

Installation of geomagnetic total field observation stations to active volcanoes by Japan Meteorological Agency

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Due to the eruption of Ontake volcano on September 27, 2014 which became worst volcanic disaster after the Second World War, Japan Meteorological Agency (JMA) decided to strengthen volcanic observation system for prediction of phreatic eruption. Geomagnetic total field observation was adopted one of the strengthened observation system, because it has an advantage to monitoring of hydrothermal circulation under a volcano. From such process, we decided installation of geomagnetic total field observation stations in 2015 fiscal year at four active volcanoes (Tarumae, Azuma, Ontake, Kirishima) in Japan.

We planned that six Overhauser magnetometers are installed approximately within one km from a target crater at each volcano for monitoring the thermal activity beneath the crater, and one Overhauser magnetometer at the foot of each volcano as reference station. Also, one flux-gate magnetometer to measure three components geomagnetic field is installed at the reference station to correct external magnetic field disturbance such as a magnetic storm. The resolution of the Overhauser magnetometer is 0.01nT, and that of the flux-gate magnetometer is 0.001nT. We adopted solar-battery method as supply system, and it works over one hundred days without solar supply due to snow in winter season. The measurement data is transmitted to JMA using satellite or FOMA communication lines.

We selected the observation sites, where the topography is relatively flat and available sunshine for solar supply, approximately within one km from a crater. To avoid the vehicle noise, the observation sites were separated more than 200 m from a roadway. It is known that the annual variations caused by the temperature dependency of magnetization of rocks or soil around the observation site become big at high magnetic gradient observation site. To do the annual variations as small as possible, we selected less than 20 nT/m of magnetic gradient site by conducting magnetic survey around the observation site.

On the Tarumae volcano, there is a fumarolic activity at the summit lava dome. According to the repeat magnetic survey since 1998 by Sapporo Volcanological Center, JMA, magnetization has been progressing after 2010 beneath the lava dome. We selected the observation stations around the lava dome with reference to the result of the repeat magnetic survey. On the Azuma volcano, there is a fumarolic activity at the Oana crater located the south-east slope of Mt. Issaikyo. According to the repeat magnetic survey since 2003 by Sendai Volcanological Center, JMA, demagnetization has been progressing beneath the Oana crater. We selected the observation stations around the Oana crater with reference to the result of the repeat magnetic survey. On the Ontake volcano, we selected the observation stations around the Jigokudani crater which erupted on September 27, 2014. On the Kirishima volcano, the thermal activity is high accompanying with sometime occurrence of volcanic tremor around the Ioyama crater at Ebino plateau. We selected the observation stations around the Ioyama crater for the purpose of the monitoring of the underground thermal activity around the Ioyama crater.

Keywords: Japan Meteorological Agency, geomagnetic total field, active volcano, hydrothermal system, phreatic eruption, Overhauser magnetometer