

Thorough descriptions, but ambiguities in validations

Comments to "Hidy et al., Terrestrial Ecosystem Process Model Biome-BGCMuSo v4.0: Summary of improvements and new modelling possibilities".

Overall:

Thank you for clarifying the nitrogen balance issue, and sorry for misunderstanding. The solution that the authors chose for the negative nitrogen balance issue may not be the best, but it is acceptable as a temporal one. I think that the authors will find a better solution eventually in the future.

Now let me comments on validations:

(1) The authors presented comparison between the MuSo and original Biome-BGC with the selected variables (i.e., GPP, TER, SWC, LAI, LHF, and abgC, cumulative NPP) for three different vegetation types (Figure 6-8), and they claimed improvements of the MuSo over the original. However, it is difficult to get a grasp of how/which the new modules contributed to the improvements from the context. It is pity that the authors chose to show some of explicit effects of the new modules in supplemental materials, not in the manuscript. Personally, I like to recommend a thorough reorganization of case studies in such a way to demonstrate more explicit effects of the new modules in relation to CO<sub>2</sub> and H<sub>2</sub>O fluxes, and storages, but I leave it to discretion of the authors.

(2) Validations against observed CO<sub>2</sub> and H<sub>2</sub>O fluxes indicate that the new model has better capability of reproducing fluxes of different vegetation types than the original, but I have concerns about reproducibility of LAI.

The average air temperature at the Bugac site is around 10 °C (P5 L30), so I expect that the winter temperatures would be near 0 °C or can be even negative °C at the site. In such a condition, how come LAI starts increasing in January (Figure 6d)? Although *Festuca* and *Carex* are evergreen species, this phenological pattern is unreasonable. Indeed, the average LAI by MuSo is close to the observed value (L26-27, p30), but it does not mean that the phenological pattern by MuSo is more realistic than that by the original.

It is well known that LAI tends to saturate earlier than net carbon uptake (e.g., abgC), which is well illustrated by observed values in the Mead1 site (Figure 7d, e). It seems that MuSo is incapable of reproducing this pattern, both LAI and agbC shows a similar seasonal variability with peaks in a similar time period.

Because of these results, I'm skeptical about performance of the phenology model, particularly heat sum growing index (section 4.3.1). There is no need to modify model results, but instead I insist on describing these results as a limitation. They should be in a list for future modifications (P33 L18-22).