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Biogeosciences Discussions

Interactive comment on "Nitrous oxide emission from highland winter wheat field after long-term fertilization" *by* X. R. Wei et al.

Anonymous Referee #1

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General comments

The study reports on N2O emissions from differently fertilised wheat plots in a longterm field experiment on the Chinese loess plateau. There is a large number of similar studies from around the world covering almost every agro-ecosystem imaginable. Fluxes and their response to N fertilisation, soil moisture and temperature are within well known ranges. So far, I miss the novelty, which is essential in a scientific publication. Yet, unusual for an N2O study, there is also data on crop yield. This opens the possibility for a novel interpretation of the N2O flux data. We are all aware that agriculture is persued to produce a good, in this case, wheat. Fertilisation is a powerful option to increase production. The land area used for production is not static but depends on productivity per unit land area and demand. With fertilisation, agriculture can satisfy

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a certain demand (e.g. for wheat) by cultivating a much smaller area than when no fertiliser would be used. Although it is common practice to express N2O emissions on a land area basis, you should try to do something more interesting in addition and express N2O emissions also on a product basis (e.g. mg N2O / kg wheat, or mg N2O /g N in wheat). This would allow to identify the most suitable form of fertilisation for the production of a certain amount of wheat in your agro-ecosystem. The last 6-7 lines of your text go into the same direction but come late, making it look like a side issue. I recommend to place the issue centre stage because it is the most interesting and novel aspect of your study. Expand the idea, be more specific, calculate the amount of N2O emitted per unit wheat grain and present it in an additional table of figure.

Specific comments

Section 2.2: "The chambers remained open for at least 2 h between each measurement cycles."

Does this mean the chambers were closed for most of the time? That they were opened about 2 hours before the measurement, closed during the measurement, and then remained closed until 2 hours before thee next measurement days later? If so, you would have prevented most of the precipitation from reaching the soil surface covered by the chamber. The covered soil area would then not represent conditions, and N2O flux, in the rest of the plot.

Section 3.1: "In these 2 observation years, the winter wheat seasons were characterized by relatively low air temperatures, which were 160% and 218% lower than those in the fallow seasons, respectively."

Here is a common misconception: 20 *C is not twice as warm as 10 *C. The *C scale is not absolute, but relates - arbitrarily - to the properties of water and its phase changes. The absolute temperature scale is K (Kelvin). A relative difference between 293 K and 283 K (20 *C and 10 *C, respectively) is marginal from a physical point of view. However, it is a big difference for a wheat plant. But, expressing this difference as you

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do in above sentence is not appropriate.

Page 4546, line 6: "...no significant soil temperature occurred within the fertilization treatments."

What do you mean by this statement?

Language: There are numerous sentences where the text needs more careful language editing (e.g. page 4548, last line "...contributed more to the N2O emission than did fertilized or no."; or section 4.1, first line: "In our experiment, N2O flux peaks following nitrogen fertilizer application for the 2 years."). I do not list all mistakes one-by-one. Please have the text checked by a native English speaker before submitting a revised version.

Section 4.1: "The application of mineral N fertilizer to soil reduces the C/N ratio, and thus increases N2O flux."

In principle, yes. In this case (Table 1), the smallest C/N ratio is in the control (no fertiliser) treatment.

Last sentence on page 4549: "The application of manure fertilizer often increases the C/N ratio and consequently decreases the N2O flux."

Differences in C/N ratio are certainly part of an explanation. Another part could be that manure addition increases soil porosity, lowering WFPS and, thereby, reducing rates of denitrification. Have a look again at your Page 4546: "The WFPS in CK, N and NP were 3 to 20% higher than in M and NPM." Hence, the positive effect of manure in lowering N2O emission and increasing grain yield may well be explained by its influence on soil structure. I am not that familiar with agriculture on the loess plateau, but in other temperate parts of the world, manure is generally considered to improve soil structure (aggregate stability, soil porosity and aeration, infiltration of water, reduced erosion, ect.). Maybe add a few sentences on the role of manure in the common agricultural practice of the region where you did your study.

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