Iterative Extended Born Approximation based CG-FFT Integral Equation Method for Low-Frequency 3D Modeling

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Summary

We present a fast method for three-dimensional modeling low frequency CSEM problems. We apply the method to the marine controlled source electromagnetic (MCSEM) exploration situation. For 3D problems fast computational methods are relevant for both forward and inverse modeling studies. For this reason, the Born approximation (BA), extended Born approximation (EBA) and iterative extended Born approximation (IEBA) are implemented and compared with the full solution of the conjugate gradient fast Fourier transformation method (CG-FFT). It is shown here how well the IEBA method performs in terms of both accuracy and speed. For forward modeling the solution at the sea bottom is of interest because that is where the receivers are usually located. But for inverse modeling, the accuracy of the solution in the target zone is important to be able to obtain reasonably accurate conductivity values from the inversion using this approximate solution method. Our modeling studies show that the IEBA method is suitable for both forward and inverse modeling.