Three-dimensional resistivity imaging of Taal Volcano, Philippines

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Taal Volcano in the Philippines erupted from the main crater on January 12, 2020. Intense explosions occurred several times generating a 10-15 km tall eruption column, and the following day they shifted to magmatic eruptions fountaining lava. Prior to these eruptions, Yamaya et al. (2013) and Alanis et al. (2013) interpreted the resistivity structure estimated by the magnetotelluric (MT) survey, and suggested that a large hydrothermal reservoir existed beneath the main crater of the volcano, which could cause a magmatic-hydrothermal eruption. Their resistivity structures were estimated by 2D inversion and 3D forward modeling due to the limitations of computers and calculation codes. In recent years, 3D inversion has become practical due to the development of computers and codes, enabling more accurate and objective structure estimation. Therefore, we re-analyzed the resistivity structure by 3D inversion using the MT data of Yamaya et al. (2013) and Alanis et al. (2013). This allowed us to use diagonal components of the MT impedance and transfer functions of the magnetic field that could not be used in 2D analysis. In addition, to assume the 3D distribution of conductive seawater enabled us to use long-period data longer than 100s.

Followings are preliminary results. The estimated 3D resistivity structure was similar to the result of 2D inversion from the surface down to a depth of about 1 km. The conductive layer widely spread and the resistivity beneath the main crater lake was relatively high. At a depth deeper than 1 km, a considerable conductive body was estimated at northeast of the crater lake. Given its large size and extent, this conductor likely indicates another structure being related to volcanic activities rather than the cap rock of the hydrothermal reservoir interpreted in the previous studies.

Keywords: Taal Volcano, resistivity structure, hydrothermal reservoir

