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Geoscientific Model Development Discussions

Interactive comment on "Addressing Biases in Arctic-Boreal Carbon Cycling in the Community Land Model Version 5" *by* Leah Birch et al.

Anonymous Referee #3

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Birch et al improve the representation of Arctic-boreal zone CO2 fluxes in CLM5 through examination of model biases compared to gridded flux products and eddy covariance tower data. They implement process-level changes that improve the uptake phenology and extent of productivity for specific plant functional types. Overall, the paper is well written, detailed, and comprehensive of this highly relevant topic and worthy of publication in GMD with minor revisions.

The entire model evaluation and analysis is based on the assumption that the uptake/respiration component flux partitioning in the FLUXCOM and at EC sites is correct. However, there is no discussion of the uncertainties inherent in these products. GPP cannot be independently observed and thus all values are simulated. Certainly, we can rely on these partitioning products for understanding, but an expanded discussion of

this topic should be included in the methods section along with the product descriptions to boost confidence in the analysis.

Certain portions of the results and discussion, such as lines 372-376, are redundant with methodology described in section 2.4. I encourage the authors to review connections between these sections to remove unneeded words and references to previously described processes and/or results.

Additional minor comments:

Line 56. If satellite products are unavailable in the winter, then they are not complete in time. Perhaps be more specific about to which kinds of products you are referring.

Line 106: Less biased compared to which other product?

Line 151: What impact does the choice of a site as development vs validation make on the results? If you swap sites between categories would you get a different answer?

Line 152: "evaluation" is preferred over "validation"

Line 187: How is "GPP onset" defined? GPP > 0? Or when NEE begins to decrease?

Figure 1: Inconsistent capitalization of FLUXCOM

Section 3.1: NEE changes between model versions are fairly small. As with overview comment above, how can you know that large changes to component fluxes are needed when there is little change to the NEE (which is what is actually observed).

Figure 3: Add units to second row of plots, PFT abbreviations should be defined in the legend Line 346: Missing a word, "note"?

Line 566: Why does separating the sites lead to mitigating the lack of data? Are you not further decreasing the amount of data your changes are based on?

Live 590: Global carbon budget change seems like it could be calculated only based on the changes made for the ABZ. This would increase the value of the study and

highlight the global importance of understanding the ABZ CO2 fluxes.

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