

INVERSION OF AIRBORNE EM DATA WITH AN EXPLICIT CHOICE OF PRIOR MODEL

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Inversion of airborne electromagnetic (AEM) data to infer information about the subsurface distribution of resistivity is a widely examined inverse problem. Many different approaches have been considered to solve this inverse problem that can roughly be regarded as either a 'deterministic' or 'probabilistic' method. The goal of deterministic methods is to locate one 'optimal' resistivity model along with some uncertainties, that represents observed data. The goal of probabilistic methods is to locate a (large) collection models (realizations from a posterior probability density) which ideally represents all available information. Here we will consider a specific type of probabilistic approach to AEM inversion, in which the available information consists of AEM data (and a model of uncertainty of the AEM data), and an explicit choice of prior information. By 'explicit' we mean the prior model should represent available information. This can be for example be in form a geostatistical model that represent a geological expert's knowledge of expected spatial (i.e. geological) structures. First, we will demonstrate that in practice the choice of the prior cannot be avoided. If the prior is not chosen explicitly, it is most always chosen implicitly by the choice of inversion methods used. For example, linearized least squares inversion is based on an implicit assumption of a Gaussian prior. Then we demonstrate how very different prior models can be explicitly defined and modeled, and demonstrate how such prior model choices affect the inversion results obtained from probabilistic inversion. Finally, we argue that the choice of prior information should not be left to be chosen by whatever inversion methodology is available. Instead, prior information should be chosen explicitly to best represent the prior geological knowledge at hand. Then, the inversion problem should be solved using whatever method that can take into the actual prior information.