International Civil Aviation Organization

INFORMATION PAPER

TWENTIETH MEETING OF THE METEOROLOGY SUB-GROUP (MET SG/20) OF THE ASIA/PACIFIC AIR NAVIGATION PLANNING AND IMPLEMENTATION REGIONAL GROUP (APANPIRG)

Bangkok, Thailand, 6 – 9 June 2016

Agenda Item 6: Research, development and implementation issues in the MET field

6.1 Observations, reports, forecasts, advisories and warnings

DARWIN VAAC MANAGEMENT REPORT

(Presented by Australia)

SUMMARY

This paper presents the VAAC Darwin Management Report which addresses the main features of the IAVW operations, highlighting any recent developments and difficulties and future planned developments.

1. INTRODUCTION

1.1 The Volcanic Ash Advisory Centre (VAAC) Darwin is responsible for monitoring the area from the Andaman Islands (India) eastwards to the Solomon Islands including the volcanically active Indonesian archipelago, Papua New Guinea and the southern Philippines. More than 249 active volcanoes lie within the area, some of which have given rise to the largest eruptions in human history. Areas within the region have poor communications and general infrastructure, incomplete volcanic monitoring and are characterised by moist tropical convection that makes remote sensing difficult for much of the year.

2. DISCUSSION

2.1 From the 1st Feb 2015 until 31st January 2016, a total of 2592 Volcanic Ash Advisories (VAA) with their accompanying Volcanic Ash Graphics (VAG) were issued by VAAC Darwin. The most significant eruption during this period was the high level, vulcanian eruption of Manam, PNG in July 2015. The eruptions of Raung and Rinjani were also very significant due to their sustained impact on flight operations across Java and Bali, Indonesia. Figure 1 details the number of advisories issued by VAAC Darwin each year over the period 1993 – 2016.

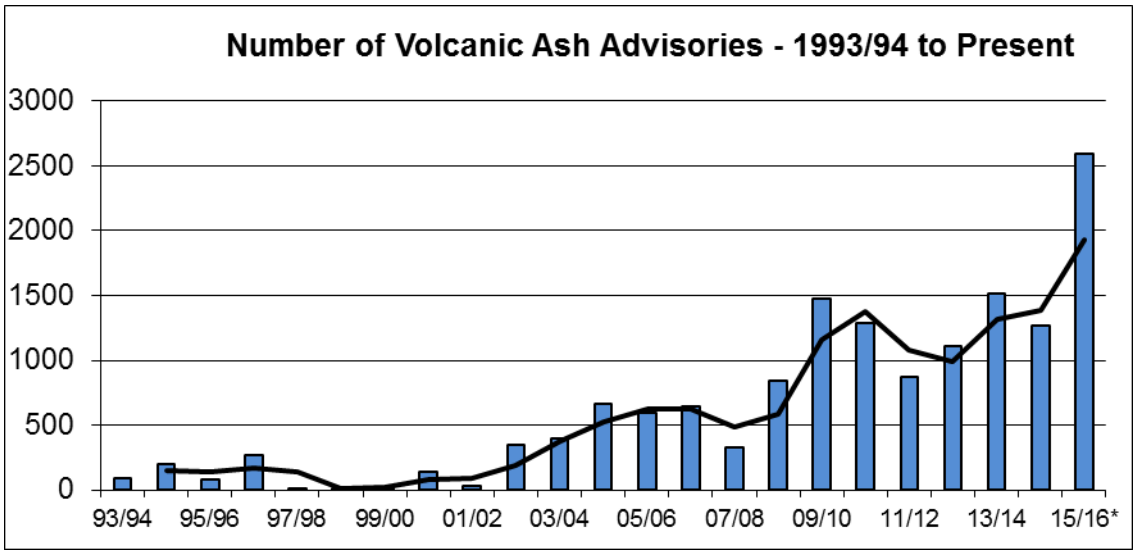

Figure 1: *Total Volcanic Ash Advisories by fiscal year issued by Darwin VAAC. The solid line is the two-year moving average. For the year 14/15, the advisory count is only until May 31st 2015.*

2.2 Figure 2 shows the spatial area where volcanic ash was observed by VAAC Darwin during 2015.

2.3 Volcanic activity in the region was dominated by low level eruptions from volcanoes such as Mt Dukono in northern Halmahera, which exhibited a sustained eruption throughout this period. Other volcanoes with sustained periods of activity included Mt Raung, Mt Rinjani, Mt Bromo in the Tengger Caldera and Mt Sinabung, all of which required the issuance of over 200 advisories. These five volcanoes were responsible for 82% of all advisories issued during the reporting period. Figure 3 shows the number of advisories issued for each volcano during this period.

