

## ***Interactive comment on “Field data to benchmark the carbon-cycle models for tropical forests” by Deborah A. Clark et al.***

**Deborah A. Clark et al.**

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Authors' responses to comments of Referee #2 (21 July 2017):

We much appreciate this referee's constructive and thoughtful comments. Below we have pasted in the entire review, and we have inserted our responses to the suggestions and questions (indicated by bracketing stars).

Interactive comment on “Field data to benchmark the carbon-cycle models for tropical forests” by Deborah A. Clark et al. Anonymous Referee #2

Review General Comments: Summary: The goal of the manuscript is to set a benchmark for observational data to be used for the improvement and validation of vegetation carbon cycle models.

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The authors report on general challenges that occur in model-data comparison, and on the limitations of data and models at different temporal and spatial scales. These are used to identify criteria for benchmark field data in tropical forests such as landscape scale sampling and long data series. The authors clarify, in detail, terms of carbon stocks and fluxes, and underline uncertainties that arise from observations. Exemplary for each stock and flux, well-documented field data of tropical forests are identified that fulfil all the above-mentioned criteria.

The manuscript summarizes needs of the modeler community and sets a starting point for the development of a benchmark-level field catalogue. The authors conclude that the development of such catalogues requires an active participation of field scientists and modelers and constant maintenance.

Article contribution and overall impact: The manuscript is very well written and gives a good overview and discussion on challenges that are confronted when comparing field data and results of vegetation carbon cycle models.

The manuscript seems rather like a review than a research article as it gathers data from literature and does not introduce new methods or analyses.

\*\*We agree with you and Referee 1 that the paper is of the type "Reviews and Syntheses."\*\*

As the manuscript is very long, it may benefit from an additional figure in the second part (Chapter 4: Benchmark field data from lowland old-growth tropical forests). You could add a figure in which you demonstrate the different stocks and fluxes and their interactions. Such a figure does not only highlight the very precisely defined terms of different carbon stocks and fluxes, it may also draw attention to potential contributors for the community-consensus catalogue of benchmark-level field inventory.

\*\*We considered such a figure but have opted not to attempt this, given the large un-

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certainties about the magnitudes of many C stocks and fluxes in tropical forests.\*\*

Overall, the manuscript is an important contribution as it highlights that field researchers and modelers need to work actively together to improve large-scale carbon stock and flux estimates.

\*\*We strongly concur with the latter point.\*\*

Specific comments:

Figure 1: Please add a legend or a description to the figure caption. I assume the different colors refer to the seven climate models and the black line is the mean? What does the grey area represent?

\*\*Thank you for noting these omissions. We will add these and additional details to the legend (see below here), and we will also add to the figure the inadvertently omitted color key to the individual models. [ Revised figure legend: Figure 1. Divergent projections (colored lines) of the changes in tropical Net Ecosystem Production through this century from seven of the CMIP5 climate models. The key identifies the models. Dashed lines - models that include coupled carbon–nitrogen (C-N) biogeochemistry; solid lines - models lacking explicit nutrient cycling. The ensemble mean is indicated by the heavy black line, and gray shading indicates the range of one standard deviation ( $1\sigma$ ) in climate model variability (adopted with permission from Cavaleri et al., 2015 [© 2015 John Wiley & Sons Ltd]). ]\*\*

Chapter 2.1 (headers): Why do you need a subsection here, as there is no 2.2?

\*\*We considered the header valuable for emphasizing the "apples to apples" point. If desired, however, we could drop this section header and re-work the first sentence of the following paragraph to underline the point.\*\*

Page 4, line 16: What do you mean by "hybrid C-cycle"? Estimates that are derived as residuals?

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\*\*We used the term "hybrid" to refer to a C-cycle estimate that is based partly on direct measurements and partly on extrapolation. This point is further discussed, with examples, in the following section. We agree that the text of this current section can be improved by more clearly defining the term at the outset.\*\*

Page 6, line 33-end of paragraph: You here mention "one class" of models. I assume you refer to demographic models such as the ED model and individual-based models such as LPJ-GUESS or SEIB-DGVM. Individual-based DGVMs can also represent within-landscape heterogeneity. In the rest of the manuscript you only refer to "demographic models". This term may not cover the full range of models that can display spatial heterogeneity.

\*\*We agree and will edit here (and elsewhere in the paper, as needed) to clarify that there are multiple model-types that explicitly represent spatial heterogeneity within a landscape.\*\*

Technical corrections:

Page 11, line 2: "underestimated" instead of "underestimate".

\*\*We believe "underestimate" is the correct form, since the sentence is "Field observations .... typically underestimate [LAI].\*\*"

Page 18, line 25: typo in R<sub>eco</sub>

\*\*We don't see the typo here (?).\*\*

Page 22, line 22: "measurements" instead of "measurement".

\*\*We will correct to plural.\*\*

(end of author responses to comments by Referee #2)

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