Volcanic ash impacts on aviation operations

Volcanic Ash Advisory Centre Tokyo

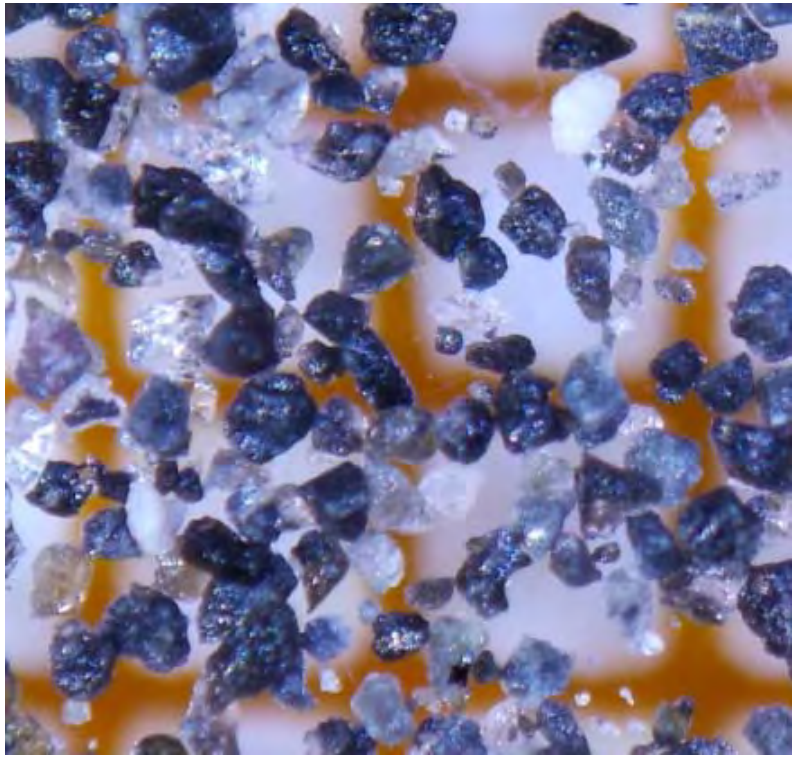
Japan Meteorological Agency

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
100μm（0.1 mm）	→	several hours
10μm（0.01 mm）	→	several days
1μm（0.001mm）	→	several years



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

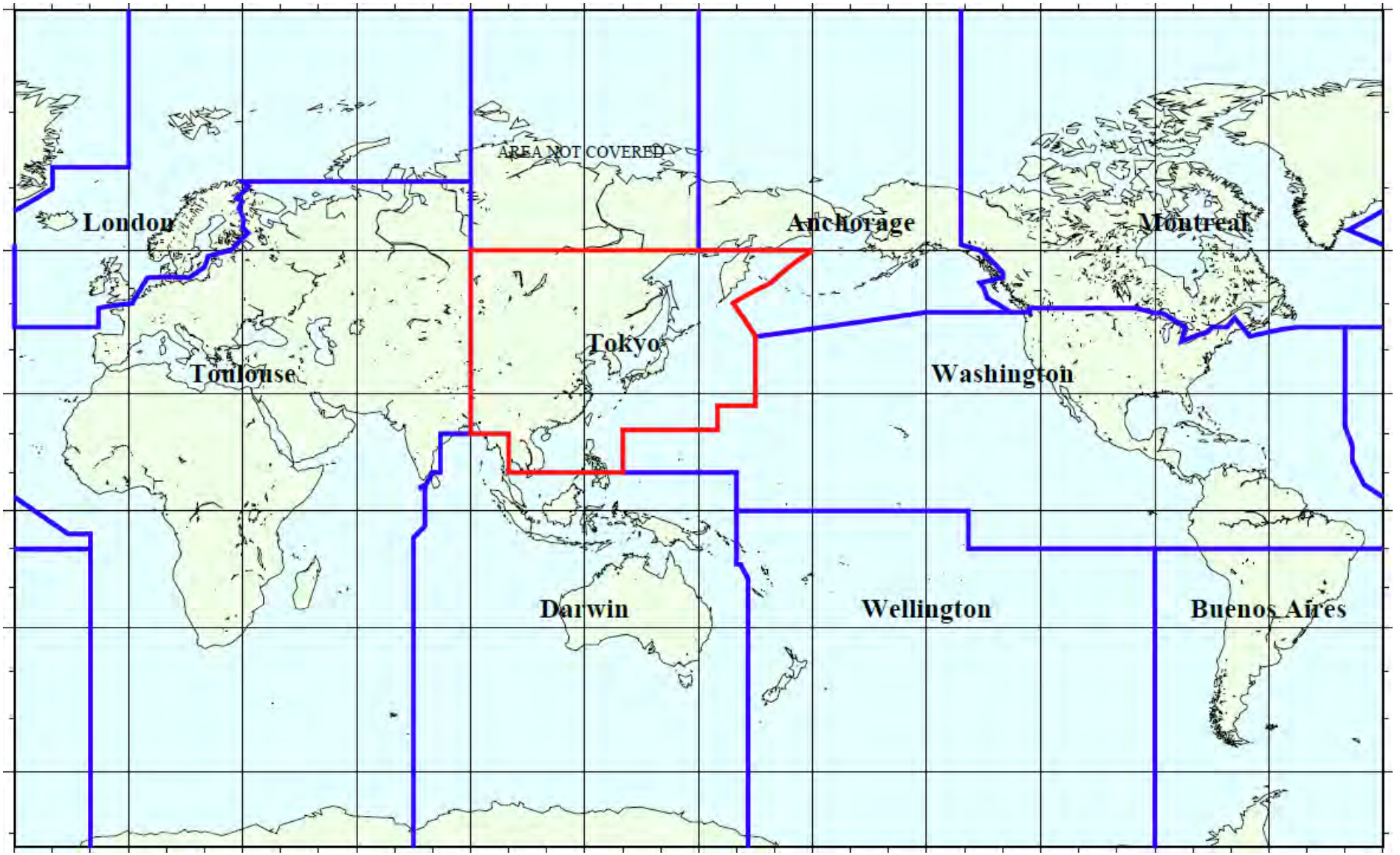
- engine failure
- poor visibility due to ash scratching windshields
- take-off/landing delays due to ash accumulation at airports

