Geophysical Research Abstracts
Vol. 21, EGU2019-14128, 2019
EGU General Assembly 2019

Importance of the ebullition pathway for accurate estimates of fertilization induced N2 emissions on wet arable soils

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To reduce agriculture related nitrogen (N) emissions, it is imperative to understand the production and transformation processes of N2O and N2 in soils as influenced by different environmental conditions and management practices. While a number of techniques exist to measure in-situ N2O emission in a high temporal resolution, measurements of N2 emissions are usually limited - due to methodical constraints - to incubation experiments with a low temporal resolution.
In consequence, measured potential N2 emissions might be biased. This is particularly the case, since similar to CH4, N2 might be released through short-term, erratic "ebullition" events, a pathway usually associated to wetland ecosystems. However, the application of liquid N fertilizer such as slurry or fermentation residues, together with rather wet soil conditions, might trigger ebullition N2 on arable soils as well.
We present an incubation study, focusing on the influence of erratic ebullition events for fertilization induced N2 emissions of an agricultural used mineral soil. N2 emissions by ebullition were manually triggered. A novel GC system was used to measure N2 concentrations in a higher temporal resolution, thus allowing for identifying and quantifying N2 emissions released through ebullition by applying an automatic calculation algorithm implemented in R.
Our results show that ebullition related N2 fluxes might contribute substantially to overall N2 emissions following fertilization. Thus, N2 flux measurements lacking high temporal resolution are prone to a systematic underestimation of obtained results.