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3D MT Modeling in Finite Volume Method

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Abstract

3D numerical modeling of magnetorelluric problem has developed as the ability of computers has improved. In this problem, topography influences the electric and magnetic fields. Therefore, we need to consider the topography to calculate the electric and magnetic fields more precisely.

To solve 3D magnetorelluric problem, we have applied finite volume method, in which we can use the unstructured mesh to solve the problem of the topography. In this modeling, we solve magnetic field at first and secondly calculate electric field with using the magnetic field. When we solve electric field, we need to pay attention not to break the conservation law of current density. To consider this condition, we calculate horizontal components of electric field on each surface of calculated cells.

We compared the results of Mackie et al. (1993). In the case of 1D, 2D and 3D, our results of the apparent resistivity and impedance phase were consistent with the results of Mackie et al. (1993). However, in 3D case, gaps of the impedance phase were appeared. Mackie et al. (1993) used rough mesh, 19 (N-S)×28 (E-W)×18 (depth). Therefore, we need to compare the results of more precise calculation. Furthermore, it is necessary to compare other results to make sure the validity of our modeling code.

As the future work, because finite volume method has the potential of unstructured mesh applied, we will be able to calculate including topography in our code.

Reference

Mackie, R. L., Madden, T. R., & Wannamaker, P. E. (1993). 3-Dimensional Magnetotelluric Modeling Using Difference-Equations - Theory and Comparisons to Integral-Equation Solutions. Geophysics, 58(2), 215?226. doi:10.1190/1.1443407