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 VAACs



Responsibility of VAAC Tokyo

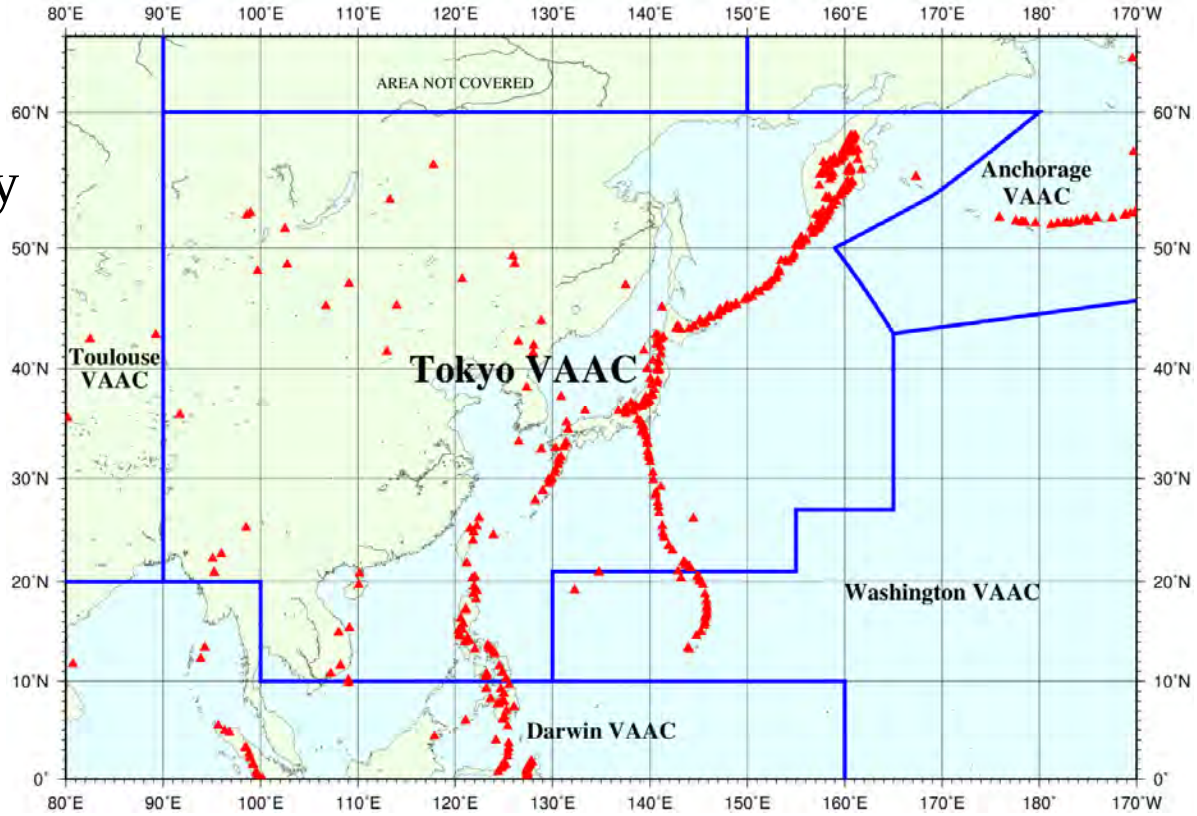
- Area of Responsibility

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

- Duty

  for the area of responsibility

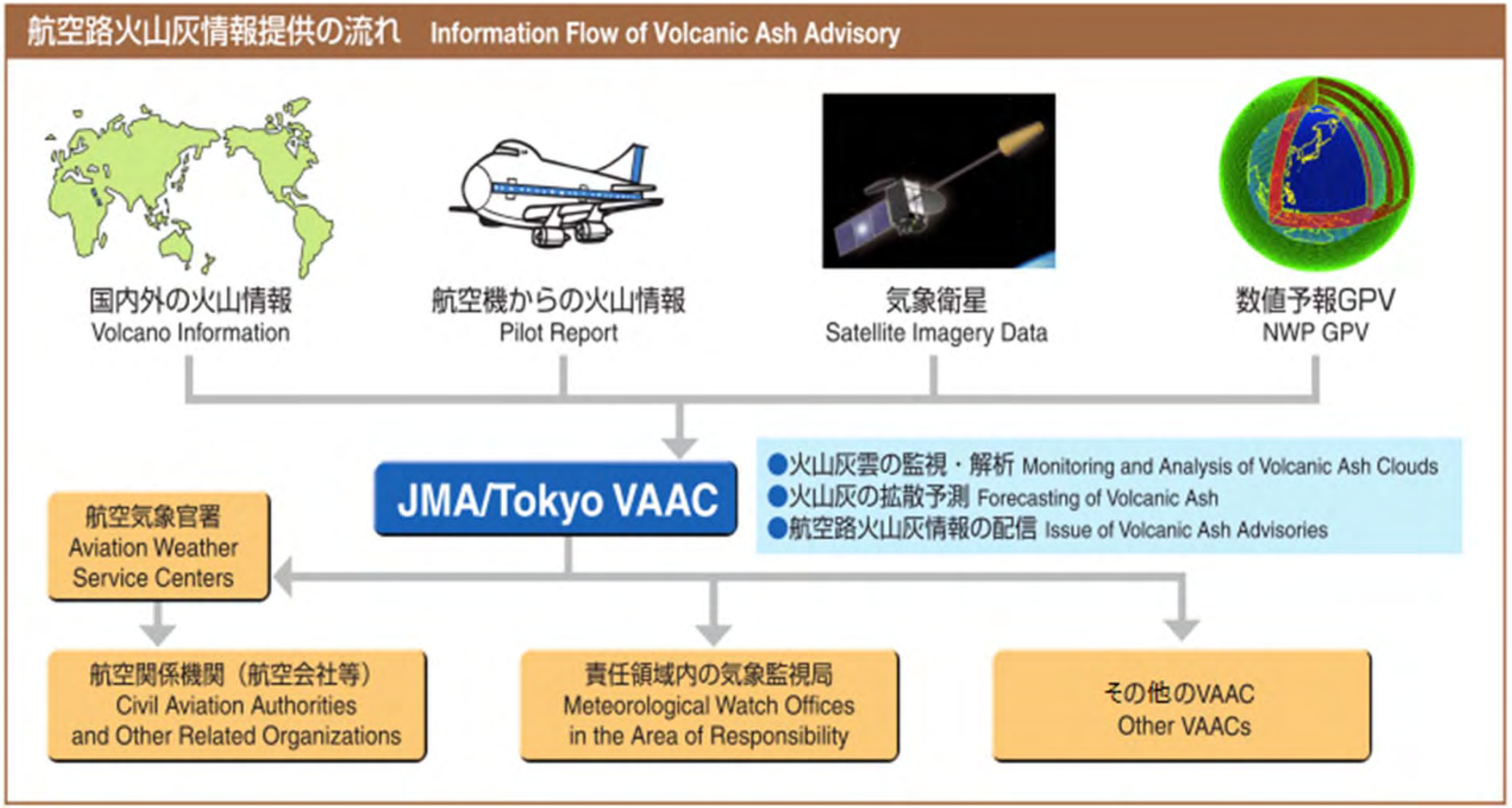
  - collect information on eruption/volcanic activity
  - monitor volcanic ash from satellite imagery
  - forecast ash extent
  - issue VAAs



