

Review of „Biogeochemical model Biome-BGCMuSo v6.2 provides plausible and accurate simulations of carbon cycle in Central European beech forests“

In this paper the authors describe a method for calibrating a set of parameters for European beech. Different sets of plots were used for calibrating and validating, parameters were optimized for single sites or for multiple sites. The resulting parameters were compared with available values in literature, with a focus on carbon stock in aboveground wood biomass, soil and litter. The paper clearly presents a method to deal with the large amount of parameters many process-based models have.

Some general comments:

The discussion section is very long and very much focused on interdependencies and trends along stand and site gradients. Would it be an option to put all this material in a separate section (with clear subsections) and focus the discussion on the consequences for model development? Maybe then the discussion and conclusions can even be merged, since right now the conclusion contains (sometimes literal) repetitions of earlier mentioned topics. The very last paragraph of the discussion (starting line 739) is what I actually expected in this section.

I think it would be interesting to discuss a bit more in depth possible interdependencies between parameters and/or variables. Interdependencies between parameters is mentioned in line 578-579, but possible implications are not really discussed. Also, a „tight relationship between AbgwC and SoilC“ is mentioned (line 517) and many parameters influence all three studied variables (Figure 3). It would be interesting to discuss the possible consequences of these interactions and the advantages/disadvantages of the proposed method in this context.

Further comments

Line 91: which elements?

Line 123: simulating more realistic dynamics (remove „a“)

Line 124: again, using dynamic annual mortality rates (remove „a“)

Line 132: simulations of crop functioning

Also, to line 132, is this relevant for the forest modelling? Are the crop parameters playing a role for forest modelling or are they completely separate?

Lines 176-180: I don't fully understand what you mean by extrapolating the E-OBS data. Do you mean that not all necessary input variables are measured and you use the gridded data to fill the gaps? Or are there sites without observations and that is what you use the E-OBS data for?

Line 244: sensitivity analysis (SA) (introduce abbreviation here)

Line 252: change brackets around Verbeeck et al 2006

Line 308-310: were the sites also selected to ensure a range of all the mentioned environmental conditions? I only saw a figure of the temperature and precipitation variability.

Line 501-502: the sentence feels a bit awkward, maybe it is meant like this: would cause a significant deviation from its mean or median of experimental observations.

Also, if the parameter should not be changed according to observations, does that indicate a process in the model itself should be improved?

Line 511: change brackets around Thronton et al 2002

Line 516: from A very tight positive relationship

Line 520-523: the sentence is a bit awkward, please rephrase

Line 541-542: awkward phrasing, please change (I think the term „averaging out effect“ can be omitted)

Line 543: what is a hybrid approach?

Line 563: remove „the“ → with decreasing plant density

line 565: change brackets around Timlin et al 2014

Lines 568-574: is this paragraph necessary?

Line 578: interdependencies

Line 605: change brackets around Thronton et al 2002

Line 731: Fix citation Kolb 2022

Line 754: any process-based model (singular)