Geophysical Research Abstracts
Vol. 21, EGU2019-12247, 2019
EGU General Assembly 2019

∂13C and ∂15N as indictors for peatland hydrology

Miriam Groß-Schmölders (1), Pascal von Sengbusch (2), Jens Leifeld (3), Kristy Woodard (3), and Christine Alewell (1)

(1) University of Basel, Environmental Geosciences, Environmental Sciences, Basel, Switzerland (miriam.gross-schmoelders@unibas.ch), (2) Office for ecological reports, Kandern, Germany, (3) Agroscope, Climate and Agriculture Group, Zürich, Switzerland

Environmental changes significantly affect biodiversity, nutrient uptake and nutrient sources in peatlands. In former studies, we identified significant relationships of stable isotope signatures, particularly of nitrogen, and peatland conditions (natural, disturbed, rewetted). We hypothesized that these changes were related to different micro biotic metabolism. Under aerobic conditions, fungi seem to be the main decomposers, but bacterial metabolism is crucial under facultative anaerobic or anaerobic conditions. In the current approach, we extent our investigations with a vegetation analysis of peat cores to verify our previous results. We studied five peatlands in central Sweden, Southern Finland and Southern Germany. Cores were collected in different environmental conditions (i.e. natural wet to natural dry to drained) to get a wide picture of stable isotope patterns related to vegetation and moisture. We identified different horizons as indicated by vegetation and peat degradation status. Different Sphagnum species represent the main vegetation at all sites. At all sites, we found distinct relationships between the stable isotope signals (15N, 13C) and the respective indicator species of Sphagnum. Species indicating relatively dry conditions corresponded to isotope signals of aerobic fungi-dominated metabolism, while species indicating wet conditions corresponded to isotope signals related to anaerobic or facultative anaerobic bacteria-dominated metabolism. We hypothesize that these relationships are linked to (i) changing availability of nitrogen and carbon in terms of aerobic and anaerobic conditions (ii) and changing metabolic pathways. Our results suggest that with increasingly dry conditions, stable isotope values (15N, 13C) decrease as a consequence of increasing fungal metabolism. These results are linked to changing peat vegetation: e.g. Sphagnum balticum and Sphagnum majus in wet conditions and large-leaved Sphagnum cymbifolia (e.g. Sphagnum magellanicum) in dryer conditions. ∂15N values seem to be highly sensitive to moisture content and show high variations with changing moisture. In contrast ∂13C signals fluctuate less than ∂15N at similar core depths, and therefore demonstrate more direct trends with changing moisture conditions. The trends are comparable in all locations, but the absolute isotope values depended on the study sites. In view of the current and profound climate change, our findings could be a fingerprinting tool to monitor past and current wetland conditions. Stable nitrogen and carbon isotopes analyses are routine measurements today and considerably less time-consuming and more cost efficient than vegetation analysis. Our approach enables us to obtain reliable information regarding peatland status and the response to changing environmental conditions over time with relatively little effort and might thus help to protect these unique ecosystems and their highly-needed ecosystem functions.