: boundary of area of responsibility

: active volcano

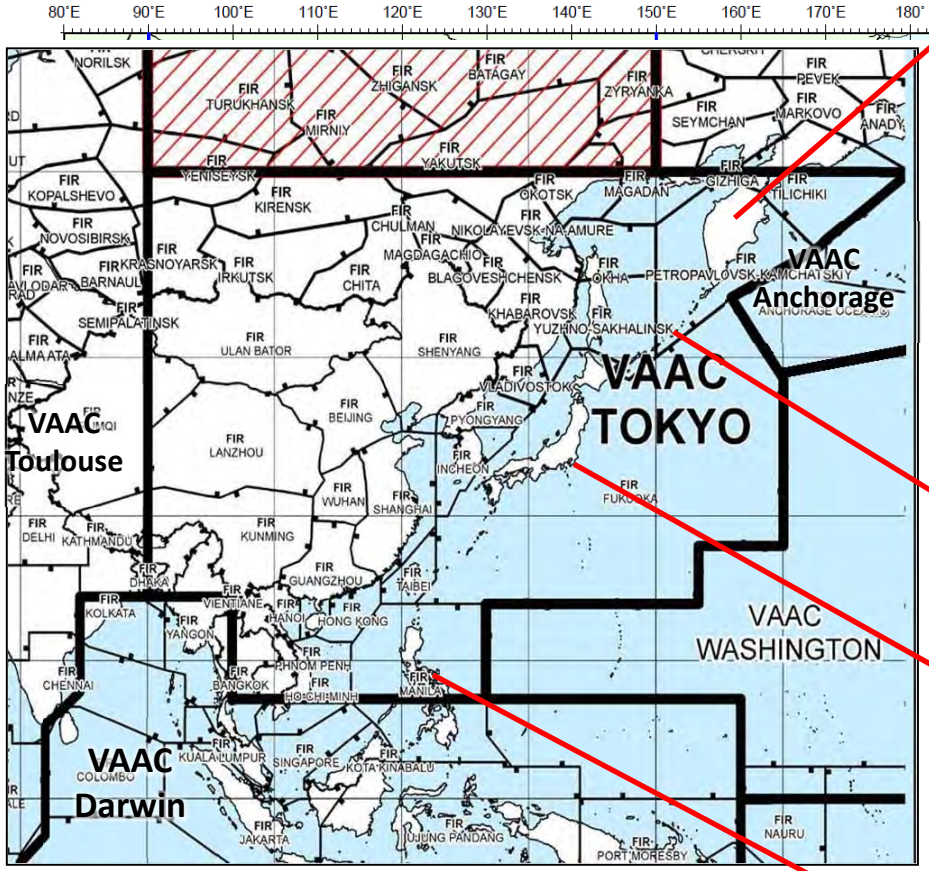
Information flow



Satellite or other info source → VAAC issues advisories → MWO issues SIGMETs → AISC issues NOTAMs → Airlines take a detour or change destination

Information sources

Satellite
- MTSAT-2
- NOAA



MWO: Meteorological Watch Office
AVO: Alaska Volcano Observatory
KVERT: Kamchatka Volcanic Eruption Response Team
KBGS: Kamchatka Branch of Geophysical Survey
SVERT: Sakhalin Volcanic Eruption Response Team
VOIC: Volcanic Observation and Information Center
PHIVOLCS: Philippine Institute of Volcanology and Seismology

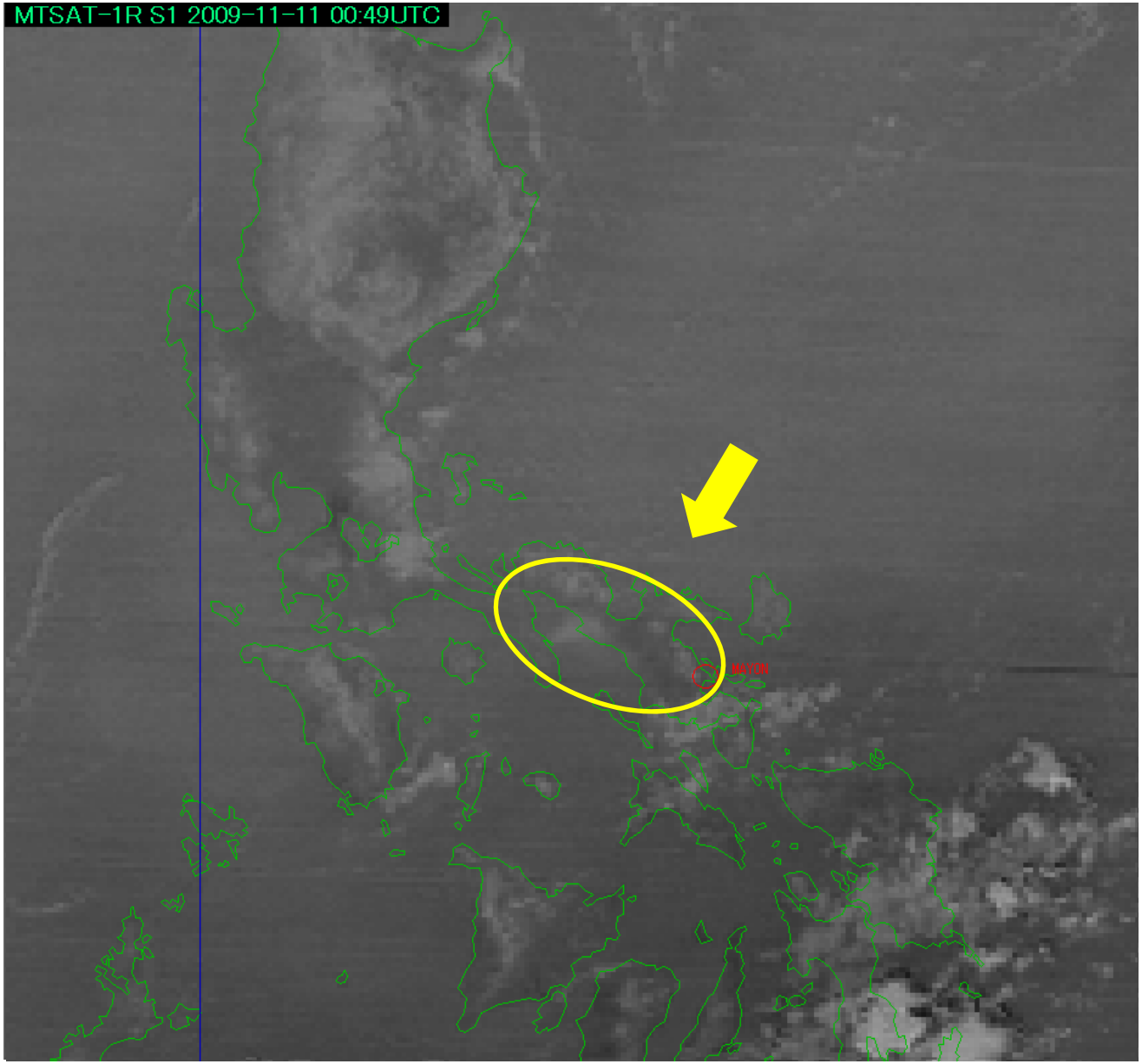
Kamchatka Peninsula
- AVO
- KVERT
- KBGS
- MWO (Petropavlovsk-Kamchatsky)
- VAAC Anchorage
- VAAC Washington

Chishima/Kurile Islands
- SVERT

Japan
- JMA(VOICs)
- Pilot Report

Philippines
- PHIVOLCS
- MWO (Manila)
- MWO (Legaspi)
- VAAC Darwin

Example of satellite imagery



Mayon

11 Nov. 2009

Example of VONA
(Volcano Observatory Notices for Aviation)

KVERT

KVERT/Volcano Observatory Notification to Aviation

(1) **VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)**	
(2) Issued:	20150513/0159Z
(3) Volcano:	Klyuchevskoy (CAVW #300260)
(4) Current Aviation Color Code:	YELLOW
(5) Previous Aviation Color Code:	orange
(6) Source:	KVERT
(7) Notice Number:	2015-171
(8) Volcano Location:	N 56 deg 3 min E 160 deg 38 min
(9) Area:	Kamchatka, Russia
(10) Summit Elevation:	15580 ft (4750 m)
(11) Volcanic Activity Summary:	Strong and moderate gas-steam activity of the volcano continues. Magnitude of volcanic tremor was 0.2-0.4 mcm/s last week. Satellite data showed a very weak thermal anomaly over the volcano on May 08-09. Gas-steam activity of the volcano continues. Aerosol plumes could affect low-flying aircraft.
(12) Volcanic cloud height:	NO ASH CLOUD PRODUSED
(13) Other volcanic cloud information:	NO ASH CLOUD PRODUSED
(14) Remarks:	
(15) Contacts:	Dr. Olga A. Girina, Head of KVERT, IVS FEB RAS girina@kscnet.ru +74152302549 Duty scientist: +79622825253
(16) Next Notice:	A new VONA will be issued if conditions change significantly or the Aviation Color Code is changes. VONAs are posted at http://www.kscnet.ru/ivs/kvert/index_eng.php. In Russia, KVERT, on behalf of the Institute of Volcanology and Seismology (IVS) FED RAS, is responsible for providing information on volcanic activity to international air navigation services for the airspace users.

