Geophysical Research Abstracts
Vol. 21, EGU2019-17325, 2019
EGU General Assembly 2019

Future precipitation patterns in agroecosystems affected carbon and nitrogen cycling – a green manure stable isotope labelling study

Andrea Watzinger (1), Andreea Spiridon (1,2), Simon Leitner (1), Berthold Helene (3), Johannes Hösch (3), Erwin Murer (4), Johannes Wagenhofer (4), Herbert Formayer (5), Wolfgang Wanek (2), and Rebecca Hood-Nowotny (1)

(1) Institute of Soil Research, University of Natural Resources and Life Sciences Vienna, Austria (andrea.watzinger@boku.ac.at), (2) Institute of Terrestrial Ecosystem, University of Vienna, Austria, (3) Department for Soil Health and Plant Nutrition, AGES Austrian Agency for Health and Food Safety, Austria , (4) Institute for Land and Water Management Research, Federal Agency for Water Management Petzenkirchen, Austria, (5) Institute of Meteorology, University of Natural Resources and Life Sciences Vienna, Austria

Climate change affects precipitation patterns in the future, and as such is a determining factor in agricultural systems in terms of soil organic matter mineralization, nutrient release and therefore plant production. This study investigates the impact of precipitation on two different soil types – a sandy calcaric phaeozem (S) and a calcic chernozem (T) representative of the Pannonian area of the Marchfeld region in Austria. A regionalized scenario RCP 6.0 derived from the 5th IPCC was used on a long-term lysimeter study in the Marchfeld, where future rainfall patterns were compared with current precipitation since 2011. Simple concentration measurements did not show clear differences in carbon and nutrient cycling between scenarios as heterogeneity between lysimeters was high. However, a more precise way of tracing carbon and nitrogen turnover in soils is using a stable isotope labelling approach. In this study, green manure (Sinapis alba) labelled with 13C and 15N stable isotopes was applied to the lysimeter soil in April 2018. Gaseous emissions, soil, plant and groundwater samples were collected at different time points throughout the growing season and analysed using isotope ratio mass spectrometry. Results showed decreased plant biomass production in the future scenario due to drought stress as indicated by increased δ13C values of the plants. Mineralization of green manure and label uptake into soil microorganisms was shown to start within hours of application. As expected, concentration measurements did not reveal differences between current and future scenarios. However, isotope results showed that inorganic N (NO_3-) was released from the green manure more slowly under the future scenario in the initial days but its proportion in crops increased during summer, emphasizing the importance of plant biomass production on NO_3- uptake from soil. This study provides a nice example how isotope tools can uncover differences in soil processes which are otherwise masked due to soil heterogeneity.