

Quantification of parameters controlling the carbon stocks in German agricultural soils

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Within the framework of UNFCCC, Germany is obligated to report on its greenhouse gas emissions from soils. This also includes the emissions in the agricultural sector. Changes in soil carbon stocks are a major source of CO₂ that need to be reported. Until now there are only regional inventories of the soil carbon stocks in the agricultural sector while for the forestry sector a repeated national inventory exists. In order to report on changes in soil carbon stocks in agricultural soils, a consistent, representative and quantitative dataset of agricultural soil properties, especially on carbon stocks and management data is necessary. In the course of the German Agricultural Soil Inventory 3109 agricultural sites are examined. Up to January 2016, 2450 sites were sampled. The sites are sampled in five depth increments and all samples are analyzed in the same laboratory. Of the sampled sites the laboratory analyses are completed for 1312 sites. The samples of all depth increments were analyzed for their texture, bulk density, pH, electric conductivity, stone and root content, organic and inorganic carbon content and nitrogen content. The data are coupled with management data covering the past ten years and with climate data. They are analyzed with multivariate statistical techniques (e.g. mixed effects models, additive models, random forest) to quantify the parameters that control the carbon stocks in German agricultural soils. First descriptive results show that the mean soil carbon stocks down to a depth of 100 cm are 126.1 t ha⁻¹ (range 8.9-1158.9 t ha⁻¹). The mean stocks only for croplands are 102.6 t ha⁻¹ (range 8.9-1158.9 t ha⁻¹), while for grasslands the mean stock is 184.1 t ha⁻¹ (range 19.4-937.8 t ha⁻¹). In total the soil scientists found a surprisingly high proportion of disturbed and unusual soil profiles, indicating intensive human modifications of agricultural soils through e.g. deep ploughing. The data set of the German Agricultural Soil Inventory is the first one to combine data on soil properties with management and climate data on a national scale. Its magnitude allows gaining conclusions on the parameters controlling the carbon stocks in the soils despite a high natural variability.