Global predictions of soil carbon by mid infrared spectroscopy

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Abstract

Mid infrared (mid-IR) spectroscopy has been shown to be a reliable technique to predict soil properties. A majority of published studies report the use of mid-IR spectroscopy for predictions at local or regional scales. For the first time, we develop robust spectroscopic calibrations of soil organic carbon (SOC) globally. We measured the spectra of 3684 samples from the International Soil Reference and Information Centre (ISRIC) database using a FT-IR spectrometer, the Vertex70 (Bruker, Germany) with a spectral range of 4000–600 cm-1. The samples originate from 55 countries and from various depths between 0 and 300 cm. We used the M5 regression tree algorithm for the spectroscopic calibration. The algorithm generates rules based on: if, then conditions to partition the data using important frequencies. The data in each partition is then fitted with its unique regression. Our results show that (i) SOC can be accurately predicted using a global spectroscopic calibration ($R^2 = 0.84$), and (ii) by interpreting the models, insights into the global spatial distribution of SOC can be gained.