OTZE - AIRBORNE EM INVERSION ON UNSTRUCTURED MODEL GRIDS

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An efficient, accurate, multi-grid algorithm has been implemented for the modeling of airborne, land and marine controlled source electromagnetic data, providing accurate 3D depth inversions of frequency and time domain data with cost-effective compute timelines.

The forward kernel can either be a 1D solver for layered models, or 2.5D or 3D solvers based on a finite difference approach. The inverted resistivity model mesh is constructed from rectangular cells similar to conventional finite difference approaches. While these cells form a standard rectilinear grid in the horizontal plane, vertically they can be arranged arbitrarily. This vertically unstructured nature of the model grid requires a mapping to the finite difference grids, which is performed on-the-fly in the solver.

This feature, together with an appropriately arranged smoothness constraint, is useful in a variety of workflows. It helps in the presence of topography and also can be used to incorporate general a priori information about the survey area for blind inversions, as well as specific structural information for hypothesis testing. However, the potentially complex model geometry requires changes to some of the other available regularizations like the cross-gradient operator which is used to include for example surface geology dip and strike observations or for joint inversions with gravity gradiometry or magnetics.

We discuss the technical aspects of the implementation, illustrated with example workflows from diverse applications: stand-alone AEM inversions, joint inversions including frequency and time-domain EM.