2D Magnetotelluric Resistivity Structure Modeling Using Finite Element Method Based on Vector Triangular Grid and Its Application to Lembang Fault MT Data

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SUMMARY

Magnetotellurics is a geophysical exploration technique that relies on the natural fluctuations of electromagnetic waves to delineate their influence on the Earth. The primary focus of this method is to reveal the resistivity structure beneath the Earth's surface. The application of numerical approaches in magnetotelluric modeling has proven to be an efficient method in various theoretical studies in the field of geophysics, particularly in the context of modeling two-dimensional structures. In this research, a 2D resistivity structure modeling is explained using a vector-based finite element method. This approach utilizes the edges of elements as vector bases. The presented results include response values such as apparent resistivity and impedance phase at the surface. The study employs the standard model from COMMEMI as a reference to validate the modeling program. Furthermore, the results from this modeling program are compared with the outcomes of the modeling program developed by Weaver et al. The good results were obtained with error values for each model for layered and homogeneous Earth < 3%. Additionally, for the reference model COMMEMI, errors of 3.4393% and 1.4050% were obtained for TE and TM modes, respectively. Furthermore, for the topography model, apparent resistivity and impedance phase results closely approximated the reference values. Subsequently, in the application to field data, specifically the Lembang Fault, errors were obtained for the TE and TM modes within the range of 1.16 – 9.16% for each MT data acquisition site.

Keywords: Magnetotelluric, Modelling, 2D Structure, Edge Element, Finite Element