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Removable of galvanic distortion on 3-D MT inversion.

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The galvanic distortion is caused by localized resistivity anomalies near the surface and creates artificial false images in the inversion of MT data. Although the effects of galvanic distortion should be imaged locally, they tend to appear as gradual resistivity changes at deeper part of survey area, that is in general close to the target depth for hydrocarbon resource exploration of several kilometers, due to the smoothness constraint. Therefore, the galvanic distortion has to be removed to improve 3-D MT inversion results. In our study, we refine the smoothness function to image local anomaly on the surface layer in the inversion to cope with the effects of galvanic distortion. In the refinement, we modify a model covariance matrix in 3-D MT inversion algorithm, WSINV3DMT. We applied WSINV3DMT to several synthetic datasets to evaluate how local anomalies on the surface influences the result of 3-D MT inversion. The synthetic resistivity models used in this experiments have low resistivity anomalies in the subsurface with and without the surface local heterogeneities, respectively. The thickness of surface blocks is 10m. We estimated synthetic MT response functions from these two models for 7 periods; 0.01s,0.05s,0.1s,0.5s,1s,5s,10s. Then we applied WSINV3DMT to those synthetic datasets. For the removable of the effect of galvanic distortion, we applied a modified model covariance matrix to MT response functions calculated from the model with local anomalies on the surface. Finally, we first confirm that the effects of galvanic distortion would generate false resistivity anomalies in the inversion, in particular in the deeper part. This problem would not be negligible in the imaging of realistic resistivity structure in the subsurface. The results from the modified model covariance matrix we have introduced show more reliable results than those from the original model covariance matrix. Since a thin surface layer is an analogue of the galvanic distortion, we could deal with the galvanic distortions by thin layers placed at each observation site.

Keywords: Magnetotelluric, Inversion, Distortion