

Reply to comments of Anonymous Referee #2

We thank anonymous referee #2 for the constructive review. We address the referee's comments in the following point by point response.

General comments

1) [...] in parts the language could be markedly improved.

Please see reply to the general comment 2) of anonymous referee #1

2) [...] there are few weaknesses that should be acknowledged. One of them is that the frequency of the N₂O emission measurements is too low to capture the temporal variability in N₂O emissions. Hence the annual emission estimates and as follows the emission factors are highly uncertain.

We are aware that this is a critical point of our study. We now mentioned this point as potential error source in the discussion.

3) [...] the use of only two control chambers in the study adds up a large uncertainty in the calculation of the ¹⁵N-tracer emissions.

Please see reply to the general comment 1) of anonymous referee #1.

Specific comments

4) P8351, R11: what was the purpose of the pressure sensor? Did you recognize a pressure drop due to gas sampling? Was any data discarded based on the pressure changes?

The purpose of the pressure sensor was (i) to check the leak tightness of the evacuated glass bottles prior to gas sampling, leaky bottles were exchanged, and (ii) to ensure that the bottles were completely filled with "chamber gas".

5) P8351, R14: was the development of the N₂O concentration always linear? Did you test for the linearity or test other flux calculation methods (non-linear)?

This is indeed an important point. We did not perform linearity tests. However, we conducted a visual test for linearity and assessed the coefficient of determination for the linear model. In addition, we tested a quadratic approach for some data. As expected, the sum of squared errors was generally lower and the coefficient of determination was generally higher for the quadratic model than for the linear model. However, the bias and the Aikake Information criterion were often higher for the quadratic model than for the linear model. Thus, no clear advantage of the non-linear model emerged from the statistical indicators for the goodness of fit. Moreover, N₂O fluxes calculated using the quadratic model were not significantly different from fluxes calculated using the linear model. Furthermore, we believe that scattering of N₂O concentrations due to random errors during sampling and measurement were much larger than the effect of the chamber on the gas exchange and hence possible

biases due to linear regression regarding N₂O measurements at our study sites. For this reason, we decided to stick to the linear model approach for N₂O flux calculations.

6) P8351, R15: Do you mean a “cumulative annual emission”?

Yes, we changed this accordingly.

7) P8352, R11 (formula): check the upper indexes (15N)

Done.

8) P8352, R18-21: Were there a lot of negative N₂O fluxes? Were these included in the annual N₂O budget calculations?

In the spruce stand 35% of fluxes and in the beech stand 17% of fluxes were omitted for ¹⁵N-N₂O emission calculations. We mentioned this now in chapter 2.5. For annual N₂O budget calculations negative N₂O fluxes were included.

9) P8353, R3-5 (formula): check whether it is correct. Should the N_t be replaced by m¹⁵NN_t?

We replaced $m^{15}\text{N}_{\text{N}_2\text{O}, \text{N}_t}$ by $m^{15}\text{N}_{\text{rec}}$ and explained the notation in the text.

10) P8353, R11-14: I would add more details of the method such as “: : this approach does not account for the peak emissions due to the fact that the emissions were measured one week after the irrigation: : ” and “leading potentially to an underestimation : : ”

We added the proposed additions.

11) P8353, R16-25: Although this method is not shown later, please, give more details. I do not fully understand how the short-term data was used to calculate the relative proportion of the tracer emission. More specifically, R19: what do you mean by “the whole period”? Two weeks, or one year? R20: change “sequent” to “consecutive”, R20: the “relative proportion” to what?

We now explicitly described the second approach and considered the comments. “The whole period” referred to the time between consecutive measurements (two to four weeks). The word “whole” is possibly misleading, thus we removed it.

12) P8356, R5-7: Please, clarify this sentence.

We rephrased the sentence.

13) P8356, R8-11: I do not understand this paragraph. In the Fig. 2 there are clear differences in the ¹⁵N-N₂O emissions between the NH₄⁺ and NO₃⁻ -labeled treatments.

Please see reply to the specific comment 8) of anonymous referee #1

14) P8357, R14: Please, give the range or percentage of recovered fraction of applied NH_4^+ here.

Done.

15) P8357, R21-22: Please, indicate more clearly which EF calculation method you use. I.e. specify always whether it is based on modelled (regression) or measured data.

We are not sure whether we understood the comment correctly. We tried to change the sentence.

16) P8357, R22-24: The formula is in an arbitrary place. Please, move to the end of the sentence.

Done.

17) P8358, R18-21: Are these results (Wolf and Brumme 2002; Brumme et al., 1999) from the same measurement site? If they are, please explain that in the text. I would also “soften” this paragraph with words “may explain: : :”, “may create: : :” since this was not studied in this experiment and hence can only be speculated.

Yes, the results are from the same measurement site. We explicitly mentioned this now. The paragraph was re-written in a more careful manner.

18) P8359, R5-7: This sentence is unclear. Where does the word “this” refer to: to the 3-week elevated N_2O emissions? Do you mean “immobilization of the added N: : :”?

We rewrote the sentence and yes, we meant “immobilisation of the added N”, thus we replaced “labelled” with “added”.

19) P8359, R10: What is a “medium-term” effect? Longer than 3-weeks?

With “medium-term”, we meant up to one year. We inserted “up to one year” in brackets.

20) P8359, R22-27: Please, separate better what are the results of this study and what of other studies. Were some of the referred studies (e.g. Brumme and Beese 1992) conducted at the same forest sites?

We followed the suggestion of the referee.

Technical Corrections

21) P8352, R3: change “detected” to “measured”

We changed that accordingly.

22) P8358, R17: change “built” to created

We changed that accordingly.

23) P8360, R1: change “to process: : :” to “to oxidize the applied NH_4^+ ..”

We changed that accordingly.

24) P8361, R3: Remove repetition “in our study”. Also, write the EF(fb) open here as it appears for the first time in the discussion.

We changed that accordingly.