Geophysical Research Abstracts
Vol. 21, EGU2019-10783, 2019
EGU General Assembly 2019

Assessing the performance of UAS-compatible multispectral and hyperspectral sensors for soil organic carbon prediction

Kristof Van Oost (1), Giacomo Crucil (1), Castaldi Fabio (1), Emilien Aldana-Jague (1), Bas van wesemael (1), and Andy MacDonald (2)

(1) UCLouvain, Earth & Life Institute, TECLIM, Louvain-la-Neuve, Belgium (kristof.vanoost@uclouvain.be), (2) Sustainable Agriculture Sciences Department, Rothamsted Research, Harpenden, Herts AL5 2JQ, UK.

Soil laboratory spectroscopy has proved its reliability for the estimation of soil organic carbon (SOC) by exploiting the relationship between electromagnetic radiation and key spectral features of organic matter located in the VIS-NIR-SWIR (350-2500 nm) region. It currently allows estimating soil variables at sampled points, however geo-statistical techniques have to be used to infer continuous spatial information on soil properties. In this regard, the use of proximal or remote sensing data could be very useful to provide detailed spectral sampling on soil spatial variability at the field or even regional scale. However, the factors affecting the quality of spectral acquisition in field conditions need to be taken into account. In this perspective, we designed a study to investigate the capabilities of two portable hyperspectral sensors (STS-VIS and STS-NIR), and two multispectral cameras (Parrot Sequoia and Mini-MCA6), against a more sensitive reference hyper-spectral sensor (ASD Fieldspec-Pro 3) to provide data for SOC modelling from ground-based measurements. The aim of the comparison was to assess the performance of Partial Least Squares Regression (PLSR) models, when moving from laboratory to outdoor conditions, namely changing illumination and air conditions and sensor distance. Moreover, to verify the transferability of the prediction models between different measurement setups, we tested a methodology to align spectra acquired under different conditions (laboratory and outdoor) or by different instruments, by means of a calibration factor based on an internal soil standard.

The results, in terms of Ratio of Performance to Deviation (RPD), showed that: i) the best performance for SOC modelling under outdoor conditions were obtained using the VIS-NIR range (RPD: 4.2), while the addition of the SWIR region resulted in a worsening of the prediction accuracy (RPD: 2.9); ii) the performance of the Sequoia and Mini-MCA6 multi-spectral broad bands (RPD: 4.2 and 3.4 respectively) surpassed the one of the STS (RPD: 2.6); iii) the STS employment in the outdoor benefitted from a laboratory model calibration adopting a spectral transfer using an internal soil standard, with the RPD increasing from 1.4 to 2.9 after the alignment. We therefore suggest that the employment of VIS-based portable instrument could be a strategy to obtain accurate and spatially distributed SOC data. Moreover, the perspective of their employment on UAS could represent a cost-effective solution for precision farming applications.