Ground-based electric and magnetic observations of Taal Volcano, Philippines

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Electromagnetic study on Taal Volcano (120.99E, 14.00N) has been executed since December 2004 by the cooperative group, which consists of researchers in Japan, France, and Philippines. We conducted field campaigns four times in January, February, August, and November 2005, including the measurements of self potential (SP), total magnetic field (TMF) intensity, ground temperature and CO2 soil degassing.

In the first campaign on 9-14 January 2005, the measurements were practiced at every 25 meters on the same lines in the Main Crater, on the Crater Rim, and on the hillside of the Volcano Island. In order to monitor the anomalous magnetic field variations due to temperature changes in geothermal areas, we constructed 21 benchmarks for the repeat precise TMF survey inside and outside the geothermal areas. We also installed the remote reference station of TMF near the volcano observatory at Buco.

The second survey was carried out on 15-24 February 2005. The SP and TMF measurements were practiced along the NE shore of Crater Lake and the northern slope of Island, both of which are prominent geothermal areas of Taal Volcano. We also carried out the repeat TMF measurements.

The TMF surveys in January and February 2005 revealed positive anomalies (+10 ˜+30 nT, Max of 40 nT) in the NE shore of the Crater Lake as well as the northern slope of island. Since the magnetic dip is about 14 degrees in this region, such local positive anomalies indicate weak magnetization under the ground. The area of positive SP anomaly coincides with abnormal TMF area, therefore, such positive anomaly may have relation with the demagnetization due to the hydrothermal system. Some other information supports the activation of hydrothermal system in the Main Crater; (1) Plants withered in the NE shore of Crater Lake, and (2) Spout of bubble in the Crater Lake became active in the second survey (Harada et al., 2005).

Since 23 September 2004, the seismic activity increased and several earthquakes were felt in the Volcanic Island. The Alert Level of the volcano was raised from 0 (Normal) to 1 (Abnormal) on 29 October 2004. The significant volcanic earthquake (Intensity of III at Pira-Piraso) was felt on 09 January 2005, during our first campaign. It seemed that volcanic activity would become active, however, no escalation of volcanic activity was observed since 01 March 2005. Alert Level was lowered from 1 to 0 on 30 June 2005.

The 3rd survey was carried out on 18-22 August 2005. The repeated TMF survey was practiced at the whole of benchmarks. The differential TMF values showed that most of the abnormal TMF area became extinct, which implied the volcanic activity had recovered to moderate condition.

We carried out the 4th field campaign on 9-17 November 2005. The results of repeated TMF survey indicate that the volcanic status had not changed from the state in August. We constructed 2 benchmarks for the repeat TMF survey in the northern slope because the spatial distribution was not enough to detect the extent of geothermal area.

In addition, we established the observation station for the continuous measurement of SP, rainfall, and ground temperature. The sensors were installed inside and outside the geothermally active zone in the northern slope of the volcano. So far the station has been working well. The present volcanic status and preliminary results of continuous measurements will be shown in the presentation.

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Reference:

M. Harada, J. Sabit, Y. Sasai, P. Alanis, J. Cordon Jr., E. Corpuz, J. Zlotnicki, T. Nagao, and J. Punongbayan, Magnetic and electric field monitoring of Taal Volcano, Philippines, Part I: Magnetic measurements, Proc. Japan Acad., Vol.81, Ser B (7), pp.261-266, 2005.