Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2017-350-AC1, 2017

Biogeosciences Discussions

Interactive comment on "The pyrogeography of eastern boreal Canada from 1901 to 2012 simulated with the LPJ-LMfire model" *by* Emeline Chaste et al.

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Received and published: 16 November 2017

Dear Referee #1,

Thank you very much for your comments and suggestions for improvement and clarification of the manuscript. Here are individual responses to your comments and some details about the revisions we plan to make for the final acceptance:

- Referee #1 comment #1: I interpret their results and discussion to say that the increase in fire activity was due to both an increase in lightning frequency and drier climate. I recommend emphasizing this aspect of their results more clearly and explicitly.

Authors #1: We agree with you and we will change one sentence in the abstract and one paragraph in the discussion section to emphasize that the increase in fire activity during the last part of the 20th century was the result of both an increase in lightning frequency and a drier climate. This aspect was mentioned in the 3rd paragraph, section "4.2 History of fire in the eastern boreal forest of Canada described by LPJ-LMfire" but it was perhaps not sufficiently emphasized. We will highlight it better in the final version.

- Referee #1 comment #2: It appears that there were no additional modifications made to the fire routine in LPJ_LMfire, such as changes to fuel limits on fire activity, beyond the new PFT parameterization. If true, I would encourage the authors to write a sentence confirming this. Authors #2: No modification was made to the fire routine compared to the version of Pfeiffer et al. (2013); we will make sure that is explicitly mentioned in the Method section of the final version.

- Referee #1 comment #3: Presenting the results of Figure 4 in a manner similar to Figure 2 would make it easier for the reader to see the spatial patterns of agreement and disagreement between model and observations. Authors #3: We really appreciate this comment to improve clarity and uniformity between all figures related to the part "3.1 Predictive skills of the LPJ-LMfire model". As suggested, we will present the results of Figure 4 in the format of Figure 2 (see Fig. 1 below). Maps reporting differences between mean aboveground biomass simulated and observed were added on the Figure 4.

- Referee #1 comment #4: Given the results shown in Figure 3, the interpretation that "heavy and intense rain events that occur later in the summer decrease the probability of starting fires, despite more lightning" does not seem well-founded. Authors #4: We agree with you concerning this sentence and we think that, if LPJ-LMfire does not simulate the bulk of the fire season between June and August, it is mainly due to a quick drying-out of soils in spring within the simulation. Here, we just suggest that the low burn rate during the summer despite high lightning density (see Fig. 2 below)

could also result from the weather being less conducive to fire due to higher amount of precipitation between July and September than between April to June (supplement S9 Fig. S8). Detailed investigations (not shown in the manuscript) at the grid-cell level have highlighted that the Fire Danger Index calculated by LPJ-LMfire was higher in spring than in summer. This index is directly related to the amount of precipitation that influences fuel moisture. We will improve our sentence both to clearly explain this point and to make sure readers take this information as a suggested interpretation.

- Referee #1 comment #5: There are multiple instances of incorrect grammar. Authors #5: The final version will be reedited for grammar and spelling.

Thank you for reviewing our paper.

Sincerely yours, Emeline Chaste and coauthors

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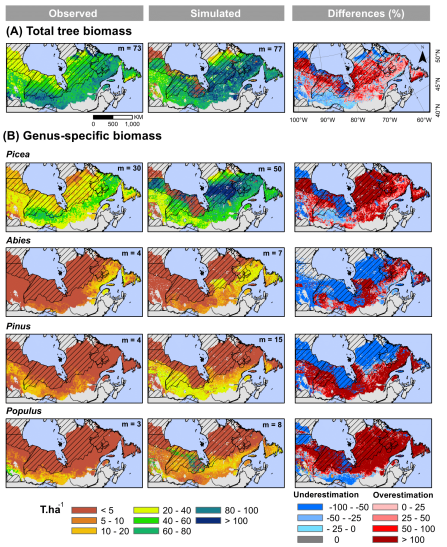

Figure 4: (A) Observed, LPJ-LMfire simulated, and differences (%) in mean total aboveground biomass (T/ha) between 2000 and 2006 across eastern boreal Canada. (B) Genus-specific aboveground biomasses. The observed aboveground biomass maps across Canada were predicted and validated with photo-plot information in the southern areas (non-hatched areas) and data published by Beaudoin et al. (2014). Median (m) tree aboveground biomass values were also mentioned for each maps and were calculated for the non-hatched area at 10 km resolution.

Fig. 1.

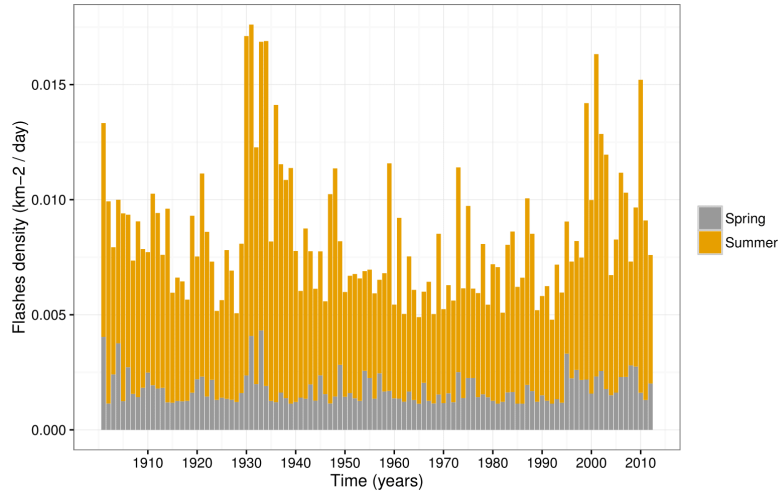

Figure 1: Temporal series of spring and summer mean flashes density.

Fig. 2.