Geophysical Research Abstracts
Vol. 18, EGU2016-375, 2016
EGU General Assembly 2016

Dynamics and fate of SOC in tidal marshes along a salinity gradient (Scheldt estuary, Belgium)

Marijn Van de Broek (1), Stijn Temmermann (2), Roel Merckx (1), Zhengang Wang (3), and Gerard Govers (1)

(1) Department of Earth and Environmental Sciences, KU Leuven, Heverlee, Belgium, (2) Department of Biology, Ecosystem Management Research Group, University of Antwerp, Wilrijk, Belgium, (3) Earth and Live Institute, Université Catholique de Louvain, Louvain-la-Neuve, Belgium

Coastal ecosystems have been attributed the potential to store large amounts of organic carbon (OC), often referred to as blue carbon, of which a considerable amount is stored in tidal marsh soils. Large uncertainties still exist with respect to the amount and controlling factors of soil organic carbon (SOC) stored in these ecosystems. Moreover, most research has focused on SOC dynamics of saltmarshes, while brackish and freshwater marshes are often even more productive and thus receive even larger organic carbon inputs. Therefore, in this study the OC dynamics of tidal marsh soils along an estuarine gradient are studied in order to contribute to our knowledge of 1) the stocks, 2) the controlling factors and 3) the fate of SOC in tidal marshes with different environmental characteristics. This research thus contributes to a better understanding of the potential of coastal environments to store organic carbon under future climatic changes.

Soil and vegetation samples are collected in tidal salt-, brackish- and freshwater marshes in the Scheldt estuary (Belgium – The Netherlands). At each tidal marsh, three replicate soil cores up to 1.5m depth in 0.03m increments are collected at locations with both a low and a high elevation. These cores are analyzed for OC, stable C and N isotopes, bulk density and texture. Incubation experiments of topsoil samples were conducted and both aboveground and belowground biomass were collected.

The results show that SOC stocks (range: 13,5 - 35,4 kg OC m-2), standing biomass (range: 2000 - 7930 g DW m-2) and potential soil respiration of CO_2 (range: 0,03 – 0,12 % per unit OC per day) decrease with increasing salinity. This shows that both the amount of OC from local macrophytes and the quality of the organic matter are important factors controlling the SOC stocks. In addition, based on the analysis of stable C and N isotopes, it appears that when a significant fraction of SOC is derived from local macrophytes, higher SOC stocks are found, while a change in aboveground vegetation type can have large effects on SOC accumulation. Moreover, as these marsh soils have been dated before, the observed depth patterns in SOC can be linked to historical changes (e.g. changes in vegetation). A calibrated model simulating sediment deposition in these marshes is coupled to a two-pool OC model to study the effect of sediment deposition rate on the fate of SOC, with most input information being collected at the field sites. This allows us to calculate the residence time of OC in these tidal marsh soils, a measure that is very uncertain, also for other ecosystems. The part concerning modelling is however still under progress at the moment of writing.

This study shows to which extent OC stocks and dynamics of tidal marsh soils along a temperate estuary are controlled by 1) the amount and quality of OC input and 2) the contribution from different sources of OC, and uses these finding to construct a 1D model to simulate these dynamics through time.