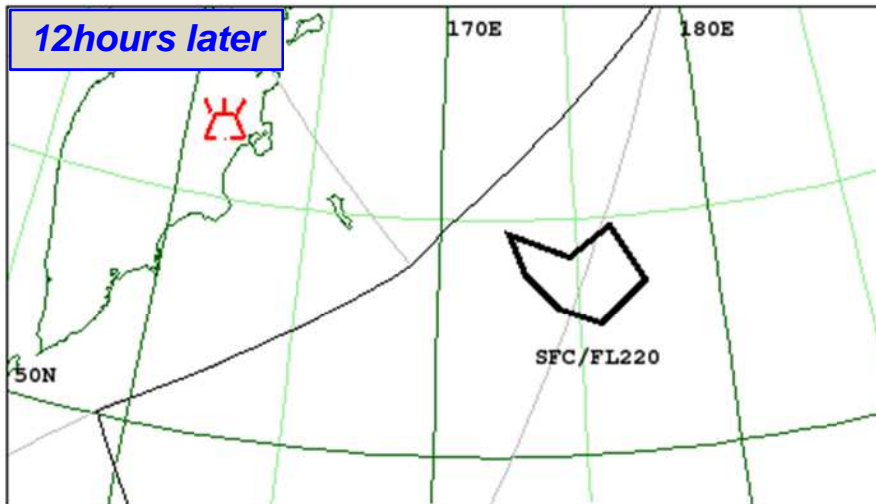
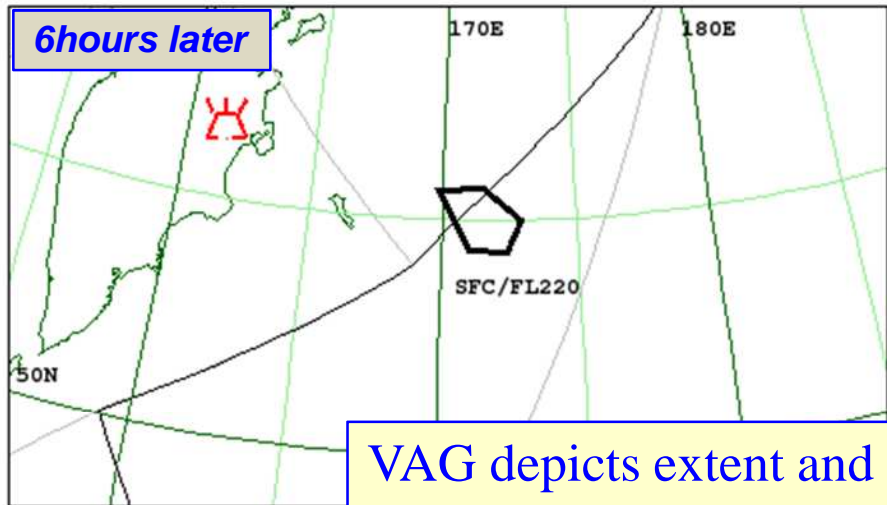
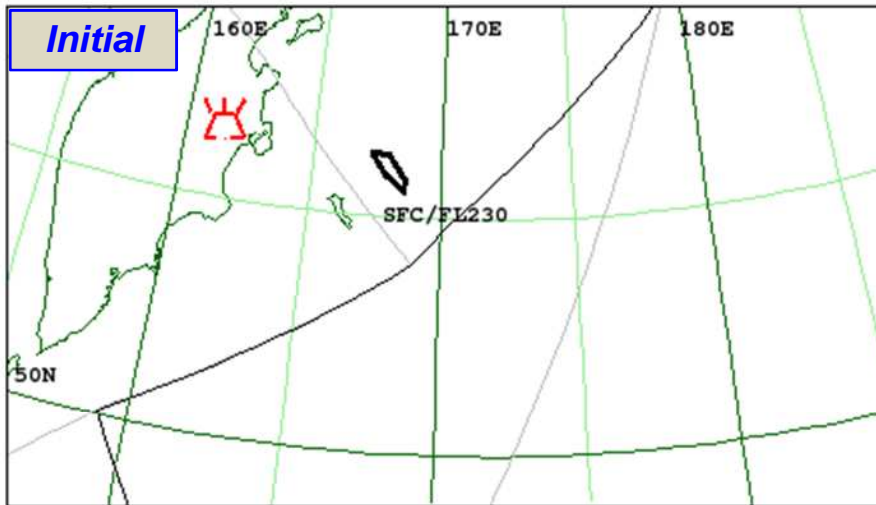
OBS VA DTG: 14/0515Z  
OBS VA CLD: SFC/FL230 N5620 E16715 - N5620 E16755 - N5605 E16810 -  
N5550 E16835 - N5535 E16830 - N5555 E16750 - N5620 E16720 MOV E 30KT

FCST VA CLD +6 HR: 14/1115Z SFC/FL220 N5535 E16950 - N5540 E17130 -  
N5500 E17255 - N5420 E17225 - N5420 E17100  
FCST VA CLD +12 HR: 14/1715Z SFC/FL220 N5440 E17230 - N5410 E17440 -  
N5445 E17615 - N5335 E17725 - N5245 E17540 - N5305 E17415 - N5350  
E17305  
FCST VA CLD +18 HR: 14/2315Z SFC/FL200 N5400 E17505 - N5245 E17850 -  
N5315 W17910 - N5215 W17735 - N5115 E17950 - N5150 E17715

RMK: PLS SEE ALSO FVAK23 PAWU ISSUED BY ANCHORAGE WHICH DESCRIBES  
CONDITION OVER OR NEAR THE TOKYO AREA.  
NXT ADVISORY: 20150414/1200Z=

