

Three-dimensional Inversion of Grounded Electrical-source Airborne Transient Electromagnetic (GREATEM) Survey Data

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Studies have shown that Grounded Electrical-Source Airborne Transient ElectroMagnetics (GREATEM) is a promising method for resistivity structures investigating in coastal areas, in addition to inaccessible areas such as volcanoes, mountains and deep forest cover. To expand the application of the GREATEM system, a three-dimensional (3-D) resistivity model that considers large lateral resistivity variations is required. In this paper, we present a frequency- domain 3-D electromagnetic (EM) inversion approach that can be applied to time domain data from GREATEM. In the frequency-domain approach, TEM data were Fourier-transformed using a smooth-spectrum inversion method, and the recovered frequency response was then inverted. To deal with a huge number of grids and a wide range of frequencies in airborne datasets, a method for approximating sensitivities is introduced for efficient 3-D inversion. Approximate sensitivities are derived by replacing adjoint secondary electric fields with those computed in the previous iteration. These sensitivities can reduce the computation time without significant loss of accuracy. Firstly, we verified both of our forwarding and inversion solutions. We then applied this approach to the GREATEM survey data from Kujukuri beach, central Japan. The inverted results of the field data are well fit with the previous study results at Kujukuri area, suggesting the applicability of this inversion approach for constructing 3D resistivity models from the GREATEM field survey data in the future.

Keywords: Airborne EM, , GREATEM, 3-D inversion, Frequency-domain inversion., 3-D forward modeling