

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

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Review of BGD Rogers et al.

General Comments

This paper describes a model analysis of the effects of North American boreal forest fires on climate. It appears to address the changes to the surface energy balance as a result of changes to area burned by running some scenarios. The paper is well-written and thoughtful, and includes a broad range of relevant literature. It provides some unique analyses and builds on our knowledge of climate feedbacks from changes to the land surface. I support the publication of this paper. I have a few specific comments below.

My major comment is that it is not clear if the models have included greenhouse gas forcing of climate that results from the increase in forests fires (combustion sources and changes to the forest carbon flux when the age structure is changed). Although it would seem that this must be included, it is not presented transparently, and I would expect a clear categorization of forcing caused by surface energy balance changes compared to greenhouse gas emissions.

Specific Comments:

Pg 12089. Line 20. The definition of mature forests at several hundred years old is confusing in the boreal context. For many parts of the boreal forest, “mature forests” may only be about 70 years old. The authors are really referring to some specific plant communities with a certain species mix. I think they really mean something closer to “very old-growth” boreal forest, not “mature”.

Pg 12091, line 6. At odds with this, the last decade showed no increase across Canada, although Alaska has an increase in area burned. For a current paper, this should be noted; Canadian data can be found at the CIFFC (Canadian International Forest Fire Centre) website.

Pg 12094 line 7. It would help to explain more how this burn probability was determined. It is not clear how much of this is based on the FRI pixel classification, and how much from the studies that are referenced. For example, I recall that Lavoie estimated that there was decreased probability of burning in jack pine stands for about the first 15 years following fire; then equal probability thereafter. Fig 2 is a significant result of the current paper and an explicit description of the method is needed.

Pg 12094, line 13. The term “deterministic” doesn’t fit well here. I think the authors are trying to say that it is difficult to predict, but it is still deterministic.

Pg 12097, line 11. The model runs appear to have biomass burning as one of the parameters. But it is not clear to me that the carbon dioxide releases through boreal fire

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combustion, or the changes in carbon sink by a changed forest, are included. Perhaps I missed this, but does the model only simulate change to energy balance, without including changes to the greenhouse gas balance? If all aspects of the fire effect (greenhouse gas budget, energy balance) are included, the paper needs to break these out clearly. Randerson's paper seemed to do this in a transparent way. On Page 12019, there is a discussion of the "biogeochemical" effect in the literature, but no apparent conclusion from the present study. If greenhouse gases are not included, enhanced discussion is needed.

Pg 12107, line 20. When temperature changes are given in degrees C, the fire-cooling effect would be better to express in degrees C also, instead of percent.

Table 1. The numbers appear to be percentages, but this is not stated.

Figure 1. The classification scheme appears to include forest areas in British Columbia that are not normally classed as boreal. Many of these are montane or temperate rainforest. The temperate rainforest especially has a very different fire regime from the boreal region. Successional trajectories are different from the boreal ones shown in subsequent figures. Also, this area of complex topography poses challenges for classification and modelling at the 2-degree grid scale. If these areas are to be included, some discussion is needed, but it would be preferable to only include boreal areas, which have been clearly defined through ecological classification.

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