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Exploring the Vis-NIR wavelength importance in SOC models under field and lab conditions in a long-term field experiment

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Soil organic carbon (SOC) is of particular interest in the study of agricultural systems as an indicator of soil quality and soil fertility. In the use of Vis-NIR spectroscopy for SOC detection, the interpretation of the spectral response with regards to the importance of individual wavelengths is challenging due to the soil's composition of multiple organic and minerals compounds. Under field conditions, additional aspects affect the spectral data compared to lab conditions. This study compared the spectral wavelength importance in partial least square regression (PLSR) models for SOC between field and lab conditions. Surface soil samples were obtained from a long-term field experiment (LTE) with high SOC variability located in the state of Saxony-Anhalt, Germany. Data sets of Vis-NIR spectra were acquired in the lab and field using two spectrometers, respectively. Four different preprocessing methods were applied before building the models. Wavelength importance was observed using variable importance in projection. Differences in wavelength importance were observed depending on the measurement device, measurement condition, and preprocessing technique, although pattern matches were identifiable, especially in the NIR range. It is these pattern matches that aid model interpretation to effectively determine SOC under field conditions.