Domain Decompostion for Two-Dimensional Magnetotelluric Forward Modeling

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ABSTRACT

In order to obtain an accurate magnetotelluric data response from a realistic geological model, the typical size of the model domain could be quite large. Consequently, the convergence rate of the forward modeling, which also depends on the size of the model domain, becomes slow, especially when air is included. In order to help speed up the convergence of the forward modeling routines, the domain decomposition technique was applied to the two-dimensional magnetotelluric case as a study case. It was later applied to the three-dimensional case. In appliying the domain decomposition method, the whole domain was laterally divided into many overlapping sub-domains where each sub-domain contained both air and earth. Each sub-domain was simultaneously solved in separate nodes using the message-passing interface. Because the size of a sub-domain is relatively small, it converges fast. The field solutions from each sub-domain were then laterally merged between neighbor sub-domains to form the field solution of the whole model. The residual of the whole domain was calculated and the process was then repeated until the residual was less than the target level. This domain decomposition technique was applied to both synthetic and real cases and was compared with regular forward modeling solution.

KEYWORD: Two-dimensional magnetotelluric forward modeling