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Magnetic anomaly change of Usu Volcano 2000-2010 detected by repeated aeromagnetic surveys

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Aeromagnetic survey is expected to contribute to the elucidation of the volcanic structure and the change of its activity. However, the track lines of repeated surveys cannot be the same, and the inspection to the repeatability and the spatial alias effect of magnetic anomaly pattern is quite important to acquire valid information of the activity. To overcome this difficulty, we applied the generalized mis-tie control method (Nakatsuka and Okuma, 2006; Nakatsuka et al., 2009).

Usu Volcano 2010 aeromagnetic survey was conducted by the Usu Volcano Aeromagnetic Study Group, in September, 2010 (Hashimoto et al., 2011). The existing reference data is the survey by the Geological Survey of Japan in June 2000 (Okuma et al., 2003, 2010). Both data were processed together with the generalized mis-tie control method to yield total-force magnetic anomaly change between two epochs. The result revealed increases of magnetic force at Nishiyama-Kompira crater activity areas, the area of Gin-numa crater, and Showa-shinzan dome, and a relative decrease zone along northern somma. The comparison of the result with other studies' observation and the interpretation is to be presented in another paper (Hashimoto et al., 2011).

Although the track lines were fixed by the post-flight differential process of GPS system in both surveys, the altitude fix in 2000 survey might not be accurate enough because of insufficient accuracy signal from a few satellites among GPS satellites. As 2000 survey flights were equipped with a radio-altimeter, the altitudes difference between GPS and radio-altimeter data was examined in detail, with the help of Volcanic DEM (10m mesh) by the Geographical Survey Institute. Considering that the data of radio-altimeter reflect artificial buildings and constructions, the slant radio-wave reflection from sideward topography, and the existence of thick surface vegetation, the GPS altitude data is proven to be generally well determined. Nevertheless, GPS altitude in 2000 survey may have occasional shift of 20-30 m, and also the unreasonable difference (< 10m) against radio-altimeter over the Lake Toya was revealed. As a whole the altitude accuracy of 2000 survey data is not minimal enough. If we consider this altitude accuracy, finer variations in the results above should be carefully interpreted, although the principal characteristics of the analysis results above are still reliable.

Keywords: Usu Volcano, aeromagnetic survey, magnetic anomaly change, generalized mis-tie control, volcanic activity, helicopter