



Quantitative retrieval of Soil Organic Carbon using spectral indices based on Visible and Near-Infrared reflectance spectroscopy

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Soil Organic Carbon (SOC) has been identified as one of the major sinks in the global carbon cycle, but the exact size and spatial distribution is still difficult to determine quantitatively. Remotely sensed estimations of the amount of SOC present in the soil are often based on the overall decrease in reflectance in the solar reflective part of the electromagnetic spectrum. However, moisture content and soil roughness result in a comparable decrease, resulting in unreliable SOC predictions. Prediction models based on Partial Least Squares (PLS) regression have the drawback that extrapolation to different soil types are often unreliable, while the cause for this can hardly be found due to the black box character of PLS.

Depending on the decomposition stage, SOC contains biochemical constituents like lignin and cellulose. Absorption features related to these constituents can be used to determine the SOC content of the soil. We investigated the relation between those absorption features and SOC for 40 samples taken from nine different soil types. The soils originated from a wide range of climatic zones and a large variety in SOC content (0.06 – 45.1%). Spectral measurements of all soil samples were performed under controlled laboratory conditions. Good relations were found for indices based on the visible part of the spectrum and for the absorption features related to cellulose. Cross validation was used to evaluate the predictive capacity of the spectral indices. The results demonstrate that it is feasible to use spectral indices derived from laboratory

measurements to predict SOC from a wide range of soil types. However, a large variation in SOC is required for the tuning of the prediction model, since extrapolation beyond the SOC range results in large errors. The results allow establishing a perspective towards spatial distributed mapping of SOC using remote measurements.