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REGULAR ARTICLE

Seasonal dynamics and profiles of soil NO concentrations in a temperate forest

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Abstract
Aims Soils are known to be significant sources of atmospheric nitric oxide (NO), a key compound in atmospheric chemistry. NO is a key regulating substance for inter- and intra-species signalling and competition and affects plant growth and soil microbial metabolisms. However, little is known about NO concentration in soils and production of NO in the soil profile.
Methods Here we report on soil NO concentrations down to 65 cm soil depth and soil surface flux measurements over a 15 months period in subdaily resolution. This is supplemented by information on aerobic and anaerobic NO production in various soil layers of a spruce stand in SW Germany.
Results NO concentrations showed a clear seasonality with highest concentrations of up to 800 nmol mol^{-1} (or part per billion in volume mixing ratio; ppbv) at the interface between the organic Of-Oh sub-layers in the summer. NO concentrations in the mineral subsoil (−65 cm) were approx. One order of magnitude lower than in the organic layer. Dynamic changes of soil NO concentrations were closely correlated with soil surface NO fluxes. Differences in soil NO concentrations across the soil profile reflected differences in aerobic and anaerobic NO production potential.
Conclusion The importance of such high NO concentrations for soil microbial and plant physiological processes remains unclear, but should be addressed in future research in order to improve our understanding of microbe-microbe and plant-microbe interactions.

Keywords Nitric oxide · Surface flux · Soil gas concentration · Soil profile · Plant interaction

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Introduction

Nitric oxide (nitrogen monoxide; NO), a stable free radical, is a key substance in atmospheric chemistry, and quickly reacts to nitrogen dioxide (NO_2) and vice versa, so that both substances are often summarized as nitrogen oxides (NO_x). NO_x is a main precursor for tropospheric ozone (O_3) and a key substance

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