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Isotopologue signatures of N2O from denitrification in soil

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There is few information on N2 fluxes from denitrification in the field, because this process is difficult to measure in situ. Isotopologue signatures of N2O such as 18O, average 15N (15Nbulk) and 15N site preference (SP = difference in 15N between the central and peripheral N positions of the asymmetric N2O molecule) can be used to constrain the atmospheric N2O budget and to characterize N2O turnover processes including N2O reduction to N2. However, the use of this approach to study N2O dynamics in soils requires knowledge of isotopologue fractionation factors () for the various partial processes involved, e.g. N2O production by nitrification or denitrification, N2O reduction by denitrification and diffusive transport. The aim of our study was to investigate whether isotopologue signatures of soil-emitted N2O can be used to estimate N2O reduction, and accordingly N2 formation.
Two arable soils were incubated in the laboratory under varying conditions in order to manipulate the partial processes of N2O turnover. of 18O, 15Nbulk and SP was determined in experiments, where only one of the partial processes was governing the isotopic signature of N2O in the incubation system of the respective treatment. of N2O reduction to N2 was derived by (i) comparing treatments with and without inhibition of N2O reduction (indirect approach) or (ii) by monitoring the time course of isotopic signatures of N2O applied to the headspace of NO3–depleted anaerobic soil (direct approach). Moreover, we incubated the soils under conditions favoring denitrification (high moisture, low O2 level, NO3- fertilization) and monitored isotopic signatures of emitted N2O. In parallel experiments with 15N-labeled NO3- pool we measured N2 fluxes directly. Isotopologue signatures were compared with 15N2 flux data in order to check their relationship with N2 production.

References

Well R, Kurganova, I., Lopes, V., Flessa H. (2006), Isotopomer signatures of N2O emitted from an arable loess soil under different moisture conditions - a soil microcosm study. Soil Biology and Biochemistry 38, 2923 - 2933.