Geophysical Research Abstracts,
Vol. 11, EGU2009-3133-5, 2009
EGU General Assembly 2009

Spatial interpolation of soil organic carbon using apparent electrical conductivity as secondary information

G. Martinez (1), K. Vanderlinden (1), R. Ordóñez (2), and J.L. Muriel (1)

(1) IFAPA, Natural Resources and Agroecology, Alcala del Rio (Sevilla), Spain (gonzalo.martinez@juntadeandalucia.es), (2) IFAPA, Natural Resources and Agroecology, Córdoba, Spain (rafaelam.ordonez@juntadeandalucia.es)

Soil organic carbon (SOC) spatial characterization is necessary to evaluate under what circumstances soil acts as a source or sink of carbon dioxide. However, at the field or catchment scale it is hard to accurately characterize its spatial distribution since large numbers of soil samples are necessary. As an alternative, near-surface geophysical sensor-based information can improve the spatial estimation of soil properties at these scales. Electromagnetic induction (EMI) sensors provide non-invasive and non-destructive measurements of the soil apparent electrical conductivity (EC_a), which depends under non-saline conditions on clay content, water content or SOC, among other properties that determine the electromagnetic behavior of the soil. This study deals with the possible use of EC_a-derived maps to improve SOC spatial estimation by Simple Kriging with varying local means (SKlm).

Field work was carried out in a vertisol in SW Spain. The field is part of a long-term tillage experiment set up in 1982 with three replicates of conventional tillage (CT) and Direct Drilling (DD) plots with unitary dimensions of 15x65m. Shallow and deep (up to 0.8m depth) apparent electrical conductivity (EC_{as} and EC_{ad}, respectively) was measured using the EM38-DD EMI sensor. Soil samples were taken from the upper horizont and analyzed for their SOC content.

Correlation coefficients of EC_{as} and EC_{ad} with SOC were low (0.331 and 0.175) due to the small range of SOC values and possibly also to the different support of the EC_a and SOC data. Especially the EC_{as} values were higher in the DD plots. The normalized ECa difference (ΔEC_a), calculated as the difference between the normalized EC_{as} and EC_{ad} values, distinguished clearly the CT and DD plots, with the DD plots showing positive ΔEC_a values and CT plots ΔEC_a negative values. The field was stratified using fuzzy k-means (FKM) classification of ΔEC_a (FKM1), and EC_{as} and EC_{ad} (FKM2). The FKM1 map mainly showed the difference between CT and DD plots, while the FKM2 map showed both differences between CT and DD and topography-associated features. Using the FKM1 and FKM2 maps as secondary information accounted for 30% of the total SOC variability, whereas plot and management average SOC explained 44 and 41%, respectively. Cross validation of SKlm using FKM2 reduced the RMSE by 8% and increased the efficiency index almost 70% as compared to Ordinary Kriging. This work shows how EC_a can improve the spatial characterization of SOC, despite its low correlation and the small size of the plots used in this study.