Continuum removal versus PLSR method for digital mapping of Clay and Calcium carbonate contents, using laboratory and airborne hyperspectral measurements

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Reflectance spectroscopy provides an alternate method to classical physical and chemical laboratory soil analysis for the estimation of a large range of soil properties. Techniques, including classical chemometrics approaches and specific absorption features studies, have been developed for deriving estimates of soil characteristics from Visible-Near Infrared (vis-NIR) reflectance measurements.

This paper aims to compare two of these techniques, namely the continuum removal (CR) analysis and the Partial least-squares regression (PLSR) method for estimating clay and calcium carbonate (CaCO₃) contents, two key soil properties for erosion prediction. The CR analysis uses the spectral absorption bands at 2206 and 2341nm to quantify respectively clay and CaCO₃ contents whereas the PLSR method with leave one-out cross-validation is a classical chemometrics technique using the vis-NIR full spectra. The CR and PLSR methods were applied to vis-NIR laboratory and airborne HYMAP reflectance measurements collected over a set of 53 bare soil sites located in La Peyne Valley area, southern France.

This study shows that the PLSR gives satisfactory results for clay and calcium carbonate contents estimation ($R^2$ of 0.65 and 0.77 respectively using HYMAP data) and clearly outclass the CR approach ($R^2$ of 0.58 and 0.47 respectively using HYMAP
data). We deduces from these results that, in the pedological context of La Peyne valley, the Partial least-squares regression method can contribute significantly to the digital mapping of soil properties.