

Interactive comment on “Climate and atmospheric drivers of historical terrestrial carbon uptake in the province of British Columbia, Canada” by Y. Peng et al.

Anonymous Referee #2

Received and published: 10 October 2013

Review of “Climate and atmospheric drivers of historical terrestrial carbon uptake in the province of British Columbia, Canada” by Y. Peng, V.K. Arora, W.A. Kurz, R.A. Hember, B. Hawkins, J.C. Fyfe, and A.T. Werner.

This paper uses a process-based modeling framework to estimate the response of the terrestrial carbon system in British Columbia to changes in climate and atmospheric CO₂. The model simulations are compared with observations and other modeling studies. The results indicate that both increasing atmospheric CO₂ and changing climate both contribute to a net uptake of carbon by forests in British Columbia, with the majority of the net uptake attributed to changing climate.

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This is a well-written and well-organized paper. Assumptions made in the modeling process, and limitations of this model, are carefully explained and justified. The methods and results appear to be scientifically sound. I recommend this paper for publication in Biogeosciences but also offer the following suggestions to the authors:

1. The authors state that the fractional vegetation cover for each PFT in their model is from the EOSD data set (with missing data filled in from the UMD Global Land Cover Classification dataset). However it was not clear to me where the `_historical_` land cover data came from for the model (1860 onwards). This should be stated somewhere in the paper.
2. The role of land-use and land-use change in the model should also be discussed. A brief mention is made of cropland being modeled as C3 grass but pasture is not mentioned at all and conversions to and from cropland and pasture are not discussed. For example, does abandoned cropland get replaced with a re-growing forest or some other vegetation types? How does the role of land-use change influence the carbon sink results in this study?
3. The authors state that wood harvesting is not included in their model and that if it were, this would provide an additional source of carbon to the atmosphere and when they account for this it would result in a lower net carbon uptake in their model. However, they might also want to account for the subsequent carbon sink from the regrowth of the harvested forest, which would offset some of the emissions from wood harvesting (depending on the time-scales of recovery and of wood harvesting activity).
4. There are a couple of model variables that have some uncertainty around them and it would be interesting to know the sensitivity of the model to these values. The sensitivity of the model to the inclusion of two PFTs for single needle evergreen pine is already discussed. However, have the authors also considered the sensitivity of the model to the spatial pattern of land cover that is used in the model or the sensitivity to the trends in the CRUNCEP climate data (which is stated to be a limitation of their

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model)?

5. Are the effects of land-use change prior to the start of the historical simulation accounted for? For example, wood harvesting prior to 1860 would result in forests in a state of partial recovery at the beginning of the simulation. Or is it assumed that all forests are in their potential state in 1860?

6. How is fire modeled in this study? It is mentioned that fire is included and that the annual burn fraction is 0.28% in the model, but additional details (including spatial patterns) are not provided.

Interactive comment on Biogeosciences Discuss., 10, 13603, 2013.