2.4 By comparison 1258 VAA were issued for the whole period of 1st July 2014 – 30th June 2015. This substantial increase in advisories can be attributed to several factors including: more frequent advisory updates during significant events; the increased availability of ground observations; the availability of higher quality satellite imagery; and an increase in the level volcanic activity throughout the region.

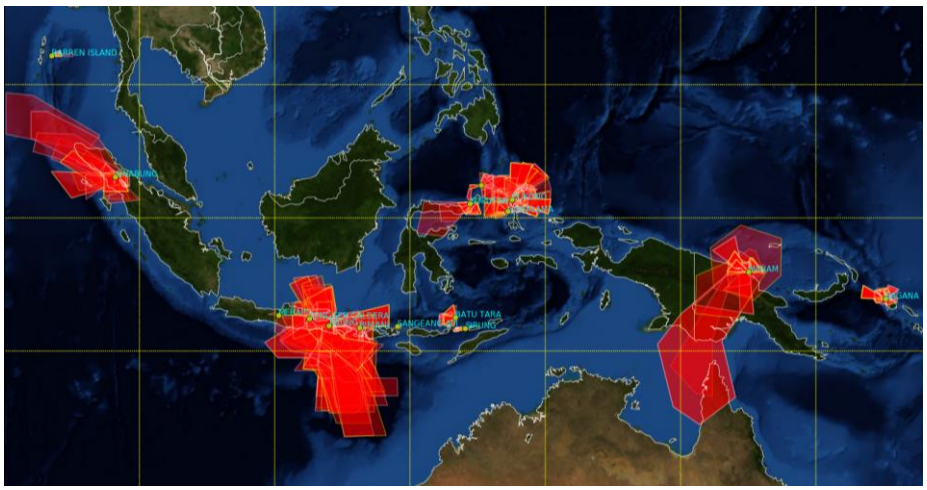

Figure 2: *Areas covered by volcanic ash forecasts during 2015*

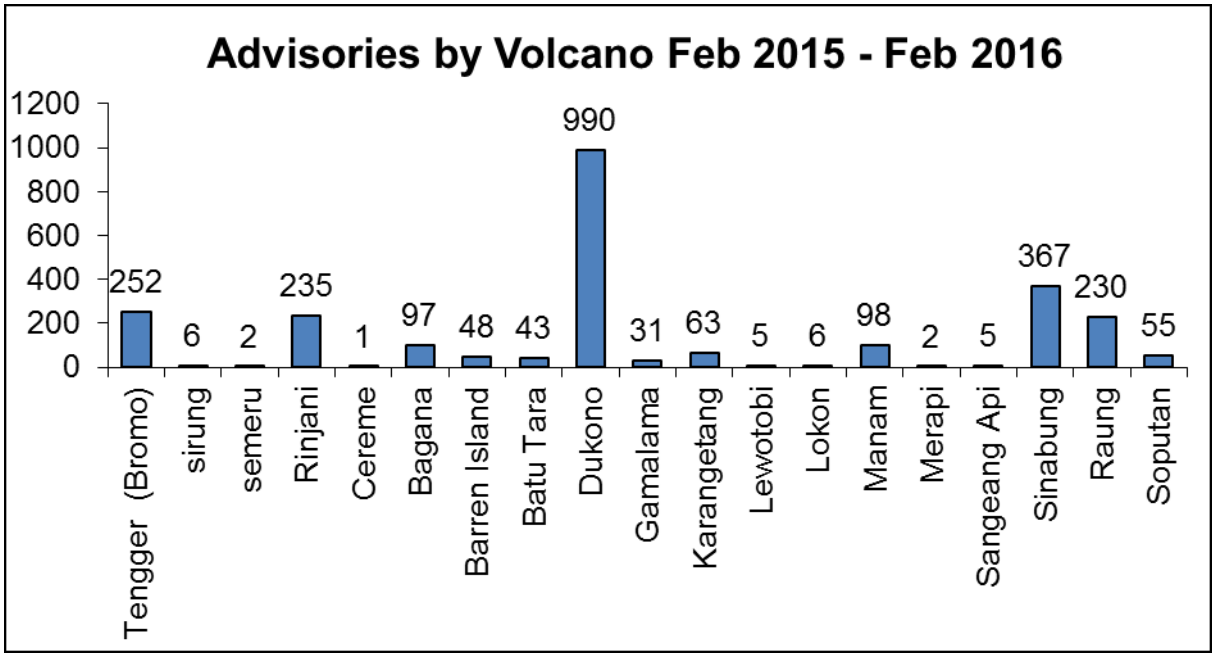

Figure 3: *Number of advisories issued per volcano during the period Feb 2015 – Feb 2016*

2.5 Eruptions above FL150

2.5.1 High level eruptions were observed at seven volcanoes during 2015; this is approximately double the average number observed during the preceding ten years. Figure 4, shows the breakdown of high level eruptions by volcano.

