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6, S435–S440, 2009

Interactive Comment

## *Interactive comment on* "Ammonia sources and sinks in an intensively managed grassland using dynamic chambers" *by* M. David et al.

Anonymous Referee #1

Received and published: 11 March 2009

Ammonia sources and sinks in an intensively managed grassland using dynamic chambers (bgd-2008-0177) by David et al., submitted to Biogeosciences

This focus of this work is on the ammonia emissions associated with different management techniques in grassland with the intention to identify various sources and sinks of ammonia. Field measurements are supplemented with measurements performed under controlled conditions in climate chamber. The main conclusions are that wet litter is a strong NH3 source, bares soil less so and green leaves a NH3 sink. The authors also conclude that extraction procedures and calculation of compensation points provide a good measure for predicting NH3 fluxes.

The study demonstrates some relevant and interesting information on the controls of





NH3 fluxes in soil-plant systems that provide a reasonable basis for the suggested conclusions. However, one fundamental concern is the apparent lack of replication. It is mentioned (section 2.2, second paragraph) that two chambers were used for the managements. But in the results and figures there are no indications of replication – apart from temporal repetition. How can the authors justify that the results are not simply a matter of spatial heterogeneity across the experimental plot rather than management responses. This needs to be clarified in the presentation and discussion of the results.

Otherwise, the manuscript is in a relatively good shape with nice, illustrative figures. However, some revision is needed before publication can be recommended.

First of all, the title needs to be changed to be more informative about content of the work. One suggestion is: "Ammonia sources and sinks in soil, plant and litter components in intensively managed grassland" It is not obvious why it is necessary to mention specifically dynamic chambers in the title – this could go into key words.

I miss some hypothesis for the work. The aims are specified, but what are the hypotheses you're going to test? Also, the focus on the extraction procedure as a mean to predict emissions should be included in the aims of the work.

Exclude results with the two French soils. I do not see they add to the value of this work, they are difficult to include in the context of the overall work on the German site. The Гsoil is even calculated based on assumptions about their pH (Table 4). And after all, the results are not used to support the conclusions.

Overall, the structure of the presentation is logical and the content is adequate. However, perhaps an issue of writing philosophy, I'd recommend to move the data presentation given in Discussion (section 4.4, first paragraph) into the Results.

Specific editorial comments

## BGD

6, S435–S440, 2009

Interactive Comment

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Interactive Discussion



Abstracts Dot is missing between NH3 and The litter (mid last paragraph)

1 Introduction Editing is needed in last paragraph. "Based on flux measurements Based on the literature,…"

2 Materials and methods 2.1 Dynamic chambers Second paragraph "The chamber surface was adapted…": This explanation is unclear. What do you mean by surface? Is it the total area of the chamber walls? Do the 20x20 cm and 30x30 cm squares refer to base area? Give also specific information on the latter. It would also be helpful if you mention actually Table 1 here. The surface area of chamber used for litter is not listed in Table 1?

Last paragraph (ECN, Petten, NL): add reference, it's given later, but should be included here. "The flow rate was measured…": Delete, this information is already given in the text above.

2.2 Experimental conditions First paragraph (Sutton et al.1): Suppose the uppercase 1 refers to a foot-note on the reference, but the note is missing?

Third paragraph Suggest Table 3 and Table 4 are reversed in order to follow a logical presentation.

2.5 Ammonia emission potentials Delete "µg" in parenthesis

3 Results 3.1 Plant and soil NH4+… First paragraph Repetition of results already given in Table should be avoided. "In the main field, having with a canopy…": Delete "with" Add space after comma between "plants,there…"

Second paragraph Again, you repeat results already given in Table. Should be avoided to reduce length.

Third paragraph "startying" should read "starting"

Fourth paragraph Suggest to rewrite sentences "The soil [NO3]….F1-

6, S435–S440, 2009

Interactive Comment



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Interactive Discussion



F6 than in CS1" Suggestion: The shift in [NO3-] and [NH4+] between field condition (F1-F6) and controlled condition (CS1) suggests that nitrification occurred during sample storage"

3.2 Measured NH3 emissions from soils First paragraph Please, explain to the reader (in Materials and Methods) how average and median emissions were calculated

Second paragraph "edappeared" should read "appeared"

3.3 Emissions of NH3 from leaf litter First paragraph (mid) Insert space between "nitrogen" and "might"

Second paragraph Suggest you write "cut grassland with hay removal (F1) (Fig. 2)."

Third paragraph The unit for leaf based NH3 emissions needs to be clarified. In the Table it is stated that the emission is related to surface area using the LAI. Does this mean that the flux is per leaf area unit, as indicated in the text? However, this is not logical when you compare the leaf fluxes with fluxes in (F6) and (F7), which are given per land area. It is stated that the average leaf flux is 41 ng, however, from Fig. 3 this value seems more to coincide with minimum fluxes observed. Please, clarify. It is also stated that the leaf flux (41 ng) is much smaller than fluxes observed (F6) and (F7). This is unclear, because in (F6) the median flux is only 37 ng (Table 5). Instead of listing the soil N contents in the parenthesis, you could just refer to Table 3.

4 Discussion 4.1 Green leaves First paragraph Here, and in other places, there is an inconsistent use italic text for "et al." You cite Van Hove et al. (2002) for having found larger emissions over… Suppose this should read compensation points.

4.2 Ammonia emissions from bare soil Second paragraph Suggest you write consistently in the past. "…F5 is…" should

6, S435–S440, 2009

Interactive Comment



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read "…F5 was…" and "…(F7), but is…" should read "…(F7), but was…"

Third paragraph Last sentence. Suggest this is rephrased: The missing fraction of nitrogen might have been lost by volatilization, denitrification or microbial assimilation during storage. Also, here you only refer to CS1, which emphasizes the argument that CS2 and CS3 can be omitted.

4.3 Litter NH3 emissions and relative humidity Third paragraph. Sentence beginning "Moreover…" should read "Moreover, experiments under controlled conditions (CL1-CL3, Figure 3-4) show that the emission of NH3 increased…" It is known that microorganisms in the form of fungi and bacteria are abundant on leaf surfaces. Perhaps it is not only a matter of plant derived N, but also from microbial cells on the surface that NH4+ is derived? It would be interesting if the authors could go a bit into detail on this possible source of N.

4.4 Emission potentials… First paragraph could be moved to results (see comments above).

Second paragraph Suppose "Figure 5" should read "Figure 4"

5 Conclusions It would be helpful if the authors could extrapolate the results a bit further and perhaps put forward recommendations for grassland management in order to minimize NH3 evaporations.

Table 3 Suggest the presentation of data follow the order (cut grass) – (main field) – (hay) to harmonize with the order in the text.

Table 4 There is an inconsistent use of decimals for reporting [NO3] and [NH4]. This should be harmonized in accordance with the precision of the analysis.

Table 5 Please, explain the unit for leaf fluxes (see above). What is the meaning of the asterisks with the units?

BGD

6, S435–S440, 2009

Interactive Comment

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Interactive Discussion



Figure 1 Some datapoints in (F6) and (F7) are not interconnected. Please, explain why. In the text, it is suggested to include abbreviations for soil and plant temperatures. "The soil (Ts) and plant (Tp) temperatures…

Figure 2 Modify text, as for Figure 1

Figure 3 Delete "growth" in the text.

Interactive comment on Biogeosciences Discuss., 6, 1625, 2009.

6, S435–S440, 2009

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