Nitrous oxide hotspots and hot moments in soil
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Periodic depletions of O\textsubscript{2} in soil cause hotspot and hot moments of N\textsubscript{2}O production in the soil environment. To what extend the produced N\textsubscript{2}O is emitted depends on the contact with the atmosphere and the delay between production and reduction. In our study, injection of either water or animal slurry resulted in an anoxic 3-cm thick cylindrical soil volume. Nitrous oxide emission rates as well as the distribution of O\textsubscript{2} and N\textsubscript{2}O by use of micro-sensors were monitored daily. The anoxic cylinder functioned as a hotspot for denitrification of the NO\textsubscript{3}\textsuperscript{-} originally present in the soil, and N\textsubscript{2}O accumulated inside the anoxic cylinder due to delayed N\textsubscript{2}O reduction and limited transport conditions. Depletion of NO\textsubscript{3}\textsuperscript{-} in the anoxic cylinder two days after injection seemed to accelerate N\textsubscript{2}O consumption causing a rapid exhaustion of the accumulated N\textsubscript{2}O. It was calculated that 20-30\% of the NO\textsubscript{3}\textsuperscript{-} originally present was emitted as N\textsubscript{2}O. Without the temporary retention in the anoxic cylinder this would have been about 40\%. Oxygen returned to the soil volume seven days after anoxia was created. A closely coupled nitrification-denitrification was responsible for an N\textsubscript{2}O production peak during the second and third week after injection, and this N\textsubscript{2}O was quickly emitted to the atmosphere due to high diffusion possibilities. These findings are important to have in mind when monitoring emission of N\textsubscript{2}O as a measure of N\textsubscript{2}O production in the soil.