Reply to comments of Anonymous Referee #1

We thank anonymous referee #1 for the constructive review. We address the referee's comments in the following point by point response.

General comments

1) […] except for the fact that N_2O chamber measurements on the control plots were conducted with significantly less chambers than in the labeling treatments […].

We agree that it is not the standard of good scientific practice to choose less control chambers than treated chambers and in particular to use only two control chambers in the short-term experiment. However, we decided to reduce the number of control chambers in favour of treated chambers since temporal as well as spatial variability of emitted natural ^{15}N in our studied forest stands was low compared to the expected variability in emitted ^{15}N in the labelled chambers, which we concluded from previous measurements (see Figure). We explicitly mentioned this now in chapter 2.2. Concerning the Figure below, please compare mean values of the control chambers between different experiments within a stand (purple columns) for assessment of temporal variability and compare the control chambers among each other within an experiment (blue columns) as well as with the values of other chambers used to measure natural ^{15}N emissions (yellow columns) to assess spatial variability. As an example, in the one-year experiment 2007/08, the coefficients of variation of the control chambers (n = 3) were 0.9% and 2.7% in the beech and spruce stands, respectively. The corresponding coefficients of variation for the NH4-labelled and the NH4NO3-labelled chambers (each n = 5; data not shown) were 15.0% and 20.1% in the beech stand and 10.2%, and 23.9% in the spruce stand.

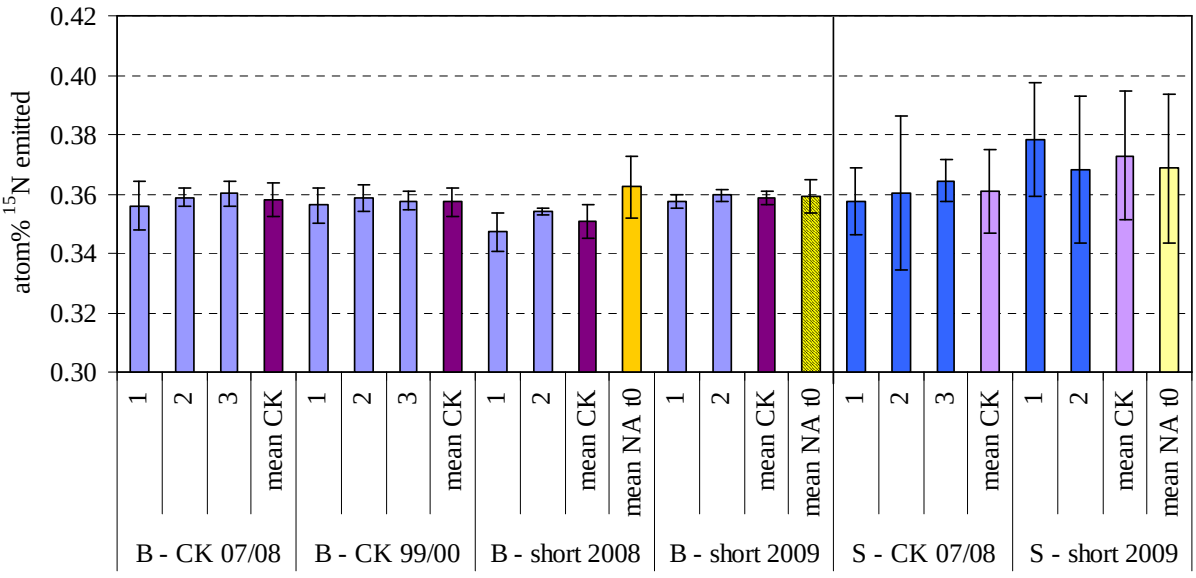

Figure: Natural abundance of ^{15}N emitted (mean ± standard deviation) of the beech (B) and spruce (S) stands at the Solling. Data derived from our one-year experiments in the beech and spruce stands in 2007–08 (CK 07/08), from another long-term experiment in our beech stand conducted by us in 1999–2000 (CK 99/00), from a short-term (3 weeks) experiment in our beech forest, which we conducted in summer 2008 (short 2008), and from our short-term experiment in summer 2009 in the beech and spruce stands (short 2009). We used the same control chambers (CK 1–3; blue columns) per stand for

every experiment. The purple columns indicate the means of these control chambers of each experiment. The yellow columns indicate the mean of chambers where the natural abundance was measured before labelling (mean NA t0; each $n = 8$). Please note that the *y*-axis does not start at zero.

2) The paper would also benefit from language editing by a native speaker.