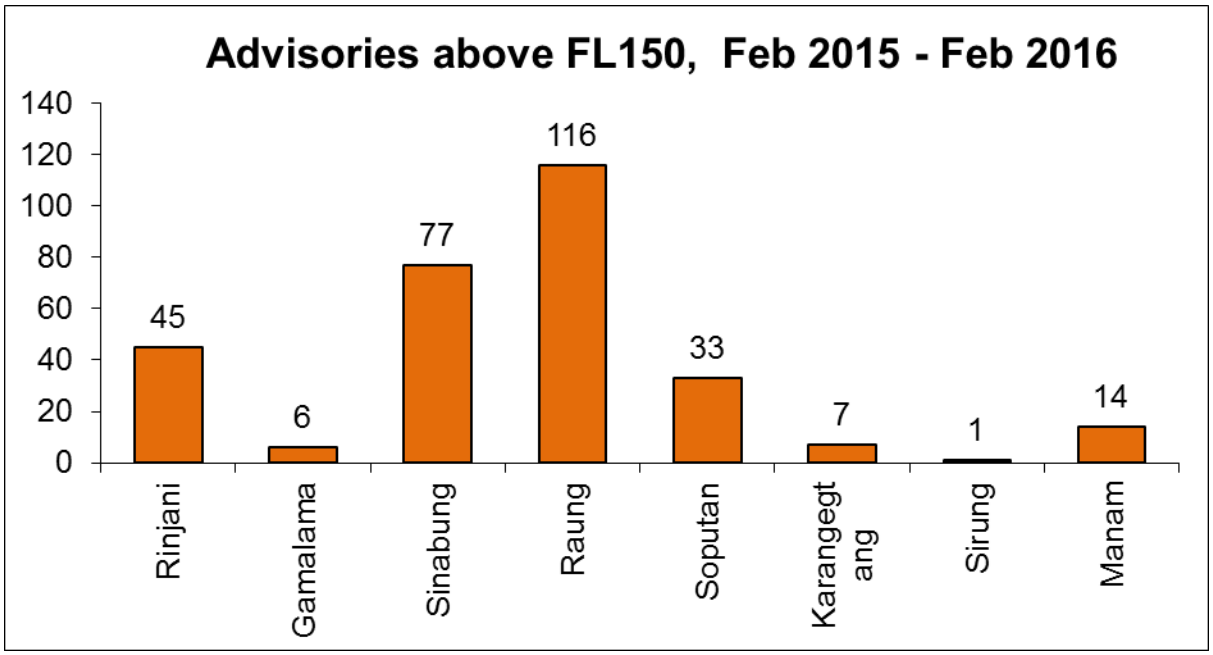

Figure 4: *Number of advisories above 15000 feet during the period Feb 2015 – Feb 2016*

2.5.2 High level eruptions were frequently observed at Mt. Sinabung over the period. These were generally related to pyroclastic flows associated with the partial collapse of a growing lava dome and did not lead to sustained high level ash plumes.

2.5.3 A high level eruption from Manam Volcano in PNG was detected on 31st July 2015. Ash from this eruption was initially detected to FL650 (approx. 20km), and eventually extended south across a large part of PNG and into the Brisbane FIR. Fifty-eight advisories were issued for the eruption. Fortuitously the recent availability of high spatial and temporal resolution image data from Himawari-8 allowed the eruption and movement of the ash cloud to be observed in detail, refer Figures 5 & 6.

Figure 5: *Manam in PNG, 31 July 2015*[1]

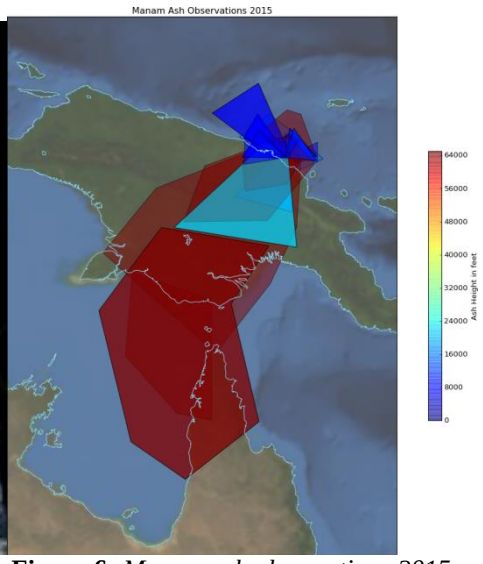

Figure 6: *Manam ash observations 2015*

2.5.4 Mt. Raung in eastern Java began a continuous, low intensity eruption on June 2015 for a period of approximately two months. Major disruptions to Indonesian domestic and international flight operations into Denpasar international Airport, Bali occurred in this period, refer Figure 7.

