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Biogeosciences
Discussions

Interactive comment on "High latitude cooling associated with landscape changes from North American boreal forest fires" *by* B. M. Rogers et al.

Anonymous Referee #1

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Overall Evaluation

This manuscript represents a very useful simulation study that evaluates the sensitivity of surface energy exchanges and atmospheric response variables to changes in the land surface of the boreal forest in North America caused by changes in fire frequency and relay floristic succession. The tools used in this study include a simple stochastic vegetation model driven by spatial variation in fire regime, a land surface model (CLM) to quantify energy and water exchanges, and a climate model (CESM) to examine how the vegetation changes influence climate. "Equilibrium" simulations are conducted for contemporary vegetation/fire regime conditions, and for no fire, 2X fire frequency, and 4X fire frequency. The study finds that increases in burn area would tend to result in surface cooling, particularly during the February to April time period,

which could decrease warming driving changes in fire frequency by up to 25% in winter (for a 4X fire frequency. The unique aspect of this study is that it has been able to connect up changes in fire frequency along with associated changes in vegetation and surface energy/water balance to examine potential impacts on temperature and other atmospheric climate variables. Previous studies have pretty much stopped at the changes in surface energy/water balance. Also, the size of the domain considered by this study (the North America boreal forest) is continental, which is a good deal larger than has been considered by previous studies, which have been either local or regional (e.g., Alaska). Thus, the analysis reported in the manuscript represents progress. In general, I found the writing to be clear, the methods appropriate, the validation convincing, the results insightful, and the discussion comprehensive. I only have a few minor specific comments which I provide below.

Specific Comments

(1) Page 12088, line 14: I was really confused by the reference to both winter-spring and February-April in this sentence, as it seemed redundant. My suggestion is to keep just report the temperature change for one or the other.

(2) Page 12088, line 25: I was surprised to see this reporting that northern high latitudes have been warming "five times" faster than the global/Northern Hemisphere mean. Most of the recent reporting of this issue is that northern high latitudes are warming at twice the global/Northern Hemisphere mean over long time periods (multiple decades). You might want to check your source for the "five times" figure to see if it is restricted to a short time period or to a particular season.

(3) Page 12094, line 10: Here you indicate that the probabilities were derived from data over 60 years, yet on previous page you indicate that the Canada fire data base was for 1961-2010. I see from information in Figure 2 that you mention that the probabilities were calculated also on information from the Alaska fire data base, but there is no information in the paper on the temporal span of that data base. I think you just need

to clarify in the text that the sixty years corresponds to the temporal span of the Alaska fire data base.

(4) Definition of the winter, spring, summer, and fall in the paper: You use these seasonal designations very explicitly in Tables, but nowhere in the manuscript do you define them. Is winter DJF, spring MAM, summer JJA, and fall SON? Please define these seasonal terms in the methods.

(5) Page 12102, line 12: Note that “late winter” does not appear as an entry to Table 3, just winter.

(6) Page 12101, line 27: “Bax2” should be BAx2”.

(7) Page 12105, line 9: Note that “29%” reported on this line is reported as “28%” in Table 4.

(8) Page 12107, lines 28-29: Change “permafrost melting” to “permafrost thawing”.

(9) Finally, the Discussion section is very comprehensive, but it also seemed rather long. I don’t have any specific suggestions for shortening it, but if another reviewer provides suggestions for how to make is shorter and more snappy, I think that would improve readability of the manuscript.

Interactive comment on Biogeosciences Discuss., 9, 12087, 2012.