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Hyperspectral imaging to investigate the distribution of organic matter and iron down the soil profile

Eleanor Hobley, Stefanie Kriegs, and Markus Steffens
Technische Universität München, Soil Science, Freising-Weihenstephan, Germany (nellie.hobley@wzw.tum.de)

Obtaining reliable and accurate data regarding the spatial distribution of different soil components is difficult due to issues related with sampling scale and resolution on the one hand and laboratory analysis on the other. When investigating the chemical composition of soil, studies frequently limit themselves to two dimensional characterisations, e.g. spatial variability near the surface or depth distribution down the profile, but rarely combine both approaches due to limitations to sampling and analytical capacities. Furthermore, when assessing depth distributions, samples are taken according to horizon or depth increments, resulting in a mixed sample across the sampling depth. Whilst this facilitates mean content estimation per depth increment and therefore reduces analytical costs, the sample information content with regards to heterogeneity within the profile is lost.

Hyperspectral imaging can overcome these sampling limitations, yielding high resolution spectral data of down the soil profile, greatly enhancing the information content of the samples. This can then be used to augment horizontal spatial characterisation of a site, yielding three dimensional information into the distribution of spectral characteristics across a site and down the profile.

Soil spectral characteristics are associated with specific chemical components of soil, such as soil organic matter or iron contents. By correlating the content of these soil components with their spectral behaviour, high resolution multi-dimensional analysis of soil chemical composition can be obtained. Here we present a hyperspectral approach to the characterisation of soil organic matter and iron down different soil profiles, outlining advantages and issues associated with the methodology.