

EGU22-3258, updated on 14 Aug 2022

<https://doi.org/10.5194/egusphere-egu22-3258>

EGU General Assembly 2022

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## High-resolution soil organic carbon mapping at the field scale in Southern Belgium (Wallonia)

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Accurate soil organic carbon content estimation is critical as a proxy for carbon sequestration, and as one of the indicators for soil health. Here, we collected 497 soil samples during 2015 to 2019, as well as five environmental covariates (organic carbon (OC) input, normalized difference vegetation index (NDVI), elevation, clay and precipitation) at a resolution of 30 m, aggregated these to represent agricultural fields and then compiled a soil organic carbon (SOC) content map for the agricultural region of Wallonia using Gradient Boosting Machine. We calculated OC input from both main crops and cover crops for each individual field. As the cover crops do not occur in the agricultural census, we identified cover crops based on long time-series of NDVI values obtained from the Google Earth Engine platform. The quality of the predictions was assessed by independent validation and we obtained an  $R^2$  of 0.77. The Empirical Mode Decomposition indicated that OC input and NDVI were the domain factors at field scale, whereas the remainder of the covariates determined the distribution of SOC at the scale of the entire Walloon region. The SOC map showed an overall northwest to southeast trend i.e. an increase in SOC contents up to the Sambre-Meuse valley followed by a decrease further to the South. The map shows both regional trends in SOC and effects of differences in land use and/or management (including crop rotation and frequency of cover crops) between individual fields. The field-scale map can be used as a benchmark and reference to farmers and agencies in monitoring SOC content changes and optimizing decisions for sustainable land use.