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The Ebergoetzen Measurement Site: Linking Biogeochemical Cycles and Soil Development in a Central European Beech Forest

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Climatic changes affect soil formation and biogeochemical processes on various spatial and temporal scales. This alters the interaction and feedback mechanism between long-term soil development and present biogeochemical cycles. To identify these mechanistic transformations and thus implications on soil function and ecosystem services, continuous and highly resolved observations are fundamental.
In spring 2017, we established the Ebergoetzen measurement site in order to investigate biogeochemical processes and related soil formation under two distinct microclimatic conditions. The sites is located in a small valley on Triassic sandstone bedrock with active soil acidification and early-stage podsolization. The area is covered by a ∼50-year-old beech forest (Fagus sylvatica) and separated into two topographical units: a south-facing slope and a north-facing slope. Both slopes were equipped with a state-of-the-art sensor network to monitor environmental parameters and biogeochemical fluxes. Soil moisture and temperature, as well as climatic parameters are continuously monitored. Each slope was equipped with suction plates to collect soil water (-150 hPa) at four different soil depths (15, 30, 50 and 70 cm). Soil solution is collected on a bi-weekly basis and analyzed for carbon and nutrient concentrations. Additional litter traps (0.5 m^2) were installed and sampled regularly to estimate the seasonal element inputs from solid matter. Dissolved element and nutrient inputs are quantified in samples from 12 stem-flow and throughfall collectors. Twelve individual trees were equipped with sap-flow meters to continuously monitor water uptake by trees.
At the north-facing slope, soil temperature and evapotranspiration were seasonally reduced compared to the south-facing slope, leading to higher water availability and leaching, thus lower soil pH values – and a potential deceleration of biochemical turnover. Based on these initial conditions, we plan to assess annual and interannual fluctuations and relate these changes to soil development processes, such as soil organic matter transformation and relocation within the profile, as well as changes in the plant-soil interactions and effects on the biogenic silicon cycle. An SQL-database was designed to automatically collect and structure all data and make it available for possible collaborations and large-scale comparisons.