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Forward calculation of Magnetotelluric responses with MPS method

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In this research, we developed a new 2-D magnetotelluric (MT) forward simulation method based on the MPS (Moving Particle Semi-implicit) method framework. Our final purpose is to calculate MT response with arbitrary three-dimensional topography.

The MPS method is a particle method and was first developed for the simulation of incompressible fluid flow (Koshizuka and Oka, 1996). Recently, the MPS method is used the digital reproduction of failure of materials,for the simulation of elastic wave propagation, etc. We use the MPS method for the simulation of electromagnetic induction.

In our forward calculation, electric and magnetic fields are defined at each particles in a calculation model. MT responses are calculated on the surface of the ground with topography with a horst-graben shape. Our simulation results indicate that MT forward calculation with the MPS method is suitable for free surface like topography, because the MPS method does not require the mesh configuration such as for FDM and FEM, particles in the MPS method could form any shape. The results of MT forward calculation (TE-mode and TM-mode) based on MPS method is reliable enough to calculate MT responses on models with topography. Based on the inherent character of MPS method, the expansion of our code from two-dimension to three-dimension will be easily achieved.

Keywords: Magnetotelluric, MPS, topography