Forecast of volcanic ash extent at T+6, 12 and 18

# Example of VAG (VAA in graphic)



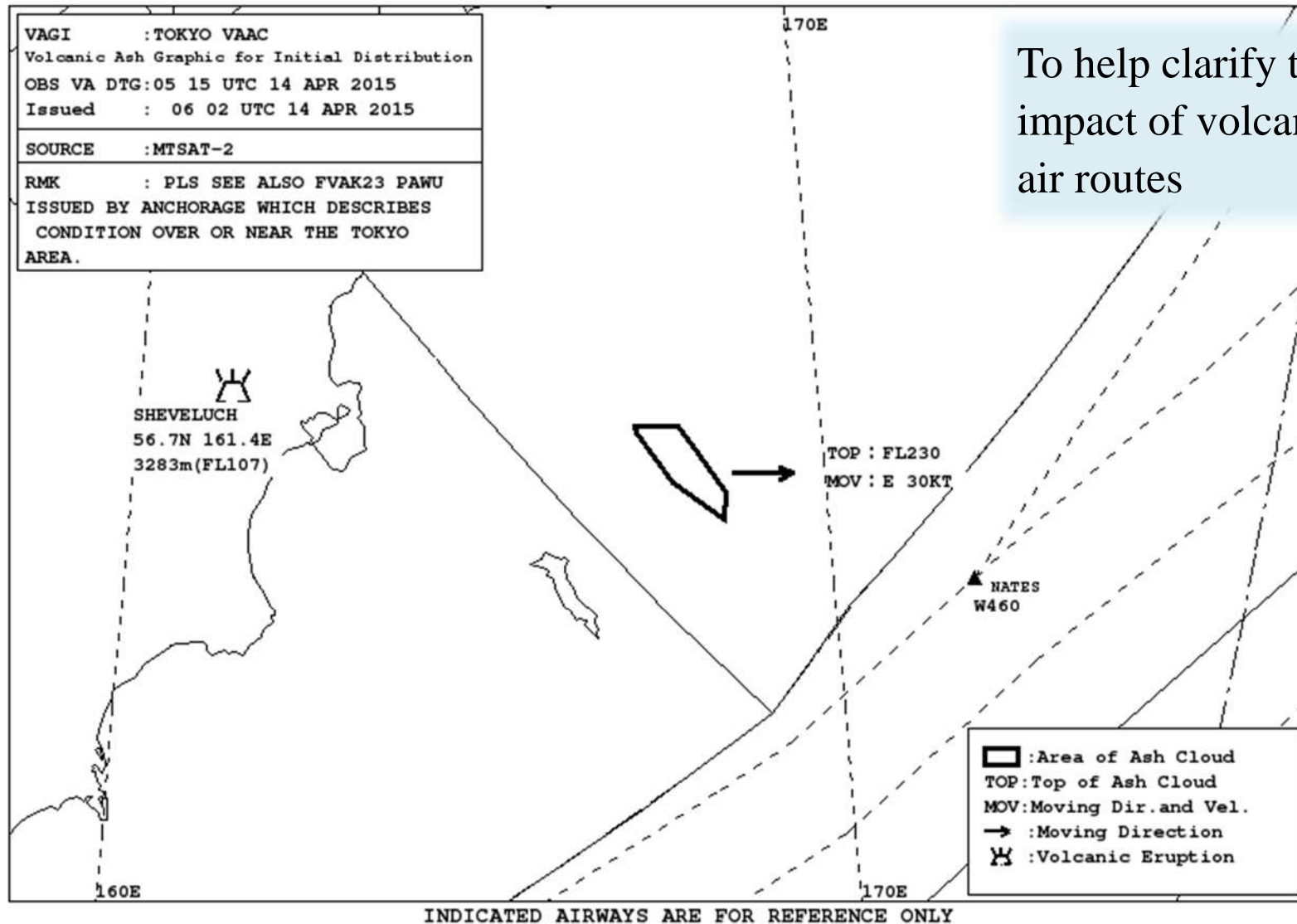
VAG depicts extent and forecast movement of ash clouds described in corresponding VAA text.

VA ADVISORY  
 DTG: 20150414/0602Z  
 VAAC: TOKYO  
 VOLCANO: SHEVELUCH 300270  
 AREA: RUSSIA  
 SUMMIT ELEV: 3283M  
 ADVISORY NR: 2015/164  
 INFO SOURCE: MTSAT-2  
 AVIATION COLOUR CODE: NIL

ERUPTION DETAILS: VA CONTINUOUSLY OBS ON SATELLITE IMAGERY  
 RMK: PLS SEE ALSO FVAK23 PAWU ISSUED BY ANCHORAGE WHICH  
 DESCRIBES CONDITION OVER OR NEAR THE TOKYO AREA.  
 NXT ADVISORY: 20150414/1200Z

