# Three-dimensional inversion of magnetotelluric data using unstructured tetrahedral elements

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3-D magnetotelluric inversion code using unstructured tetrahedral elements is newly developed in order to correct topographic effect by directly incorporating it in computational grid. Electromagnetic field and response functions are distorted at the observing sites of magnetotelluric (MT) method due to undulating land surface. Without correcting the distortion, we can wrongly interpret subsurface structure. Of the two method proposed to correct topographic effect, the method incorporating topography explicitly in the inversion is applicable to wider range of survey data than the correction method since the latter requires some assumptions. For forward problem, it has been shown that the finite element method using unstructured tetrahedral element is useful to incorporate topography because it can represent complicated object precisely and robustly with relatively fewer elements. In this paper, using the newly developed code, the author shows the applicability of the unstructured tetrahedral element to MT inversion

The inversion code calculates electromagnetic field on the earth with the edge-based tetrahedral element. And it searches the subsurface resistivity and components of distortion matrix of each site as model parameters. In inversion, the code iteratively updates the models to minimize the object function consisting of the data misfit, the model roughness and the strength of galvanic distortion using the Gauss-Newton method. And, the code is parallelized with the OpenMP/MPI hybrid parallel programming.

The newly developed code was applied to synthetic data of the model including topography. As a result of the inversion, anomalies of true model were recovered correctly. This result showed that inversion using unstructured tetrahedral elements is useful to interpret resistivity structure correctly instead of topographic effect.