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Modelling soil Organic Carbon and mineral composition using reflectance and emissivity data

Veronika Kopačková (1), Jan Jelének (1), Lucie Koucká (1), Kateřina Fárová (1), and Miroslav Pikl (2)

(1) Czech Geological Survey, Remote sensing, Czech Republic (veronika.kopackova@seznam.cz), (2) Global Change Research Institute CAS - CzechGlobe, Belidla 986/4a, Brno, Czech Republic

Conventional laboratory analysis such as X-ray diffraction (XRD), silicate analysis and organic carbon (OC) are time-consuming and expensive. On the other hand, soil spectroscopy has shown to be a fast and reproducible technique that has been increasingly used for rapid, non-destructive and cost-effective soil analyses. In this study, optical (reflectance) and thermal (emissivity) soil spectroscopy was employed to soil profile samples that represent the all major variability in forest soils in the Czech Republic (the soil samples taken from all the horizons down to 80-cm depth were utilized). Optical spectral libraries were collected using a Spectral Evolution spectrometer (SR 2500, 0.4-2.5 μm), in order to normalize and align these spectral measurements taken during the summer 2016 the internal soil standard (ISS) concept, in which a soil standard sample exhibiting stable spectral performance was used. The emissivity spectra for selected soil samples were acquired in September 2017 using a Fourier transform infrared (FTIR, 8-14 μm) spectrometer. The reflectance and emissivity data of soil profiles together with mineral (XRD) and geochemical analysis were used to model the soil mineral compositions when focusing on the relationship between phyllosilicate composition and Organic Carbon (OC). Furthermore, soil reflectance/emissivity data were resampled to a spectral resolution of the following satellite sensors – WorldView3, Sentinel-2, EnMap and HispIRI – and potential capability of using these new-generation satellite data to model OC and soil mineral composition is further discussed.
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