

Application of the skew parameters in 1-D and 2-D inversion of MT data

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SUMMARY

1-D and 2-D magnetotelluric (MT) inversion is often used in practice. However, some MT data used in such inversions may show 3-D behavior in a certain frequency range, and the question is how these effects should be accounted for. The idea we present here is to increase the confidence intervals for the data within the frequency range, where they correspond to a higher-dimensional media, proportionally to the values of the observed skew (inhomogeneity) parameters.

For example, the following criteria may be used to prepare MT curves for 1-D inversion. For amplitude data the values N , $Skew_S$ and $Skew_B$ are used. These parameters are dimensionless and range from 0 to 1, indicating deviation of the medium from 1-D (N) and 2-D ($Skew_S$, $Skew_B$) models. Then the modified confidence intervals $\Delta lg|Z|$ for the amplitude curves may be calculated as: $\Delta lg|Z| = \Delta lg|Z|_{original} + N + Skew_S + Skew_B$. For phase data, the phase tensor parameters $\Delta\varphi$ and β are used. These parameters are measured in degrees and also indicate deviation of the medium from 1-D ($\Delta\varphi$) and 2-D (β) models. Accordingly, the modified confidence intervals for the phase curves $\Delta arg(Z)$ may be defined as: $\Delta arg(Z) = \Delta arg(Z)_{original} + \Delta\varphi + \beta$. The MT curves prepared in this way during inversion will make it possible to fit data more accurate in those frequency ranges where the dimension of the medium corresponds to the dimension of the inversion used.

This technology is implemented in the Inversio program, which is designed for analysis and 1-D/2-D inversion of large amount of MT data. At the analysis stage the interpreter, looking at the frequency sections of the skew parameters, decides which of the parameters to use to penalize the curves. The simplicity of the technology makes it very convenient in large-scale MT projects with a variable geological structure of the environment.

Keywords: Skew parameters, 1-D inversion, 2-D inversion
