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Interactive comment on “Direct contribution of nitrogen deposition to nitrous oxide emissions in a temperate beech and spruce forest – a ^{15}N tracer study” by N. Eickenscheidt et al.

Anonymous Referee #1

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General comments

This paper presents experimental results of a ^{15}N tracer study, comprising a short-term (3 weeks) and a long-term (1 year) experiment, on the direct contribution of deposited N to nitrous oxide soil emissions in two adjacent Norway spruce and beech forest stands in the Solling, Central Germany. It provides evidence that the direct contribution of throughfall-deposited N to N_2O emissions is much smaller than previously thought, using other methods to determine the ratio of N_2O from N deposition to total N_2O emissions of the soil. The topic of this paper is well in the scope of Biogeosciences. The study appears to be well conducted, except for the fact that N_2O chamber measure-

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ments on the control plots were conducted with significantly less chambers than in the labeling treatments (two in the case of the short-term experiment compared to four for each treatment; and three control chambers in the long-term experiment compared to seven chambers for each treatment plot). The own results are put nicely into the context of a large range of other results, pinpointing the fact that most other approaches overestimate the direct contribution of N deposition to N₂O soil emissions. If the editors of Biogeosciences do not see a general problem in the lower number of control chamber replicates, I recommend publication of the paper after consideration of some points which are specified below. The paper would also benefit from language editing by a native speaker.

Specific comments

p. 8346, l. 11: Here and throughout the manuscript: the formula 15N₂O is misleading, or incorrect *sensu stricto*. I am quite sure that you have analyzed 15N¹⁴N¹⁴O or 14N¹⁵N¹⁴O, i.e. *m/z* 45, not *m/z* 46 (as it would be the case for “true” 15N₂O). Therefore, I recommend replacing 15N₂O with 15N-N₂O, as you have used on p. 8357, l. 4, throughout the manuscript to be chemically correct.

p. 8350, l. 6: “Two chambers served as control.” This is not really the standard of good scientific practice, especially as the data of the control chambers form the basis for all your calculations of increased emissions after N addition and of 15N-excess of N₂O.

p. 8350, l. 7: What do you mean with “irrigation”? “Irrigation event”?

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

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”?

p. 8356, l. 8-11: I don’t understand this paragraph. In the previous paragraph you

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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.

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

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.

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.

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.

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

p. 8363, l. 4-5: What do you mean with “edaphic and soil conditions”? What’s the difference?

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

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

Technical corrections

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

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- p. 8361, l. 24: Replace “no” with “not”.
- p. 8362, l. 3: Replace “detect” with “represent”.
- p. 8362, l. 11: Replace “considerable” with “considerably”.
- p. 8362, l. 22: Write “to the emission” instead of “on the emission”.
- p. 8363, l. 5: Write “may result” instead of “may results”.
- p. 8363, l. 6: Write “does not” instead of “do not”.

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