Revised electrical conductivity structure of the upper and mid-mantle in the North Pacific region

Hisayoshi Shimizu[1]; Takao Koyama[1]; Kiyoshi Baba[1]; Hisashi Utada[1]
[1] ERI, Univ. of Tokyo

It is well recognized that the electrical conductivity structure in the Earth's interior obtained using geomagnetic and geoelectric field variations provides independent information to discuss the dynamics and material heterogeneity in Earth. Both the 1-D (Utada et al., 2003; Kuvshinov et al., 2005) and 3-D (Koyama, 2002) have been applied so that results are interpreted together with the results of the global seismic tomography (e.g. Fukao et al., 2004) and/or of high-pressure experiments (e.g. Hae et al. 2006, Yoshino et al. 2007, Huang et al. 2007) to discuss the state of the mid mantle (e.g. Fukao et al., 2004; Koyama et al., 2006).

After some years since the first estimation of the 3-D mantle structure was done by Koyama (2002), we would like to revisit and revise the conductivity structure in the mid-mantle. Possible improvement of the conductivity estimates should be brought through (1) by improving the estimate of the response functions from electromagnetic observation, (2) by better understanding of the behaviors of the response functions against 3-D conductivity heterogeneity in the mantle, and (3) by introducing new information (response function) which is sensitive to the 3-D structure. Improvement of the response function has been accomplished by Baba (2007) by estimating response functions at geomagnetic stations and of submarine cables in the Pacific area using longer time series. Shimizu et al. (2008) summarized the characteristics of the GDS and D responses due to conductivity heterogeneity of 1,000 km scale in the mantle transition zone, and also, showed that the HTF (horizontal transfer function) may be used as additional information for 3-D inversions. Now, it is all set for new conductivity estimates.

In this paper, we are going to show the revised 1-D reference conductivity model, which is essential for further analyses, obtained by using the revised GDS and MT responses. The problem of correcting the effect of the ocean-land conductivity contrast on the 1-D conductivity inversions is also revisited, and the methods are also improved. Three dimensionality of the mantle structure is also discussed using spatial distributions of the anomalous part of the GDS, D and HTF responses and their period dependence. They all contain key information for 3-D conductivity inversion.