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Modelling the distribution of soil organic carbon with depth, as a function of land use and soil type at the regional scale in north Belgium (Flanders).

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Recent research identified the Soil Organic Carbon (SOC) pool as an important element of the global C-cycle. Nevertheless, a great uncertainty still exists in the CO2 fluxes between soil and atmosphere. The rate of exchange of CO2 between soil and atmosphere depends to a large extent on the stability of the stored SOC. As carbon stored in the subsoil is more stable than carbon stored in the topsoil, not only the amount of SOC stored, but also its distribution within the profile is essential to improve sustainable management of this reservoir. Here we study the depth distribution of SOC is studied in relation to land use and soil type based on a large dataset containing almost 7000 profile pits sampled throughout Flanders (Belgium) during the Belgian national soil survey. Hence, a general depth distribution model was constructed and applied to all land use - soil type combinations in the database. For each parameter (e.g. SOC content at the surface) a specific pedo transfer function (PTF), expressing its relationship with land use, texture and drainage variables, was constructed. Combining the output of the different PTF's, allowed us to construct an overall model, predicting the distribution of SOC density by depth using land use and soil type information. Furthermore, this approach enables SOC mapping at the regional scale until a reference depth free of choice. The results indicate that the influence of land use on SOC content is restricted to the topsoil, while soil type determines the SOC content throughout the profile. Significantly lower SOC contents were found under cropland than under forest or grassland near the surface of the profile, while at the bottom of the profile no differences in SOC content could be observed between these land uses. Furthermore, the SOC content near the surface of the profile is remarkably higher in fine textured soils than in coarse textured soils and tends to increase with soil wetness under sand and silt textured soils. SOC near the bottom of the profile also increases with soil wetness, but only in fine textured soils. The rate of decline of SOC content with depth depends on texture and land use. Soils with a higher sand content seem to be characterized by a rather slow decline of SOC content with depth. Under forest this decline is remarkably steep. Following the present three-dimensional spatial distribution approach the total amount of SOC stored in Flanders is calculated at 62.20 $\pm$ 0.72 Mt C for the top 0.3 m and at 103.19 $\pm$ 1.27 Mt C for the top 1 m.