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Biogeosciences Discussions

Interactive comment on "Modelling basin-wide variations in Amazon forest productivity – Part 1: Model calibration, evaluation and upscaling functions for canopy photosynthesis" *by* L. M. Mercado et al.

Anonymous Referee #1

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TThe paper describes the seasonal behavior of canopy photosynthesis for a number of sites with the Amazon rainforest. The authors compute a set of parameters for a photosynthesis-energy balance model that produce the best fit to observations from eddy correlation towers at the various sites. They attempt to reconcile carbon and latent heat fluxes and the del13C composition of the canopy. The paper is a thorough and multifaceted analysis of season rainforest fluxes. Their attempt to match predicted gross photosynthesis, evaporative fraction and del13C with observations highlights some of the weaknesses in scientific understanding of processes. The paper is

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worthy of publication once a few issues are addressed.

Below are my specific and technical comments:

Some of the justification of this study in the introduction refers to uncertainty in the response of the Amazon rainforests to climate change (e.g. Cox et al ’00). I think it needs to be acknowledged that the main drivers of long term changes in this system are likely to be different from those that control interannual variability or season cycles. One must be cautious about overstating the value for long term predictions. Better understanding and modeling of the seasonal cycle does not guarantee improvement in our understanding and in predictions of long term trends.

As often happens in this interdisciplinary field sign conventions get mixed up. Comparing equ 1 and 2 with 4 and 5, the signs are wrong in the former pair.

Page 2975, last paragraph mentions a number of criteria that were used to select measurement data. What fraction of the data were finally used at each site?

Page 2979, last sentence says the model did well in all seasons except one. There were only 3 seasons. A more informative statement would be - well simulated in the two dry seasons but not in the wet season.

Regarding figure 2: I would expect that when PAR=0 then Gp should intersect at Gp=-Rc and Gp* should intersect at Gp*=0. The fact that they do not implies a positive bias in Gp and Gp* measurements since it is impossible for photosynthesis to occur at PAR=0. Some discussion of this should be integrated into the text. Also for this figure the distinction between Gp (first 3 sites) and Gp* (last 2) is not indicated in the y-axis labels and there are no titles on the Tapajos graphs. In my pdf copy of the figure it is impossible to distinguish the symbols representing observations and simulations but they are distinguished by line shade (grey versus black). I think the authors should also address the apparent discrepancy between the lower Gp* at Tapajos during the dry season and the Saleska et al 03 conclusion that Gp* is relatively high in the dry

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season.

Page 2984 first paragraph: the wrong citation is used here, it should be Collatz et al 91 not 90. The correct citation is given in Table 10 but that reference is not listed in the reference section. The Collatz et al 90 citation on page 2986 is correct.

Page 2988 first paragraph and elsewhere in the paper the biases in the estimation of respiration from observations are discussed. I think the analysis recently published by van Gorsel et al 07 and 08 are relevant here as well.

Appendix A equation A6: define f

Discussion of stomatal conductance equation A11: "lambda parameter".is a Lagrangian multiplier representing the marginal benefit of plant carbon gain relative to the cost of water loss. I see it as the reciprocal of that, it is the marginal water cost per carbon gain. Confusion would be less if in the definition of the term the units were expressed as mol H2O/mol CO2 rather than just mol/mol.

Finally, it is too bad that the authors did not use the full record of multiple years at Tapajos to evaluate interannual variability. This would have provided new important information to the analysis.

Interactive comment on Biogeosciences Discuss., 6, 2965, 2009.