3D Inversion of Time-Domain Electromagnetic Data for Ground Water Aquifers

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Abstract

Airborne time-domain electromagnetic surveys are effective tools for ground water aquifer mapping, mineral exploration, and environmental applications. 3D inversion of airborne electromagnetic data is a challenging computational problem. The size of the surveys and the spatial resolution required to adequately discretize the transmitters and receivers result in very large meshes. Solving the forward problem repeatedly on such a mesh can quickly become impractical. Fortunately, using a single mesh for both the forward and inverse problem for all of the transmitters is not necessary. The forward problem for a single source or a small group of sources can be solved on different meshes, each of which need only be locally refined with fine cells close to the selected transmitters and receivers. Away from the selected transmitters and receivers, the mesh can be coarsened. The forward problem can then be broken into a number of highly parallel problems. Each forward modelling mesh is optimized specifically to the selected transmitters and receivers, and has far fewer cells than the fine inversion mesh. In this abstract we present an implementation of this idea using a finite volume discretization on OcTree meshes. We demonstrate our approach to invert 3D airborne electromagnetic data, and show how it can be used tomap ground water aquifers and shale units from aSkyTEM dataset over the Horn River Basin, British Columbia.