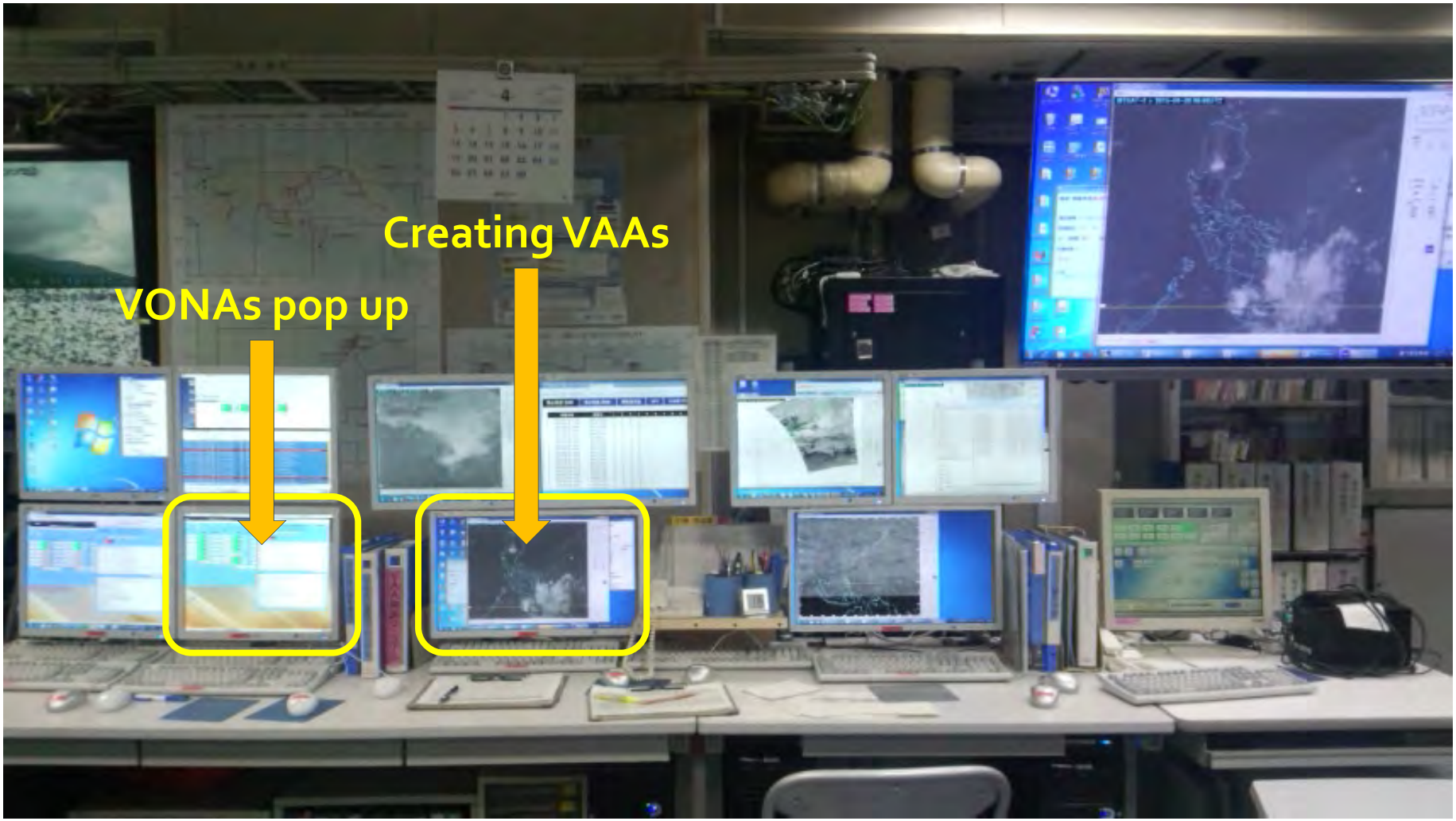
PHIVOLCS

Republic of the Philippines
Department of Science and Technology
PHILIPPINE INSTITUTE OF VOLCANOLOGY AND SEISMOLOGY
PHIVOLCS Bldg., C.P. Garcia Ave., University of the Philippines Campus, Diliman, Quezon City
Tels. 426-1468 to 79; 928-2230; 926-7749; 926-9338
Telefax - 927-10-95

PHIVOLCS DOST

(1) **VOLCANO OBSERVATORY NOTICE FOR AVIATION (VONA)**	
(2) Issued:	(20150506/1346Z)
(3) Volcano:	Bulusan (CAVW# 0703-01=)
(4) Current Aviation Color Code:	
(5) Previous Aviation Color Code:	
(6) Source:	Bulusan Volcano Observatory (PHIVOLCS)
(7) Notice Number:	PIVS-VONA-BV-20150506-1
(8) Volcano Location:	N 12 deg 46 min E 124 deg 3 min
(9) Area:	Sorsogon
(10) Summit Elevation:	5135 ft (1565 m)
(11) Volcanic Activity Summary:	Steam explosion column 250m high occurred at 9:46pm at NW vents
(12) Volcanic Cloud Height:	820 ft (250 m)
(13) Other volcanic cloud information:	The clouds reached 250 meters above the summit and drifted W (West).
(14) Remarks:	
(15) Contacts:	Philippine Institute of Volcanology and Seismology Volcano Monitoring and Eruption Prediction Division vmepd@phivolcs.dost.gov.ph (632) 927-1095; (632) 426-1468 loc 127
(16) Next Notice:	A new VONA will be issued if conditions change significantly or alert levels are modified. While a VONA is in effect, regularly scheduled updates are posted at http://www.phivolcs.dost.gov.ph

VAAC Tokyo's operation room



Example of VAA (text)

