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Biogeosciences Discussions

Interactive comment on "Vertical structure and diurnal variability of ammonia exchange potential within an intensively managed grass canopy" *by* B. Herrmann et al.

B. Herrmann et al.

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We are grateful for the comments of the two reviewers. We have corrected the indicated technical corrections and typographical errors. Especially we rephrased chapter 2.5 "calculation of stomatal compensation points";. Originally both equations contained typographical errors.

In the following we are addressing the specific points raised by the reviewers:

Answers to reviewer 1:

P 2898 L5 and P 2901 L11: We removed the word micrometeorological technique. We agree that this is misleading.

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P 2902 L8: We will clarify the description of the extraction methody but we feel that a more detailed description is out of the scope of this paper. More details of the extraction technique are given in the cited literature (Husted and Schjoerring, 1995).

P 2902 L 10: The apoplastic extractions have been done in a laboratory trailer. During nighttime greenl light was used.

P 2902 L14: It is assumed and have been tested that the addition of the sorbitol solution does not change the original pH in the apoplast.

P2904 L 24: Nighttimes NH3 fluxes will not be controlled by stomatal exchange and consequently Gamma values are more informative for plant physiological processes.

P 2907 L8: Attached leaves means leaves that are still alive. We changed the wording to intact leaves.

P 2908 L4-6: We agree with reviewer 1 that non stomatal exchange might be a reason for the observed discrepancies. Bioassay studies are a measure for the equilibrium NH3 concentration in the stomatal cavity, whereas micrometeorological and cuvette measurements are indicating the NH3 concentration in the surrounding atmosphere of the plants. We added this in the manuscript.

Reviewer 2:

General comment:

An important point is certainly the in canopy temperature profile that has potentially a large effect on the calculated stomatal compensation points. We used the measured temperature profile in the canopy and recalculated the stomatal compensation points shown in Figure 3.On May 29th and the previous days the sky was mostly overcast and the temperature differences in the canopy have been small. Consequently the effect on the calculated stomatal compensations is below 20% and does not change the overall picture.

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To the specific points:

P 2899 2nd paragraph: We added a sentence to point out to the fact that the exchange with the stomata is not the only process that determines the net exchange flux.

"On the canopy level the apparent compensation point will also be influence by all other surfaces (soil, leave litter) and will depend on the pH of these surfaces (Ref: Burkard et al, BGD, 5, 2505-2539, 2008 Flechard et al, Roy. Meteor.Soc., 125, 2611-2641 1999)."

Also we addressed the importance of the presented work for the modelling community: "A priori knowledge of the stomatal compensation point or a simple parameterisation of it is important for modelling NH3 exchange in ecosystem models using the canopy compensation concept."

P 2900 top paragraph

We corrected the wording in the introduction with the description of previous analysis of the diurnal behaviour of. Because there are not many investigations for grassland published the measurement of the diurnal behaviour was considered to be an important topic.

P 2903 We reanalyzed the vertical profiles and can confirm that the difference of gamma between the top layer and the lower layers are clearly visible and are significant. The larger scatter in the top layer comes from the differentiation into two different species (Lolium perenne and phleum pratense) that was not possible for the lower layer. Phleum pratense contributed only about 10%, but had a six times lower; value. In the previous analysis the scatter has been calculated under the assumption of equal contribution of the two species.

P. 2906 lines 1-3 Figure 4 shows a decreasing apoplastic NH4+ concentration for the second day that coincides with a lower canopy temperature. We added the sentence

"After the cut apoplastic NH4+ concentration decreased on the second day (Fig 4) in parallel with the canopy temperature. Lower temperature would be in favour of higher

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apoplastic [NH4+] assuming constant production. We assume therefore that a temperature dependent physiological control regulates the apoplastic [NH4+] production".

Discussion section:

The reviewer proposed to discuss the vertical profiles only based on the temperature independent gamma values. Temperature profiles in the canopy have been measured and the presented stomatal compensation points are corrected for the canopy temperature. Doing so allow us a comparison with the measured in canopy profiles.

Interactive comment on Biogeosciences Discuss., 5, 2897, 2008.