

Interactive comment on “Improving the representation of fire disturbance in dynamic vegetation models by assimilating satellite data” **by E. P. Kantzas et al.**

Anonymous Referee #1

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General comments:

This study proposes an algorithm to assimilate the statistical information of fire provided by satellite-based burned area products to improve the representation of fire in the dynamic vegetation model. This is a very interesting topic considering that great importance of fire in affecting both carbon and water cycles in the boreal and arctic region (i.e. focus area of this study). I think the method is reasonable, though with potential limitations in representing extreme, large fires (which is likely becoming more common in the study area with climate warming). Also, in my view, the manuscript may be better organized and the presentation (and writing) could be improved. I recommend major revision.

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Specific comments:

1. One potential limitation of the proposed algorithm is that extreme, large, and rare fires may not be well represented by the model, especially in areas with low FRI, e.g. tundra areas. This is because the algorithm tends to accommodate the large fires into the areas with shorter FRI values and thus with high accumulated burned areas. Continued strong warming in the boreal and arctic regions might promote the occurrence of those large fires, and this limitation should be addressed. Also, I think this might partly explain why the FRI map generated by the new algorithm shows such great variability.
2. The organization and presentation of the paper might be improved. For example, why not put the results from applying CCL algorithm (i.e. section 2.1.2) in the Results section? Also, adding a section in the methods (e.g. before section 2.2) introducing how the LPJ-WM model represents the fire parametrization and the associated post-fire evolution of vegetation and soil carbon (?). This background information will help clarify some of the details presented in the results and discussion, particularly regarding the post-fire recovery simulations.
3. Fig. 4: I do not understand why the fraction burned area maps of different years were compared. Why not pick one year of model simulations within the temporal period of the GFED product? Even though the algorithm may not simulate fires with locations exactly matching the GFED data (due to statistical nature of the algorithm), it provides a visual comparison of the distribution of fire sizes between the model and the satellite product.
4. Fig. 5: It would be helpful to provide time series of the recovery trajectory of simulated vegetation biomass and carbon fluxes. This could help diagnose how well the model can represent the post-fire vegetation recovery since the literature provides abundant information on the post-fire recovery process in the boreal forest. Besides, the authors also acknowledged that fire had a potential large impact on the soil heat transfer (e.g. affect the stability of permafrost) and soil carbon dynamics (e.g. promote

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the soil carbon decomposition in the permafrost areas), and these processes are critical in characterizing the boreal/arctic carbon cycle. Does the LPJ-WM model account for those processes? This has not been addressed in the paper at all.

Minor comments:

1. Page 2880, Line 3: please remove “they”.
2. Page 2882, Line 25-: the GFED fire emissions data were never used nor addressed in the study. So I do not think it is necessary to include this information.
3. Section 2.1.1: Why aggregated the GFED data to 0.25° resolution since the DVM model (i.e. LPJ-WM) was run at 0.5° resolution?
4. Page 2884 Line 8: the category (6) should only include the fire size smaller than 500 km², right? That means that category (5) has been excluded.
5. Page 2886, #2: The study area (i.e. Canada and Russia) covers a large latitudinal zone. So would it be very reasonable to assume the area of each grid-cell (0.5°) as a constant? Page 2887, #5: should μ_{fire} not be replaced by μ_{ffire} ? Otherwise, please define μ_{fire} . Page 2887, #6: Please clarify what BAC(lat, long,y) represents. My understanding is the accumulated array BAC(lat, long) is calculated through all the years during the transit run (i.e. the total 112 years) and fixed for each grid cell. Page 2888, #7: I think the authors were trying to say “the deficits in BAC are ...”, not “the shortcomings in BAC..”

Interactive comment on Geosci. Model Dev. Discuss., 8, 2875, 2015.