非構造四面体要素を使用したインバージョンの海洋MT探査への適用性評価

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Evaluation of the applicability of the inversion method using unstructured tetrahedral elements to the marine MT method

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The author applied a 3-D inversion scheme using unstructured tetrahedral mesh to a synthetic data of the marine magnetotelluric method and verified its effectiveness. Topographical effects have been a critical issue in marine MT (magnetotelluric) modelling and interpretation. Observation sites of marine MT surveys are located on undulating surfaces. Those undulations make anomalous electromagnetic field at the sites. If those effects are ignored, it is, therefore, possible to misinterpret resistivity structures. The finite element method using unstructured tetrahedral elements is one of the most effective methods to correct topographic distortions in the marine magnetotelluric data since it can precisely incorporate the bathymetry into computational grids without using too many elements, and a number of robust meshing algorithms have been proposed such as Delaunay triangulation method and the advancing front method. Schwarzbach & Haber (2013) has shown the applicability of the element to the marine controlled source electromagnetics. In addition, in relation to land MT problems, Usui (2015) has shown that the influence of topography can be sufficiently reduced by representing topography with the element. However, when used in marine MT problems, the unstructured tetrahedral element has been limited to forward calculations. Therefore, the author applied the 3-D inversion scheme of Usui (2015) to marine MT problem and confirmed that that the inversion using unstructured tetrahedral elements can properly estimate subsurface resistivity structure instead of the undulations of the sea floor.