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Biogeosciences Discussions

Interactive comment on "The annual ammonia budget of fertilised cut grassland – Part 2: Seasonal variations and compensation point modeling" *by* C. R. Flechard et al.

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We thank the reviewer for their constructive comments on our MS.

1- Concerning soil characteristics: we acknowledge that parameters such as C/N ratio, pH, CEC, texture, etc, are controls of NH3 exchange with the soil surface. Most of these parameters were measured at the start of the long-term monitoring experiment in 2001, and values were not different between the two fields back then, but no data are available for the time frame of the NH3 flux campaign. The primary objective of our NH3 flux study was not to compare intensive and extensive managements, which is why the data from the extensive field cover only a short period of time and were used

to fill gaps in the intensive field time series. We do not have enough data to provide a comprehensive, comparative table as suggested by the referee. Further, soil and site characteristics are given in more detail in the companion paper (part 1) by Spirig et al., so we believe it is sufficient to add the following information to the site description in Part 2 (this paper):

"Soil pH, C/N ratio and CEC were measured in 2001, with values of 7.5, 9.2 and 21 to 27 mMol /equ /100 g dry soil, respectively, and no significant difference between INT and EXT at that time"

2- On emission fluxes during background exchange: Cuticular desorption fluxes cannot be ruled out and indeed most probably occurred occasionally during the evaporation of liquid films (dew, rain) on leaf surfaces. However, we do not agree that such occurrences contributed to the high Rw values we report because we used exclusively night-time data to derive Rw functions (Fig. 4), such that evaporation events would have been filtered out in the process. Nonetheless, we concur that a static and deposition-only parameterisation of Rw, as derived from night-time data, may have shown limitations when applied to 'dynamic' daytime exchange, which may explain some of the observed model-measurement discrepancies of Fig. 9, as discussed in the Discussion.

3- On the robustness of the Rw parameterisation: we have added the following sentence to the end of section 4.1, p9654, l24:

"...soil wetness), which result in an overall coefficient of determination (R2) of the parameterised (fitted) vs measured Rw data (Fig. 4) of 0.08. "

On nocturnal stomatal opening: we were unable to determine whether stomates may have been partially open at night, as our estimates of Rs (Eq. 7) were based on water vapour fluxes selected for dry conditions, which occurred only extremely rarely at night at this site, due to frequent dew formation. We agree that there might be nocturnal stomatal opening, which would provide an additional sink for NH3, implying that the Rw value derived from the measured flux would actually be higher (than that derived

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under the assumption of totally closed stomates). However, for an Rw of typically 50-100, the magnitude of the underestimation in the derived Rw would likely be less than 5-10% in most cases, unless Rs was well below 500 sm-1. In any case, the assumption of nocturnal stomatal opening would only strengthen our case for an elevated Rw value at this site.

On seasonal differences in Rw: there were clear seasonal differences in Rw, but they were mostly controlled by temperature and surface humidity. Summer conditions (warm, drier) were conducive to higher surface resistances, and spring/autumn conditions (cool, wet) favoured lower Rw values. The response of Rw to phenological changes of the grassland was overshadowed by the temperature and humidity effect and could not be established with clarity.

Interactive comment on Biogeosciences Discuss., 6, 9627, 2009.