Magnetotelluric survey of the Miki fault, the Yamasaki fault system, southwest Japan

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Introduction

Clear electrical conductivity variation is expected to be identifiable in the vicinity of an active fault (e.g., Ritter *et al.*, 2005), and the electrical conductivity distribution can provide a new image of the subsurface structure of an active fault. The audio-frequency magnetotelluric (AMT) method is a powerful tool for investigating the electrical conductivity structure of active faults in the upper few km of the Earth’s crust. In particular, this method is more sensitive to the structure of a strike-slip fault, where vertical to high-angle fault planes and fracture zones are expected, than seismic reflection or refraction surveys.

The Yamasaki fault zone (YFZ) consists of the Nagisen Fault, the main part of the YFZ, and the Kusadani Fault. The main part of the YFZ is further divided into a northwestern (NW) group (the Ohara, Hijima, Yasutomi, and Kuresakatouge Faults) and a southeastern (SE) group (the Biwako and Miki Faults) based on their latest faulting events and mean slip rates; AD 868 and 1.0 m/kyr for the NW group vs. AD400 - 600 and 0.8 m/kyr for the SE group (Okada, 1987; Earthquake Research Committee, 2013).

AMT surveys have made at 81 stations along 7 survey lines across the faults of the NW group, while the survey has made at only 17 stations along 1 survey line across the fault of the SE group. It is important to make clear the subsurface structure of the SE group to know the whole nature of the YFZ and difference between the NE and SE groups of the main part of the YFZ. In the SW group, we focused on the Miki fault and its general strike of N60°W (Hyogo Prefecture,1999).

Observation

An AMT survey was undertaken in November June 2015 at twelve stations along the transect across the Miki fault, this transect is laied near the trench excavation survey site by Yoshioka *et al.*, (2008). The remote station of the magnetic field was made ~25km north from the northeastern end of the transect to analyze the data using the remote reference method (Gamble *et al.*, 1978). Two horizontal components of electrical field and three components of magnetic field were measured.

Analysis

After MT response functions were obtained, we adopted the phase tensor analysis (Caldwell *et al.*, 2004) to estimate dimensionality of the resistivity structure beneath the study area and to determine the direction of the regional strike, if the structure is two-dimensional. Then the two-dimensional resistivity model was constructed using the code of Ogawa and Uchida (1996).

Result

The optimum model obtained (named MKI model) is characterized by the three conductive zones. The boundary between shallow two conductive zones is locate at the surface trace of the Miki fault (AIST, 2008). The bottom of another deep conductive zone found in the northeastern side of the Miki fault corresponds to the lower boundary of the between Osaka Group.

Keywords: Miki fault, Yamasaki fault system, active fault, resistivity structure, Magnetotelluric method

