

## ***Interactive comment on “Dynamics of ammonia exchange with cut grassland: synthesis of results and conclusions of the GRAMINAE Integrated Experiment” by M. A. Sutton et al.***

**K. Pilegaard (Editor)**

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**General comments:** The paper provides a synthesis of the GRAMINAE integrated experiment at a grassland near Braunschweig in May-June 2000. The paper provides a summary of the achievements of the individual studies (reported in separate papers) and develops an integrated picture of the capabilities of the applied measurement techniques and the processes controlling ammonia flux.

Following an introduction, the paper gives a summary of the experimental outcomes as related to the objectives (part 2), a detailed overview of the measurement results (part 3), a section on the results of three different modelling approaches (part 4) and a

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conclusions section structured around five key questions.

This type of paper is more difficult to evaluate than a normal research paper. A synthesis paper must be designed to be read as a stand-alone paper and thus has to find a balance between providing enough information on the individual results and a real synthesis bringing these results to a higher level of understanding.

The key questions for the success of this paper are then:

- 1) Do parts 3 and 4 of the paper provide better information than just by reading the abstracts of the individual papers?
- 2) Is new insight gained by combining the information?
- 3) Is a real synthesis (i.e. a kind of synergistic effect on knowledge by combining the information) achieved?

Ad. 1) Parts 3 and 4 provide combine and already somewhat synthesize the information from the individual papers. It is much easier to get a comprehensive understanding of the experiments from reading this than by reading the individual abstracts.

Ad. 2) Although I have not read all the underlying papers, I find that the information provided here is combined in new ways and thus provides "new" information. However, in a few cases identical or almost identical figures as in the underlying papers are presented (Figure 4, Figure 6, and Figure 7). These could be left out and a reference made to the original papers.

Ad. 3) This is especially provided by the "Conclusions" section. I find that this section really communicates the key findings for the scientific community from this very detailed study. Maybe these questions/answers could be highlighted in the abstract.

I agree with reviewer 1 that parts 3 and 4 are rather lengthy and detailed and I notice that the authors in their response to this reviewer have suggested some shortening which also agree with some of my detailed suggestions below. My hope is that the

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revision will highlight the real synthesis parts of the paper which I find extremely useful for the scientific community.

### Specific comments:

#### *Abstract:*

p. 1123, l. 27: I miss some results of the model comparisons. How do they compare?

#### *Summary of the experimental outcomes:*

I suggest that this section (and Table 1) is left out apart from the last paragraph (p. 1126, l.2-5) which can be appended to part 1. The text is a kind of check of whether the project met its goals. This might be interesting for those who funded the project, but the scientific community is only interested in the actual outcome of the experiment.

#### *Overview of the measurement results:*

p. 1127, l. 15: Change "Fig.1" to "Figure 1".

p. 1127, l. 27: The information of the huge change in surface temperature is rather important and although it is mentioned later, I would like to see a more detailed discussion of the potential effect of surface temperature on  $\text{NH}_4^+$  fluxes.

p. 1129, l. 25: "...as indicated the..." should probably read "...as indicated by the..."

p. 1129, l. 26: either "may also" or "have also". Not both!

p. 1130, l. 9 and Figure 3: It would be useful to indicate the extent of the fertilized field on the distance scale of Figure 3.

p. 1132, l. 4-15: I do not feel really convinced of what set of fluxes ( $F_{mg}$  or  $F_{ag}$ ) are most reliable. It also seems that the authors are in doubts. Is it possible to qualify the arguments for one or the other somewhat better than done here?

p. 1134, l. 8: "the agreement between the flux estimates is extremely encouraging". This is not a very precise phrasing and actually indicates that the agreement is not very

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good. Especially the discrepancy in the post-fertilization period seems to be very large. As always time-series plots are a little misleading. The discrepancy between  $F_{grad}$  and  $F_{REA}$  would be much more obvious in an X-Y plot.

p. 1134, l. 12: It is argued that the REA measurements are unreliable in this specific period due to light (easterly) winds. If what this means is low turbulence why does this not affect the gradient measurements?

p. 1134, l. 13: How can the quality of the FIDES estimate be judged to be of ("surprisingly high") quality? The true flux is not known and also the true fluctuations in the flux are unknown.

p. 1135, l. 28: "which would limit the carbon sink for ammonium....". I simply do not understand what is meant here. I understand that reduced photosynthetic activity reduces the carbon uptake, but the rest is a bit mysterious to me. Please explain!

p. 1136, l. 10: instead of "bioassays" which is probably an insider phrase, I prefer "apoplastic  $\text{NH}_4^+$  and H concentrations" (if that is what is actually meant).

p. 1136, l. 26: Unless this is meant to be subjunctive mood "were" should be "was".

p. 1136, l. 28: Delete "the".

p. 1140, l. 1-3: Here is a reference to the possible effect of surface temperature (in this case of the canopy). I wonder whether the experiment has gained data to provide a kind of flux vs. temperature relationship, ideally separately for soil, litter and canopy? I would like to see a figure showing this, if possible.

#### *Modelling of ammonia exchange dynamics:*

Would it be possible to show the different model structures and parameter inputs in a table? In addition to the figures given, it is very tempting to ask for a figure directly comparing the simulated  $\text{NH}_4^+$  fluxes with the measurements.

*Conclusions:*

p. 1151, l. 16-20: In line with my comment to part 2, I suggest that these lines are deleted.

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