POSSIBILITY OF THREE-DIMENSIONAL MAGNETOTELLURIC (MT) INVERSION BY USING MT PHASE TENSOR DATA

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The MT method is a very useful tool to explore fluid and thermal anomaly, because it is very sensitive to electrically conductive bodies. The electrical field, however, is also very sensitive to tiny bodies close to the measurement site, which is much smaller than inductive scale length and is not of our interests. This is called as “galvanic distortion” (e.g. Jiracek, 1990), and may lead us to wrong estimation of MT impedances. This effect cannot be fully removed by using a single EM measurement data (Groom and Bailey, 1989) and is a big problem for the MT method.

Caldwell et al. (2004) found distortion-free data parameter, “MT phase tensor”. The MT phase tensors are equivalent to MT impedance phases in one- and two- dimensional problems. They, however, have no information on scale length, and thus the MT inverse problem cannot be solved uniquely by using MT impedance phase data at single measurement site. It is equivalent to Groom and Bailey’s result. The MT impedance phase data at several sites, however, may solve the two- and three-dimensional problem uniquely, because they include a horizontal scale-length, that is, distance between measurement sites each other. Note that one-dimensional problems cannot be solved by this idea, because there is no horizontal scale-length in measurement data.

By using MT phase tensor as data parameters, degrees of freedom of data parameters are decreased to the half. In the case that distortion effect is not frequency-dependent, however, only four degrees of freedom are decreased, which is a number of components of a distortion tensor. Therefore it may be possible to estimate the electrical conductivity correctly by using these data parameters.

In this paper, we show a result of numerical tests of three-dimensional inversion by using MT phase tensor data and discuss it.

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