Seeing between Boreholes - a Feasibility Study

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Abstract

Cross-well electrical resistivity tomography (ERT) enables 2D and 3D imaging of electrical properties using existing boreholes. Compared with conventional surface DC/IP surveys, down hole ERT has the advantages of having depth-constrained inversion, a sense of target geometry, and repeatability. Previous studies generally assume that the boreholes are vertical and are in the same plane as what is to be imaged. However exploration boreholes are usually drilled at various dip angles and azimuths in order to maximize geological information to be obtained. Such deviation effects can cause errors well above typical data noise levels and are problematic in accurately imaging target structures. For near surface cross-well ERT, in particular, we are dealing with a transition from half-space to full-space scenarios as the electrode arrays are moved from top to bottom of a borehole. This study investigates how borehole deviations and the half-space to full-space transition affect the inversion and interpretation of cross-well ERT. We find that the deviation and transition effects are both depth and electrode separation dependent, and are especially important at shallow depths. In order to accurately image target structures, we propose that accurate array locations need to be obtained so that correct geometry factors can be applied to correct for such effects.

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