Geophysical Research Abstracts,
Vol. 11, EGU2009-10753, 2009
EGU General Assembly 2009

Assessing the effect of vegetation in the estimation of soil properties with field VNIR radiometry

I. Melendez-Pastor (1), P. Córdoba-Sola (1), J. Navarro-Pedreño (1), I. Gómez (1), and M. Koch (2)

(1) University Miguel Hernandez of Elche, Agrochemistry and Environment, Elche, Spain (imelendez@umh.es), (2) Center for Remote Sensing, Boston University, Boston (MA), USA

Spectroradiometric soil surveys (field radiometry) are a valuable technique for soil classification and properties estimation. Field radiometry combines -in a relatively easy-to-use procedure- a fast, accurate and non-destructive sampling method. A wide range of soil properties have been quantitatively estimated with field or laboratory radiometry. In addition, field radiometry is a basic stage in remote sensing studies. It allows the up-scaling process of soil, vegetation or water parameters from the ground level to the airborne or spaceborne sensors level. Field radiometry plays a crucial role in training and validation stages of quantitative remote sensing. A complex problem in remote sensing appears when several components are mixed within a pixel and the resulting pixel's spectrum is a combination of the individual components.

This work assess the effect of vegetation in soil properties estimation with linear regression models. Field spectra were taken from soil-vegetation mixtures under natural illumination with a portable spectroradiometer in the visible and near-infrared (VNIR) spectral range. Soil and vegetation samples for each radiometric sampling point were taken and analyzed in laboratory. Soil moisture content and soil organic carbon measured by the LOI (Loss-On-Ignition) method (Konen et al. 2002) were used in this approach. A derivative analysis of field spectra was used to determine the position and magnitude of absorption bands according to the method employed by Melendez-Pastor et al. (2008). Pearson correlations between soil parameters and each spectral band were computed and correlograms for the first and second derivate were obtained. Maximum (approximates to +1) and minimum (approximates to -1) Pearson correlations were used to normalize correlograms between 0 to 1. High relatively correlated bands (with values ranging from 0 to 0.1 or from 0-9 to 1 for the normalized correlograms) were identified and used as explicative variables in the regression models. In addition, vegetation water content and the NDVI (Normalized Difference Vegetation index) computed from field spectra also were used as explicative variables. Four combinations of explicative variables were used to predict soil variables: 1) high correlated bands, 2) high correlated bands and a soil parameter (LOI is used to predict soil moisture and vice versa), 3) high correlated bands and vegetation parameters, and 4) high correlated bands with soil and vegetation parameters. Models were developed for LOI and soil moisture with the first and second derivate.

Medium to high correlation coefficients (R) were obtained in all regression models. R values ranged from 0.7 for the first approach (just high correlated bands) to 0.9 for the prediction of soil moisture with high correlated bands of the second derivate with vegetation parameters. Regression models with the second derivative achieved better model's adjustments and were almost equal for all combinations of explicative variables. A small improvement was observed for first derivate regression models using soil and vegetation explicative variables. Vegetation moisture was the most important parameter for the improvement of soil properties estimation. The combined used of soil and vegetation parameters for quantitative remote sensing of soil parameters allows accuracy improvements and a better knowledge of land cover mixtures. Regression models with the second derivate spectral peaks are less sensitive to changes in the vegetation coverage and thus retrieves better soil parameters estimations.

References

Konen, M., P. Jacobs, C. Lee Burras, B. Talaga, J. Mason. (2002) Equations for predicting soil organic carbon using loss-on-ignition for north central U.S. soils. Soil Science Society of America Journal, 66:1878-1881.

Melendez-Pastor, I., J. Navarro-Pedreño, I. Gómez, M. Koch. (2008). Identifying optimal spectral bands to assess soil properties with VNIR radiometry in semi-arid soils. Geoderma, 147: 126-132.