Geophysical Research Abstracts
Vol. 18, EGU2016-4505, 2016
EGU General Assembly 2016

Climate change amplifies gross nitrogen turnover in montane grasslands of Central Europe both in summer and winter seasons

Zhe Chen (1), Changhui Wang (1,2), Sebastian Unteregelsbacher (1), Haiyan Lu (1), Silvia Gschwendtner (3), Rainer Gasche (1), Allison Kolar (1), Michael Schloter (3), Klaus Butterbach-Bahl (1), and Michael Dannenmann (1)

(1) IMK-IFU,Karlsruher Institut für Technologie (KIT), Garmisch-Partenkirchen, Germany (zhe.chen@kit.edu), (2) State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, the Chinese Academy of Sciences (IBCAS), Beijing 100093, China, (3) German Research Center for Environmental Health (GmbH)

The carbon and nitrogen rich soils of montane grasslands are exposed to above average warming and to altered precipitation patterns as a result of global change. In order to investigate the consequences of climatic change for soil nitrogen turnover, we translocated intact plant-soil mesocosms along an elevational gradient. Following three years of equilibration, we monitored the dynamics of gross nitrogen turnover and ammonia oxidizing microbes over an entire year.

Gross nitrogen turnover and gene levels of ammonia oxidizing bacteria (AOB) and archaea (AOA) showed pronounced seasonal dynamics. While both summer and winter periods equally contributed to cumulative annual N turnover, the highest gross N turnover and abundance of ammonia oxidizers were observed in frozen soil of climate change sites due to physical liberation of organic substrates and their rapid turnover in the unfrozen soil water film. The control site never experienced soil freezing due to a significant insulating snowpack. Climate change conditions accelerated gross N mineralization by 250% on average. The AOB community benefited more from increased soil ammonium production under climate change conditions than the AOA community and thus accounted for a significant increase in gross nitrification rates. Climate change impacts were restricted to the 2-6 cm topsoil and rarely occurred at 12-16 cm depth, where generally much lower N turnover was observed.

Mineralization pulses in a changing climate may result in soil organic matter loss with their associated negative impacts on key soil functions. In this context, N cycling processes in frozen soil can be a hot spot for gross N turnover and thus be of paramount importance for understanding seasonal patterns, annual sum of N turnover and possible climate change feedbacks.