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## Integrated analysis of multi-scale electrical signatures for characterizing soil water dynamics in century-old biochar enriched agroecosystems

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Electrical resistivity and induced polarization tomography and electromagnetic induction are widely used in hydrogeophysical applications. In this work we perform a multi-scale analysis of DC-resistivity, spectral induced polarization (SIP) and electromagnetic induction (EMI) measurements to evaluate soil water dynamics of a century-old biochar enriched agroecosystem. Our study aims at comparing the spatio-temporal variations of the electrical signature (resistivity or conductivity) between the natural (reference) soil and soil enriched with biochar visible as black patches (0.30 m thick x 20 m of diameter) in the study area and relate this signature to a soil moisture status. In this first overall and qualitative approach we combine 1) field large-scale time-lapse electrical resistivity tomography (ERT) transects (12.6 m) and EMI conductivity maps covering the whole study area (13 ha), 2) intermediate-scale ERT/SIP profiles from on-site pits (2 m L x 1 m W x 1 m D), and 3) laboratory columns-scale (0.10 m L x 0.044 m ID) SIP signatures of undisturbed soil samples.

Large-scale results show a heterogeneous-resistive soil top horizon in both soil types, but with similar hydrodynamic behaviour following precipitation events. The column scale SIP signatures reveal that texture and pore structure are the main driver of soil moisture dynamics with insignificant role of the biochar content. Large and intermediate scale monitoring campaigns during the entire growing season of two different crops are planned for the current and next year. The ultimate objective is to quantify the effect of century-old biochar on soil water dynamics and root water uptake.