

1-D Inversion and Analysis of Marine Controlled-Source Electromagnetic Data

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Marine Controlled-source electromagnetic data are now routinely collected over promising oil and gas prospects identified by seismic investigations. They allow an identification of resistive layers at depth, thereby pointing to possible oil and gas bearing sediments, where conductive salt water has been displaced by resistive oil or gas.

We present results from an investigation of the applicability of one-dimensional inversion of the data. Data noise has not been measured by the contractor, so we have developed a noise model by inspection of the individual data sets to make it possible to perform a meaningful inversion and analysis. Inversion is carried out with multi-layer models and L1-optimization and with 4-layer models in the least-squares sense.

A general analysis of the resolution capabilities of the MCSEM method regarding buried resistive layers has been carried out within the framework of 1D inversion. The analysis addresses the importance of including prior information on water layer resistivity and thickness and the dependence on the frequencies used.

For the data set in question, the model sections display a resistive layer at a depth of ~800 m below the sea bottom. While the thickness and resistivity of the layer are not well determined, the product of the two, the resistance, is well resolved. This parameter is indicative of the total amount of possible hydrocarbons.