# Example of VAGI (VAG for initial distribution)

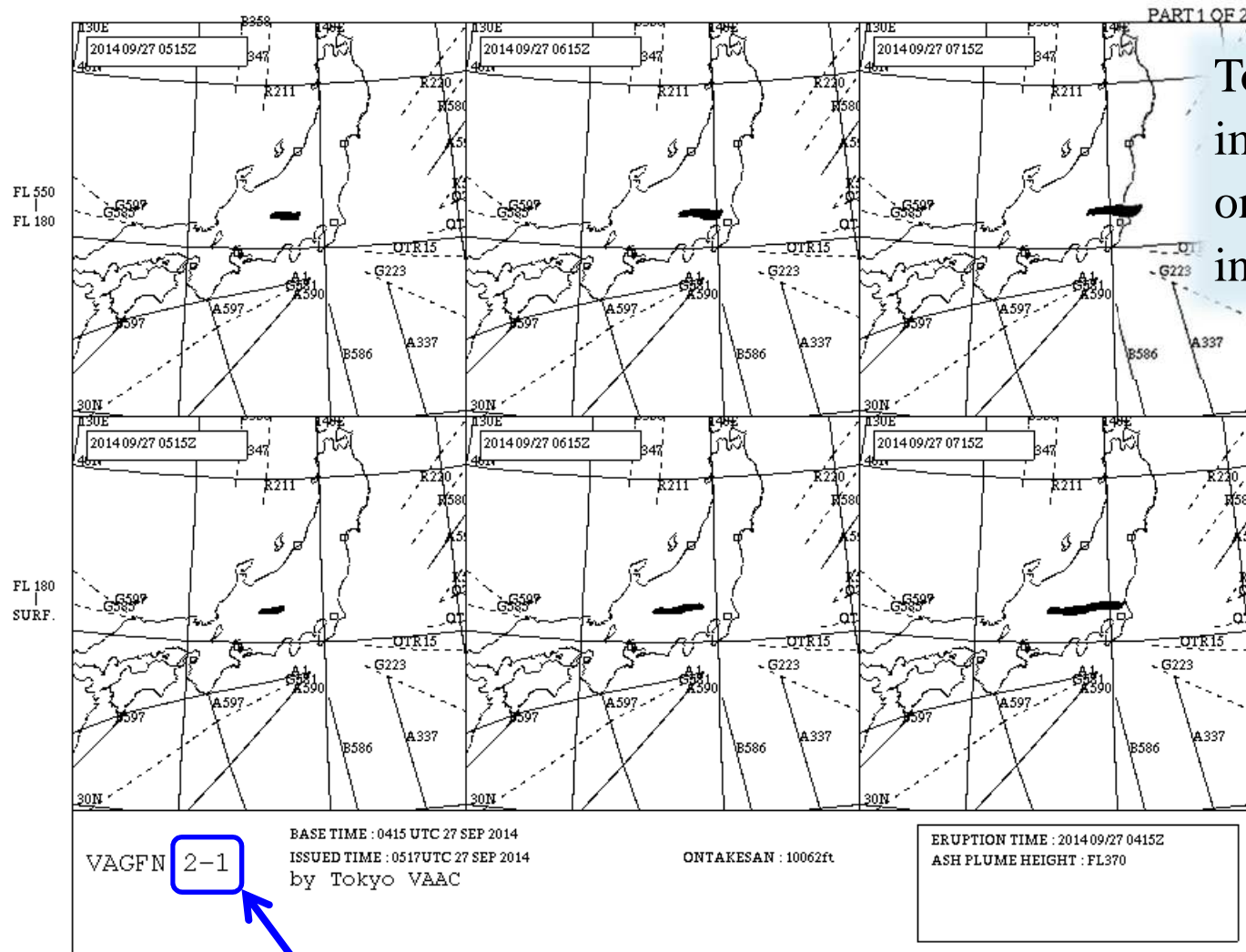
The latest extent of volcanic ash identified from satellite imagery



To help clarify the current impact of volcanic ash on air routes

# Example of VAGFN (VAG forecast for narrow area)

Hourly volcanic ash trajectory forecast distributions for domestic volcanoes up to 6 hours ahead; updated as a minimum at 6-hour intervals

