Monitoring possibility of volcanic activities at Sakurajima by the geomagnetic field

Masashi Ogiso[1]; Yoshitomo Ikoma[2]; Tomoaki Takizawa[1]; Tadayuki Uesugi[3]; Shingo Nagamachi[1]; Shuuichi Toyodome[4]; Takeshi Owada[5]; Ikuko Fujii[6]

[1] JMA; [2] Kanoya Mag. Obs., JMA; [3] Kanoya Magnetic Observatory; [4] none; [5] Magnetic Observatory,JMA; [6] Kakioka Magnetic Observatory

We report on geomagnetic field observations at Sakurajima to investigate of the possibility to monitor volcanic activities at Sakurajima by the geomagnetic field.

Kanoya Magnetic Observatory stopped the geomagnetic observation at Sakurajima in 1999, since the effect of a magnetized volcanic ash or movement of soil of the volcano made it difficult to detect the geomagnetic variations due to the volcanic activity from the observed data. However, a new observation tunnel, Arimura tunnel, was built on the Sakurajima Island in 2006 and was available for geomagnetic field observation during the summer of the year. Use of the tunnel made us possible to observe the geomagnetic field at a site closer to an active zone than in the observation out of the tunnel. Furthermore, the volcanic ash or movement of soil would not affect the geomagnetic field in the tunnel. A feasibility study suggests that the recent activity of Sakurajima could generate geomagnetic total force variations at amplitudes from 0.01 to 0.1nT at Arimura tunnel due to a demagnetization effect and the variations of geomagnetic transfer functions at an amplitude of 0.01 due to a temporal variation of a resistivity structure of Sakurajima Volcano (Fujii, 2007). On August and September 2006, we conducted geomagnetic total force observations at Arimura tunnel and geomagnetic field variation observations at three points including Arimura tunnel to explore a possibility to observe the geomagnetic field variation in a required level.

We used two proton precession magnetometers and one overhauser magnetometer for the geomagnetic total force observation. The observed values are small compared with those of Kanoya. These suggest that total force magnetometers are affected by the magnetic bodies such as an iron frame used for the tunnel. Besides, signal intensities of all magnetometers were so small that it was difficult to measure the total force precisely. We conclude that we would not be able to detect the geomagnetic variations due to the volcanic activities from the geomagnetic total force data at Arimura tunnel.

In geomagnetic field variation observation, we got good data at nighttime, while noisy at daytime due to artificial disturbances at all observation points. We calculated geomagnetic transfer functions at periods from 30 to 512 seconds by using a six-hour segment of the geomagnetic field variation at nighttime at each point. Since the transfer function shows the same characteristics among three points, it is suggested that the transfer functions are related to large-scale conductivity structure, not a small-scale structure such as a volcanic dike. Estimated errors of the transfer functions are 0.06 at maximum, which is larger than the estimated value of 0.01 for monitoring the volcanic activity at Sakurajima. At Arimura tunnel, the estimated errors are smaller than 0.01 at periods from 200 to 512 seconds. The result indicates that there is a possibility of monitoring the volcanic activity at Sakurajima with geomagnetic field variation observation.