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Prediction of SOC content at European scale by coupling Vis-NIR spectroscopy and a modified local PLSR algorithm

M. Nocita (1,2), A. Stevens (2), D. De Brogniez (1,2), F. Bampa (1), G. Toth (1), P. Panagos (1), B. van Wesemael (2), and L. Montanarella (1)

(1) Land Resources Management, Institute for Environment and Sustainability, Joint Research Centre - European Commission, Via E. Fermi, 2749, I-21027 Ispra (VA), Italy., (2) Georges Lemaître Centre for Earth and Climate Research, Earth and Life Institute, Université Catholique de Louvain, Place L. Pasteur 3, 1348 Louvain La Neuve, Belgium

The spatial variability of soils still represents an important challenge to accurately report the soil status. Visible near infrared soil spectroscopy (VNIRS) has been shown to be an efficient tool for the prediction of soil organic carbon (SOC) at fine scales. However, when applied to regional or country scales, VNIRS did not provide sufficient accuracy as an alternative to standard laboratory soil analysis for SOC monitoring. Under the framework of LUCAS project of the Joint Research Centre (JRC), about 20,000 samples were collected all over European Union. Soil samples were analyzed for several physical and chemical parameters, and scanned with a Vis-NIR spectrometer in the same laboratory. The scope of our research was to predict SOC content at European scale using LUCAS spectral library. We implemented a modified local partial least square regression (l-PLSR) including, in addition to spectral distance, other potentially useful covariates (geography, texture, etc.) to select for each unknown sample a group of k predicting neighbors. The dataset was divided into tuning (15%), training (60%), and validation (25%) subsets. The tuning subset was used to find the most performing combination of model parameters. The best model was then calibrated and validated on training and validation subsets. Although the high variability of land-use systems covered by LUCAS sampling campaign, the chosen methodology resulted in a fair prediction ability (RMSE: 5-6 g C kg-1) at continental scale, but not precise enough to be used for SOC monitoring on a point by point basis. The results indicated that a local approach might improve the ability of VNIRS in predicting SOC trends, with the increasing variability of land managements at larger scales.