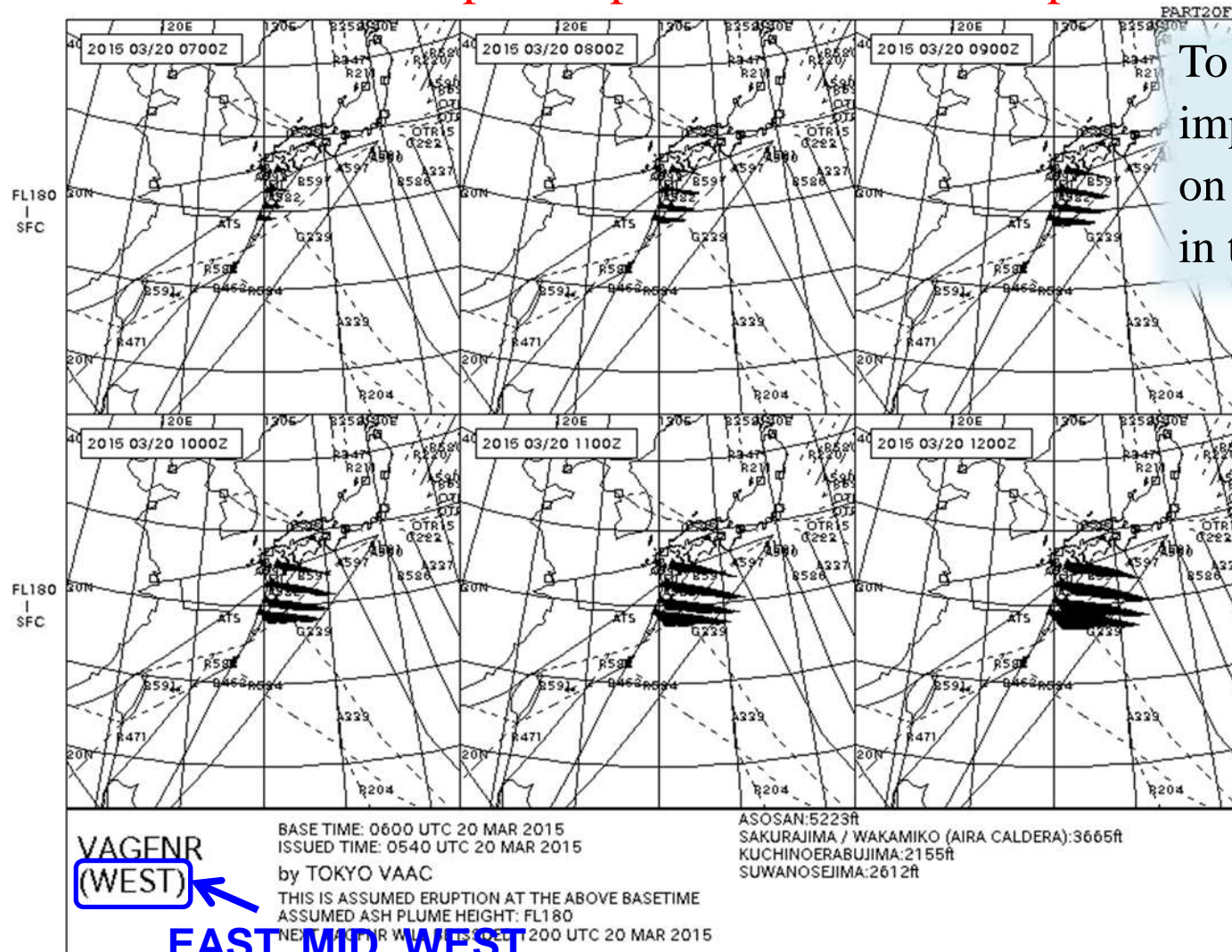


To assess the future impact of volcanic ash on domestic air routes in detail

2 pages

# Example of VAGFNR (VAGFN of hypothetical routine eruption)

Hourly volcanic ash trajectory hypothetical forecast distributions for domestic volcanoes thought to be at high risk of eruption, with the assumption of a continuous eruption up to 6 hours ahead; updated at 6-hour intervals

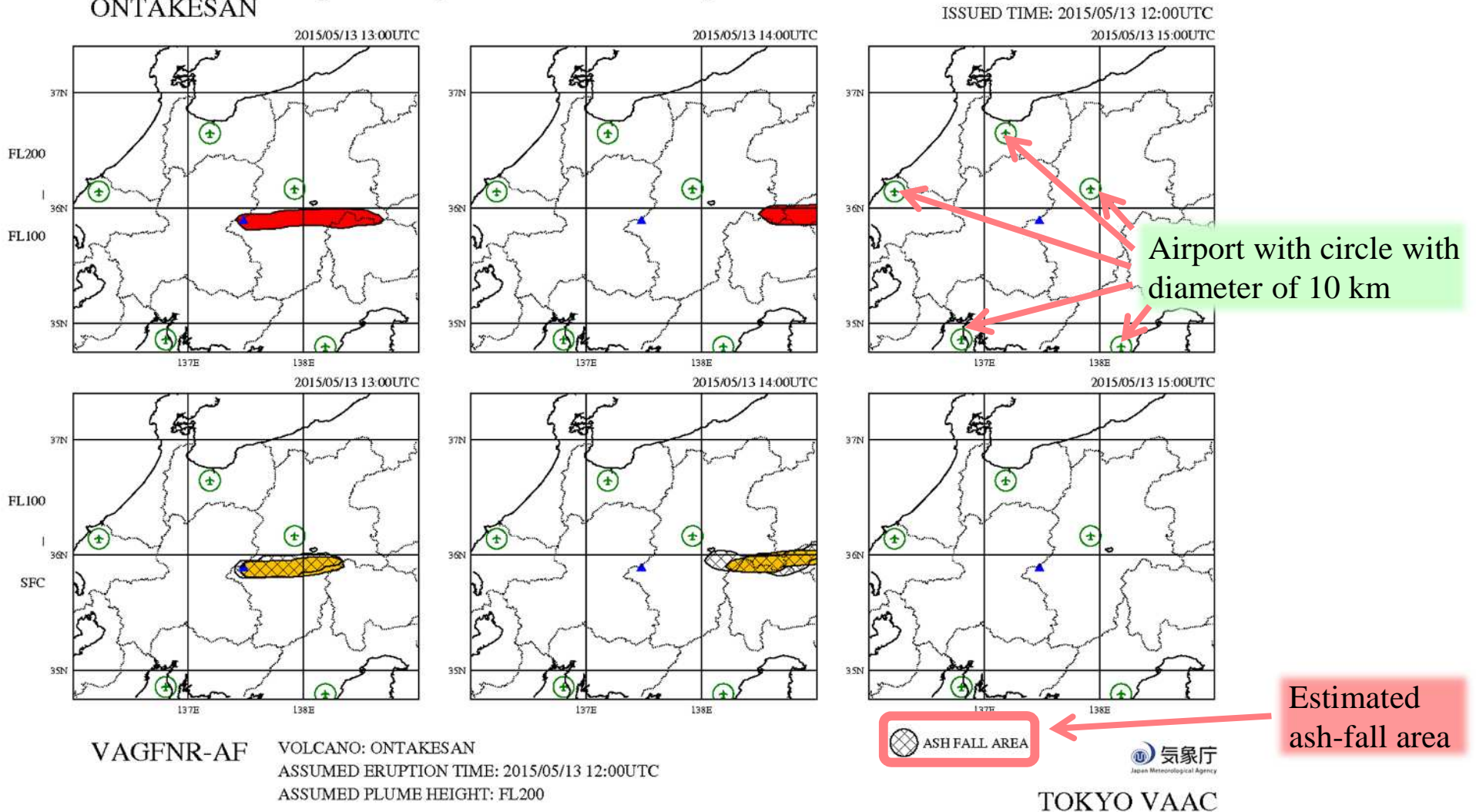


To assess the future impact of volcanic ash on domestic air routes in the event of an eruption

