

Streakline analysis of the 18 August 2000 eruption cloud of Miyakejima

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1. Introduction: The eruption of Miyakejima volcano started on 8 July 2000. Large eruptions were recorded on 10, 18 and 28 August 2000, with volcanic cloud heights of about 8, 14 and 8 km, respectively. These clouds were detected by GMS-5/VISSR and NOAA/AVHRR images [1]. We focus here on the eruption of 18 August 2000 at 17:02 JST. It was reported that several aircrafts had encountered the volcanic ash cloud. Here, we discuss two aircrafts bound for Narita that suffered serious damage to their engines and windows. One is a B747 aircraft that encountered the clouds at the altitude of FL340, about 10.3 km, at 18:30 JST. The other is a B737 aircraft that encountered the cloud at the altitude of FL 360 at 18:32 JST [2, 3]. In order to clarify the flow altitudes of the volcanic cloud shown in GMS image at 19 JST, corresponding streaklines are calculated by a vertical shear model (VSM).

2. GMS-5/VISSR images of eruption clouds: The eruption cloud were detected by GMS AVI images, taking the brightness temperature difference between 11 and 12 μm , during 18 - 24 JST on 18 August 2000 [1]. In the monochrome AVI image, opaque ash clouds tend to be bright as AVI become high, while water vapour predominant areas tend to be relatively dark. Figure 1 shows a GMS AVI image observed at 19 JST on this day. The eruption cloud spreading to the north and southeast was observed. It was reported that two aircrafts, mentioned in Sec.1, had encountered the southeastward plume [2, 3].

3. Streakline analysis: Figure 2 shows a streakline image corresponding to the satellite image (Fig. 1) calculated by VSM, which utilizes the upper wind data as an input. In this case, the upper wind data observed at Hachijojima station on 18 August 2000 was used. The wind data set in time at interval of one-hour was preprocessed by the linear interpolation for each standard pressure level, 925 - 150 hPa. The trajectories of dimensionless and weightless particles, which were released into the atmosphere at fourteen pressure levels above Miyakejima volcano, were calculated using the

wind data set. The emission rate of model's ideal particles was assumed to be constant, one particle per one-hour interval at a pressure level during 17 - 19 JST. Finally, their positions at 19 JST were displayed that correspond to the satellite image of volcanic cloud.

The simulation result indicates that the northward plume corresponds to the streaklines of lower pressure-altitudes, 925 - 500 hPa. In contrast, southeastward plume is reproduced well by the streaklines of higher pressure-altitudes. The particles that flow at the pressure levels of 200, 250 and 300 hPa of which the estimated altitudes are about 9700 - 12500 m from the upper wind data at Hachijojima at 21 JST, were depicted as larger radial circles. The distribution corresponds well to the encounter reports [2, 3].

4. Summary: The eruption cloud of 18 August 2000 was well shown in GMS AVI images. The streakline image calculated by VSM reproduced well the satellite image at 19 JST. The encounter reports on this day were explained well by the satellite image and simulation result. It was also found that the upper wind data of six-hourly intervals is important for calculation on transport and dispersion model, and that VSM can supplement the height information to satellite images of volcanic clouds.

References: [1] N. Iino et al., Satellite imagery of ash clouds of the 2000 eruption of Miyake-jima volcano, Proc. CEReS Int. Symp. Remote Sensing of the Atmosphere and Validation of Satellite Data, pp.13-18, 2001: Satellite images of volcanic clouds at Miyakejima in 2000, <http://www.mech.kagoshima-u.ac.jp/lab/netu/miyake008/miyake-e.htm>. [2] A. Tupper et al., Aircraft encounters from the 18th August 2000 eruption at Miyakejima, Abstracts book of the 2nd International Conference on Volcanic Ash and Aviation Safety; No. 1-03, 2004. [3] S. Onodera, Prevention of volcanic ash encounters in the proximity area between active volcanoes and heavy air traffic routes, same in [2]; No. 5-05, 2004.

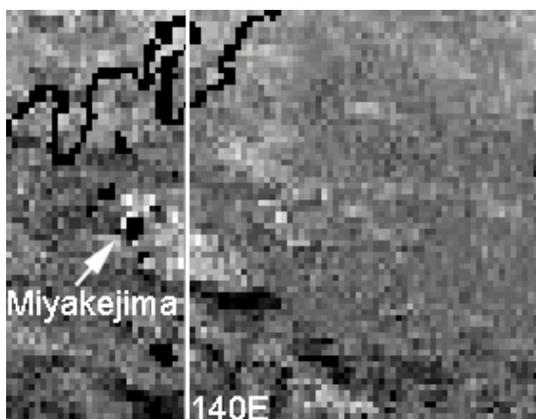


Fig. 1 GMS AVI image at 19 JST on 18 August 2000.

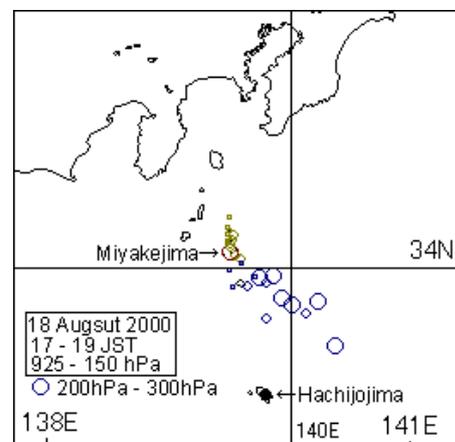


Fig. 2 The simulation result at 925 - 150 hPa, for the ejection during 17-19 JST on 18 August 2000.