Investigation of the stagnant slab by maneuver seafloor electromagnetic surveys: Report on the first observation phase

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Electromagnetic survey is one of the geophysical method to image Earth's interior and has a complementary nature with seismic surveys. Electrical conductivity of mantle minerals primarily depends on temperature. It also changes largely when partial melt exists and the melt is interconnected. Moreover, water dissolved in minerals strongly enhances the electrical conductivity. Constraining these parameters, electromagnetic method can contribute to mantle dynamics studies.

We have run a seafloor electromagnetic survey project in Philippine Sea in order to image the stagnant slab and surrounding mantle. Observations at seafloor is necessary to resolve the geometry of the slab because existing data sets are based on the observation by land geomagnetic stations and submarine cables, which are distributed coarsely and unevenly. Although it is difficult to establish steady observation stations at seafloor, iterative maneuver observations using ocean bottom electromagnetometers (OBEMs) can acquire the data required to image the stagnant slab.

The project iterates one-year-long survey tree times. Earthquake Research Institute, University of Tokyo and Institute for Research on Earth Evolution (IFREE), Japan Agency for Marine-Earth Science and Technology (JAMSTEC) have resourced the project with the OBEMs. All of the OBEMs are the products of Tierra Tecnica Ltd. The OBEMs measure time variations of three components of the magnetic field, two components of the electric field and the instrumental tilts with one-minute intervals for one year. In the first phase, we deployed 11 OBEMs in October, 2005 and recovered all of them successfully in November, 2006 (See figure). R/V Kairei of JAMSTEC was utilized for both cruises. In the second cruise, we deployed another 12 OBEMs so that the second phase was started. We found that all the 11 OBEMs recorded mostly good data.

We have been analyzing the data sets of the first phase. The time series are cleaned, corrected for the record timing, the instrumental tilts, and the components of daily variations and tides. Then, magnetotelluric (MT) and geomagnetic depth sounding (GDS) responses are estimated. The effect for the land-ocean distribution and seafloor topography on the responses are examined and stripped by using three-dimensional numerical modeling. We will report the detail of the observation, the data quality and some results of the preliminary analysis in the poster.