Estimation of MT response function to reveal resistivity structure around the Hyuganada area

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Hyuganada area is on an interplate earthquake zone between the Eurasian plate and the subducting Philippine Sea plate. Slow earthquakes, such as low frequency tremor (Yamashita et al., 2015) and slow slip event (Nishimura et al., 2014), were also occurred. The differences of these motion types may relate to the existence of fluid and sediments on the plate boundary interface (e.g. Obara, 2009).

Magnetotellurics (MT) is the passive exploration method to reveal underground resistivity structure. Electrical resistivity is a physical property which sensitive to fluid and sediments. To understand the generation mechanism of the regular and slow earthquake, it is necessary to reveal the resistivity structure beneath the Hyuganada area.

In this study, we estimated MT impedance from electromagnetic data observed at ocean bottom sites around Hyuganada.

Electromagnetic data were recorded at twelve stations around Hyuganada by Ocean Bottom Electro-Magnetometer (OBEM). They had surveyed for half to one year between May in 2017 and August in 2019. In addition to three components magnetic field and two horizontal components electric fields, tilt, temperature (at all stations) and pressure (at two stations) had been measured at 8Hz or 60s sampling. We applied the BIRRP code (Chave and Thomson, 2004) to estimate MT impedance from time series data of the electromagnetic fields. The horizontal magnetic field data recorded at Kakioka Geomagnetic Observatory were also used as the data of the remote reference site.

The MT impedances at long periods (more than 3,000s) had poor decision accuracy at four stations whose depths are less than 1,000m. We considered that this is because the electric field was affected by oceanic current and/or tide. At almost stations, apparent resistivity at short periods was smaller than at long periods, and they indicated the tendency regarded as a one-dimensional structure at less than 100s period. This result implied there was a conductive layer just below the seafloor. We assumed this layer to be a sediment layer.

Previous marine MT studies showed that bathymetry near the coast strongly distorts MT impedance as known as coast effect (e.g. Key and Constable, 2011). Therefore, we will perform 3-D forward calculation for resistivity models incorporating with bathymetry to evaluate the coast effect.

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