Geophysical Research Abstracts
Vol. 18, EGU2016-7818-1, 2016
EGU General Assembly 2016

Dynamics of organic carbon stock of Estonian arable and grassland peat soils

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Peat soils represent globally a major reserve of soil organic carbon (SOC). Estimation of changes in SOC stocks is important for understanding soil carbon sequestration and dynamics of greenhouse gas emissions. The aim of this study was to estimate the SOC stock of Estonian agricultural peat soils and SOC stock change depending on land use type (arable land and long-term grasslands (over 5 years)). The soils were classified as Histosols according to WRB classification. Generally the arable land was used for growing cereals, oilseed rape, legumes and used as ley in crop rotation. The main technique of soil cultivation was ploughing. During 2002-2015 the soil samples of 0-20 cm soil layer (one average soil sample per 1-5 ha) were collected. The SOC content was measured by NIRS method. The SOC stock was calculated by assuming that soil mean bulk density is 0.3 g cm-3. The SOC stock change in arable land was estimated during 3-13 years (N=91) and in grassland 4-13 year (N=163). The average SOC content of peat soils varied from 150.6 to 549.0 mg g-1. The initial SOC stock of arable land was 271.3 t ha-1 and of grassland 269.3 t ha-1. The SOC stock declined in arable peat soils faster (-2.57 t ha-1 y-1) compared to the changes in grassland peat soils (-0.67 t ha-1 y-1). According to the length of the study period the SOC stock change per year varied from -5.14 to 6.64 t ha-1 y-1 in grasslands and from -14.78 to 0.83 t ha-1 y-1 in arable land, although there was no clear relationship between the SOC stock change and the length of the study period. More detailed information about the properties of agricultural land and land use history is needed to analyse the causes of the SOC stock changes in agricultural peat soils. However, from the current research we can conclude that the SOC stock of arable and grassland peat soils is declining during the cultivation. These decreases are important to specify when considering the role of peat soils in atmospheric greenhouse gas balances considering peat soils spatial variability related to regional and local differences in ecology, hydrology and climate.