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Three dimensional resistivity modeling for the GREATEM survey data

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ABSTRACT

The Ground Electrical source Airborne Transit Electro Magnetic (GREATEM) system uses a grounded electrical dipole source of nearly 2 to 3 km length as a transmitter and a three-component magnetometer in the towed bird as a detector. With a grounded source, a large-moment source can be applied and a long transmitter-receiver distance used, yielding a greater depth of investigation but limiting the survey area. Other advantages include a smaller effect of flight altitude and the possibility of higher-altitude measurements.

A series of data processing are used to obtain the transient response curves in the end from GREATEM field survey data, these steps include (1) movement correction: which made by subtracting predicted magnetic field variations, as derived by the response function based on the movement measured by the gyro, from the observed magnetic field variations, to yield moving-noise-free data. (2) Coordinate transformation: to transfer magnetic field components from bird-based coordinates to geographical coordinates that based on directional sensor data. (3) Removing local noise: magnetic field data obtained from the ground magnetometer were used to remove natural and artificial noise. (4) Data stacking: as GREATEM data is affected by the horizontal resistivity structure change, to over come this issue a stacking of data is need. (5) Signal portion extraction: search for 0-level, the partial signal (transient) was extracted.

We are going to make a 3D resistivity model for GREATEM data based on 1D resistivity structures inverted from GREATEM field survey data as initial model. The 3D EM forward modeling scheme based on finite difference (FD) staggered grid method (Fomenko and Mogi, 2002) used to calculate the response of 3D resistivity model at each corresponding survey line. Convolution is carried out in frequency domain to add the frequency characteristic response of field survey instrument to forward model synthetic data of EM transit response in order to compare it with field survey data transit response obtained after data processing.

In current work, we have developed 3D stacking of data in each grid, and employed this method practically on the data of GREATEM filed survey at the Kujukuri beach that has been conducted to test the GREATEM survey system and clarify the subsurface structure in coast line area such as the Kujukuri beach which located on the east coast of the Boso peninsula in Chiba Prefecture, Japan.

Keywords: GREATEM 3D resisitivity model, GREATEM survey at cost line