# Example of VAGFNR-AF (VAGFNR and ash fall)

Hourly volcanic ash trajectory and ash fall hypothetical forecast distributions for domestic volcanoes thought to be at high risk of eruption, with the assumption of a continuous eruption up to 3 hours ahead; updated at 3-hour intervals

Estimation of ash dispersion/deposition for assumed eruption of ONTAKESAN





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# Active volcanoes in responsible area of VAAC Tokyo

Eruption of Sakurajima in 18 August 2013

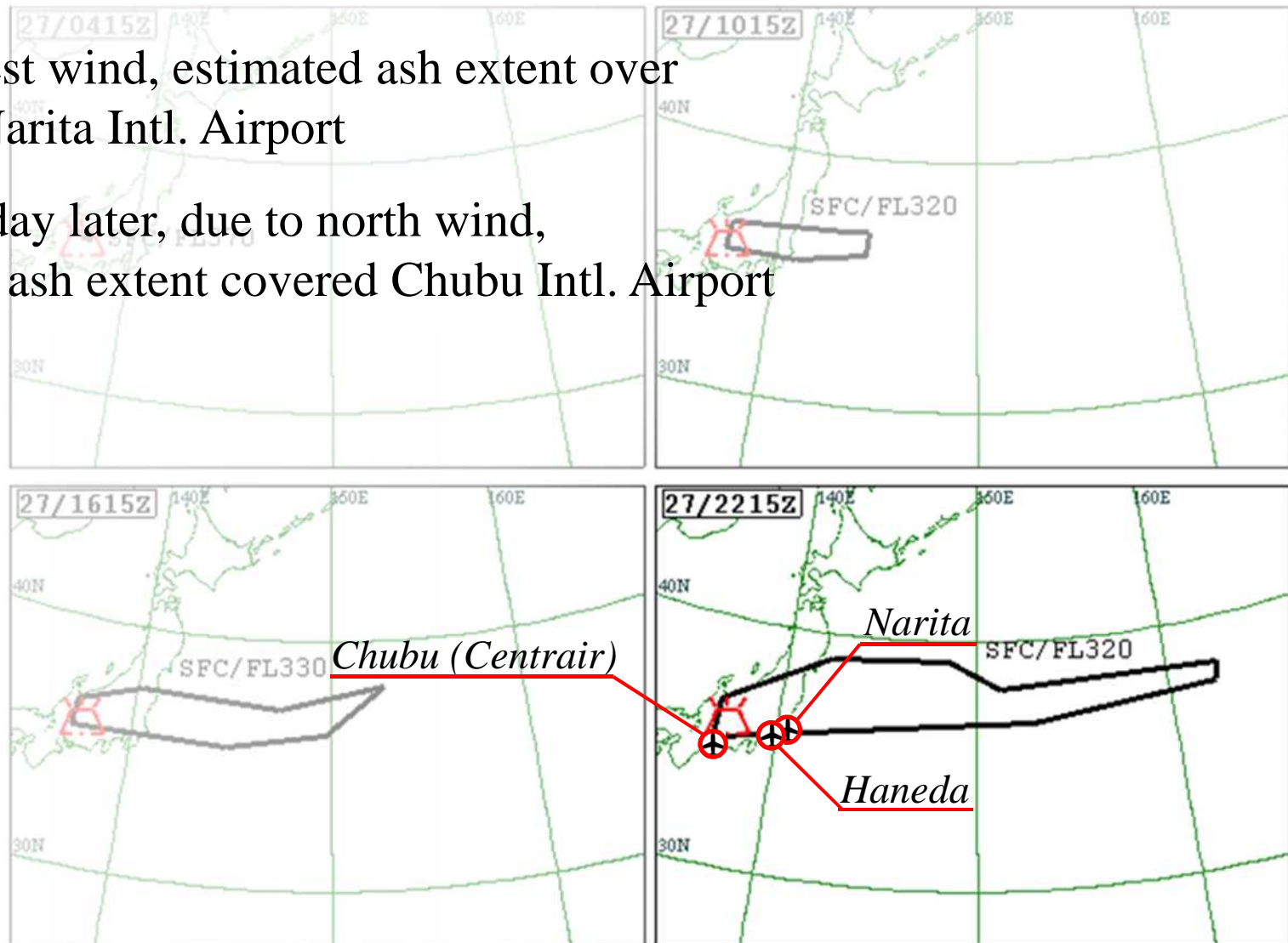


Eruption of Kuchinoerabu-jima in 29 May 2015

# Case study during the eruption of Mt. Ontake in 2014

Estimated ash extent in VAAs/VAGs covered international airports.

- due to west wind, estimated ash extent over Haneda/Narita Intl. Airport
- around 1 day later, due to north wind, estimated ash extent covered Chubu Intl. Airport

