Spatiotemporal dynamics of biogenic Si pools in initial soils and their relevance for desilication

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Zielsetzung:

The project has the objective to clarify the interactions between dynamics of biogenic Si pools and desilication rates in transient state soil systems. This will be the first attempt ever to quantify sizes and turnover dynamics of both phytogenic and zoogenic Si pools in soils at the same time, together with the controls acting on them. Starting with a characterization of soils' initial state at catchment scale we will analyze the annual SiO_2 production of the vegetation as a function of (i) spatial distribution of plant available Si in soils as well as (ii) dynamics of invading Si accumulators. To do so we will employ modern remote sensing techniques (UAV). After four vegetation periods, changes in soils' phytogenic Si pool will be compared to cumulative SiO_2 production of Si accumulators by mass balance calculations. Using plot scale manipulation experiments we will elucidate the influence of an increasing phytogenic Si pool on desilication rates. At four sites annual Si exports via soil solution will be determined under pure stands of both, Si accumulator and non-accumulator plants. Plant SiO2 will be subjected to dissolution experiments to yield mechanistic information necessary for the development of algorithms to model observed desilication rates. The dynamics of the zoogenic Si pool (testate amoebae) in soil will be quantified as a function of plant pattern dynamics at catchment scale. For the first time, the attempt will be made to quantify the zoogenic Si pool size by analyzing living and dead amoebae with Energy-dispersive X-Ray Spectroscopy combined with Scanning Electron Microscopy (SEM-EDX). The factors controlling testate amoebae densities will be identified in plot and lab experiments. We will test the presumed carbon, water / nutrient and Si limitation on amoebal growth at plot scale using a completely randomized block design. The influence of silica supply on testate amoebae (idiosome growth) will be clarified in lab experiments under controlled conditions (clonal cultures).

Projektleiter/innen ZALF:
Prof. Dr. Michael Sommer

Projektmitarbeiter/innen ZALF:
Dr. Axel Höhn; Dr. Danuta Kaczorek; Dr. Daniel Puppe; Prof. Dr. Michael Sommer

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Beteiligte Institutionen

BTU - Brandenburgische Technische Universität Cottbus-Senftenberg

Projektmitarbeiter/innen (extern)

Prof. Dr. Manfred Wanner