Biogeosciences Discuss., 10, C7694–C7698, 2014
www.biogeosciences-discuss.net/10/C7694/2014/

Biogeosciences Discussions
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Interactive comment on "Nitrous oxide emissions from maize-wheat field during four successive years in the North China Plain" *by* Y. Zhang et al.

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Received and published: 4 January 2014

Dear editor or reviewer:

Many thanks for giving us the constructive comments on our manuscript. We have revised our manuscript carefully according to your suggestions. The followings are the responses to your comments.

Comment: I am concerned about the statistical design of the experiment, and lack of some details relating to methods. As I understand the manuscript, there was just a single plot of 6.5×3.5 m2 in each of the two treatments – unfertilized and N-fertilized – with the plots separated by a 1.2 m zone to prevent nutrient transfer between treatments. Three chamber bases ("pedestals") were inserted in each plot, and crop seeds were

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Interactive Discussion
Discussion Paper

sown within the chambers. Presumably the same density of sowing was employed in the surrounding plot area? The text does not say.

Response: The comment about the statistical design of the experiment is answered in the second comment. The densities of sowing for maize and wheat in the pedestals were the same as the densities in the surrounding area, and the sentence was inserted in the text (Line 5, P18341).

Comment: The use of single plots, irrespective of the number of replicate chambers, appears to constitute pseudo-replication, and this raises problems with statistical analysis. I have consulted the Zhang et al 2011 paper, and the same plot system appears to be true of the work in that paper.

Response: Yes, the more replication could be more representative due to large spatial variation of N2O emission from soil. Considering the operation of experiment and a large amount of air samples for analysis, three replicate chambers in one plot were designed in this study. Our experimental design may cause an extent of uncertainty for the statistical analysis, however, even if several plots had been designed for each treatment, the uncertainty of the statistical analysis would also exist because the plots designed only limit in small field in comparison with the large area of the agricultural field. In addition, the main objective of this study was to investigate the yearly variation of N2O emission from the agricultural field, the investigation by using single plot for each treatment is reasonable for the statistical analysis.

Comment: There is inadequate experimental detail; how were the flux measurements conducted when the crop height exceeded that of the chambers (90 cm)? Conceivably the wheat was a short-straw variety that could be covered by the chambers even at full height, but that would not be true for the maize, so were the plants bent down in order to enclose them, or was some other procedure used?

Response: The top part of the maize plant above the chamber was cut off when its height exceeded 80 cm (after ~40 days growing). We added the description in 2.2

BGD

10, C7694–C7698, 2014

section (Line 6, P18341).

Comment: What form of N was applied? There is international interest in whether different N forms vary in their emissions, and unless this is routinely reported, valuable information goes to waste.

Response: In order to reveal N2O emission from the agriculture field, the form of N fertilizers applied were strictly according to local farmers' choice, and four types of N fertilizers (NPK, NK, NS and urea, Table 1) were applied to the field during the four investigating years. The same form of NPK fertilizer was used as basal fertilizer in the four maize seasons and four wheat seasons, whereas three kinds of fertilizers (NK, NS and urea) were adopted as supplemental fertilizer. Because very large yearly variation of N2O emission from the field was observed and three kinds of fertilizers were not simultaneously applied into the field, it is difficult to distinguish the influence of different N forms on N2O emission based on this study. Your suggestion is valuable, we will conduct the field measurements about the influence of different N forms on N2O emission in the near future.

Comment: Even though the earlier paper has full details of the gas sampling and related matters, I think it is important to present here at least a summary of how things were done, rather than forcing the reader to look up the literature for all the information.

Response: According to your suggestion, we added the experimental details in sections 2.2 (Line 9 and Line 12, P18341) and 2.3 (Line 24-25, P18341) in our revised manuscript.

Comment: As regards the overall findings reported, the differences between the crops and seasons are discussed, and the authors' findings are compared with those reported by others for crops in the same area, in Table 4. However, my impression is that the EFs reported here are generally greater that those reported elsewhere. This merits more discussion.

BGD
10, C7694–C7698, 2014

Response: According to your suggestion, we have discussed the reason in 4.2 section (Line 24, P18347) as followings: The annual EFs from the maize-wheat seasons in 2008-2009, 2009-2010, 2010-2011, and 2011-2012 were 2.4 %, 0.6 %, 1.1% and 2.9%, respectively. The EFs measured in 2009-2010 and 2010-2011 were in good agreement with the reported values in the agricultural fields of the NCP, but the EFs measured in 2008-2009 and 2011-2012 were two times greater than the upper value reported in the NCP (Table 4). In comparison with 2009-2010 and 2010-2011, as shown in Fig. 1 and Fig. 2, the extremely high N2O EFs obtained in 2008-2009 and 2011-2012 were mainly ascribed to the rain events with relative high frequency or great intensity just around fertilization events. In addition, the relatively high sampling frequency conducted by this study may be partially responsible for the greater EFs. Smith and Dobbie (2001) investigated the impact of sampling frequency on cumulative N2O fluxes by manual chambers with sampling intervals of 3-7 days and auto-chambers with sampling intervals of 8-h intervals, and found that the short-lived N2O peaks after fertilization can not be detected by manual sampling under low sampling frequency. The sampling frequency in this study was everyday with duration at least 10 days after each fertilization event, whereas the sampling frequencies for most previous studies in the NCP were 1-2 times weekly (Zeng et al., 1995; Dong et al., 2000; Ding et al., 2007; Sun et al., 2008; Wang et al., 2009; Li et al., 2010; Cai et al., 2013). On the other hand, the very good linear (R2=0.9996) respond to N2O concentration (0.93-1.97 ppm) of the GC-ECD improved by our group could make sure the accurate quantification of N2O in the air samples with remarkably different N2O concentrations. Most of commercial instruments of GC-ECD have been found to be non-linear respond to N2O concentrations (Hall et al., 2007; Fang et al., 2010), the single point calibration for N2O flux measurements prevailing used by previous studies would result in relatively low EFs.

Comment: line 10, p18341: delete "y" at the end of "chromatography". It should be "chromatograph".

Response: We have revised "chromatography" to "chromatograph".

BGD

10, C7694–C7698, 2014

Comment: The cited author's name in line 21, p18343 and line 19, p 18349 should, I think, be Chapuis-Hardy.

Response: We have checked it and the first author's name is L. Chapuis-Lardy.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/10/C7694/2014/bgd-10-C7694-2014-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 10, 18337, 2013.