The revised manuscript was checked by a native speaker. We further restructured chapter 4.4 (Contribution of N deposition to N_2O emissions).

Specific comments

3) p. 8346, l. 11: Here and throughout the manuscript: the formula $^{15}N_2O$ is misleading, or incorrect sensu stricto. […]

The referee is correct in that we measured m/z 45. We replaced $^{15}N_2O$ with $^{15}N\text{-}N_2O$.

4) p. 8350, l. 6: "Two chambers served as control." This is not really the standard of good scientific practice,

Please see reply to the general comment 1).

5) p. 8350, l. 7: What do you mean with "irrigation"? "Irrigation event"?

We replaced irrigation (event) by application in the revised manuscript.

6) p. 8350, l. 24+25: "bi-weekly" or "biweekly" is ambiguous, it could mean "twice per week" or "every other week".

We now wrote "every second week".

7) p. 8350, l. 26-28: This sentence is not clear to me. Do you mean: "During one irrigation event in the one-year experiment, amounts of added N and water were equal to the amounts added with one irrigation event in the short-term experiment"?

We fully agree with the referee and changed the sentence accordingly.

8) p. 8356, l. 8-11: I don't understand this paragraph. In the previous paragraph you describe broadly the differences between the labeling treatments, and here you state that there were no differences in 15N-N2O fluxes between labeling treatments. I can also see differences in the nitrate labeling treatments of a factor of 10 or more with respect to 15N-N2O fluxes.

This was not described accurately. We made the paragraph and whole chapter 3.2 more clear by adding the word "significant/ly" in the revised manuscript.

9) p. 8356, l. 19: Here and in the following, do you mean 15NH415NO3?

Yes, we do. Chambers which received a $^{15}NH_4NO_3$ tracer were called "NH_4^+-labelled", chambers which received a $NH_4{}^{15}NO_3$ were called "NO_3^--labelled", and chambers which received the $^{15}NH_4{}^{15}NO_3$ tracer were called "NH_4NO_3-labelled". We now introduced our abbreviations in chapter 2.2

10) p. 8357, l. 1-2: "In the beech stand, we observed no differences in 15N2O flux for both treatments: : :": I can see clear differences. The question is, whether the differences were significant.

In our manuscript we only discussed differences when statistical tests have confirmed that they are significant. In the revised chapter 3.3, we added the word "significant/ly" where necessary.

11) p. 8357, l. 2-3: ": : :and they followed the same seasonal trend as the total N2O flux in both treatments: : :": Again, I see differences. N2O flux in beech reached its maximum in June, whereas 15N-N2O fluxes reached their maximum in July. Please describe the results more carefully.

We followed the suggestion of the referee.

12) p. 8360, l. 14-18: For N2O fluxes, soil moisture is at least as important as soil temperature, if not much more (except for freeze-thaw events). Thus, you should also consider soil moisture when deriving EFR from a regression analysis.

The referee is correct in stating that soil moisture is in general important for N_2O fluxes. However, in the beech stand N deposition was significantly positive correlated to precipitation but N_2O emissions were not (nor to soil moisture) whereas in the spruce stand N_2O emissions were correlated to precipitation but not to N deposition. We only looked for control variables that were significantly related to both N_2O emissions and N depositions, because only in this case a systematic error occurs when determining the emission factor by regressions analysis neglecting this control variable.

13) p. 8361, l. 5-8: This sentence needs to be rephrased. The meaning is not clear.

We rephrased the sentence.

14) p. 8363, l. 4-5: What do you mean with "edaphic and soil conditions"? What's the difference?

This was a mistake. We inserted "climate" instead of "edaphic".

15) Fig. 1: You should show the N2O fluxes for control, ammonium-labeled and double-labeled treatments separately.

We followed the suggestion of the referee.

16) Fig. 4: You should show also a second diagram, replacing soil temperature with soil moisture.

Please see reply to the specific comment 12).

Technical corrections:

17) p. 8361, l. 23: Write “which may be a result of” or “which may result from”.

We changed that accordingly.

18) p. 8361, l. 24: Replace “no” with “not”.

We changed that accordingly.

19) p. 8362, l. 3: Replace “detect” with “represent”.

We changed that accordingly.

20) p. 8362, l. 11: Replace “considerable” with “considerably”.

We changed that accordingly.

21) p. 8362, l. 22: Write “to the emission” instead of “on the emission”.

We changed that accordingly.

22) p. 8363, l. 5: Write “may result” instead of “may results”.

We changed that accordingly.

23) p. 8363, l. 6: Write “does not” instead of “do not”.

We changed that accordingly.