

Discussion on egusphere-2022-835

Anonymous Referee #2

Referee comment on "Modeling of non-structural carbohydrate dynamics by the spatially explicitly individual-based dynamic global vegetation model SEIB-DGVM (SEIB-DGVM-NSC ver1.0)" by Hideki Ninomiya et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-835-RC2>, 2022

Comments to the Anonymous Referee #2

Thank you for your comments, I really appreciate them. I'm glad to hear that you are interested in my manuscript. As you know, understanding the dynamics of NSC is crucial for studying how trees respond to extreme weather events, but there is still limited research on modeling these dynamics.

Regarding your concerns, I have modified the simulation scheme accordingly. I totally agree with you. It is better to compare with observation which age/tree size is similar with the simulated forests. However, I did not consider them in the model honestly. This is because the age and tree size data were not measured simultaneously with the NSC data. It is challenging to obtain these data at the same time since measuring NSC involves cutting trees in field sites and extracting the NSC content after making them dry. The trees used for measuring NSC are often located in parks and other field sites that are not well managed for research. As a result, I could not find NSC data with age/size information from trees managed by universities or research institutes. Instead, the NSC data used in this study are presented as relative values of NSC to total dry woody biomass. To compare the model with observations, we used the simulated relative values of NSC to total simulated dry woody biomass to avoid the influence of age and size.

About how the coefficients of NSC_{max} (a and b) were determined for the global-scale validation are written in below answer for specific comments

I added the comparison as you suggested between the new model and the original SEIB-DGVM. Since the original SEIB-DGVM only calculates NSC in the trunk, I did not compare the NSC seasonality at a point scale. Instead, I compared the total NSC across climate zones and biome types on a global scale. I also made modifications to Figure 5 to show the differences between the original and new model. The additions to the Results and Discussion section demonstrate the superiority of the new model.

Answer for Specific Comments:

Introduction

Line 42: What do the "spatial and temporal drivers" describe?

Answer: It means the drivers in Line 40-41: anthropogenic drivers, such as rising temperatures and CO₂ partial pressures, and transient disturbances such as wildfires, droughts, biotic attacks, and land-use changes.

Line 80-95: "The authors explain the indirect impacts first, but it seems easier to understand if the direct impacts are explained first."

Answer: I have reorganized the order of the paragraphs

Line 118-120: "It would be easier to understand if it were stated after line 110, which describes the advantages of individual-based SEIB-DGVM."

Answer: I moved the sentence in Line 118-120 after line 110.

Line 126-129: "To demonstrate the superiority of the enhanced model (SEIB-DVGM-NSC), I think a comparison of the enhanced model with the original model (SEIB-DGVM) in discussion section would be of more interest to the readers."

Answer: As you suggested, I have added the comparison between the new model and the original SEIB-DGVM. I mentioned "enhanced model" in line 126-129, so in the revised manuscript, you can understand the extent to which the new model has been improved over the original model

Model

Line 158-160: "It would be better to have an explanation of the process of carbon stocking in the trunk in the original model."

Answer: I added the further explanation: In the original SEIB-DGVM, the NSC in trunks is supplemented to 250 g dry matter (DM) from the litter after seed establishment and is based on the existing leaf biomass after the first 30 days of the growing season. It is used for foliation after the dormant phase and metabolic processes such as the synthesis of a storage organ and remobilization of the nutrients within it.

Line 257-258: “I did not understand how the authors determined the coefficients in Table 2. Please add a little explanation.”

Answer: I added a little explanation: The allocation factors of NSC utilization depend on the climatic region (Table 2), and have been adjusted to prevent the allocated share of R_a from hindering an increase in NSC_{organ} during spin-up simulations.

Line 260-262: “What happens if the total carbon stock is insufficient?”

Answer: I added the further explanation: When the total NSC is not enough to pay for the charges, a 1% of reduction in the biomass of all of the living organs occurs. The removed biomass of sapwood is transformed into heartwood, while the removed biomass of other organs is placed into the litter pool.

Line 292-294: “With regard to the comparison with observations of NSC dynamics, is the age and/or tree size of the simulated forests same or similar with the observations? This point may be important since it is mentioned in this manuscript that tree size is important for carbon allocation.”

Answer: I answered your concern on page 1.

Line 405-406: “Why decide from January percentage of NSC and biomass?”

Answer: I am sorry for misunderstanding you. The parameter a determines the initial amount of carbon fixed through photosynthesis that goes into the NSC pools. I noted that the NSC levels

typically fluctuate from spring to summer in all climate zones, so I used the January amount as the baseline.

I added the sentence: the parameter a in Eq. (10) controls the base amount of photosynthetically fixed carbon mobilized for the NSC pools. The parameter b in Eq. (10) controls the seasonal fluctuations of the NSCs from the parameter a .

Line 411-413: "It is unclear to me how the coefficients of NSCmax (a and b) were determined for the global-scale validation."

Answer: I added the further explanation: The same parameter a and b were basically used for global-scale validation as for point-scale validation. However, because the NSCs are influenced by environmental conditions at the field sites, the observed global mean values used for global-scale validation were different from the values used for setting parameters for point-scale validation. Therefore, some adjustments were made to certain parameters to align with the values used in the global-scale validation.

Results

Discussion

Line 620-622: "The sentence is not clear. What did the authors want to say?"

Answer: I am sorry for confusing you. What I meant was that we adjusted the new NSC process and its related parameters based on climate zones rather than biome types.

Line 626-627: "The sentence is not clear. What did the authors want to say?"

Answer: I am sorry for confusing you. What I meant was that as we used data from different measurement sites for global-scale validation, we could not account for the potential influence of varying surrounding conditions on the data collected."