

Image analysis of volcanic clouds during the 2011 Kirishima Shinmoedake eruption

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We report the development and spatial scale of the sub-plinian eruption of Kirishima Shinmoedake in January 26-27, 2011. In addition to the multipoint image observation and the cloud diffusion analysis of satellite images in the previous reports [1-3], we analyze Ohnami-ike volcano monitoring camera images [4] and the photographs published.

For the image analysis of the plume, we improved the photo analysis program [5] and developed a method fitting the skyline created from the elevation tile [6] to the image. By considering the curvature of the earth when creating skyline, accurate altitude estimation became possible.

Since 2008, fumes and white vaporous clouds were often observed at Shinmoedake. Then, volcanic ash containing fresh magma was confirmed at the small eruption on January 19, 2011 at 01:27 [7]. After that, it changed to continuous discharge of ash cloud as observed on January 22 and 25. The plume flowed and rose to about 5-7 km downstream, with its top reaching 1700 to 2200 m above sea level, and flowed horizontally. Discharge of the plume continued until around 14:00 on January 26, and reached the highest point of 1700-1900 m above sea level at the downstream 3-4 km. Despite poor visibility due to atmospheric turbidity on January 26th, near-infrared video images and photographs from the observation point of 50 km south-southwest of Shinmoedake, captured the whole plume shape and developmental process of the sub-plinian eruption started at 15:29 on January 26th. The upper part of the large-scale ash cloud was also observed from a southern point of Kagoshima City located in 58 km southwest of Shinmoedake, and the visible web camera in the Hitoyoshi Basin located in 38 km north of Shinmoedake. By sharpening and analyzing these images, the plume height was obtained. On January 26, the plume rose to 7-8 km downstream, the altitude above sea level was 5000-6000 m, rarely 7000 m. This is close to sea level altitude 7000 m (accuracy 1 km) [8] obtained from radar analysis of the Tanegashima and Fukuoka data. On January 27, continuous magmatic clouds were observed since the morning. At the explosion at 15:30 and 15:41, sub-plinian type eruption restarted, and heavy ash cloud reaching 7000-8000 m above sea level was seen from each observation point.

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