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Nitrous oxide emission peaks and distribution of nitrous oxide in the soil profile during rain events: A soil column experiment

Line Vinther Hansen[1], Andreas Brændholt[1], Azeem Tariq[1,2], Lars Stoumann Jensen[1], and Sander Bruun[1]

[1]Department of Soil and Environmental Sciences, University of Copenhagen, Denmark (livh@plen.ku.dk)
[2]School of Environmental Sciences, University of Guelph, Canada (atariq02@uoguelph.ca)

Nitrous oxide (N_2O) emissions are notoriously variable at different spatial and temporal scales. As recognized in the literature, peaks in emissions of N_2O occur after fertilization, precipitation and freeze-thaw events. Although the individual microbial processes have been extensively studied, the understanding of the underlying mechanisms behind the pulse emissions is still subject to many uncertainties. The N_2O produced in connection with a rain event can either be entrapped in the soil matrix and be subject to N_2O reduction or be released later when soil diffusivity increases as water infiltrate into the soil or evaporate.

To understand the mechanisms behind the observed flux emissions related to precipitation events, we are conducting a laboratory experiment to quantify the N_2O movement in the soil. In 50 cm tall soil columns exposed to a simulated rain event, gas samples are extracted from the soil matrix at three depths via reinforced silicone tubes. At the surface, gas is sampled for flux estimates.

A common trigger of pulse emissions is a lowered soil oxygen content. Continuous monitoring of the soil oxygen with sensors at three depths provides measurements of O_2 dynamics in the soil simultaneously with the N_2O content. This can add to the understanding of how O_2 relates to N_2O production, reduction and movement. Tensiometers will additionally provide data on the soil water status during simulated precipitation events.

The experimental set-up can furthermore be used for studying the effects of other factors affecting N_2O movement and emission in soil e.g., soil types, type of fertilizers, soil temperature etc.