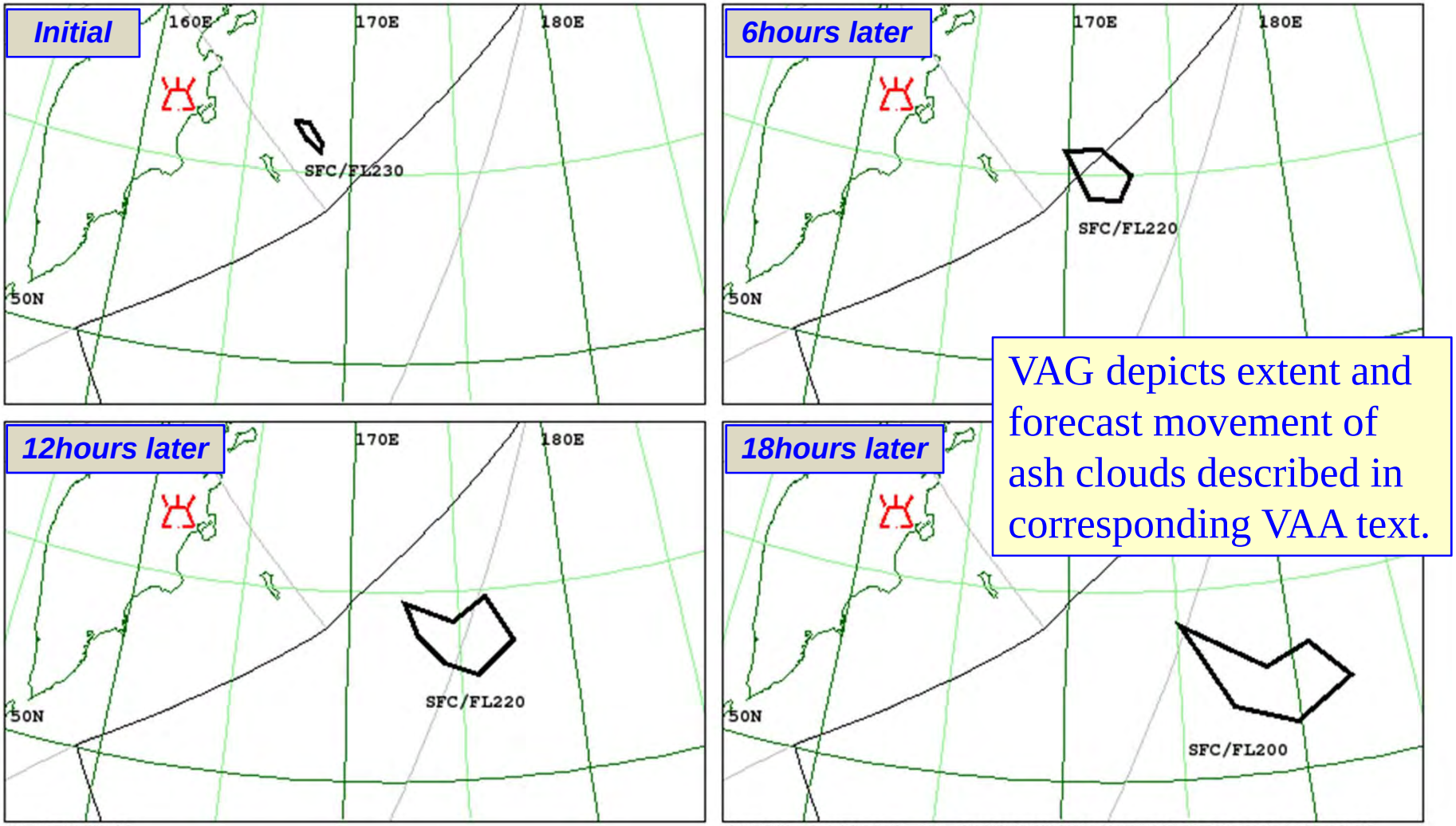
① FVFE01 RJTD 140602
② VA ADVISORY
③ DTG: 20150414/0602Z
④ VAAC: TOKYO
⑤ VOLCANO: SHEVELUCH 300270
⑥ PSN: N5639 E16122
⑦ AREA: RUSSIA
⑧ SUMMIT ELEV: 3283M
⑨ ADVISORY NR: 2015/164
⑩ INFO SOURCE: MTSAT-2
⑪ AVIATION COLOUR CODE: NIL
⑫ ERUPTION DETAILS: VA CONTINUOUSLY OBS ON SATELLITE IMAGERY
⑬ OBS VA DTG: 14/0515Z
⑭ OBS VA CLD: SFC/FL230 N5620 E16715 - N5620 E16755 - N5605 E16810 - N5550 E16835 - N5535 E16830 - N5555 E16750 - N5620 E16720 MOV E 30KT
⑮ 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
⑯ RMK: PLS SEE ALSO FVAK23 PAWU ISSUED BY ANCHORAGE WHICH DESCRIBES CONDITION OVER OR NEAR THE TOKYO AREA.
⑰ NXT ADVISORY: 20150414/1200Z=

Volcano data, info source, eruption information

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

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

VAAC Tokyo's advisory on website

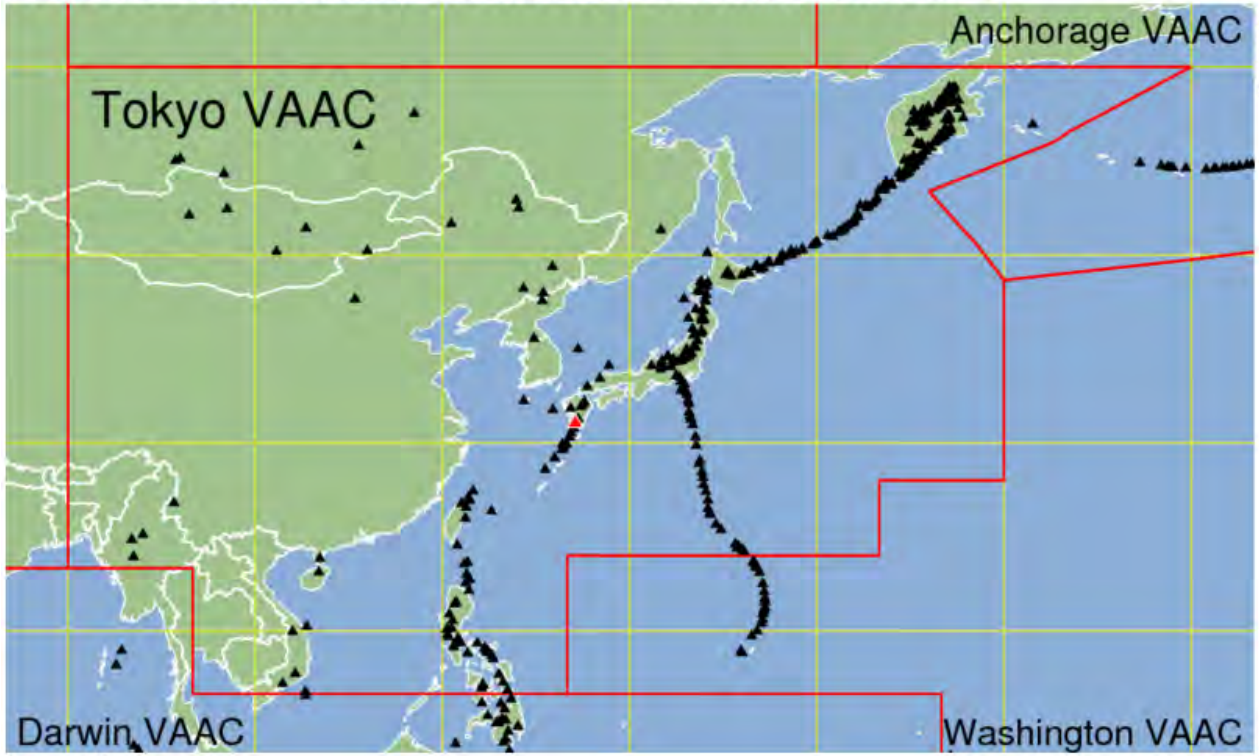
http://ds.data.jma.go.jp/svd/vaac/data/index.html

Tokyo VAAC Tokyo Volcanic Ash Advisory Center
Japan Meteorological Agency

▸日本語
Updated at 04:21 UTC, 14 May 2015

HOME | Volcanic Ash Advisories | VAGFNR | VAGFNR-AF | VAAC Operation | References

Latest Volcanic Ash Advisories within 24 hours



SAKURAJIMA / WAKAMIKO (AIRA CALDERA)

Legend:
▲ : volcanoes
▲ : volcanoes for which VAAs (Volcanic Ash Advisories) have been issued.
Click on a ▲ or the name of a volcano listed on the right to view its latest VAA.

