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Interactive comment on "Moderate forest disturbance as a stringent test for gap and big-leaf models" *by* B. Bond-Lamberty et al.

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** Please note ** because these plain text comments can be hard to read, we have also uploaded this response as a supplementary PDF.

We thank both referees for their thoughtful comments. Changes in the revised text are highlighted in red.

Referee #2

21. My main concern about this manuscript is that the authors treat a fractional decrease in LAI like it would give the same relative decrease in FPAR. In reality these fractions are not at all the same and they depend on the absolute value of LAI and the light- interception model you use. If you apply the most simple model, Beer's law

assuming a light extinction coefficient (k) of 0.5 (FPAR = 1 – EXP(-LAI $\times$ k)) you would get the results from the table attached (Table 1). For this reason, I think that FPAR from the different models has to be included in the results and that a large part of the discussion has to be rewritten, and this means a major revision. RESPONSE: This is an excellent and important point, and one we had completely overlooked. Thank you. While FPAR is not a standard output for any of these models (nor was it measured in the field), all use a common Beer's law formulation to compute it, and thus we can use that as a common frame of reference. The ms now discusses FPAR extensively in the discussion (lines 384-397), and has a new figure 5 focusing on it.

22. From parts of the abstract (11218:2-5, 22-23) and the introduction (11219:4-6) you get the impression that the study is about simulating the processes of tree mortality and moderate disturbances themselves, though what you is looking at the effect and recovery after a disturbance. RESPONSE: We have attempted to clarify this (e.g. line 24).

23. 11219:5-6. "but one complicated by" is this good English? RESPONSE: It was correct, but the sentence has been reworded and clarified. Thanks.

24. 11220:25-28. You could add that it would be for the reason to identify knowledge gaps and processes that are missing or not properly implemented for describing these mechanisms. RESPONSE: Added (lines 99-101).

25. 11221:12. Should it be "early 1900s" and not "early 1990s"? 11221:12. Frequently disturbed? RESPONSE: Thanks–this was a mistake, and has been corrected.

26. 11222:3. You could briefly mention the methods used for estimating LAI and NPP as they are not so straight forward to measure and are important for the study. RESPONSE: This description has been expanded to briefly summarize the observational methods (lines 133-136).

27. 11222:4. "Gough et al." twice. RESPONSE: Corrected.

28. 11222:10-11. Fig 2 and the text (11227:25) say 37%? RESPONSE: Corrected.

29. 11222:21. Should it be “We tested three”, or did you test several models of which you only chose to show the result from three? RESPONSE: Clarified.

30. 11223:21-25. It might read better to divide it into two sentences. RESPONSE: Good suggestion; changed.

31. 11224:20-21. I think you can reduce the number of “soil” in this sentence. RESPONSE: Agreed; changed.

32. 11224:25-26. How can it be that the results were so bad (11227) if the model was optimized? Why are only one parameter (maximum stomatal conductance) significantly changed while there is no or minor changes to the rest? From where have the rest of the parameters been taken? How important are these huge deviations in absolute values for the interpretation of the results? RESPONSE: We agree this is a concern, and flag this issue (as well as suggesting a possible reason for it) more prominently in the text. See lines 37 and 434-436.

33. 11225:14. “C pools and NPP noted above”? RESPONSE: Clarified.

34. 11226:10. Can you be a little bit more specific about which parts of the trees that were removed from the forest and which parts that entered the litter pools? RESPONSE: Clarified.

35. 11226:16. Is “and be subject to less competition” better? RESPONSE: Clarified.

36. 11227. A table that summarizes these results is needed. It should include absolute values before and after the treatment and the relative change. It should also include the fraction of absorbed light. RESPONSE: We have chosen instead to keep the absolute values summarized in the text, but include a new figure and extensive discussion (lines 384-397) about FPAR (which is not always a standard model output). We believe this addresses the substance of this comment, albeit slightly differently than requested.

37. 11230:4. Repeated word “processes”. RESPONSE: Thanks–this was a mistake, and has been corrected.

38. As said above, a lot of the discussion has to be revised as you assume that the relative change in LAI can be interpreted as change in FPAR. E.g. the conclusion “It was instead Biome-BGC that best maintained light absorption” (11230:21-22) is wrong and you have not shown that. RESPONSE: Yes, the discussion has been extensively revised to reflect this insight (lines 384-397 and elsewhere).

39. 11232:14. Take away “remains”. RESPONSE: Corrected.

40. 11232:17-20. I would not keep the philosophical ending of the discussion. RESPONSE: That was a mistakeâĂŤour apologies! Removed.

41. Another aspect that could have been discussed is how the experiment is different from a real disturbance and what impact that has on the results and if the models might do better than the experiment in some respects? RESPONSE: This is an interesting point, and was addressed by Gough et al. (2013, cited in references). We don’t think it needs significant discussion here, but are happy to do so if the editor thinks it necessary.

42. There are a lot of question marks in the conclusions! RESPONSE: Yes-this study raises more questions than it answers, we agree. We have simplified them a bit (line 454).

43. Table 1:key. Those HT max values seem high, should the unit be cm? RESPONSE: Corrected.

44. Figure 2. “Model performance in replicating results”, I think that the English could be tightened up here. I think that it is better to explain what is shown directly than refer to Fig 1. If you include a table with absolute values you can refer to it. It would be good to add FPAR. RESPONSE: The caption text has been tightened and clarified. Re FPAR, it is not included since it’s not a direct model output, but is shown (see response

to comment #21 above) in the new Figure 5.

45. Figure 3. Is this the most straight-forward way to show these results? I am not a statistician and for me it is a little bit more complicated than necessary. RESPONSE: This figure attempts to summarize model performance across all metrics into a single ("Taylor") plot. We agree that the description of this figure–how it was generated, and what it means–was poor, and have clarified this (lines 322-327). We find it a useful summary figure, however, and have left it (including the RMSE component, which is a fundamental part of a Taylor plot).

46. Figure 4. Better to have the units directly to the y-axis. "Shading shows meteorological variability", how can there be a meteorological variability in N and C stocks? "vertical dashed line", it looks solid grey to me. RESPONSE: This figure was obviated by the new FPAR analysis, and has been removed.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/11/C6174/2014/bgd-11-C6174-2014-supplement.pdf

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Interactive comment on Biogeosciences Discuss., 11, 11217, 2014.