Electrical resistivity structure beneath the fault segment gap: A case study of the Yamasaki fault zone, southwest Japan

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The relationship between the earthquake magnitude and the displacement accompanying an earthquake was proposed by Matsuda (1975) for Japanese inland earthquake and this formula is widely used to estimate the magnitude which will occur at a given fault-segment. However, many papers which pointed out the larger earthquake magnitude was observed than the estimated ones, have been published. Revealing subsurface structure of an active fault is important to overcome the problem (The Earthquake Research Committee, 2010) and, furthermore, is an interesting academic theme.
Clear electrical resistivity variation is expected to be identifiable in the vicinity of an active fault as a result of enriched and interconnected fluid (meteoric waters and/or groundwater) in fractures and/or uneven fluid distribution across the fault because of impeded cross-fault fluid flow (e.g., Electromagnetic Research Group for the Active Fault, 1982). The electrical resistivity distribution can provide a new image of the subsurface structure of an active fault.
We have made an audio-frequency magnetotelluric (AMT) survey along many lines across the Yamasaki Fault System (FZC) and the Gomura Fault System. The characteristic conductive zones (Fault Zone Conductor: FZC) have been commonly found beneath the surface traces of them, and we recognize the FZC is a good sign to identify a hidden active fault.
The Yamasaki Fault Zone (YFZ) is a ~120 km long, typical left-lateral strike-slip fault. According to the Earthquake Research Committee (2013) and Okada (1987), The YFZ consists of the Nagisen Fault Zone, the main part of the YFZ, and the Kusadani Fault. The main part of the YFZ is further divided into the northwestern (NW) group (consisting of the Ohara, Hijima, Yasutomi, and Kuresakatouge faults) and the southeastern (SE) group (consisting of the Biwako and Miki faults) based on their latest faulting events and mean slip rates.
We made an AMT survey along the line across two regions where no surface trace of active faults are observed: one is a clear gap between two fault-segments of the Yasutomi fault and the Biwako fault (Region I) and another is a region where is eastern extension of the Kuresakatouge fault (Region II). We obtained the two-dimensional resistivity model along the line (FKS model) and is characterized by three conductive areas and two of them are located near the points where hidden faults are expected to exist.
In this paper we show the FKS model and its feature, then discuss relationship between the FKS model and two adjacent resistivity models: one is the model along the line across both the Yasutomi and Kuresakatouge faults (Kubota, 2012) and another is the model across the Biwako fault (Ito, 2015).

Keywords: conductivity structure, active fault, Yamasaki fault zone, Magnetotellurics

