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Biogeosciences Discussions

Interactive comment on "CO_2 flux determination by closed-chamber methods can be seriously biased by inappropriate application of linear regression" *by* L. Kutzbach et al.

Anonymous Referee #2

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Using peatland fluxes as an example, this paper describes how CO2 fluxes obtained by the closed chamber method may be biased, if they are calculated by fitting a linear regression. The authors present an alternative, exponential model for estimating the fluxes that they derive from diffusion and photosynthesis theory. The paper is well written and the topic is highly relevant for the readers of Biogeosciences.

However, I suggest that the authors comment on the effect of some practical issues that the chamber community faces, such as disturbance caused by the chamber deployment, on their results (see general comments below). Discussion on, and possible solutions to, such problems would heighten the impact of this paper.

GENERAL COMMENTS

The authors state that the initial flux at the moment of the closing of the chamber is the most correct flux estimate. This is in accordance with the theory presented in the paper, as at the zero moment the change in concentration itself has not yet impacted the flux. However, while the theoretical presentation of the measurement affecting the measurand seems sound, in practice the initial concentration readings during the flux measurement are often disturbed by the chamber deployment, possible lag in the sensor response etc. Therefore, I suggest the authors comment on how the high level of noise in the initial flux readings affects the curve fitting.

Another related issue is the varying measurement practices regarding the starting moment of the measurement. Especially with manual chamber measurements and manual recordings, the measurement does not always start at the moment when the chamber is placed in the collar. This may even be a conscious choice: the measurement is started when, by a subjective decision, the sensor seems to have stabilized. In such cases, the recordings at the zero moment may actually not have been taken at the true zero moment (chamber placement). The authors should state explicitly how the measurements in the different sites were conducted in this respect. Furthermore, it would be of value to know, whether the data was filtered in any way, for example if some strange-looking initial concentration readings were excluded. In case of the manual measurements, the data might have been filtered already in the field. The authors state in the practical recommendations that "... the interval length of discarding data at the beginning to avoid disturbance is critical and should not be too long", but they should also discuss the impact of the possible delay on their results.

SPECIFIC COMMENTS

Give more details on the chambers: automatic or manual, chamber dimensions.

In Introduction (last paragraph), the authors write that they study the flux estimation method in vegetated surfaces. However, one of their study sites, Linnansuo, is a cu-

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tover peatland with no vegetation. This fact makes Linnansuo data set different from the others, because in the curve estimation the photosynthetic processes can be eliminated. In Results (6th paragraph) the authors write, regarding the Linnansuo dataset "rather many of these regressions showed curvatures not conforming with the theoretical model". However, in Discussion (fourth paragraph) they state: "Modelling... is more complicated for vegetated surfaces than for bare soil surfaces". The data could be more thoroughly examined from the point of view that only respiration is measured in Linnansuo.

Discussion (4th paragraph): the authors list the changing chamber temperature, photosynthetically active radiation and the change in headspace turbulence as factors that may have caused the unexplainable curvatures of the exponential model. Were the chamber temperature and photosynthetically active radiation during the measurement known? Could the data be divided into different categories based on whether the temperature and/or radiation conditions were constant or not and the model behavior in each category then examined? Then it might be possible to evaluate to which degree the changing temperature and radiation affect the model behavior. Especially in Linnansuo and Samoylov sites where no cooling system was used, the assumption of a constant temperature may not hold. In particular, the chamber temperature is Samoylov is bound to rise considerably when the level of photosynthetically active radiation is high, as the closure time is quite long.

Discussion, practical recommendations, 8th bullet: The authors state that the changing light, temperature and humidity conditions can be accounted for by nonlinear functions. This statement does not seem to be entirely consistent with what was written in the earlier part of Discussion (fourth paragraph). To my understanding, the authors did not actually attempt to use such nonlinear functions to eliminate the problem caused by varying environmental conditions. Therefore, this idea should be properly tested before it can be recommended.

TECHNICAL CORRECTIONS

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The last equation lacks a number.

Table 4. In the caption, flin’(t0) should be fqua’(t0).

Interactive comment on Biogeosciences Discuss., 4, 2279, 2007.