Biogeosciences Discuss., 6, C634–C640, 2009
www.biogeosciences-discuss.net/6/C634/2009/

Biogeosciences Discussions

Interactive comment on "A comparison of CO_2 fluxes via eddy covariance measurements with model predictions in a dominant subtropical forest ecosystem" *by* J.-H. Yan et al.

Y-L Li

yuelin.li@uni-bayreuth.de

Received and published: 9 June 2009

Dear Referee 2,

Your comments about our manuscript are highly appreciated. We have incorporated your suggestions into our revised manuscript. I summarize the changes that we have carried out in the following list.

A) Responses to the Referee's general comments

General Comments:

This paper summarizes recent efforts applying the eddy covariance technique to mea-

sure net ecosystem carbon exchange to a subtropical forest ecosystem. The site is part of the growing ChinaFlux Network (www.chinaflux.org). The authors present an initial analysis of flux measurements for 2003 and use a process-based ecosystem atmosphere model to parameterize the primary productivity and respiration fluxes.

This paper is novel in that it presents recent results from a rapidly growing network of flux monitoring sites (to wit, ChinaFlux has 24 sites, where as AmeriFlux has over 300 sites). The site itself displays interesting characteristics - a subtropical humid climate with distinct rainy and dry seasons.

A severe limitation to this study is the rejection of night time flux data due to "uncertainties associated with measurements during the nighttime" (pg 2923). While I recognize the many complications (and frustrations) inherent in doing flux measurements, the omission of these data provides strong constraints and limitations on the applicability of this study.

Most readers will assume that the study will include night and day CO2 flux data. The authors need to state and make explicit that only nighttime flux data are rejected at the beginning of the study (especially in the title, abstract, and Section 2.2 of the Materials and Methods) rather than scant mention towards the end of the paper (pg 2923, lines 25-26). The title as stated is misleading. Consequently any reference to measured CO2 fluxes needs to make the distinction that daytime CO2 fluxes are measured – resolving any ambiguity in the text (especially Figures 4-6).

The authors need to provide additional elaboration and description of their criteria for rejection of a flux measurement (see page 2920 line 22). What were the determining factors that caused the open-path analyzer data to fail? With the remaining, acceptable nighttime data (pg 2924, line 2 states >40

An additional objective that this study could examine is: "Given the unreliability of the nighttime flux data (but strong reliability of the daytime data), how effective are gap-filling strategies to determine cumulative net carbon uptake? Do different strate-

BGD
6, C634–C640, 2009

gies agree in their results?" While this study does have merit, additional analyses are needed to justify their conclusions, as detailed in the following section.

Response:

Thanks a lot for your valuable comments on our manuscript. As you know, this work is just a beginning of eddy flux measurements in the south of China. We hope it plays an important role being a part of the growing ChinaFlux Network, we also hope to publish our primary results soon and encourage us to further our study. Here, our authors like to say thanks for your positive comments again, we would like to re-submit our manuscript soon with the requested revisions for publication in Biogeoscience. We agreed that night and day CO2 flux data should be involved as your suggestion. Especially, we will rethink the nighttime flux data so that we could present our results more clearly, at the same time, we realize that a long period measurements data provide a bigger picture of the inter-annual variability, we tried our best to present the data in 2003-2005 in the revised version. Based on more data, we justified our conclusions as you had suggested. B) Responses to the Referee's specific comments

1. Comments: Does Figure 6A only contain daytime CO2 flux data? If not, then please remove any nighttime CO2 flux measurements from Figure 6A, as the true flux measurements in this study occur during the daytime. I presume some nighttime data were included in the model-data comparison because of the positive flux values.

Response: Yes, Fig. 6A only contains daytime CO2 flux data. When light is weak, e.g. early morning or afternoon, even though PPFD is above zero, flux values are positive. Especially, during winter time or early spring time, it's possible.

2. Comments: While the authors do attempt to provide a value of cumulative NEE via soil respiration measurements from previous studies (see pages 2924, lines 2-13), these estimates should be more correctly stated as "inferred NEE of -242 and -276 g C m-2" (pg 2924, line 10). Additionally, it is unclear that soil respiration measurements were scaled up to determine ecosystem respiration for both measured and

BGD

6, C634–C640, 2009

CBM-derived NEE. Rather, could the authors utilize nighttime CBM model outputs to estimate nighttime NEE, and consequently, model-derived cumulative NEE?

Response: Agreed. We should state as inferred NEE. How to scale up soil respiration that we measured on spots to determine the ecosystem respiration, and what is the picture of measured and modelled NEE like should be expressed clearly. Following your comments, we have tried to improve in the revised manuscript.

