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## Thema
AG Digital Soil Mapping

Neue Methoden in Forschung und Anwendung

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## Titel
Challenges in using mid-infrared spectroscopy for the determination of soil physical, chemical, and biochemical properties on undisturbed soil samples

## Abstract
Diffuse reflectance infrared Fourier transform (DRIFT) spectroscopy in the mid-infrared range (MIR) has become an established analytical tool for quantitative and qualitative analysis of soil samples. The heterogeneity of soil requires sample preparation procedures to optimize the reproducibility and accuracy of the spectroscopic measurement. These procedures have not been standardized. Generally, soil is dried and ground before measurement to avoid reflections of surface water films and minimize the intra- and inter-particle variability, respectively. Additionally, the sample surface is levelled to a plain surface for an ideal reflection. These sample preparation techniques are limited to disturbed samples only. Thus, a potential DRIFT mapping of undisturbed soil samples requires an adjusted calibration to allow for an accurate prediction of soil properties.
In this study, we developed a method for calibrating the prediction of DRIFT spectra collected from undisturbed soil samples. In a first step, differences of spectral information measured from undisturbed and ground soil samples have been evaluated. Therefore, we record the DRIFT spectra of 120 German and 120 West-African chemically well characterized soils. DRIFT spectra of both, ground and sieved only soil samples are recorded and both calibrated against different physio-chemical soil properties, such as texture, CEC, organic carbon, pH, or iron oxides. In preliminary experiments, we found that spectra of sieved and ground samples significantly differed in specific spectral regions representing clay minerals, as well as organic matter. It can be assumed that the prediction of surface related soil parameters could be superior using sieved soil spectra, as grounding alters the surface structure of the soil.
In a further step, microtopgraphy effects on spectra quality from disturbed and undisturbed soil samples have been evaluated. Therefore, spectral information has been taken from two dimensional disturbed and undisturbed soil samples at a high spatial resolution. The spectra quality was significantly higher in the disturbed soils since microtopography was absent in these samples. Thus, a digital elevation model (DEM) will be constructed using close-range digital photogrammetry to correct these topography effects.
With this new method, there is a potential of imaging soil parameters on a microscale that can help considerably in locating and understanding soil processes on a small scale.