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Resistivity structure beneath the Kikai submarine caldera volcano and tidally induced EM signals from OBEM observations

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This study aims to understand the current magma supply system that could lead to giant caldera-forming eruptions. The Kikai submarine caldera volcano, located in southern Kagoshima Prefecture, is known for the 7.3 ka caldera-forming eruption, the most recent giant caldera eruption in Japan. Topographic and petrological studies indicate that a central lava dome was emplaced by renewed magma supply after this eruption (Tatsumi et al., 2018). To investigate the current state of the magma supply system, we deployed and recovered 32 Ocean Bottom Electro-Magnetometers (OBEMs) around the Kikai Caldera between 2016 and 2022. In this presentation, we report (1) improvements in the estimation of the resistivity structure using MT surveys, and (2) characteristics of the observed data in the tidal frequency band.

(1) Sub-seafloor resistivity structures inferred from the present dataset have previously been reported (Obata et al., 2025, JpGU). Here, we present an improved resistivity model obtained through a three-step inversion procedure, including one-dimensional structure estimation using the Occam 1D method (Constable et al., 1987).

(2) Tidally induced magnetic variations arise as conductive seawater moves in the geomagnetic main field, and these signals can be observed both by satellites and at the seafloor. Inversions using satellite data have already been conducted (Grayver et al., 2016, 2017). Seafloor observations, however, provide access to toroidal magnetic fields that cannot be detected at satellite altitudes, thus potentially placing new constraints on resistivity modeling. From the OBEM data obtained in this study, vertical electric fields could be estimated by calculating potential differences among multiple electrodes. We present characteristics of the magnetic field data in the tidal frequency range, as well as observations of vertical electric field.