Electrical conductivity distribution in the mid-mantle beneath the north Pacific estimated by using a submarine cable network

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We examine global features of the three-dimensional structure of the electrical conductivity in the mid-mantle by using the data of voltage of submarine cables and magnetic field variations at geomagnetic observatories and stations.

Some previous studies estimated the electrical conductivity in the Earth in the oceanic region. Their studies, however, considered less the oceanic effect which causes an estimation of the erroneous structure. In this study, a new one-dimensional inversion algorithm fully considering the oceanic effect was developed. Given a priori information of the jump at the depth of 400 km and 650 km, a reliable one-dimensional reference model beneath the Pacific was obtained. The character of this model is that a jump of the electrical conductivity at the depth of 400 km is by 1.5 order and the jump at 650 km is by three times, which is very similar to the results of the laboratory measurement of the electrical conductivity of Mg{1.8}Fe{0.2}SiO4 by Xu et al. [1998].

And also a new three-dimensional inversion algorithm for a global study was developed where development of three-dimensional inversion is just a frontier subject in EM induction studies. The three-dimensional structure in the mid-mantle beneath the Pacific was estimated by this code. The characteristic features were revealed such as a conductive region beneath Hawaii more conductive by three times than the one-dimensional reference model, a resistive region beneath Philippines less conductive by a half, and a conductive region beneath Mariana more conductive by three times. The two formers of features are consistent with the structure of the seismic wave velocity, on the other hand the last feature only appears in the electrical conductivity structure.