**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.

Anonymous Referee #2

1 General Comments

This paper summarizes recent efforts applying the eddy covariance technique to measure 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 CO$_2$ 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 CO$_2$ fluxes needs to make the distinction that daytime CO$_2$ 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% of the nighttime data were rejected), could a small nighttime record be analyzed/compared to CBM model outputs? Additionally, as this study was conducted in 2003, are there be more annual records (2004-2008) that could be presented in the study to provide a bigger picture of the inter-annual variability?

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

2 Specific Comments

- Does Figure 6A only contain daytime CO_2 flux data? If not, then please remove any nighttime CO_2 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.

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

  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.

  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.

- 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 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.

- Table 2 Figure 4: I wonder if your monthly average CO_2 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 CO_2 fluxes and monthly average midday PAR and monthly rainfall. This could provide additional support for the regressions shown in Figure 2.

- pg 2915, line 5: Please update your studies to include recent IPCC reports as well

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

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

- 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.

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

3 Technical comments:

- pg 2914, line 17: Include space on gC^{-2} and throughout

- pg 2916, line 3: include "the" after (4)

- pg 2918, line 6: change to "...the SDM technique .."

- pg 2918, line 7: change to "The CO_2 flux .."

- pg 2920, line 8: change to "using half-hourly records ..."

- All axes labels that refer to fluxes should have a space between the "mol" and the""m^{-2}"

- Figure 1b, Correct the right vertical axis label

- Figure 2: Change x-axis label to PAR for consistency within text.

- Figure 4: It might be instructive to shade the background for the wet season (March-October) to distinguish it.

- Figure 5: Fix the superscript on the vertical axis label.