2.5.5 Mt. Soputan in the north of the island of Sulawesi underwent a series of four high level eruptions in January and February 2016 and resulted in significant disruption to the nearby Manado airport. Figure 8 shows the initial eruption of Mt. Soputan from the CVGHM observatory post in the town of Silian.

2.5.6 Mt. Rinjani on the island of Lombok, Indonesia began to erupt in late October 2015 which again caused major disruptions to operations into Denpasar airport. In response to stakeholder feedback on the recent Raung eruption, the update frequency for advisories was increased from six hourly to three hourly, refer Figure 9.

[1] Himawari-8 satellite image courtesy of Japan Meteorological Agency (JMA)

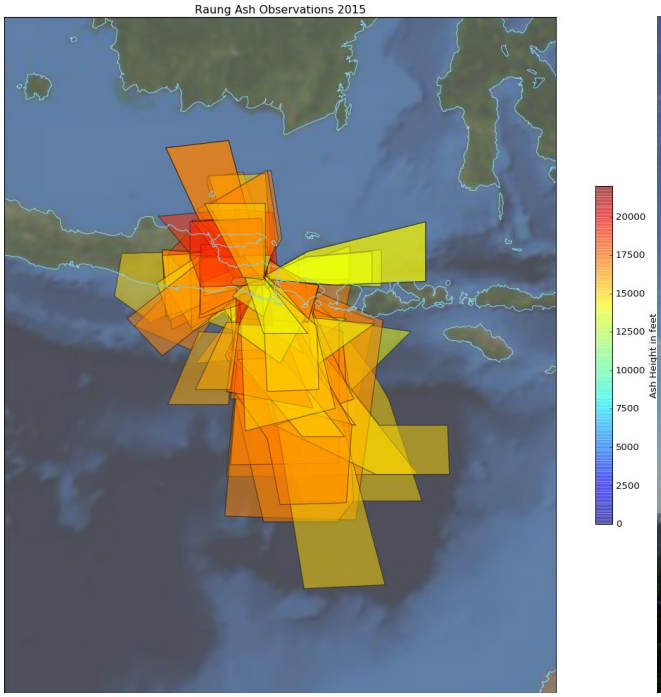

Figure 7: *Raung ash observations 2015*

Figure 8: *Soputan, 05 Jan 2016*[1]