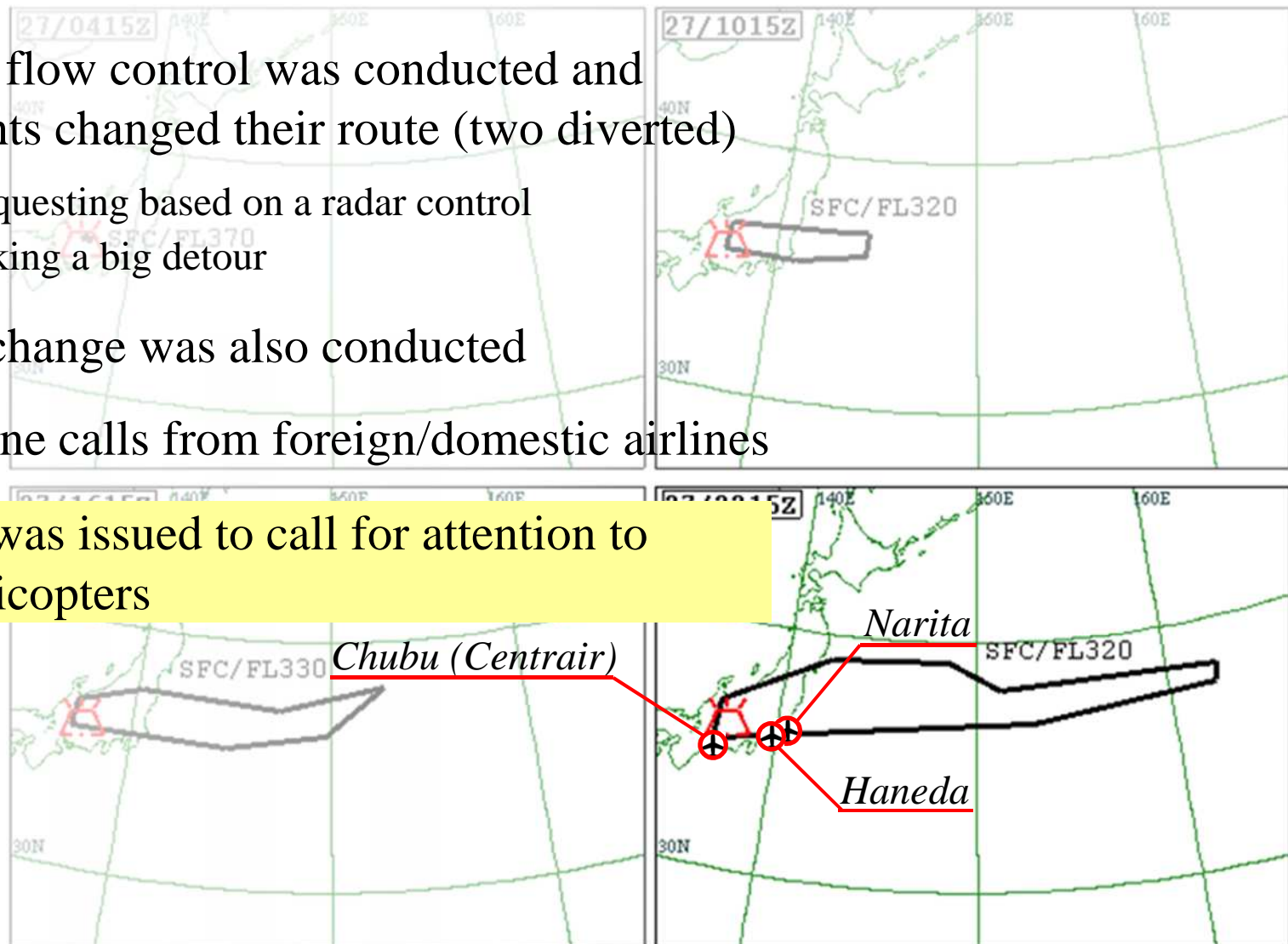


# Case study during the eruption of Mt. Ontake in 2014

Estimated ash extent in VAAs/VAGs covered international airports.

- Air traffic flow control was conducted and many flights changed their route (two diverted)
  - day : requesting based on a radar control
  - night: taking a big detour
- Capacity change was also conducted
- Many phone calls from foreign/domestic airlines

- NOTAM was issued to call for attention to rescue helicopters



# Necessary preparedness



For prompt response, relevant organizations need to be ready in

- issuing/obtaining/using information
- conducting air traffic flow control for re-routing
- smooth and appropriate communication and coordination

