The fate of N2O consumed in soils

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Soils are capable to consume N2O. It is generally assumed that consumption occurs exclusively via respiratory reduction to N-2 by denitrifying organisms (i.e. complete denitrification). Yet, we are not aware of any verification of this assumption. Some N2O may be assimilatorily reduced to NH3. Reduction of N2O to NH3 is thermodynamically advantageous compared to the reduction of N-2. Is this an ecologically relevant process? To find out, we treated four contrasting soil samples in a flow-through incubation experiment with a mixture of labelled (98%) 15N(2)O (0.5-4 ppm) and O-2 (0.2-0.4%) in He. We measured N2O consumption by GC-ECD continuously and delta N-15 of soil organic matter before and after an 11 to 29 day incubation period. Any (N2O)-N-15 assimilatorily reduced would have resulted in the enrichment of soil organic matter with N-15, whereas dissimilatorily reduced (N2O)-N-15 would not have left a trace. None of the soils showed a change in delta N-15 that was statistically different from zero. A maximum of 0.27% (s.e. +/- 0.19%) of consumed (N2O)-N-15 may have been retained as N-15 in soil organic matter in one sample. On average, N-15 enrichment of soil organic matter during the incubation may have corresponded to a retention of 0.019% (s.e. +/- 0.14%; n=4) of the (N2O)-N-15 consumed by the soils. We conclude that assimilatory reduction of N2O plays, if at all, only a negligible role in the consumption of N2O in soils.
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