Atmos. Chem. Phys. Discuss., 3, S1050–S1053, 2003
www.atmos-chem-phys.org/acpd/3/S1050/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Soil-atmosphere exchange of CH_4, CO_2, NO_x, and N_2O in the Colorado Shortgrass Steppe following five years of elevated CO_2 and N fertilization" *by* A. R. Mosier et al.

Anonymous Referee #2

Received and published: 15 July 2003

GENERAL COMMENTS

The paper focus on the effect of water and water+N addition on the biosphere-atmosphere exchange of environmental important trace gases one year after the end of a CO2 fertilisation experiments. In this paper the authors ask whether CO2 fertilisation has long-term/mid-term effect on exchange rates. They come to the conclusion that for some gas exchange rates the soil still has a pronounced memory effect, e.g. with respect to NO emissions and CH4 uptake. The finding of such a memory effect is new and very interesting. The authors attributed the memory effect mainly to changes in the N status of the soil and to changes in microbial N turnover rates. There is no

doubt that the argumentation chain is logic. However, I do miss additional field data on the N status of the different investigated plots and on microbial N turnover rates to support this hypothesis and to strengthen this paper. In view of the intensive studies which have been performed at the site, it is not unlikely that such data may be available. Please add if possible.

Furthermore, I would also suggest a reorganization of the introduction section, so that the reader will not misdirected by results from the previous experiment. The focus of this paper is clearly what has happened one year after the end of CO2 fertilization experiment and not the CO2 fertilization experiment itself.

In general the topic of this manuscript is well within the scope of "Atmospheric Chemistry and Physics" and it can be recommended to be published if the above mentioned additional data are included.

ABSTRACT

In general the abstract is informative and gives a very good overview about experimental results. However, some sentences are very long and the readability can be improved by shortening of sentences (e.g. sentences 1+2). Line 18: the verb is missing: Fluxes of.... were measured ...for the next month. Line 23: Add also the results for N2O here.

INTRODUCTION

I really started to get confused when I read the introduction section. The authors are right that not too many information is around on effects of elevated CO2 on biosphere atmosphere exchange of primarily and secondarily active trace gases. In the following hypotheses and results of the previous experiment are summarized and thereby, one is loosing track to the focus of this paper, which is a report about what has happened after the end of the CO2 experiment. From my view, the section on the results of the previous experimental phase should be incorporated in the discussion section [page

ACPD

3, S1050–S1053, 2003

Interactive Comment

2694: line 4-26].

Page 2693, Line 16: skip CH4 since it was already mentioned before. Page 2694, Line 1: give reasons why CH4 uptake should decrease. E.g. a) increases in soil water will decrease the diffusivity of the soil for atmospheric CH4 [however, some of your earlier publications show, that CH4 uptake was limited due to water stress], or b) increased availability of mineral N may decrease CH4 uptake [however, some papers show that increased N availability may also stimulate CH4 uptake].

Page 2694, line 5: year round, from April 1997

Page 2694, line 14: correct weatter into wetter

MATERIAL AND METHODS

Page 2697, line 3-6: I do not doubt that NO is the main reactive gas emitted from the soil. However, it would be very helpful if the authors would also mention if they found NO2 deposition and what the approxim. NO2 deposition rate was. Furthermore, a short statement should be made if NOx fluxes were corrected for the reaction with O3 or for photo dissociation of NO2.

Furthermore, it is necessary to mention if the vegetation composition has changed due to the five year pre-treatments. Or, are the plots still comparable? In view of the effect of OTC`s on microclimate I doubt this.

RESULTS AND DISCUSSION

Page 2698, line 10-12: I do not understand how the authors, based on Table 2, can state that irrigation led to increased NO emissions and to decreased N2O emissions (I think that this statement is related to the magnitude of NO emissions. If yes, that should be clarified). This conclusion can only be drawn from Figure 1. However, a one day period as a control before the start of the experiment is rather short.

Page 2698, lines 10-27: If the soil of the elevated CO2 plots is N depleted, which is the

ACPD

3, S1050–S1053, 2003

argument of the authors for reduced NO and N2O emissions as compared to ambient plots, it should be possible to show this by soil analysis. However, such an analysis is not provided and it remains a question of believing or not believing that increased CO2 has led to a significant depletion of the soil N pool.

Page 2699-2700: Also for CO2 and CH4 the discussion of results finally turns to rates of microbial populations, mineralization and N depletion. It would make the paper much stronger if evidence for these changes- even in view that the main experiment already ended one year before, can be given.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 2691, 2003.

ACPD

3, S1050–S1053, 2003

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