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On the electrical conductivity structure beneath the back arc region of SW Japan based on both land and seafloor data

Takuto Minami[1*], Hiroaki TOH[1], Takafumi Kasaya[2], Masashi Shimoizumi[3], Naoto Oshiman[4]

[1]Graduate School of Science, Kyoto Univ., [2]JAMSTEC, [3]Kyushu Polytechnic College, [4]Disaster Prevention Research Institute

The back-arc region of southwest Japan is an area of high seismicity. In this region, it has been pointed out that the subducting Philippine Sea plate affects the seismic and volcanic activities in that region. However, the precise relation has not been revealed yet. It is because the subsurface structure near the coastline area is actually difficult to infer precisely using the land observation data alone. Taking this into consideration, an EM research group, including Kyoto University and Tottori University, started the seafloor observation off the San-in region. Now, seafloor EM data have been obtained at 10 sites in total. However, there are not avalable 2-D or 3-D inversion codes for use near the coastline with adeguate ability to describe precise bathymetry. For example, Ogawa and Uchida (1996)'s 2-D inversion code, which is a finite element method (FEM) code often used to delineate conductivity structures beneath, is limited for rectangular elements to describe the bathymetry near coastlines. In our study, we adopted Utada (1987)'s FEM forward code because it adopts triangular elements which can readily express the arbitrary inclinations of the bathymetry in concern. We further improved it to achieve the accuracy in discription of bathymetry as well as the theoretical responses for both land and seafloor sites. The improvements are as follows:

1. We adopted the differentiation method of Li et al. (2008) to calculate more precise responses.
2. We improved the code so that we can use electric and magnetic fields that are observed at different sites.
3. We developed a code which generates the numerical mesh which precisely express the bathymetry near coastline by triangular elements.

To examine the accuracy of the improved code, we compared the responses calculated by the new code with the analytical solution in the hemi-cylindrical geometry (Ward and Hohnmann, 1988). As a result, we found the differences between two responses very small.

Finally, we tried to explain the observed data on the NS land-sea array extending to the north from the boundary between Tottori and Hyogo Prefecture. The 2-D modelling yielded a 2-D conductivity structure whose RMS is 3.3, and found following two noticeable features of the 2-D section.

1. A conductive anomaly found at 10 to 25km depths beneath the region near the coastline is extending seaward as far as 100km off the San-in region.
2. There appears a large conductive anomaly in the deeper extending part 50km to 200km off the San-in region.

In this presentation, we report the improvement of Utada (1987)'s FEM forward code and the result of the 2-D modelling.

Keywords: magnetotellurics, electrical conductivity structure, land-sea array, finite element method