Geophysical Research Abstracts
Vol. 19, EGU2017-19593, 2017
EGU General Assembly 2017

Soil nitrate accumulation dominates the nonlinear responses of soil CO_2 and CH4 fluxes to multi-level nitrogen addition in a temperate needle-broadleaved mixed forest

Huajun Fang

The responses of soil-atmosphere carbon (C) exchange fluxes to increased atmospheric nitrogen (N) deposition are controversial, leading to great uncertainty in the evaluation on the C sink capacity of global forest ecosystems elicited by anthropogenic N inputs. To date, we hardly knew how much was the critical level of N input for the alteration of the soil C fluxes, and what factors controlled the changes in soil CO_2 and CH4 fluxes under N enrichment. Nine levels of urea addition experiment (0, 10, 20, 40, 60, 80, 100, 120, 140 kg N ha-1 yr-1) was conducted in the needle-broadleaved mixed forest in Changbai Mountain, Northeast China. Soil CO_2 and CH4 fluxes were monitored weekly using the static chamber and gas chromatograph technique. Environmental variables (soil temperature and moisture in the 0-10 cm depth) and dissolved N (NH4+-N, NO_3–N, total dissolved N (TDN), and dissolved organic N (DON)) in the organic layer and the 0-10 cm mineral soil layer were simultaneously measured. High rates of N addition ($\geq$ 60 kg N ha-1 yr-1) significantly increased soil NO_3–N contents in the organic layer and the mineral layer by 120%-180% and 56.4%-84.6%, respectively. However, N application did not lead to a significant accumulation of soil NH4+-N contents in the two soil layers except for a few treatments. N addition at a low rate of 10 kg N ha-1 yr-1 significantly promoted soil CO_2 emission and CH4 uptake, whereas high rate of N addition (140 kg N ha-1 yr-1) significantly inhibited them. Significant negative relationships were observed between changes in soil CO_2 emission and CH4 uptake and changes in soil NO_3–N and moisture contents under N enrichment. These results suggest that soil nitrification and NO_3–N accumulation could be important regulators of soil CO_2 emission and CH4 uptake in the temperate needle-broadleaved mixed forest. The nonlinear responses to exogenous N inputs and the critical levels for the alteration of soil C fluxes should be considered in the ecological process models.