As of 24 July, 2014, information of volcanoes in VAAs such as names, locations, volcano numbers and others are those in the database for VAA which is maintained by ICAO.
The database does not represent any formal position by ICAO.

VAAC Darwin's advisory on website

http://www.bom.gov.au/info/vaac/

Australian Government
Bureau of Meteorology

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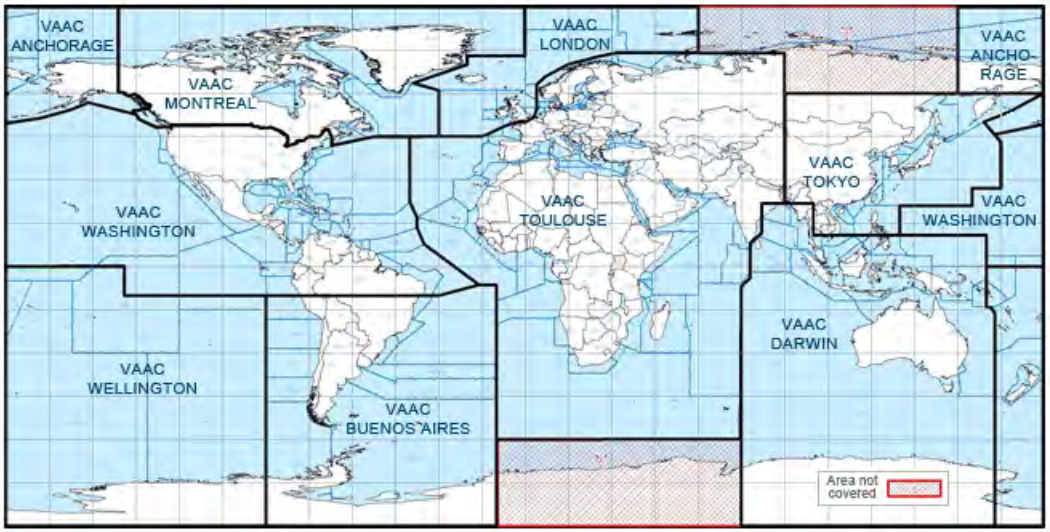
Keeping aircraft clear of volcanic ash

Nine Volcanic Ash Advisory Centres around the world advise the international aviation industry of the location and movement of clouds of volcanic ash. The area covered by the Darwin Volcanic Ash Advisory Centre includes Indonesia, Papua New Guinea and part of the Philippines. This area has seen some of the biggest eruptions known to history.



The above map shows the areas of the world that are covered by the nine Volcanic Ash Advisory Centres. The International Civil Aviation Organization has a downloadable Handbook on the International Airways Volcano Watch with details on how the warning system works - the Volcanic Ash Advisory Centres give specialist advice to Area Control Centres and Meteorological Watch Offices in the affected area, who then issue 'NOTAM' and 'SIGMET' warnings respectively to aircraft.

VAAC Washington's advisory on website

http://www.ssd.noaa.gov/VAAC/washington.html

NOAA Satellite and Information Service
National Environmental Satellite, Data and Information Service (NESDIS)

Office of Satellite and Product Operations

DOC / NOAA / NESDIS / OSPO / SPSD

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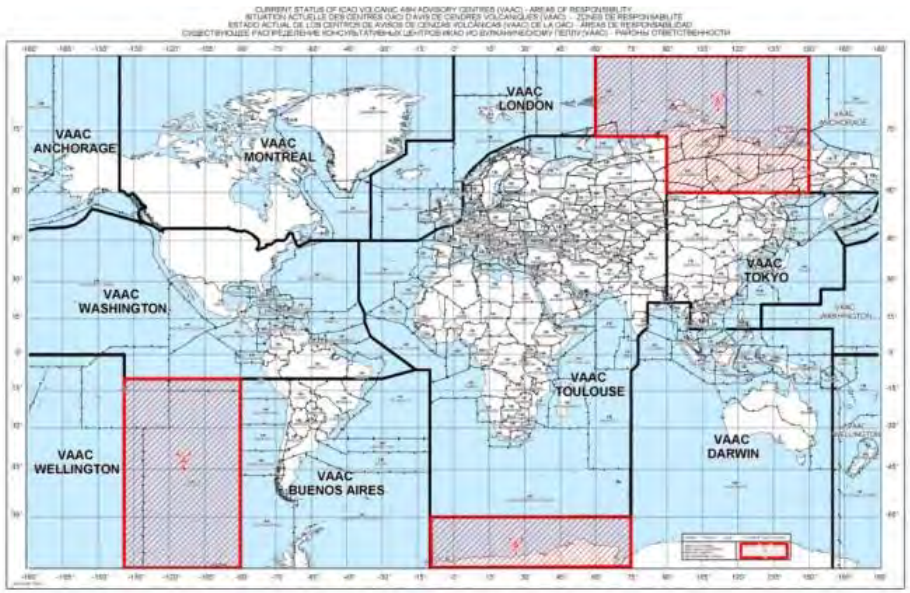
Washington DC
Volcanic Ash Advisory Center



ICAO Products

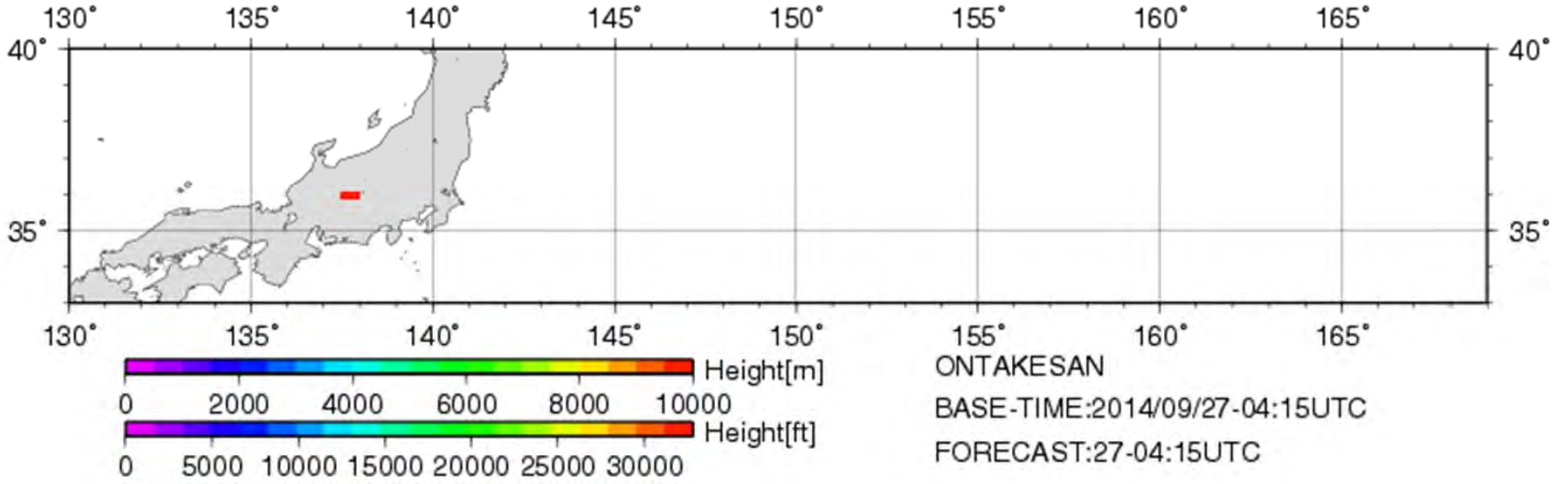
Volcanic Ash Advisories (VAA)

