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Characterization of data error in time-domain induced polarization tomography based on the analysis of decay curves

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Time-domain induced polarization (TDIP) measurements are based on the recording of remnant voltages after current switch off and thus typically suffer from low signal-to-noise ratios. The analysis of the discrepancy between normal and reciprocal measurements has demonstrated to be a suitable method to quantify the data error in TDIP data sets, permitting to compute images with enhanced resolution. However, due to time constraints, it is not always possible to collect reciprocal measurements. Hence, we propose an alternative methodology to quantify data error in TDIP, which is based on fitting model curves to the measured IP decay. Based on the goodness of the fit, we can identify outliers and derive error parameters for the inversion of the tomographic TDIP data. In order to assess the practicability of our approach, we present a comparison of imaging results obtained based on the fitting of decay curves with those obtained based on the analysis of repeated measurements and normal-reciprocal measurements. Inversion results presented here were computed for extensive field data sets collected at the Rifle (CO) and Shiprock (NM) test sites. These data sets include TDIP data collected with different devices and using different IP windows.