Geophysical Research Abstracts
Vol. 12, EGU2010-8589, 2010
EGU General Assembly 2010

Carbon accumulation by biological soil crusts in relation to relief and sampling depth

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In arid and semiarid ecosystems the soil surface is covered by biological soil crusts (BSC). These BSC are microbial communities of cyanobacteria, lichens and mosses. Due to the photosynthetic activity of these microorganisms, BSC are main carbon contributors to arid ecosystems. The cover is related to ecosystem functions like surface stabilization, water redistribution and nutrient fixation. These functions rely on the microbial community composition of the BSC. Cyanobacteria and cyanolichens excrete exopolysaccharides, which build microaggregates with soil particles. This stabilizes and seals the soil surface. Therefore cyanobacteria and cyanolichen dominated crusts introduce runoff, which affects the distribution of carbon.
The total amount of soil organic carbon was determined in relation to the relief position and BSC thickness showing a strong correlation between relief, sampling depth and carbon amounts.
At the Arid Ecosystem Research Center (AERC) station of the Nizzana sand dunes (NW Negev, Israel) the dunes and the interdune corridor are covered by BSC up to 80% of the total area. The BSC are composed of a thin topcrust section and a mineral subcrust section. The overall thickness changes in relation to the relief position. Along a dune transect topcrust and subcrust samples were taken and analyzed on their C_org, C_carb, and C_total concentration. The total amount of carbon (g mˆ-2) was calculated from the carbon concentrations, the BSC bulk density and the sampling depth. Comparing the topcrust and subcrust values of the sampling points the topcrust sections showed 3-4 times higher concentrations of organic carbon than the subcrust sections. The light intensity decreases with soil depth, resulting in a higher biological activity and carbon fixation in the topcrust sections. The subcrust showed relative higher amounts of C_carb contributing to the soil surface stability. Depending on the relief position the total amount of accumulated carbon was 4 times higher at the interdune positions than at the top slope. The data shows a high dependence of total carbon storage by BSC on the relief position and the high importance of the separate crust sections for the accumulation of C_org and C_carb.