3D synthetics of manetic and electric fields induced by a MMR control source

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Electric and magnetic responses induced by control electric source, which can be observed by OBEM at seafloor, provide information on electric conductivity structure in the shallow crust. With a moving control source covering sufficient region of interest and with OBEM array distributed on the seafloor to observe numerous signal of the responses, one can address some constraint on the crustal conductivity structure. In this work, we have developed a numerical code to calculate synthetics of electric and magnetic fields induced by a given position of the electric source for a given conductivity structure in the crust.

In previous works of MMR research in ocean, electric and magnetic responses are given by an analytic solution on a cylindrical coordinate, which forces time-consuming static observation in order to keep the two electrodes in vertical. Moreover, the analytic solution can only be applicable for one dimensional horizontally stratified conductivity structure. To eliminate this limitation, we have developed a numerical code based on finite difference method to solve electric and magnetic fields in an arbitrary three dimensional geometry. Only the minimum number of mesh is required because we adapt equivalent circuit at boundaries to describe infinite medium. We have conducted numerous forward calculations for given electric conductivity structures in the crust, which give us insight to expect the structure from observations. We are now developing inversion code to get more quantitative structures.