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3-D inversion of magnetotelluric Phase Tensor

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Three-dimensional (3-D) inversion of the magnetotelluric (MT) has become a routine practice among the MT community due to progress of algorithms for 3-D inverse problems (e.g. Mackie and Madden, 1993; Siripunvaraporn et al., 2005). While availability of such 3-D inversion codes have increased the resolving power of the MT data and improved the interpretation, on the other hand, still the galvanic effects poses difficulties in interpretation of resistivity structure obtained from the MT data. In order to tackle the galvanic distortion of MT data, Caldwell et al., (2004) introduced the concept of phase tensor. They demonstrated how the regional phase information can be retrieved from the observed impedance tensor without any assumptions for structural dimension, where both the near surface inhomogeneity and the regional conductivity structures can be 3-D. We made an attempt to modify a 3-D inversion code (Siripunvaraporn et al., 2005) to directly invert the phase tensor elements. We present here the main modification done in the sensitivity calculation and then show a few synthetic studies and its application to the real data. The synthetic model study suggests that the prior model (m_0) setting is important in retrieving the true model. This is because estimation of correct induction scale length lacks in the phase tensor inversion process. Comparison between results from conventional impedance inversion and new phase tensor inversion suggests that, in spite of presence of the galvanic distortion (due to near surface checkerboard anomalies in our case), the new inverion algorithm retrieves the regional conductivitity structure reliably. We applied the new inversion to the real data from the Indian sub continent and compared with the results from conventional impedance inversion.