3-D resistivity modeling based on marine magnetotelluric data in the Kumano-nada, southwestern Japan arc

M. Kuroda[1], H. Ichihara[2], T. Goto [3], T. Matsuno[4], K. Tadokoro[5] and T. Kasaya[6]
[1]Graduate School of Environmental Studies, Nagoya University, mkuroda@seis.nagoya-u.ac.jp
[2]Earthquake and Volcano Research Center, Graduate School of Environmental Studies, Nagoya University, h-ichi@seis.nagoya-u.ac.jp
[3] Earth-Science Laboratory, Graduate School of Science, University of Hyogo, tgoto@earth-univ-hyogo.jpn.org
[4] Kobe Ocean-Bottom Exploration Center (KOBEC), Kobe University, matsuno@port.kobe-u.ac.jp
[5]Earthquake and Volcano Research Center, Graduate School of Environmental Studies, Nagoya University, tad@seis.nagoya-u.ac.jp
[6] Japan Agency for Marine-Earth Science and Technology (JAMSTEC), tkasa@jamstec.go.jp

SUMMARY

The Nankai Trough, located in the SW Japan arc, is an inter-plate earthquake zone where huge earthquakes (magnitude 8 or greater) occur with intervals of 100-200 years. Since the occurrence of huge earthquakes is influenced by fluids (e.g. Kodaira et al., 2004), estimating the distribution of pore fluids will lead to elucidation of the mechanism of occurrence of huge earthquakes. Resistivity is sensitive to the presence of fluids. Therefore, the resistivity structure was estimated using the magnetotelluric method in the Kumano-nada where the 1944 Tonankai earthquake occurred (Kimura et al., 2005; Kasaya et al., 2005). However, these previous studies have the following issues: (1) the survey was conducted along only a single line, (2) the accuracy of the estimated MT impedances was not high, and (3) estimating two-dimensional resistivity structure using only TM-mode impedance. Therefore, in this study, we aimed to estimate a precise three-dimensional resistivity structure in the Kumano-nada. First, we conducted magnetotelluric surveys at new seven seafloor sites in Kumano-nada. Next, we calculated MT impedances using the BIRRP code (Chave and Thomson, 2004) and an objective method for extracting high-quality MT impedances (Kuroda et al., in revision). The three-dimensional resistivity structure was modeled based on all components of MT impedance using the FEMTIC code (Usui, 2018; 2021), which considers the seafloor topography. The preliminary three-dimensional resistivity model explained the local increase of apparent resistivity and an anomalous impedance phase in a period range around 2000 seconds at the observation sites near the Nankai Trough. In the western part, the modeled resistivity was decreased with increasing depth. On the other hand, a discussion of detailed resistivity structure requires both the careful selection of an initial model of the resistivity structure and the consideration of more detailed seafloor topography into the inversion model.

Keywords: Magnetotelluric method, OBEM, FEMTIC, The Kumano-nada, The Nankai Trough.