Geophysical Research Abstracts
Vol. 19, EGU2017-13112-1, 2017
EGU General Assembly 2017

Is CH_4 consumption by soils controlled by physics or biology? Results from a study of plot-scale variability of greenhouse gas fluxes

Martin Maier, Sinikka Paulus, Clara Nicolai, and Philipp Nauer

Freiburg University, Institute of Forest Science, Chair of Soil Ecology, Freiburg, Germany
(martin.maier@bodenkunde.uni-freiburg.de)

Soil-atmosphere fluxes of trace gases vary on different spatial scales, between landscapes and ecosystems down to the plot scale within apparently homogenous sites. The production and consumption of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) underlie different spatial and temporal changes, und thus, their interrelation is difficult to unravel. Small-scale variability in soil properties is well-known from soil surveys, affecting theoretically water availability for plants, soil aeration, vegetation, the local photosynthesis rate, and, eventually, greenhouse gas fluxes.

We investigated the small scale variability of greenhouse gas fluxes in a homogenous Scots Pine stand in a former riparian flood plain. Soil-atmosphere fluxes of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) were carried out at 60 points on a 250 m^2 plot with strata of diverse soil substrates and understory vegetation. Gas flux measurements were combined with soil physical lab measurements, and a soil vegetation survey.

The soil was a source of CO_2 and a sink for CH_4 and N_2O. No correlations between the fluxes and only weak correlations between the fluxes and soil physical factors were observed. CH_4 and CO_2 fluxes were significantly different for the soil-vegetation strata. Separating the dataset into the different soil-vegetation strata showed that CH_4 consumption increased significantly with soil gas diffusivity and soil respiration. Methane consumption in the silt stratum was higher at a given soil gas diffusivity than in the sand stratum, indicating a higher methanotrophic microbe population and thus better habitats in silt. CH_4 consumption increased with soil respiration in all strata, so that we speculate that the rhizosphere and decomposing organic litter (as origin of most of the soil respiration) facilitate a preferred habitat of methanotrophic microbes. The patterns of N_2O consumption were more complex, but consumption seemed to be limited at locations with higher soil respiration. Thus, we conclude that soil texture has a significant effect on greenhouse gas fluxes on the plot scale and that the fluxes of CO_2, CH_4 and N_2O are linked.

Acknowledgement
This research was financially supported by the project DFG (MA 5826/2-1).