Biogeosciences Discuss., 10, C915–C918, 2013
www.biogeosciences-discuss.net/10/C915/2013/

Biogeosciences Discussions

Interactive comment on "Effects of soil temperature and moisture on methane uptakes and nitrous oxide emissions across three different ecosystem types" *by* G. J. Luo et al.

G. J. Luo et al.

klaus.butterbach-bahl@kit.edu

Received and published: 11 April 2013

Reviewer's comment: Across-ecosystem comparison of N2O and CH4 emissions is rare and this manuscript might contribute to new insights of system-level generalization of environmental controls on those two trace gases. However, there are several issues the authors need to address. 1.Uptake vs. emission. The authors use gaseous uptake and gaseous emission interchangeably, which causes confusion to readers. The uptake process represents sink for trace gas, such as CH4, through bacteria in soils that consume CH4 as an energy and carbon source. As a result, the gaseous flux is negative, in other word, from atmosphere to soil. On the other hand, emission

usually stands for positive flux from soil to atmosphere. Here are several places of wrong use of uptake and emission.

We checked the entire manuscript to avoid misunderstandings. We are aware that negative fluxes in atmospheric sciences means that the flux is directed toward the soil. However, in the context of CH4 fluxes we talk of CH4 uptake rates to indicate that the soil is consuming atmospheric CH4. And uptake rates are positive, though the flux is still directed from the atmosphere to the soil. If we talk about fluxes of CH4 and N2O at the same time, we only generally explain how they are affected by environmental changes. This discussion is not new, but as we have a strong background in soil sciences and we explicitly always talk about CH4 uptake (or N2O emission were appropriate), we don't see the point here to change that. The readability of graphs when dealing with CH4 uptake (and also to display both, i.e. N2O emission and CH4 uptake as in Fig. 1-3) is from our point of view also better as if we use negative values.

Reviewer: Subtitle of 4.1: " Controls of N2O uptake", By no means can N2O flux be translated to N2O uptake. They are completely irrelevant processes.

Agreed, but subtitle 4.1 reads "Controls of nitrous oxide emission" in our original submission.

Reviewer: I would image by saying "CH4 uptake" the authors indicate all CH4 flux are negative. However, they are all positive in figure 13. If it is the case, the authors should replace CH4 uptake by CH4 emission.

As explained above, uptake of CH4 by soils is positive, though the flux is directed from the atmosphere to the soil. It is common to use positive values if CH4 uptake values are provided.

Reviewer: 2.Time scales of the data are not clear. Are the variables presented in figure 13 hourly or daily data? How did the authors aggregate the data into daily time scale from something (e.g. soil water content) at 1 min interval? Please describe your

BGD

10, C915–C918, 2013

methods.

Fluxes, as well as measured values of soil moisture/ temperature, were obtained in subdaily (two-horuly/hourly) time resolution. Daily average values were calculated as mean values of all observations during a day. The respective information is provided in the original papers dealing with the individual datasets. The following sentence has been introduced at the end of the Material and Method section to reflect this: "Flux data as well as measurements of soil moisture/ soil temperature at all sites were obtained in subdaily resolution either in approx. 2-hourly (fluxes) or in even shorter time intervals (temperature/ moisture). In this study we use daily average values only."

Reviewer: The relationships between gaseous fluxes and environmental controls in this paper only hold true for a certain time interval (daily?), yet it's well known this control is time-scale dependent, in other word, the relationships won't work at weekly, monthly, or annual time scale. The authors need to address this limitation in Discussion.

We added a paragraph at the beginning of section 4.3 to address this comment: "In our across-ecosystem analyses as well as in our analyses on site scale we used daily average values of N2O and CH4 fluxes and soil moisture and temperature for the different sites to identify relationships between environmental drivers and soil N2O and CH4 fluxes. It should be noted that a further aggregation at weekly or monthly time scales will likely result in a weakening of displayed relationships as was e.g. shown for the Höglwald dataset by Luo et al. (2012)."

As outlined in this paragraph we looked into time-scale dependencies of relationships for the Höglwald dataset in the Luo et al., 2012, manuscript.

Luo GJ, Brüggemann N, Wolf B, Gasche R, Grote R, Butterbach-Bahl K, 2012, Decadal variability of soil CO2, NO, N2O, and CH4 fluxes at the Höglwald Forest, Germany. Biogeosciences, 9, 1741–1763, doi:10.5194/bg-9-1741-2012

Specific comments: 1.Line 1417. The authors used a model-generated temperature

BGD

10, C915–C918, 2013

and moisture data for the tropic forest site. Please address the uncertainty of this simulated data set.

We added the following sentence: “Simulated soil moisture and soil temperature values agreed with observed data by ±3% WFPS or ±1°C, respectively. The model itself is has been successfully evaluated for this site for its predicting capability with regard to nitrous oxide fluxes and soil environmental conditions in earlier studies (Kiese et al., 2005; Werner et al., 2007)”. More details can be found in the cited studies.

2.Table 4. First row of Soil temperature (T). A variable M in lieu of the variable T, appeared in the equation. Typing error was corrected

3.Table 5. First row of soil temperature. A variable M in lieu of the variable T, appeared in the equation.

Typing error was corrected

Interactive comment on Biogeosciences Discuss., 10, 927, 2013.