MT survey and 3-D resistivity structure in the Niseko area, southwestern Hokkaido

*Makoto Tamura[1], Toru Mogi[2], Junna Kanahiro[2], Daisuke Oka[1], Junya Maruyama[1], Takahiro Suzuki[1], Noritoshi Okazaki[1]

1. Geological Survey of Hokkaido, Hokkaido Research Organization, 2. Division of Sustainable Resource Engineering, Fucluty of Engineering, Hokkaido University

In the Niseko area, southwestern Hokkaido, there are many volcanoes distributed along East-West direction that is so called “Niseko volcanic group”. And many hot springs are distributed around Iwaonupuri and Niseko-Annupuri volcano. Recently, geothermal explorations for energy development have been performed in this area.
During such situation, we are carrying out the priority research “Modelling of geothermal structure and assessment of geothermal resource potentials in the Niseko area” for sustainable application of geothermal resources. In this presentation, we show the MT survey and the 3-D resistivity structure analysis result as a part of this research.
We performed wideband MT survey at 18 stations in 2017 and 24 stations in 2018 around the Niseko area. Five components of electromagnetic fields were measured by ADU-07e and ADU-08e (manufactured by Metronix Geophisics). We obtained 32Hz data that was recorded for more than 5 days, 1024Hz data that was recorded more than 5 nights (1:00-5:00 : LT) and 32kHz data that was recorded one hour. Horizontal components of magnetic field data recorded at Ookura Vil., Yamagata Pref. were used for the remote reference processing of 32Hz and 1024Hz data. For 32kHz sampled data, we measured data at the same time in multiple stations for the remote reference processing. Also, we performed noise elimination processing for 50Hz electrical power lines.
MT responses at the frequency band of 12288-0.000488Hz were estimated using the robust time series processing code BIRRP (Chave and Thomson, 2004). Furthermore, we tried to obtain a 3-D resistivity structure with the aid of the ModEM inversion scheme (Egbert and Kelbert, 2012). Topographic effects might strongly affect the MT impedances because the survey area is located from the top to the foot of the volcano. In order to consider the topography into the 3D inversion, we used inland DEM data of 10m spacing provided by Geospatial Information Authority of Japan, and the seabed data of 500m spacing provided by Japan Coast Guard. Three-dimensional inversion was performed using four components of the tensor impedance from the field records.
In the results, we detected several conductive zones. A conductive zone was detected from the surface to several kilometers depth beneath the Iwaonupuri volcano. This would indicate volcanic hydrothermal system or hydrothermal rock alteration area. Also, we detected conductive zones around Ooyunuma Pond that is a hot spring bog, and southern foot of the Niseko-Annupuri volcano area where many hot springs are distributed. These conductive zones would indicate thermal water aquifers or related altered area.

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Keywords: Niseko volcanic group, Magnetotelluric survey, resistivity structure, 3-D modeling