3. Comments: Perhaps regressions of "valid" nighttime NEE measurements against temperature, or other more sophisticated data fitting procedures (see Reichstein 2005, Global Change Biology 11:1424-1439) can help gap-fill missing nighttime NEE records. While certainly there are more factors influencing nighttime NEE than just temperature, at least this provides a first order approximation, separate from CBM outputs that can be used to corroborate nighttime NEE results.

Response: Agreed. I have fitted our data with Reichstein methods, so that we could present our results with more methods and corroborate nighttime NEE results.

4. Comments: Incorporating both of these suggestions would provide three independent, inferred estimates of nighttime NEE to thereby infer cumulative NEE: (a) scaling up soil respiration measurements, (b) CBM model outputs, and (c) gap filling of missing data using nighttime environmental regressions. If these measurements corroborate, then the study conclusions would be more robust.

Response: Totally agreed.

5. Comments: Page 2922, line 12: More justification is needed to explain why the CBM predicted more daytime cumulative carbon uptake than measurements. Could this discrepancy be the result of model parameterization? Recent studies (Sacks et al. (2006), Global Change Biology 12, 240-259, Zobitz et al Ecosystems (2008) 11:250-269 and other related papers) have indicated the strong sensitivity of model results to parameters and initial conditions. The authors state on page 2925, line that tuning of

BGD

6, C634–C640, 2009

the parameters L and vCmax did not significantly alter model predictions. What about the other parameters in the model? I would expect strong sensitivity to model results with carbon pools (wood, root, and soil) and turnover coefficients. Assuming a constant pool size (in effect steady state dynamics) for carbon pools (especially microbial carbon pools) is a strong model assumption that needs to be justified.

Response: Agreed. We have explained why the model systematically overestimated the net CO2 fluxes in revised version, according to your comments, we disscussed the parameters sensitivity by the two references you mentioned.

6. Comments: Table 2 Figure 4: I wonder if your monthly average CO2 fluxes would be stronger if you took averaged data centered at midday, (e.g. 11 AM - 1 PM, when the photosynthetic signal is the strongest), rather than across the entire daytime period. It might be worthwhile investigating correlations between measured monthly daytime CO2 fluxes and monthly average midday PAR and monthly rainfall. This could provide additional support for the regressions shown in Figure 2.

Response: Agreed. We have sorted out the sensentive periods as you sugguested. Correlations between measured monthly daytime CO2 fluxes and monthly average midday PAR and monthly rainfall are added.

7. Comments: pg 2915, line 5: Please update your studies to include recent IPCC reports as Well.

Response: Agreed. It has been cited.

8. Comments: pg 2916, line 12: Please specify how continuously these measurements have been conducted (e.g. is it correct to assume since the 1970s?).

Response: Agreed. It has been detailed described in revised version.

9. pg 2919, line 11-12: Provide a reference, or some justification on the assumption for the turnover rates of your pools.

BGD
6, C634–C640, 2009

Response: Agreed. Reference has been added.

10. Comments: pg 2919, line 21: If c1 and c2 (scaling factors) are set to 1.0, then is it really necessary to describe them? I would rather err on the side of simplicity when describing models.

Response: Agreed. It's necessary to describe the scaling factors.

11. Comments: pg 2920, line 3: What caused the gaps in the data? Be more specific.

Response: Just as the site descriptions said, Dinghushan Biosphere Reserve is located in a region with a subtropical humid climate with distinct rainy and dry seasons, where thunder and storm are quite frequent during rainy seasons, thunder and high humidity are the main factors which damage the equipments.

12. Technical comments: âĂć pg 2914, line 17: Include space on g C-2 and throughout âĂć pg 2916, line 3: include "the" after (4) âĂć pg 2918, line 6: change to "...the SDM technique .." âĂć pg 2918, line 7: change to "The CO2 flux .." âĂć pg 2920, line 8: change to "using half-hourly records ..." âĂć All axes labels that refer to fluxes should have a space between the "mol" and the""m-2" âĂć Figure 1b, Correct the right vertical axis label âĂć Figure 2: Change x-axis label to PAR for consistency within text. âĂć Figure 4: It might be instructive to shade the background for the wet season (March-October) to distinguish it. âĂć Figure 5: Fix the superscript on the vertical axis label.

Response: Some of them were caused by different word system, I improved or corrected all of them.

C) Summary

All the referee's comments are valuable, which help us to improve the manuscript considerably. We feel that we have been able to answer almost all of the questions of the reviewers. We hope that these changes are appropriate to permit publication of the results in Biogeosciences.

BGD
6, C634–C640, 2009

Sincerely, Yuelin Li (for the authors)

Interactive comment on Biogeosciences Discuss., 6, 2913, 2009.