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Interactive comment on "Calculations of automatic chamber flux measurements of methane and carbon dioxide using short time series of concentrations" *by* N. Pirk et al.

N. Pirk et al.

norbert.pirk@nateko.lu.se

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We thank Miguel Portillo-Estrada for his review of our manuscript and the improvements he suggests. The following describes our view on the four points raised.

Point 1: *I would like to see a more general conclusion using all the data at once apart of the specific findings in one or another chamber. More clearly, I was wondering whether it would be possible to draw more general conclusions valid for all types of climates within the North-South transect. The paper focuses in the implication of some environmental factors as PAR or wind speed on the use of different models for calculating the fluxes, and supports the discussion with some examples in figures (as well as other*

examples in the supplementary information). But would, for example, PAR affect the curvature difference in the CO_2 fluxes universally? I miss a graph plotting the 50000 data points and a bigger conclusion drawn from it. Then, showing the specific examples in the supplementary material. And the same for the wind speed, etc. In this way, I think that the findings of this paper would be easier to apply to future research. E.g. knowing which type of flux model to use in one or another environment depending on the environmental parameters (water table, PAR, wind speed...). Is that possible?

We understand that it would be desirable for future studies to have a general statement about the effect of these environmental parameters and a conclusion on which flux model is best in which setting. An overall summery of all the ~ 50000 flux measurements is the idea behind Table 2 of the main article, which shows the differences between flux estimates broken down into the five sites. The underlying flux estimates of all ~ 50000 flux measurements are shown in the Supplement of the main article for each site individually, because we consider the aggregation of all sites complicated because different algorithms are used to derive the respective reference estimates. So the most general conclusion we can make here is that the plot-scale differences were larger than the inter-model differences. We also see serious issues with the applicability of the NDFE model to our measurements, probably because the decrease of the vertical concentration gradient affecting the gas diffusion is not the main reason for the curvilinear behavior. Still, we find it not inconceivable that there are cases in which this model is applicable.

The absolute values of the curvature coefficient (λ) depend very much on the specific conditions of the chamber, as exemplified in Figure 4a for different gasket tapes, so plotting λ of all sites and chambers in one graph would not clarify the picture. One would therefore need to split up these graphs to show more data of e.g. the curvature-wind speed relation. Accordingly, we propose to add the attached figure below (Fig.1) to the Supplement of the main article. Unfortunately, we cannot show more examples of the curvature-water table relation shown in Figure 4b, because Fäjemyr was the only

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site where the water table was automatically measured right next to the chambers.

Point 2: *I feel that the title and abstract do not correspond exactly with the content of the paper. I would have written a title like: exploratory analysis on the calculations of CH_4 and CO_2 fluxes in closed chamber measurements related to environmental parameters. Or even better: "implication of environmental variables on the choice of flux model for closed chambers".*

We acknowledge that the title of the manuscript, “Calculations of automatic chamber flux measurements of methane and carbon dioxide using short time series of concentrations”, is indeed quite general, while the titles suggested by Miguel Portillo-Estrada are more specific. Of course, the effects of environmental conditions on flux estimates are one topic of the study, but we moreover tried to exploit the information contained in the curvature of the concentration time series. This second aspect should not be neglected in the title, so we believe a more general title suits the study better. We would therefore prefer to stick to the original title. See below for the revised version of the abstract.

Point 3: *The abstract seems to lead to a paper which is going to solve the fitting choice problem with a large amount of data (50000 fluxes). I would like to see a more realistic presentation of the work in the abstract. I had too high expectations when reading it. Also the abstract does not tell the conclusions drawn from the research.*

We did not intend to make a statement about which model is best or “correct”, but rather quantify the typically expected differences of the flux estimates from different models and try to find the underlying reasons for the potential differences. So we certainly do not want to give the impression in the abstract that we solved the model choice problem.

To this end, we revised the relevant part of the abstract (beginning of the second paragraph): “We used more than 50000 such flux measurements of CH_4 and CO_2 from five field sites located in peat forming wetlands ranging from 56 to 78 °N to quantify the

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typical differences between flux estimates of different models. In addition, we aimed to assess the curvilinearity of the concentration time series and test the general applicability of curvilinear models."

We also propose to change the last sentence of the abstract, and append the overall conclusion: "We assess the possibility to exploit this effect for a partitioning of the net CO_2 flux into photosynthesis and ecosystem respiration as an example of how high-resolution automatic chamber measurements could be used for purposes beyond the estimation of the net gas flux. This shows that while linear and curvilinear calculation schemes can provide similar net fluxes, only curvilinear models open additional possibilities for high-resolution automatic chamber measurements."

Point 4: *It lacks of a clearly exposed hypothesis sentence at the end of the introduction.*

We agree that we should state the hypothesis more clearly at the end of the introduction. A similar point was raised by Reviewer 1 (point 1), upon which we proposed to specify the objectives of the study in the last paragraph of the introduction. Here, a clearly stated hypothesis can be inserted, so that the revised last paragraph of the introduction reads: "Here, we aim to improve the understanding of the processes leading to curvilinear concentration time series of chamber flux measurements, and quantify differences between flux estimates derived from different models. We hypothesize that the curvature of the concentration time series is in part caused by systematic effects of the closed-chamber technique, and that these are related to the environmental site conditions. Such an analysis can only be meaningful if random experimental uncertainties are kept to a minimum. [...]"

Interactive comment on Biogeosciences Discuss., 12, 14593, 2015.

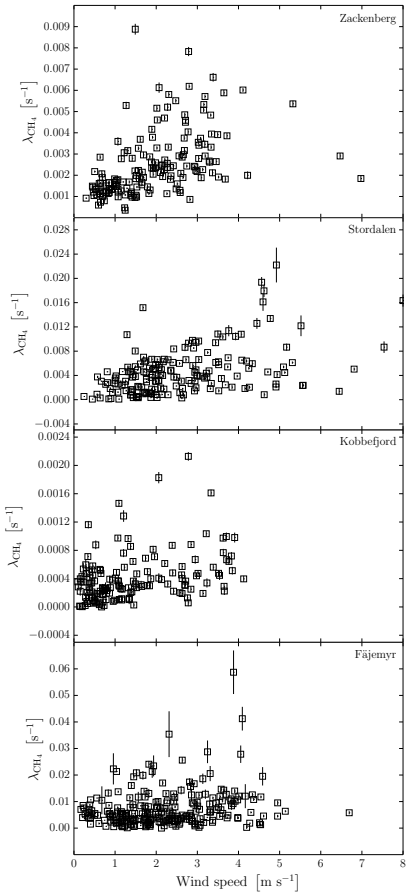

Fig. 1.

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