Developments of digital soil morphometrics methods: examples from New Zealand

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The soil profile has been the key support for soil observation since the inception of pedology. Traditionally, pedologists would look at the soil profile, and use their senses --- sight, touch, hear --- to infer properties about the soil that is being observed. The emergence of a wide range of in-field technologies is opening opportunities to update the way soil profiles are observed and described. Digital Soil Morphometrics is leveraging these developments, and aims at developing more quantitative and objective methods to collect data and assess properties from the soil profile.

In this paper, we present some advances in digital soil morphometrics techniques in New Zealand. A soil monolith extractor has been developed in house and facilitates the application of digital soil morphometrics techniques. Three distinct soil profiles have been sampled using the monolith extractor to test new ways to collect information from the soil profile.

Digital images have been collected on these soil monoliths, and calibrated using a set of reference colour chips. The spectral resolution of these images have been enhanced by combining the spatial resolution of the CCD images (1 mm) with the spectral resolution and range of an ASD FieldSpec 3 visible NIR spectrometer (1 nm between 350 and 2500 nm).

A processing chain combining image processing methods such as principal components analysis and image segmentation has been developed to support the delineation of soil horizons, and collect information about the soil structure, but also to estimate soil properties such as soil organic carbon at a very fine scale over the whole profile.

Overall, the application of these soil profile imaging techniques offer a more objective and precise method to explore horizontal and vertical variations on the soil profile.