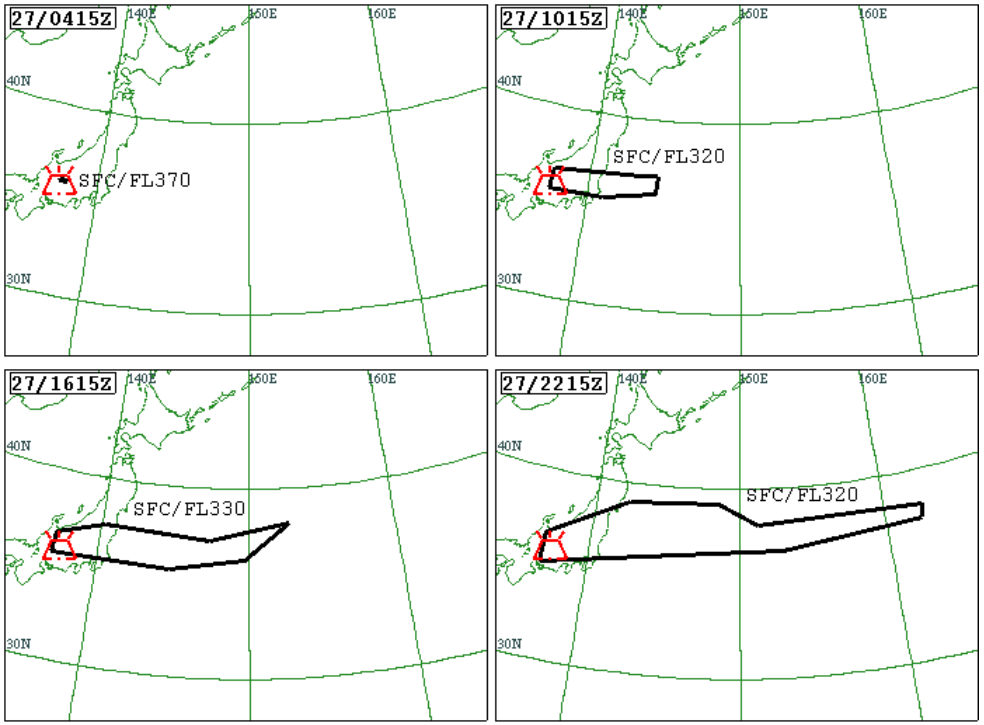
- Current Volcanic Ash Advisories
  - Updated in Real Time

Related Information

About The Washington VAAC Program
Other VAACs and their Volcanic Ash Advisories
Volcano Links

Case study during the eruption of Mt.Ontake in 2014





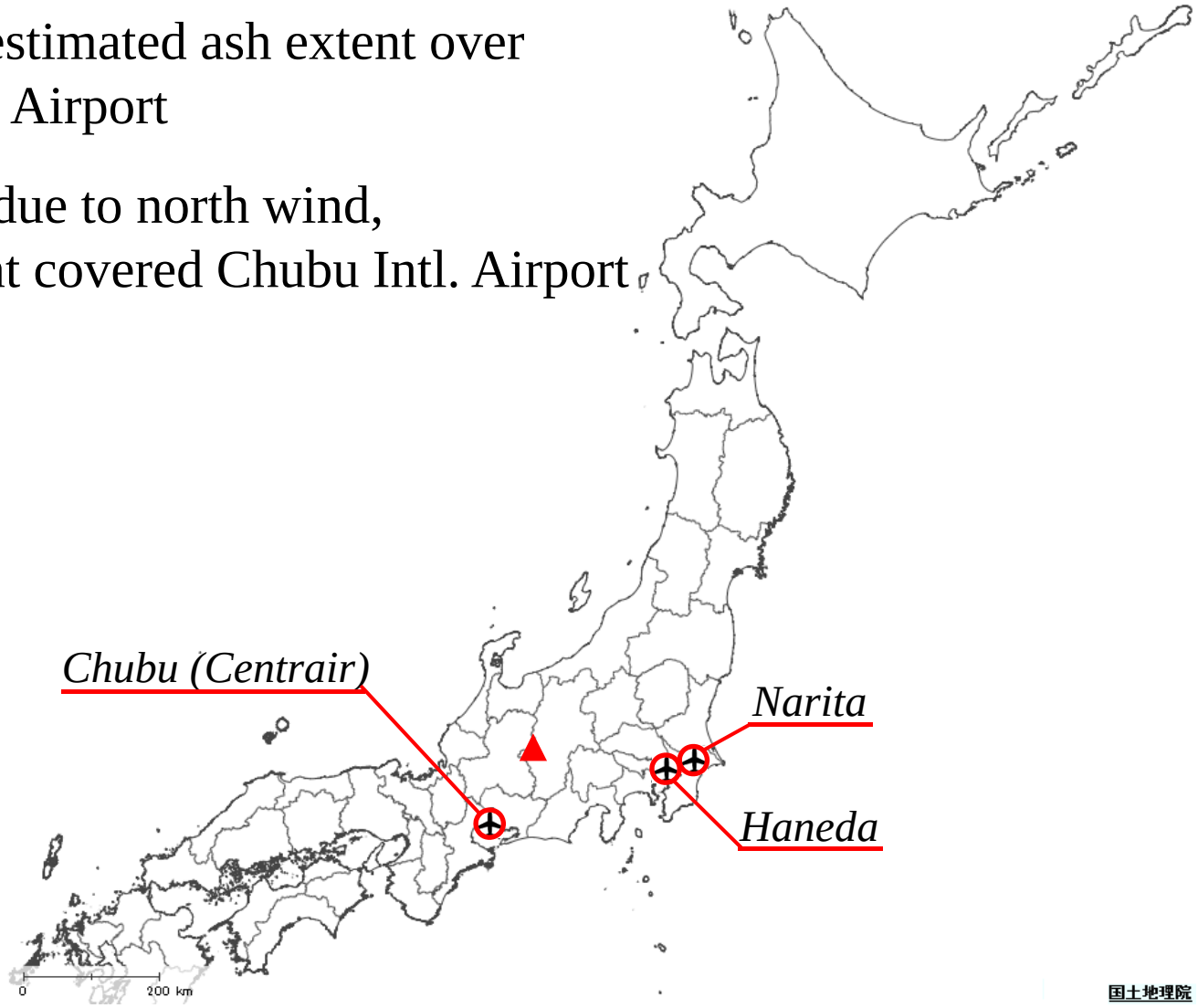
VAG

at 05:17Z on 27 Sep. 2014

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.

