御嶽山における MT 観測と 1 次元比抵抗構造解析

Magnetotelluric observation and 1-D resistivity modeling in Mt. Ontake Volcano

西嶋就平・市原寛・堀川信一郎・前田裕太・松廣健二郎・田ノ上和志 (名古屋大学)
Shuhei Nishijima, Hiroshi Ichihara, Shinichiro Horikawa, Yuta Maeda, Kenjiro Matsuhiro, Kazushi Tanoue (Nagoya University)

Abstract

Investigating of underground structure such as distribution of magma chambers, hydrothermal area is essential for volcanology. Around the Mt. Ontake volcano, previous studies modelled resistivity structure based on electromagnetic methods. Abd Allah & Mogi (2016) clarified subsurface resistivity distribution beneath the top of Mt. Ontake using the grounded electrical-source airborne transient electromagnetic (GREATEM). Ichihara et al. (2018) clarified resistivity distribution below the southeast flank of Mt. Ontake using the magnetotelluric (MT) method. However, resistivity structures over 1km deep have not been investigated around the top of Mt. Ontake. In this study, we conducted MT measurements around the top of Mt. Ontake to clarify the 3-D resistivity structure including deep area.

We measured MT data at 9 sites around the top of Mt. Ontake on 10-12 September and 7-11 October, 2019 using ADU-07e system from Metronix Geophysis Co. (Fig. 1). The sampling frequencies are 32, 1024, 32k, and 524kHz. The data were recorded 1-2 days for the 2 lower frequencies and 1-3hours for the 2 higher frequencies. We estimated MT impedances at site OTT008 using BIRRP program (Chave & Thomson, 2004). To reduce noise, the remote reference technique was applied. For the 32Hz data, we used horizontal magnetic field data from site OKR at Okura village, Yamagata prefecture observed by Geothermal Energy Research & Development Co. For the 1k, 32k, and 524kHz data, we used horizontal magnetic field data at the site OTT009 which observed the same time with site OTT008. Good quality MT impedance was estimated between frequency between 48Hz and 12kHz. However, impedance phases show gap between estimated impedances from 32kHz and 1kHz sampling data.

We then estimated preliminary 1-D resistivity structure based on grid search which find

minimum RMS misfit between observed impedance and calculated responses. We supposed that resistivity structures consist of horizontal 2 and 3 layers from sounding curves of apparent resistivity at site OTT008 and site 305 (previous data by Kanehiro et al., 2018), respectively. The obtained resistivity structure beneath the site 305 is consistent to the previous structure by Abd Allah & Mogi (2016). Trend of the resistivity structure is also similar to the model by Abd Allah & Mogi (2016) at the site OTT008 although more conductive resistivity is estimated in this study. We will conduct additional MT surveys and then analyze 3-D resistivity distribution in the future.

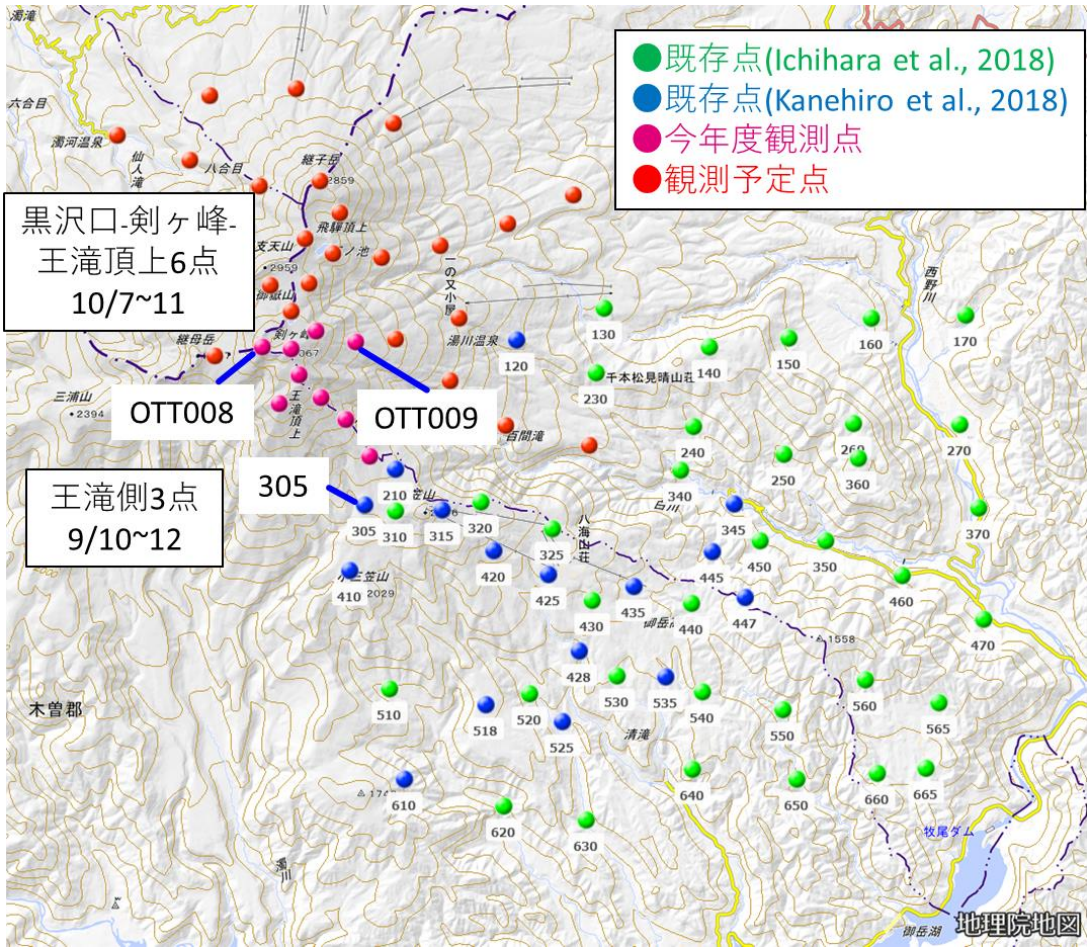

Fig.1: Topographic map in the Mt. Ontake volcano with MT sites.

Acknowledgement

Geothermal Energy Research & Development Co. provided us with their continuous geomagnetic records as remote references.

References

J. Kanehiro, T. Mogi, H. Ichihara, K. Yamaoka, M. Adachi and R. Tanaka (2018) MT survey of geothermal area in southeastern flank of Mt. Ontake. Japan Geoscience Union meeting 2018.

H. Ichihara, J. Kanehiro, T. Mogi, K. Yamaoka, N. Tada, E. A. Betrand and M. Adachi (2018) A 3D electrical resistivity model around the focal zone of the 2017 southern Nagano Prefecture earthquake (MJMA 5.6): implications for relationship between seismicity and crustal heterogeneity. Earth, Planets and Space. 70:182.

S. A. Allah and T. Mogi (2016) Three-dimensional resistivity modeling of GREATEM survey data from Ontake Volcano, northwest Japan. Earth, Planets and Space. 68:76.