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Improving the soil organic carbon and pH VisNIR calibrations within the field of uniform soil cover by extending the model with the samples from the nearby locations

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The potential of using VisNIR spectroscopy to estimate soil properties has been widely reported. The measurements of the electromagnetic radiation reflected from a soil sample in the region between 400 and 2500 nm, reveal the information about the physical and chemical composition of soil. Generally, local calibrations of soil properties using VisNIR spectroscopy outperform regional and global calibrations in terms of prediction errors and produce results comparable to the traditional SOC measurement techniques. Nevertheless, examples of poor calibration results of soil properties within agricultural fields having uniform soil cover and a relatively small range of concentrations of the analyzed constituent have been published.

In this study the the potential for improving the calibration of SOC content and pH levels by incorporating the soil samples collected from other locations in the region in question into the calibration model is investigated. This is a preliminary study conducted within the EUFAR's ADDRESSS project on the application of airborne hyperspectral and LiDAR data in soil monitoring. In the current stage a limited-extent soil survey has been conducted.

A sample field of 35 ha (centroid: 46^o56'43"N, 17^o43'24"W) with a uniform soil cover of cambisol developed over limestone and dolomite was selected in the Balaton Uplands National Park in Western Hungary near Tihany. 20 soil samples were collected there. The samples were air dried, ground, and sieved through a 2mm sieve. SOC content was characterized using the dichromate oxidation (Walkley Black's) method and it ranged from 0.85 to 2.14 g kg^{-1}. Soil reaction was measured in 1:1 KCl solution and the pH values ranged from 6.34 to 7.34. Spectral measurements of the soil samples were conducted using ASD Fieldspec 3 spectrometer in the laboratory conditions.

A cross-validated calibration VNIR model provided the estimated concentration of the analyzed soil properties which were compared to their reference values. Additionally, the spatial distributions of both constituents were obtained using kriging interpolation and measured and predicted values were compared. Additionally, 11 soil samples were collected from three other locations within the region. They represent various soil types, developed over a tertiary tuff and triassic limestone. The introduction of additional soil samples extended the concentration range of SOC (0.85 to 3.20 g kg^{-1}) and pH (6.34 - 7.49). The calibration results improved substantially, suggesting that extending the within-field model with the samples from nearby locations enhances the modeling of soil constituents.