Geophysical Research Abstracts
Vol. 17, EGU2015-12083-1, 2015
EGU General Assembly 2015

Spatial prediction of Soil Organic Carbon contents in croplands, grasslands and forests using environmental covariates and Generalized Additive Models (Southern Belgium)

Caroline Chartin, Antoine Stevens, and Bas van Wesemael
Université Catholique de Louvain, TECLIM, Earth & Life Institute, 1348 Louvain-la-Neuve, Belgium
(caroline.chartin@uclouvain.be)

Providing spatially continuous Soil Organic Carbon data (SOC) is needed to support decisions regarding soil management, and inform the political debate with quantified estimates of the status and change of the soil resource. Digital Soil Mapping techniques are based on relations existing between a soil parameter (measured at different locations in space at a defined period) and relevant covariates (spatially continuous data) that are factors controlling soil formation and explaining the spatial variability of the target variable. This study aimed at apply DSM techniques to recent SOC content measurements (2005-2013) in three different landuses, i.e. cropland, grassland, and forest, in the Walloon region (Southern Belgium). For this purpose, SOC databases of two regional Soil Monitoring Networks (CARBOSOL for croplands and grasslands, and IPRFW for forests) were first harmonized, totalising about 1,220 observations. Median values of SOC content for croplands, grasslands, and forests, are respectively of 12.8, 29.0, and 43.1 g C kg-1. Then, a set of spatial layers were prepared with a resolution of 40 meters and with the same grid topology, containing environmental covariates such as, landuses, Digital Elevation Model and its derivatives, soil texture, C factor, carbon inputs by manure, and climate. Here, in addition to the three classical texture classes (clays, silt, and sand), we tested the use of clays + fine silt content (particles < 20 μm and related to stable carbon fraction) as soil covariate explaining SOC variations. For each of the three land uses (cropland, grassland and forest), a Generalized Additive Model (GAM) was calibrated on two thirds of respective dataset. The remaining samples were assigned to a test set to assess model performance. A backward stepwise procedure was followed to select the relevant environmental covariates using their approximate p-values (the level of significance was set at $p < 0.05$). Standard errors were estimated for each of the three models. The backward stepwise procedure selected coordinates, elevation and clays + fine silt content as environment covariates to model SOC variation in cropland soils; latitude, precipitation, and clays + fine silt content (< 20 μm) for grassland soils; and latitude, elevation, topographic position index and clays + fine silt content (< 20 μm) for forest soils. The validation of the models gave a R^2 of 0.62 for croplands, 0.38 for grasslands, and 0.35 for forests. These results will be developed and discussed based on implications of natural against anthropogenic drivers on SOC distribution for these three landuses. To finish, a map combining detailed information of SOC content for agricultural soils and forests was for the first time computed for the Walloon region.