Biogeosciences Discuss., 10, C6213–C6216, 2013
www.biogeosciences-discuss.net/10/C6213/2013/

Biogeosciences
Discussions
Open Access

Interactive comment on "Simulating boreal forest carbon dynamics after stand-replacing fire disturbance: insights from a global process-based vegetation model" *by* C. Yue et al.

C. Yue et al.

chaoyuejoy@gmail.com

Received and published: 29 October 2013

Anonymous Referee #4 Received and published: 14 September 2013

I agree with the assessment of Referee #1 and offer a few related minor points intended to improve the manuscript by placing it in a broader context.

[General Response] We would like to thank the reviewer for the comments and suggestions. In line to the other reviewer's comments, the revised manuscript has been shortened and some structural change has been made. To allow to easily track the essential modifications in the revised manuscript, we keep the newly inserted text as the color of "red". As the page and line numbers in the original and revised manuscripts

are different due the structural change of the manuscript, we try our best to help the reviewer quickly locate the modifications by indicating the section and paragraph numbers in the revised manuscript.

1. Extending results beyond the evaluation sites: for example the lodgepole pine forests in Yellowstone National Park often have extensive standing dead to this day 25 years after the 1988 fires. How generalizable are the results i.e. how unique are these forests?

[Response] In current manuscript we calibrated the model for forest regrowth after stand-replacing fires in Alaskan and Canadian boreal forests. Given the processes in the model, it could be equally used for simulation of the fires in Yellowstone National Park that lead to extensive lodgepole pine trees dying. However, this would require again careful model parameterization against multiple observation datasets before regional application. The major aim of the current manuscript is to present the new developments of the ORCHIDEE model (i.e., the chain from ORCHIDEE to ORCHIDEE-FM to ORCHIDEE-FM-BF.) that make it suitable for simulating boreal forest carbon balance in the context that stand-replacing fires are the dominant natural disturbance. Thus we do not include the observation data from Yellowstone National Park in the current study, but it could be something interesting in the future.

2. I find that the modeling assumptions for the most part are well justified in the literature with a few important exceptions. On page 7306 line 24, is the age dependence of LAI entirely empirical? Is it a function of stand height (and thereby the space in which leaves can grow)? I worry that specifying a maximum LAI is not a robust approach for modeling the impacts of a changing atmosphere, climate, and biogeochemical cycles.

[Response] Thanks for the reviewer's comments. Ideally, the LAI simulation should include considerations on the allocation of NPP to leaf biomass taking into account the tree geometry and canopy competition for light (which may depend on factors including tree height). Because the version of ORCHIDEE used in present study is based on

a big leaf approximation, tree geometry and canopy competition are not fully taken into account. High priority is given to leaf biomass allocation so that even for a short time after fire (eg., 2-3 years) the LAI would approach the maximum LAI. Thus an age-dependent empirical relationship is used to mimic the LAI change during forest succession as observed in the field (section 2.2.2.2 in Bellassen et al., 2011). This is not the best approach but it serves a stage of model development. In fact, the developments of a new energy scheme that takes into account explicit forest structure, and a new allocation scheme that takes into account the tree geometry are underway and in the future the regional simulation would have chance to benefit from these new developments.

3. The paragraph on line 10 of page 7327 could try to address the 'why' questions for why some sites are overestimated and some sites underestimated. Otherwise the Discussion is somewhat long and could be made more succinct without losing meaning. One way to make the Discussion more succinct is to link subsections more strongly to the objectives listed in the Introduction so as only central points are expanded upon.

[Response] Following the reviewer's suggestion, we restructured the discussion trying to make it more succinct and clear (section 4.2 in the revised manuscript). We also add small subtitles in discussion section 4.4 to make it more clearly linked to the objectives listed in the introduction.

4. In figures 5 through 9, red and green should not be used in the same figure if at all possible. In this case, there is no discernable reason to be using both red and green. Figures 12 and 13 are better, but many figures have small font that is rather hard to read.

[Response] We suppose this comment was made to improve the readability of the figures for colorblinds. We followed a professional website (http://jfly.iam.u-tokyo.ac.jp/color/) and tried to use color scheme that is unambiguous both to colorblinds and non-colorblinds. Where possible, this consideration has been taken in all

the figures present in the manuscript and the Supplementary Material. If the selected colors do not serve this purpose, we can make further change in the color scheme. The fonts of figures were also increased.

Interactive comment on Biogeosciences Discuss., 10, 7299, 2013.