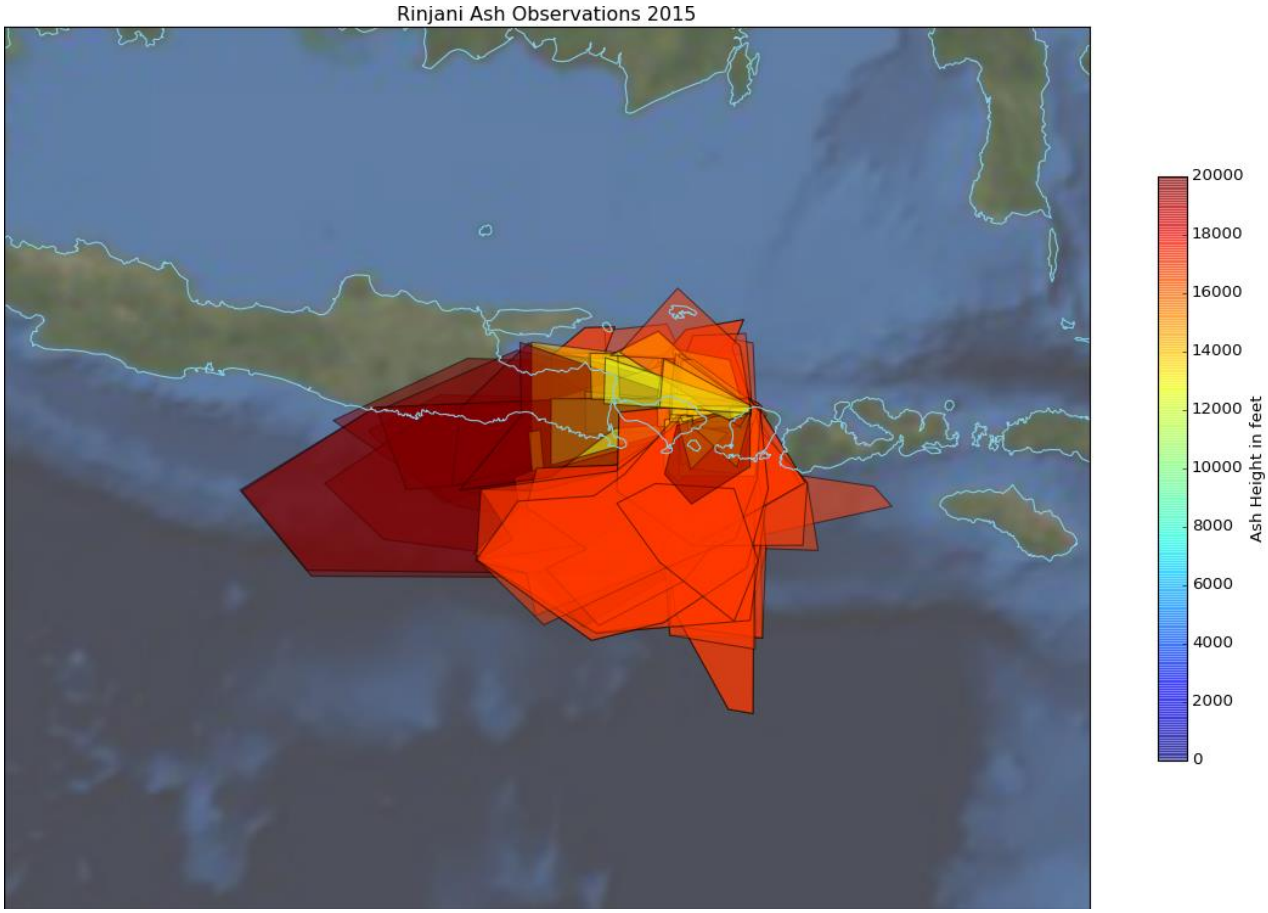

Figure 9: *Rinjani ash observations 2015*

[1] Image curtesy of Bandan Geologi (Center for Volcanology and Geological Hazard Mitigation), Indonesia

2.6 Significant Operational Changes

2.6.1 Operational use of Himawari-8 (HW8) satellite data commenced in February 2015 and has resulted in a significant improvement to the VAAC's volcanic ash detection capability. In addition to the increased temporal and spectral resolution, the HW8 satellite makes near real-time estimation of quantitative volcanic ash parameters such as total ash column load and ash particle effective radius possible. During 2016 this new capability will be used to deliver next generation guidance to support the volcanic ash safety risk assessments of aircraft operators.

2.6.2 VAAC Darwin operations were relocated from the Darwin to the Melbourne, Australia offices of the Bureau of Meteorology. The relocation took place over a five month period, during which time operational staff and resources were shared between the Darwin and Melbourne sites. Following the relocation of seven VAAC personnel and the successful completion of a two week period of mirrored operations, VAAC Darwin formally commenced operations from the Bureau's National Operations Centre on the 31st August 2015. The VAAC will retain the name VAAC Darwin until at least 2017.

2.6.3 Since September 2015 a volcanologist has been seconded to the VAAC from Geoscience Australia as volcanic ash science officer. This expertise has greatly benefited the VAAC through the enhanced training of operational staff, the continued development of volcanic ash dispersion model products and the building of stronger relationships with vulcanological agencies in Indonesia and Papua New Guinea

2.7 VAAC Backup

2.7.1 Testing of the VAAC Tokyo – VAAC Darwin Scheme of cooperation for backup procedures was undertaken on two occasions. On 25th November 2015 and 27th January 2016, testing of the backup capability was undertaken; during these tests both VAACs were able to successfully monitor and disseminate VAA and VAG on each other's behalf.

2.7.2 The backup arrangements were operationally invoked on the 8 January 2016 when a communications system outage lead to VAAC Tokyo assuming responsibility for the VAAC Darwin region for approximately 4 hours.

2.7.3 Backup testing with VAAC Wellington occurred on the 19th April 2016.

2.8 Quality Management

2.8.1 Operations at VAAC Darwin are certified to AS/NZS ISO 9001:2008 quality management standards and VAAC Darwin remains the only VAAC to have obtained this level of certification in its own right. ISO has now published the 2015 revision to the standard and VAAC Darwin has begun the process to obtain certification under the new standard during 2016.

3. ACTION BY THE MEETING

3.1 The meeting is invited to note the information contained in this paper.

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