Singular Value Decomposition of the Phase Tensor

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SUMMARY

To understand the detailed characteristics of magnetotelluric data (MT), the current study proposes a decomposition based on the singular values of the phase tensor. This mathematical methodology is inspired by the conventional ellipse illustration of the distortion free phase tensor however, it uses the full singular value decomposition (SVD) in a traditional manner. The outcomes of the SVD are utilized to illustrate the dimensionality information of the MT data by comparing the configurations of two associated ellipses. As another illustration method, Mohr circle diagrams are utilized in this study. To control the orientation of the singular value-based ellipses and to check the dimensionality of the data, Mohr circles were plotted for comparative purposes. Furthermore, extension to earlier works is provided by implementing the error-based weighted-least-square (WLS) analyses of multi-site and multi-frequency combinations. Our extension may be used to clarify the discrepancy between the two-dimensional and the three-dimensional modeling approach necessities. Synthetic tests were performed to observe validity of the developed methodology for both single-site-single-frequency and multi-site-multi-frequency handling of the data.

Keywords: Singular value decomposition, Phase tensor, Dimensionality