Quantifying the Impact of Transmit Frequency Selection on Data Quality in Electrical Geophysical Methods

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Abstract

Electrical resistivity measurements involve selecting an appropriate frequency, yet the impact of this choice has been largely overlooked in previous research, especially its role in determining the quality and reliability of data in low frequency DC electrical measurements in non-chargeable materials. Understanding if the selection of transmit frequency effects data quality is instrumental, especially considering the importance of uncertainty in final inverted images. Electrical resistivity data quality is typically quantified as the stacking and reciprocal error of a measurement along with the contact resistance. In this experiment we utilized a combination of laboratory and field data to examine the relationships between contact resistance and the various error parameters across a range of frequencies, measured by a commercially available instrument. Lab measurements were collected to assess data quality in a controlled environment where the transmit frequency and contact resistance were varied, with field experiments conducted across diverse environments. In addition, to analyzing the produced voltage across various frequencies, using an electrical oscilloscope. We found that each frequency produced similar data quality, with no consistently observed relationship between the transmit frequency and either metric of data quality, . The impact of measurement frequency on the data quality of low frequency DC electrical resistivity measurement on non-chargeable materials is minimal and can differ on site-to-site bases, based on measurement parameters, with unique patterns possibly observed at different locations.