# Necessary preparedness

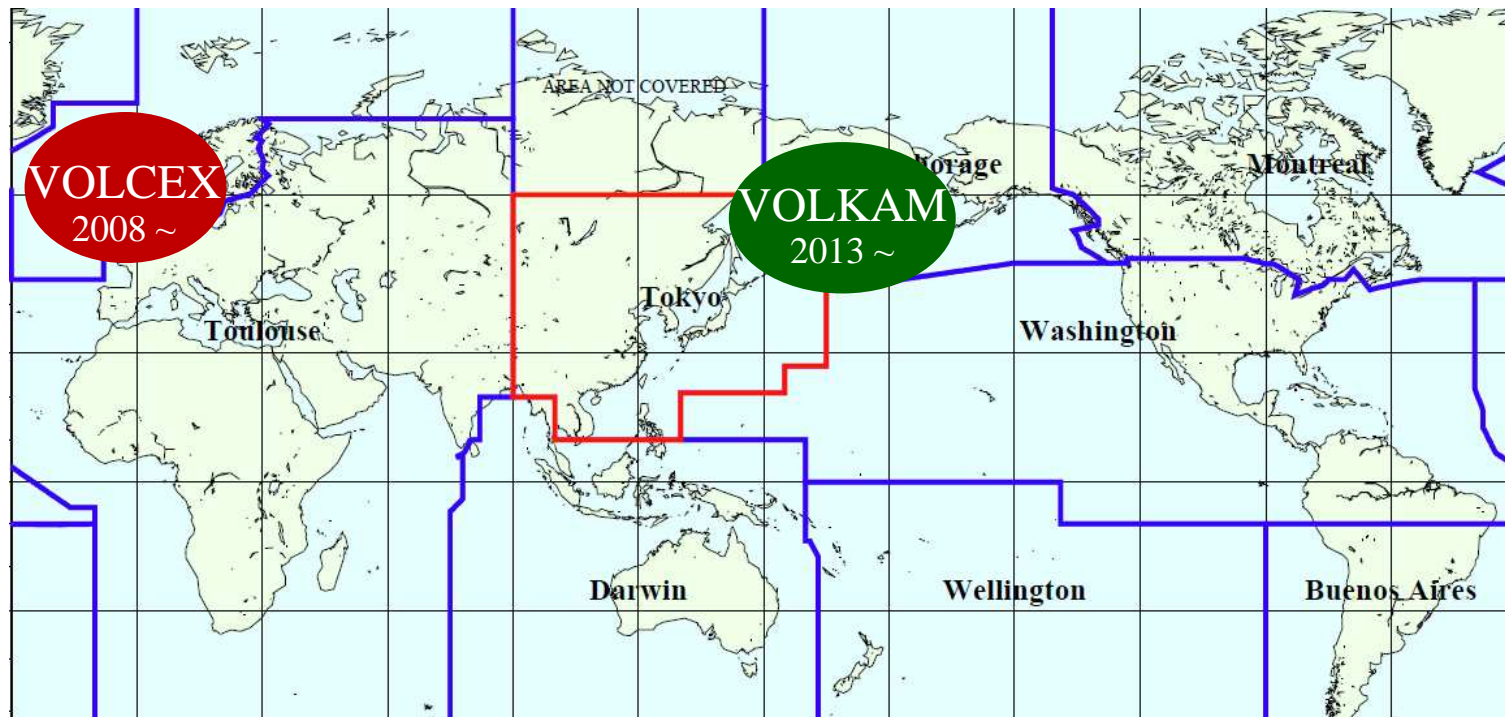
Aviation Safety



Avoid Volcanic Ash

## Volcanic Ash Exercises

aiming at building a proper scheme against volcanic ash including smooth communication/coordination between relevant organizations

