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東北地方上部マントル沈み込み帯の３次元電気伝導度構造
Three dimensional electrical conductivity model in the subduction zone beneath north-eastern Japan

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Our final goal is to infer a geofluid map (GFM) from both of the seismological (seismic velocity, Vp/Vs, Q etc.) and electrical conductivity structures in the wedge mantle of subduction zone beneath northeastern Japan. While plenty of high-resolution three dimensional (3-D) seismic tomographic images has been revealed there, none of 3-D electrical conductivity distribution model, of which the resolution is comparative to those of seismic tomography, has been proposed in terms of wedge mantle in subduction zones. Here, we show a high-resolution 3-D electrical conductivity distribution model in the wedge mantle beneath northeastern Japan used as input of GFM.

We carried out long-period MT observation using the state-of-the-art equipments, LEMI-417 and NIMS. The total 72 site observation has been completed. To remove tilt changes, baseline steps and drifts of fluxgate magnetometers, we first subtracted magnetic field variations to which a median filter was applied, from raw data. The horizontal coordinate of magnetic field data in each site was rotated before the response calculation such that the declination of the averaged horizontal component should be consistent with the 2010 absolute geomagnetic observation map provided by Geospatial Information Authority of Japan. We used the BIRRP processing code (Chave and Thomson, 2004) to estimate MT responses and have successfully retrieved them up to 61440 seconds in period.

The MT impeadance responses were inverted into 3-D electrical conductivity model using WSINV3D (Siripunvaraporn et al, 2005), the data-space Occam inversion method. The all input data error floor was assigned to be 10 percent. We investigated the optimal reference model with trial and errors. The test model was (1) uniform models, (2) layered models and (3) layered models with subducting slab models. The best RMS in each reference model was (1) 2.81, (2) 2.71 and (3) 2.48, respectively. Hence, we adopted the reference model of the layered model with subducting slab.

The conductivity profiles normal to the trench axis in higher latitude than N 39 degrees delineate conductive region on the subducting slab, and the conductive region is raised just beneath the central range of northeastern Japan (Ou-backbone range). This electrical image is well consistent with that obtained by the seismic tomographic model. On the other hand, a profile in lower latitude than N 39 degrees reveals that the conductive region is overturned towards backarc. The top of the overturned conductive body coincides with Gassan Volcano location, one of the outstanding backarc volcanism. However, Chokai Volcano, another distinctive backarc volcanism has no subsurface conductive root originated from deep upper mantle. The overturned mantle convection image is not found in the seismic tomographic image.