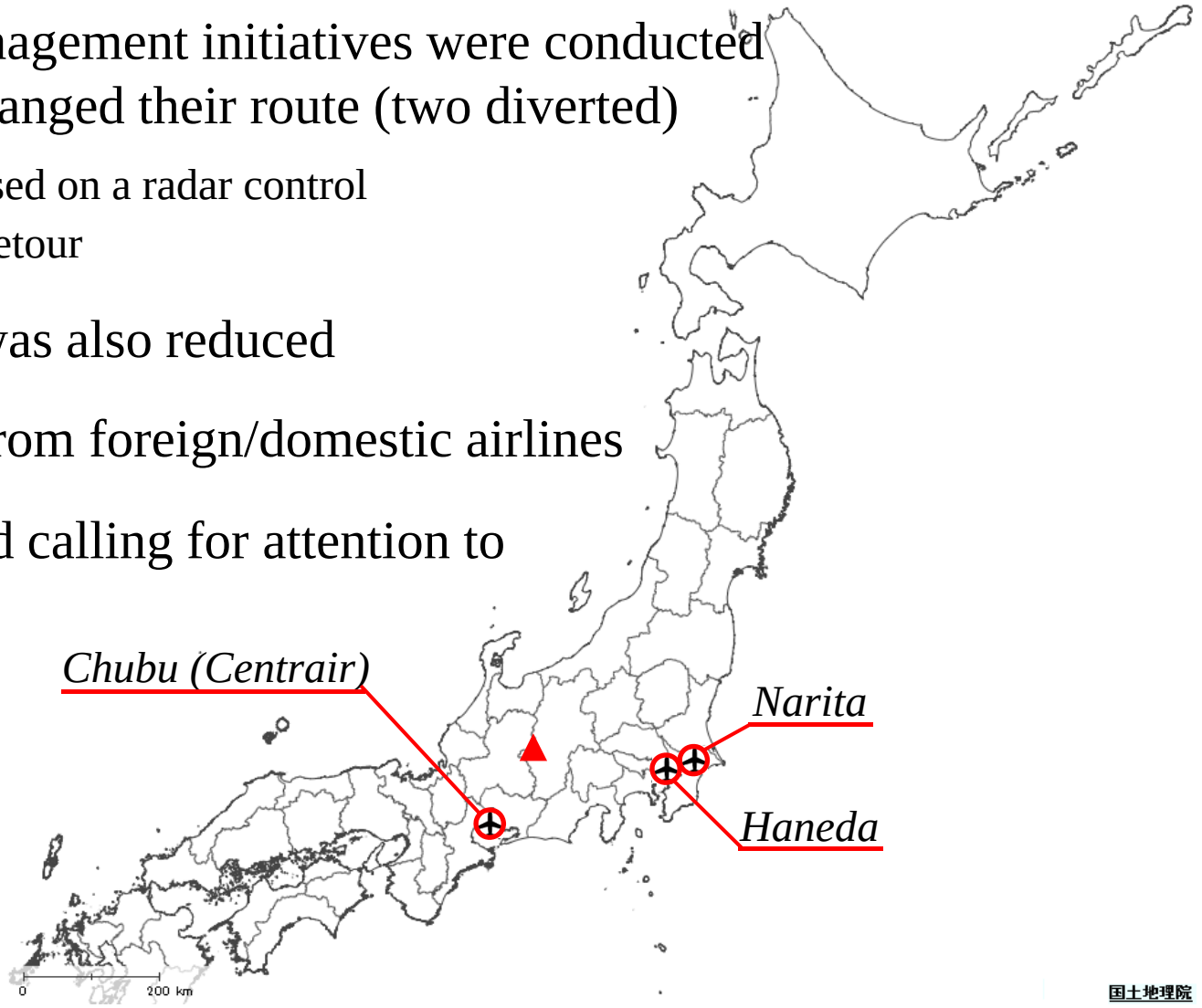
- Air traffic flow management initiatives were conducted and many flights changed their route (two diverted)

  day : requesting based on a radar control
  night: taking a big detour

- Airspace capacity was also reduced

- Many phone calls from foreign/domestic airlines

- NOTAM was issued calling for attention to rescue helicopters



Necessary preparedness

Aviation Safety  Avoid Volcanic Ash

For prompt response, relevant organizations need to be ready in

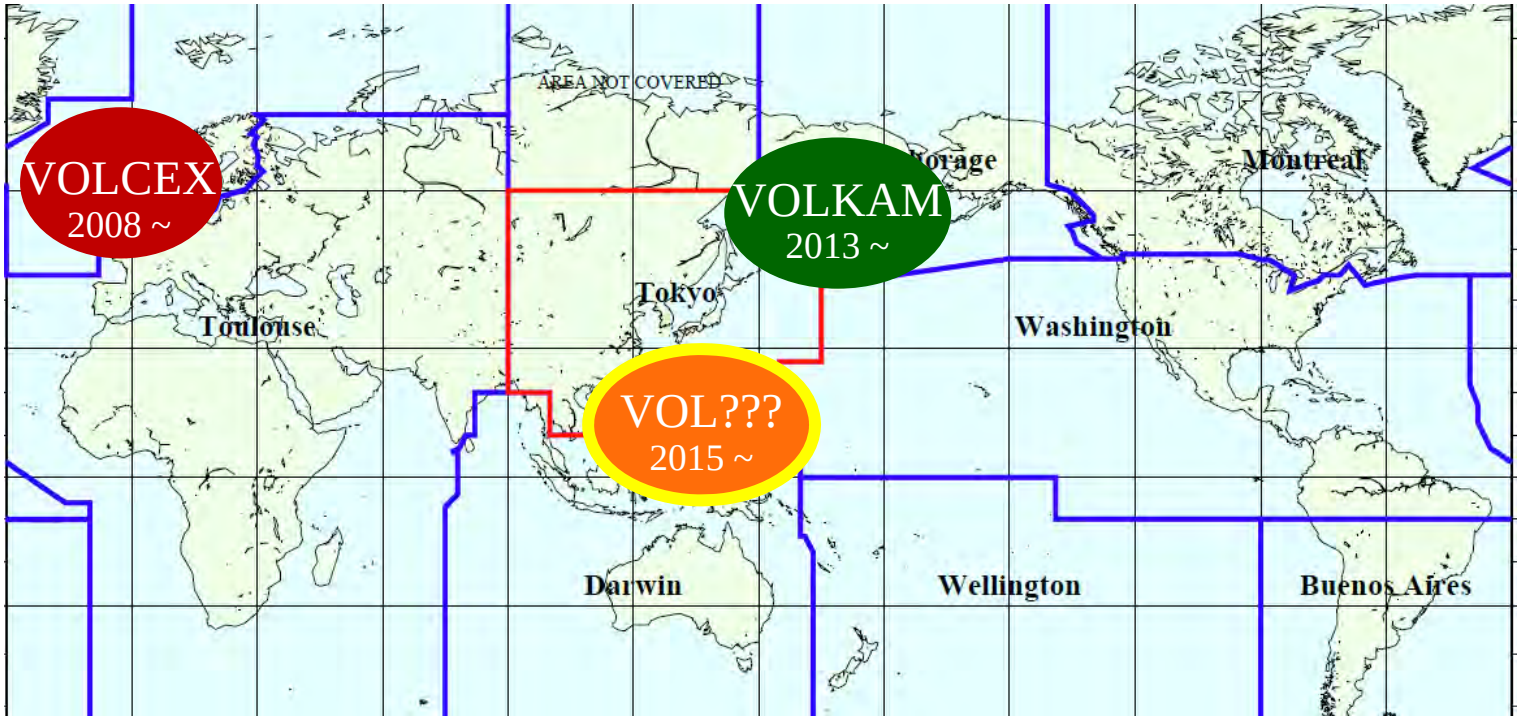
- issuing/obtaining/using information
- conducting air traffic flow control for re-routing
- communicating/coordinating smoothly and appropriately

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



Thank you