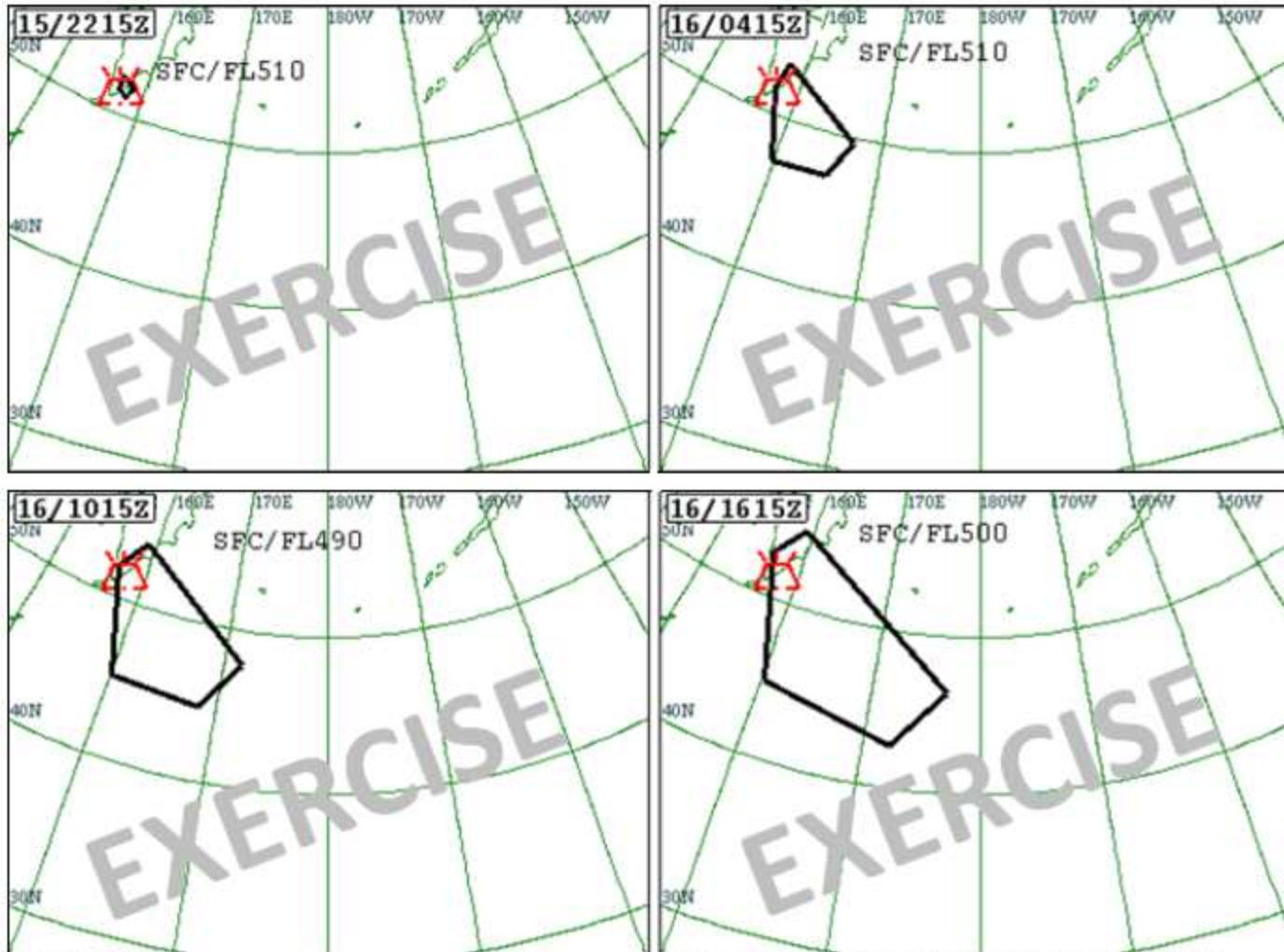


# VOLKAM15

21:45 (UTC)	Ksudach (Kamchatka, Russia)	EXPLOSIVE ERUPTION STARTS
22:00	Volcano Observatory (KVERT)	Phone call to Yelizovo MWO providing info related to the eruption; VO send VONA
Sequentially	Yelizovo MWO	Issues first SIGMET to VAAC Tokyo, MATMC, PK ACC and others
22:10	VAAC Tokyo	Issues first VAA to MATMC and other key players concerned
Sequentially	MATMC and PK ACC	MATMC requests Moscow NOF to issue NOTAM
Sequentially	Moscow NOF	Issues NOTAM and indicates colour code RED
Sequentially	AVO	Conduct telephone notification to US and Canadian agencies
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.	.	.

# VOLKAM15

VOLCANIC ASH ADVISORY INFORMATION IN GRAPHICAL FORMAT MODEL VAG



VA ADVISORY  
DTG: 20150415/2300Z  
VAAC: TOKYO  
VOLCANO: KSUDACH 300050  
AREA: RUSSIA  
SUMMIT ELEV: 1079M  
ADVISORY NR: 9999/2

INFO SOURCE: EXERCISE VOLKAM15 MTSAT-2 KVERT  
AVIATION COLOUR CODE: NIL  
ERUPTION DETAILS: EXERCISE ERUPTION AT 20150415/2145Z FL510 EXTD SE  
MOV 60KT REPORTED  
RMK: EXERCISE VOLKAM15 NIL EXERCISE EXERCISE EXERCISE  
NXT ADVISORY: 20150416/0300Z



# Necessary preparedness

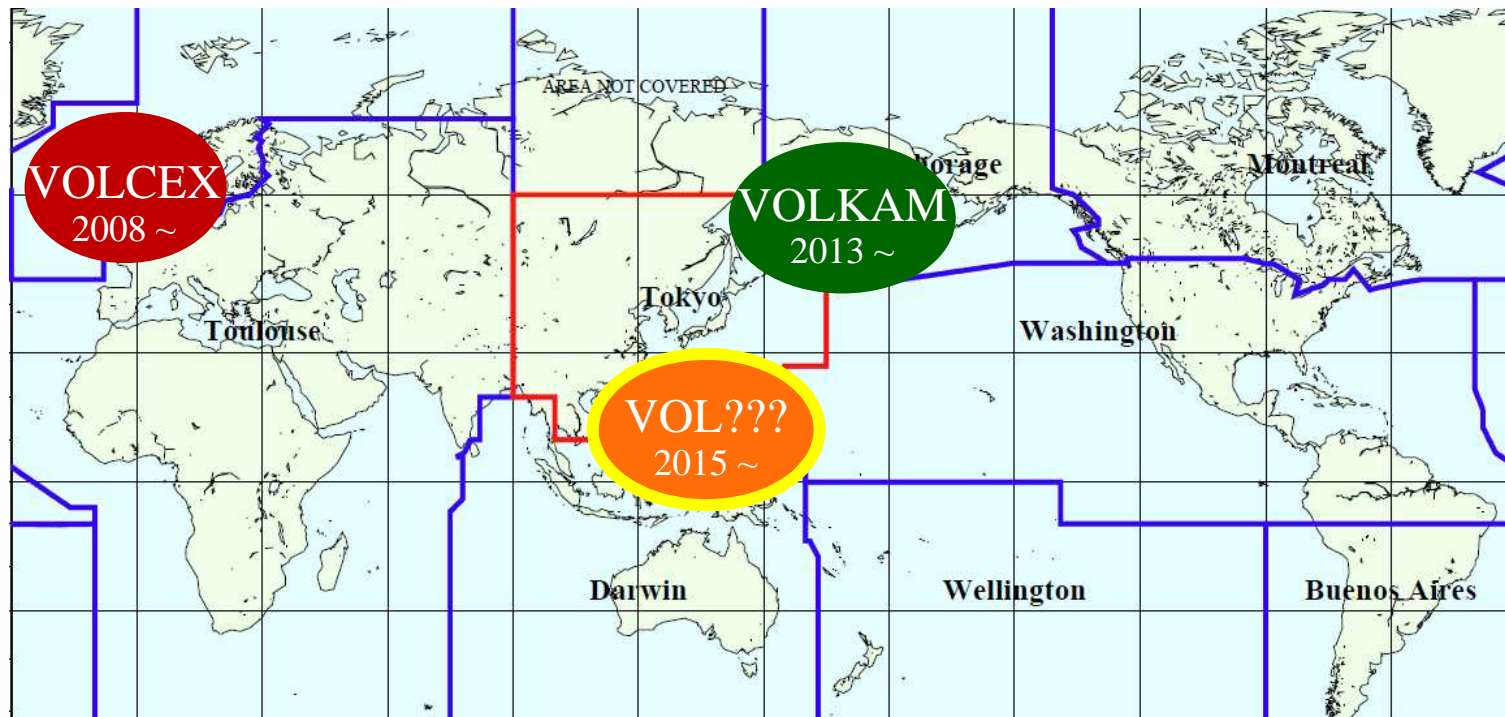
Aviation Safety



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aiming at building a proper scheme against volcanic ash including smooth communication/coordination between relevant organizations



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# Conclusion

Once a volcano erupts, its impact onto air traffic is significant.



It is essential to avoid volcanic ash for aviation safety.

Various existing advisories would be a help for conducting smooth and appropriate air traffic management against volcanic ash

Thank you