**Coupled processing of electrical and electromagnetic methods for improved subsurface modeling**

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Electrical geophysical surveys are widely used for site characterization and to inform subsurface modeling. Electrical resistivity imaging (ERI) and electromagnetic induction (EMI) are the most commonly used methods for such studies. While both are used to provide subsurface models of electrical resistivity distribution, they each offer different advantages and limitations. For example, in typical land-borne applications, EMI offers rapid data acquisition, resulting in high lateral spatial coverage but limited resolution with depth. Conversely, ERI offers high resolution with depth but limited spatial coverage, often due to temporal constraints.

This work used coupled EMI and ERI surveys in different environments. We explored the benefits of coupled and/or synergistic processing of co-located or partially co-located surveys. In land-borne characterization surveys, we combined the rapid spatial acquisition of EMI with the higher resolution direct electrical conductivity information provided by ERI. Our results showed improved subsurface models when synergistically processed, a finding similar to recent studies that supported the need to calibrate EM data against ERI data. In waterborne site characterization, high-resolution spatial characterization of the water (conductive) layer can improve the subsurface imaging. Using coupled processing, EMI data provide such detailed information for the water layer and subsequently inform ERI data processing. Our study highlights the potential benefits of quantitatively coupling ERI and EM methods for improved site characterization and subsurface modeling.