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Inverse analytical approach to quantify the fraction of heterotrophic nitrification on trace gas emissions based on indirect isotope labelling of soil organic matter

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In the last decades N trace gas emission from soils were intensively investigated due to great impact to global warming and stratospheric ozone depletion. The structure of soils thereby allows coexistence of anaerobic and aerobic zones which permit oxidative processes (i.e. nitrification) and reductive processes (i.e. denitrification) to occur simultaneously. In order to improve our knowledge about N gas production and consumption in soils it is essential to distinguish between different processes and pools involved in soil N_2O and NO release. Recent studies (e.g. Bateman and Baggs, 2005; Du et al., 2006; Rütting and Müller, 2007) demonstrated that with respect to heterotrophic nitrification organic N compounds (N_{org}) can be also a source of N trace gas production. Due to the heterogeneous structure of the N_{org} pool in soils it is impossible to label this pool homogeneous by ^{15}N. Therefore the production of N trace gases (and also the nitrite production) based on the organic N pool cannot be determined by direct labelling with ^{15}N.

(Müller et al., 2004) use an indirect labelling of the organic N pool and determined the heterotrophic nitrification using a complex numerical model. The analysis of the contribution of heterotrophic nitrification to N traces gases and/or nitrite by the classical analytical approach is all but impossible. Small variations in the determination of stable isotope abundance result in very high variation of the calculated source distribution using the analytical approach. Implementation of ^{14}N abundance in analytical approaches (inverse analytical approaches, IAA) reduces these uncertainties signifi-

cantly and results in much more reliable calculation of different sources.

The classical and the inverse analytical approach will be presented and sensitivity analyses will be demonstrating the advantage of the new approach.

References

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