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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

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Response to Reviewer's Comments

Dear Editor

We have revised the manuscript according to the suggestion of the Reviewer. Following amendments have been made in the manuscript.

Anonymous Referee #2 Received and published: 18 March 2011

General Comments

Query: 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 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.

Reply: The jars were only covered for a short period of time (max. 30 min) for each flux measurement. The parafilm was perforated to ensure gas exchange which ensured natural gas exchange. This was tested in previous studies. Additional description of the gas measurement method has been added to the materials and methods section. Please see Page 5-6 Lines 157-160.

Query: The results are generally presented in a clear way, but should be clarified by places. Some redundancies could be avoided (see specific comments below).

Reply: The Result section is improved a lot after incorporating the corrections suggested in specific comments and also by incorporating the amendments suggested by the Reviewr-1.

Query: 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.

Reply: The discussion of the manuscript has been streamlined and is now largely rewritten. Special emphasis is now given to N2O emission as suggested by the reviewer. In this context discussion has been added to explain the results obtained in this study.

In particular an emphasis on the possible dynamics of denitrification kinetics has been added.

Query: 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.

Reply: Both CO2 and CH4 have been included in the objective of the manuscript after considering the suggestion of Reviewer-1 and the discussion section of these two components has been shortened.

Specific comments:

Query: 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.

Reply: Improvements in the Text has been done especially the discussion section has been changed as suggested by the Reviewers.

Query: 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).

Reply: Soil characteristics i.e. organic C, N and pH have been included at the beginning of the experiment. Please see Page 4-5 Line 133-136.

Query: As far as I know, the symbol for nanogram (10-9 g) is ng, not _g

Reply: Symbol is changed as suggested throughout the Text

Query: Lines 4205/1-2 and 4208/12: what means “negative value”? Is it enrichment lower than that of the fertilizer?

Reply: If the calculation results in a negative value then the 15N abundance of the N2O must have been lower than the 15N abundance from either the NO3- or the NH4+ pool. It is explained in the section 2.3. Please see Page 6, Line 172-175 and page 13 Lines 330-337.

Query: Line 4205/7: the authors should explain why they use C2H2 (to block N2O reduction in order to estimate total denitrification, I assume). Reply: Yes! C2H2 was used to block N2O reduction in order to estimate total denitrification. It has been added in section 2.4. Please see Page 6 and 7 Line 179-181.

Query: Line 54205/8: why do you use % vol/vol here and not % g/g as in Section 2.2?

Reply: It is changed into g/g as suggested. Please see Page 7 Line 182.

Query: Line 4206/9: 3.6% of what?

Reply: 3.6% higher than the ambient. However, the difference was non-significant hence 3.6% has been deleted/removed.

Query: 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.

Reply: Microbial activity is stimulated due to N supply which also increases soil respiration. A decrease of CO2 is a typical observation within the first weeks after N application.

Query: Line 4206/14: form ! from (??)

Reply Corrected accordingly. Please see Page 8 Line 213.

Query Line 4206/23: the CH4 oxidation is not constant but increases steadily

Reply Sentence is corrected as suggested in 3.2. Please see Page 8 Line 221.

Query Line 4207/16: these values are already given three lines above.

Reply These values have been Deleted as suggested.

Query: Line 4209/17: the units should be _g CO2-C, not _g N2O-N.

Reply: The sentence is re-written and values have been deleted in Discussion section 4.1.

Query Line 4209/20: what “soil having 25% CO2 high concentration” refer to? Reply: The sentence has been re-worded in response to reviewer 1. This was unexpected because in the field 25% higher CO2 fluxes were observed under CO2 enrichment possibly caused by the enhanced biomass and root biomass production and general higher activity under elevated CO2 (Kammann et al., 2008). This has been included in the section 4.1 Page 11 Line 277-281.

Query: Lines 4210/13-17: this sentence is too complex. Please clarify

Reply: This sentence has been corrected. Please see Page 11-12 Line 292-296.

Query: 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.

Reply: This possibility has been changed that increased inhibition of CH4 oxidation under elevated CO2 or increased CH4 production under field conditions may be due to greater C availability in the soil under elevated CO2. Please see Page 12 Line 299-301.

Query: Line 4210/23: do nitrate really inhibit CH4 oxidation?

Reply: his sentence/possibility is changed. Please see Page 12 Line 299-301.

Query: Lines 4210/24-28: this sentence is too complex. Please clarify

Reply: This part of the manuscript is now largely re-written. Please see Page 12 Line301-305.

Query Lines 4211/1-4: what is the use of this comment?

Reply: Deleted; This part of the manuscript is now largely re-written. Please see Page 12 Line301-305.

Query: Line 4211/5: what are the +N and –N treatments? In the Material and methods section, there are only treatments with different N additions.

Reply: Deleted; This part of the manuscript is now re-written. Please see Page 12 Line 306.

Query: Line 4212/6: “one time period”: what does this mean? Please clarify.

Reply: This portion of Discussion section has been deleted in section 4.2. Please see Page 13 Line 319—

Query: 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.

Reply: Deleted/removed as suggested.

Query: Line 4212/27: give more explanation on “using Stevens et al. (1997)”.

Reply: Explanation has been given in section 4.2. Please see Page 13 Line 328-337.

Query: Line 4212/28: give values on the contribution of denitrification to N2O emissions in both treatments.

Reply: Values have been given in Page 13 Lines 324-328

Query: 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.

Reply: This part of Discussion section has been changed in section 4.2. Please see Page 13-14 Line 338-344.

Query: Line 4213/5: what is the basis of this percentage?

Reply: Rütting et al. (2010) showed that denitrification increased from 4.7% to 8% under elevated CO2, a similar trend was observed in our study. The calculations were based on a three pool model and could be performed because a triple labeling approach was applied where NH4+ , NO3- or both N moieties were labeled. Please See Rütting et al., (2010) paper..

Query: 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.

Reply: The discussion has been streamlined already in response to reviewer 1. In response to comments by reviewer 1 references to previous studies have been referred to in more detail. Please see Page 14 and 15.

Query: Line 4214/20: what are the two soils? (the two treatments?)

Reply: This part of Discussion section has been deleted/removed

We believe that manuscript is improved a lot and it will be now considered for publication in Atmospheric Chemistry and Physics.

Thanks in anticipation

Best wishes/Sincerely

Prof Dr M Kaleem Abbasi

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/11/C1420/2011/acpd-11-C1420-2011-supplement.pdf

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