Biogeosciences
Discussions

Interactive comment on "Ecophysiological modeling of the climate imprint on photosynthesis and carbon allocation to the tree stem in the North American boreal forest" *by* Fabio Gennaretti et al.

Anonymous Referee #2

General comments: Gennaretti et al. adapted MAIDEN ecophysiological forest model for North American boreal forest, which is a further application and development of MAIDEN model. It is great to see the progress of MAIDEN, and its extended application for different species and locations in tree ring and forest ecosystem research. Such process-based models will benefit our understanding in dynamic of forest carbon cycle, and its response to climate change. This paper was well written. The detailed supplementary file is also very helpful for readers to follow the key points of the article. Considering this is about further adaption of such a mature and multi-regional applied model, some more specific scientific questions/motivations might be helpful to strengthen the innovation of this research.

Specific comments:

1. Page3 last paragraph: About parameter tuning, there are 6 (reference: daily GPP) + 12 (reference: annual ring width) parameters tuned in this application. It is very smart of suing Bayesian optimization for such a large number of parameters tuning. However, there are only 2 references (GPP and detrended tree ring). This might have impact on the final choice of the parameter value. Some solid check about the relationship among different parameters (correlation or interaction), and sensitivity analysis for Dstem parameters is needed.

2. Page 7 line 18: Typo "Ring with" should be "Ring width"

3. Page 8 line 5: The input data for MAIDEN include daily temperature and precipitation, as well as CO2. Is the solar-related parameter needed, e.g. sunshine hour, cloud cover fraction? If not, please briefly demonstrate how photosynthesis was estimated.

4. Page 8 last paragraph: In the third step of this research (evaluation of the model performance), the indirect comparison between variance explanation (R2) of model simulation and climate response function was applied. It would be helpful to verify the model performance by showing the same climate response function analysis for the model simulation, e.g. combined Table 2 and 3 for the both observed and simulated GPP and Dstem. And it would be even more convincing to show the moving correlation analysis (figure 6) between simulated Dstem and monthly climate.

5. Page 9 line 3: R2 was widely used in this model-data comparison. a) The calculation method for R2 is needed here. b) Was model (parameter) was tuned using the same whole observation, or only a portion of the observation? A bit curious about the not small negative value of R2.

6. Page 9 line 15: It makes sense that the annual GPP has a very poor correlation with ring width. One of the obvious reason is the definition of "annual" and the carbon carry over from previous year, which is the stored carbon in MAIDEN. I guess "annual"

in the paper means the calendar year (Jan to Dec). It would be very useful to check the correlation between GPP in effective carbon year (or growth year, e.g. previous July to current June or from previous Phase 4 to Phase 3) and ring width observation.

7. Page 12 line 23: Does increasing CO2 contributed to this positive relation between summer temperature and Dstem? Is there any CO2 fertilisation signal in both the simulated Dstem and the observed ring width?

8. Page 11 line 1: Does this stored carbon include previous year's stored carbon? What would happen, if the stored carbon was used up, e.g. carbon was stored very little during previous year?

9. Page2 line 5: "compartments" mean "component"?

10. Figure 4: The method of calculating R2 need to be specified, either in the method part or the figure caption part. Is there any constraint when R2 was calculated, especially for the negative R2?

11. Figure 5: Please enlarge the scatter plot for both the Daily GPP and the Annual GPP

12. Figure 6: Is it possible to add the same moving correlation for simulated Dstem?

13. Figure 7: Please enlarge the scatter plot for both the detrended and raw Dstem.

14. Figure 9: The information about the colour scale is needed in the caption.

15. Table 1: It would be good to add the prior range in this table