Network-MT survey around the Niigata-Kobe Tectonic Zone in Central Japan (2)

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The Japanese dense GPS array revealed a tectonic zone with high strain rates along the Japan Sea coast in the central Japan, which is called the Niigata-Kobe Tectonic Zone (NKTZ; Sagiya et al., 2000). It is suggested that the NKTZ has played an important role in the deformation of the Japanese inland, because of large historical earthquakes and active faults concentrated in this zone. Iio et al. (2002) proposed that the concentrated deformation in the NKTZ is a result of the weakened lower crust beneath the NTKZ. It is important to establish the crust-to-mantle electrical conductivity structure around the NKTZ to clarify the origin of the NKTZ, as conductivity is sensitive to the existence of fluids. In this study we aim to obtain a new resistivity model using state-of-the-art Network-MT technique over the central part of Japan.

The Network-MT method (Uyeshima et al., 2001) is a field observation technique based on the magnetotelluric (MT) method, which employs commercial telephone networks to measure voltage differences with long dipole lengths. The long dipole lengths enable the observed responses to be relatively free from the effects of small-scale near-surface heterogeneity.

The Network-MT array we used is distributed widely in the northern part of the Central Japan. We show the result from the data obtained at 16 sites along the ~150 km-long transect, recorded with 1-second interval during 4-10 months at each site. The three-component magnetic field was measured with 1-second sampling interval near the center of the transect.

Good voltage difference data was obtained at almost all sites except four sites. These four sites are located in the southernmost part of the transect, and data at these sites were severely contaminated by artificial noise, especially leakage current from electric railways.

We computed MT responses using BIRRP program code (Chave and Thomson, 2003) and magnetic data obtained at the Kakioka Magnetic Observatory of Japan Meteorological Agency as a remote reference.

Stable and precise MT responses were obtained at 11 sites. Except the 11 sites, one of the other five sites showed unstable MT responses for TE mode, possibly because of unsuitable arrangement of electrodes. Four of the five sites are corresponded to the sites severely contaminated by artificial noise. Apparent resistivity of TM mode changes markedly at the boundary between the near-coast sedimentary basin and the mountain district, suggesting existence of large resistivity change.

Prior to the two-dimensional analysis, we examined dimensionality and regional strike of the resistivity structure beneath the study area, using the Phase Tensor analysis (Caldwell et al., 2004). The regional strike of the conductivity structure was almost the same at all the sites, which is sub-parallel to active faults in the area of this study. The dimension parameter indicated that regional structure is not three-dimensional. We determined that two-dimensional analysis is proper for the data set of this study.

The 2-D resistivity model along the transect, which is perpendicular to the regional strike, was determined using the 2-D inversion code of Ogawa and Uchida (1996). Our model is characterized by two conductive areas; one is located at the near-surface part of the northernmost part of the transect, and the other area is located at the depth of the lower crust beneath the central part of the transect. This conductor at lower crust indicates presence of fluid and may make the lower crust weak, resulting high strain rate at the surface.

In this presentation, we introduce our Network-MT campaign and propose the two-dimensional resistivity model along the transect across the central part of the Network-MT survey area in the central Japan.