Soil organic carbon mapping at the regional scale for different dates

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Soil organic carbon (SOC) is a dynamic soil property that reacts to management practices at a scale of 5-50 years. Many problems still exist to derive its spatial distribution. SOC maps at the global or continental scale are characterised by great uncertainties, due to a high spatial variability in determining factors (vegetation, climate and land use). Therefore, SOC mapping studies were carried out at a more detailed scale (i.e. national or regional level). However, these studies were also characterised by serious problems to obtain a complete and detailed SOC distribution. Following the traditional approach, i.e. the calculation of mean SOC stocks by landscape unit using data according to this particular unit, no reliable SOC specific values could be obtained for environments with few or no observations. Nevertheless, most of these environments cover small areas or are not well accessible, they are most often characterized by extremely high or low SOC values and so have an important contribution to regional SOC spatial pattern and stock calculations.

To overcomes this problem, this study uses an alternative SOC mapping and applies it at the national scale. SOC in Belgium is studied in relation to land use, soil type (i.e. texture and drainage), soil management (i.e. manure application) and climate (i.e. mean annual temperature and precipitation) over time, using two databases: (1) national soil survey (Aardewerk, 1947-1974) and (2) recent field measurements (2005-2006). Based on this information, key parameters and input variables are selected and

a regression model, predicting SOC as a function of these site variables, is constructed. The use of the model in combination with geographical information concerning soil type, land use and climate, allows calculating SOC stock and mapping its spatial distribution. A more complete and spatially detailed SOC distribution could be obtained compared to the traditional SOC mapping technique. Typically, the regression model can predict SOC for landscape units with an $r^2 = 0.9$, regardless of the number data available.

Moreover, the proposed methodology allows a fast update of SOC status, based on new data. In conclusion, it is shown that this approach can be used as a tool to perform temporal SOC analysis, in order to detect actual sinks or sources of $CO_2$and improve soil management to meet the national commitments in the framework of Kyoto protocol and protecting soil from fertility decreases.