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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Trace gas fluxes of CO_2, CH_4 and N_2O in a permanent grassland soil exposed to elevated CO_2 in the Giessen FACE study" *by* M. K. Abbasi and C. Müller

Anonymous Referee #2

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General comments: The objectives of this manuscript are to analyse the response of GHG emissions from a grassland exposed to elevated CO2. It mainly focuses on N2O with an analysis of the different components of N2O emissions, namely total denitrification and the ratio N2:N2O. It also addresses CO2 and CH4 emissions with a more coarse approach. The global approach of this study is well presented. The experimental methods are presented in a short but generally sound way. Several topics should be detailed (see specific comments below). However in Section 2.2, there is one concern about the gas sampling procedure: as far as I could understand, the soil is put in a jar which is covered with perforated parafilm. Does this perforation make it possible to have natural exchange of gas with the outside or not. If yes, how are the

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emissions inferred from gas concentration measurements? It seems that accumulation of the different gases occurred over the whole experimental period (57 days after N application). Is it the case? If yes, the concentration in the atmosphere might increase so much that it has an influence on the flux, especially for CO2 (which concentrations were reached at the end?). This could explain the decrease in CO2 fluxes along time. Please comment and give precisions. The results are generally presented in a clear way, but should be clarified by places. Some redundancies could be avoided (see specific comments below). The Discussion is the weaker part of this manuscript. The relative importance of the different sub-section should be reconsidered to evidence more clearly the significant outcomes of this study. It is often difficult to understand what refers to the present study and what refers to the literature or to previous experiments on the Giessen site. The text should be organized in a may that makes it clear. As a whole, the more significant results of this study are on denitrification and N2O fluxes. To my opinion, Sections 3.5 and 4.3 present the key-results of this manuscript. Consequently the discussion should be more developed, with a more detailed analysis of the uncertainty and interpretation in terms of microbiological functioning of the soil. I am not fully convinced on the need to include the results on CO2 and CH4 in the same manuscript, as there are not enough details to fully interpret them. They could be useful to make a GHG balance, but this is not relevant under lab conditions.

Specific comments: - as a whole the text should be checked for clarity. Many sentences are rather cumbersome and sometimes not understandable. Please check and/or make it read by an independent reader. - The manuscript would be more readable if the authors explain their approach and justify the measurements and data analysis which they made. - Section 2.1 and 2.2: for data interpretation, it would be necessary to give the soil characteristics at the beginning of the experiment, especially for mineral N and organic matter (C and N). - As far as I know, the symbol for nanogram (10-9 g) is ng, not ηg - Lines 4205/1-2 and 4208/12: what means “negative value”? Is it enrichment lower than that of the fertilizer? - Line 4205/7: the authors should explain why they use C2H2 (to block N2O reduction in order to estimate total denitrification, I

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11, C935–C937, 2011

assume). - Line 54205/8: why do you use % vol/vol here and not % g/g as in Section 2.2? - Line 4206/9: 3.6% of what? - Line 4206/11: why did the CO2 flux decreased so steadily along time? There is no comment on this in the discussion. This might show a bias in the experimental set-up. - Line 4206/14: form → from (??) - Line 4206/23: the CH4 oxidation is not constant but increases steadily - Line 4207/16: these values are already given three lines above. - Line 4209/17: the units should be μg CO2-C, not μg N2O-N - Line 4209/20: what "soil having 25% CO2 high concentration" refer to? - Lines 4210/13-17: this sentence is too complex. Please clarify - Line 4210/20-21: "inorganic N pools tended to be higher in the elevated CO2 . . .". This is in contradiction with the comments in lines 4210/6 where N is limiting under high CO2 concentration. - Line 4210/23: do nitrate really inhibit CH4 oxidation? - Lines 4210/24-28: this sentence is too complex. Please clarify - Lines 4211/1-4: what is the use of this comment? - Line 4211/5: what are the +N and –N treatments? In the Material and methods section, there are only treatments with different N additions. - Line 4212/6: "one time period": what does this mean? Please clarify. - Lines 4212/21-26: these sentences refer to general statements, not related to increased CO2 concentration and are not useful here. They should be removed. - Line 4212/27: give more explanation on "using Stevens et al. (1997)". - Line 4212/28: give values on the contribution of denitrification to N2O emissions in both treatments. - Line 4213/1-2: is there a difference between treatments? This should be specified (or suppressed) as the comments (lines 4212/27-4213/10) are very vague and do not come to any conclusion. - Line 4213/5: what is the basis of this percentage? - Lines 4213/25-28: this is an important topic; It should be presented into more detail (which year, field conditions, treatments, . . .) referring to the relevant publications. - As a whole, in Section 4.2, the authors should distinguish more clearly what refers to the previous experiments in Giessen (field conditions) and what refers to the present study or to other publications. - Line 4214/20: what are the two soils? (the two treatments?)

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 4199, 2011.