On the applicability of spectral IP for the characterization of floodplain soils

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Induced polarization (IP) can offer additional information on the textural and biogeochemical properties of sediments, for example, to derive robust petrophysical relationships for properties, or states, that commonly covary, e.g., texture and soil water content (SWC). Such relationships have been proposed to interpret geoelectrical monitored data. However, they have principally been explored in lab-based studies; application to field-based studies is comparatively limited.

In this work, single quadrupole measurements were made using an Ontash and Ermac PSIP device at two sites on a river floodplain. In situ measurements of volumetric water content and temperature were made to explore published petrophysical relationships, and samples were collected for gravimetric water content, texture, and cation exchange capacity measurements. The intrusive samples were collected to coincide with the depth of investigation of the spectral IP measurements.

The complete analysis included obtaining Cole-Cole parameters for each of the measured spectra. The Figure summarises some initial patterns in the data. Fig. a displays the expected increasing real electrical conductivity for increasing SWC. Fig. b shows the expected covariance of cation exchange capacity (CEC) and SWC. Fig. c and d show the relationship of imaginary conductivity, a common proxy for surface electrical conductivity, with CEC and sand content. While the measurements in the south field exhibit the expected trend, the relationship for the north field is weak. These results indicate that generalizable relationships may also require information about soil physicochemistry.

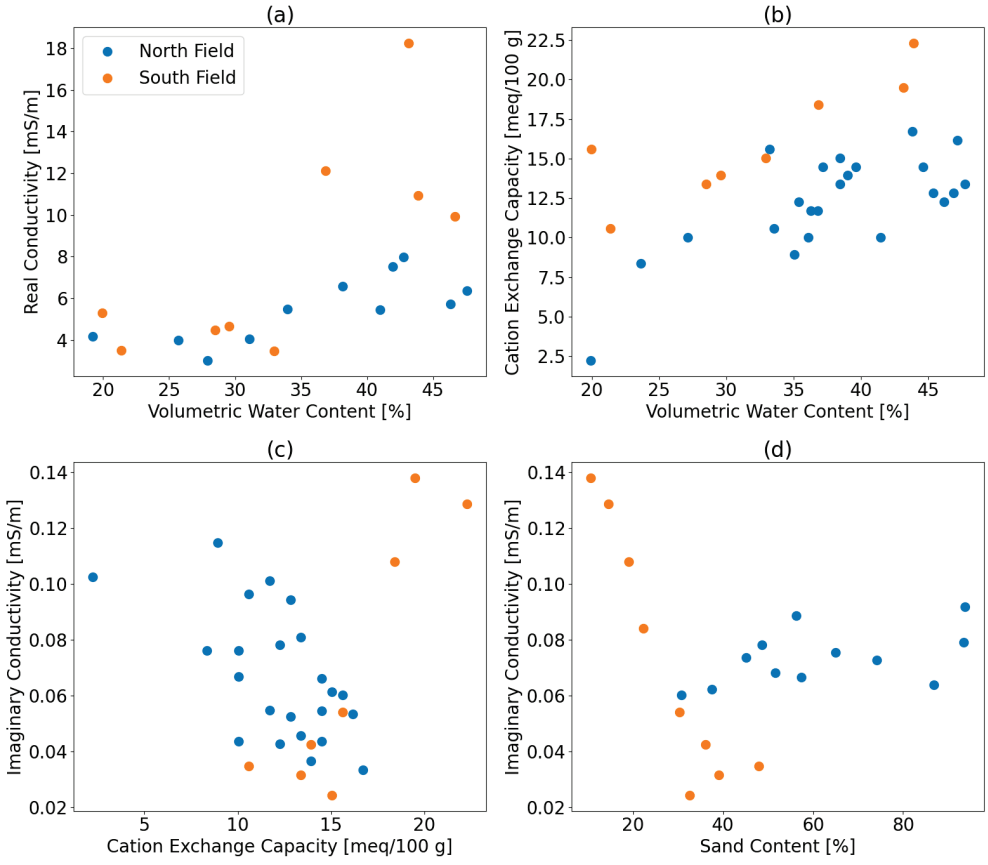

Figure: Summary plots showing covariance of IP and soil parameter