

New activity occurring on Taal Volcano, Philippines? - Indications from Electromagnetic (EM) observations

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We have conducted EM observations on Taal Volcano, Philippines, in the central part of Luzon Island since 2005. The seismic and volcanic activity abruptly increased in January 2005 and in June 2010, leading to totally evacuation of the inhabitants of Volcano Island near the center of Taal Lake. Remarkable changes in the total magnetic field (TMF) and self potential (SP) were observed during both the 2005-2006 and the 2010-2011 seismovolcanic crises. Magnetotelluric (MT) surveys on Volcano Island revealed a large resistive block of about 3 km radius (Yamaya et al., 2013; Alanis et al., 2014), which was interpreted to be a hydrothermal reservoir filled with two-phase fluids (gas and liquids). A shallow block adjacent to the hydrothermal reservoir shows strong attenuation of seismic S-waves. This was suggested to be an active magmatic body (Kumagai et al., 2014). From 2013 to present, Taal volcano has been apparently quiescent. In particular, the geothermal area along the NE shoreline of the Main Crater Lake (MCL), which is now exposed above the lake surface owing to the lack of rainfall during the year 2015, shows no enhancement of geothermal activity. However, we conducted repeat TMF surveys in December 2015 and found that remarkable changes in TMF have occurred since March and May 2014, as shown in Fig. 1. The anomaly pattern of the TMF shows negative changes largely occurred in the north and positive changes largely occurred in the south as would be expected from piezomagnetic effects generated by a simple Mogi model of a pressure source at about 2.5 km depth under the MCL. This suggested that, although the surface activity appears quiescent, the hydrothermal reservoir is most likely inflating right now. Owing to the lack of data at the reference station, we could not identify when such changes in TMF took place during the period from May 2014 till December 2015.

Keywords: Taal Volcano, Hydrothermal reservoir, TMF changes, Piezomagnetic effect

