

Interactive comment on “Effects of vegetation structure on biomass accumulation in a Balanced Optimality Structure Vegetation Model (BOSVM v1.0)” by Z. Yin et al.

Anonymous Referee #2

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This is in principle a very interesting manuscript. It describes a new modeling approach to terrestrial vegetation which deals explicitly with vegetation structure and adaptation although in a simplified way. The manuscript provides the model description and the sensitivity to two model parameters, and the source code of the model is available in the supplementary information.

My major concerns about the manuscript are that (i) its objective is not clearly formulated, (ii) it contains no attempt to test the model against observations even though this should be relatively easy to do as it predicts properties that are easily accessible, (iii) I get no sense for how sensitive the model is to its parameters, given that the model contains a large number of parameters with inherent uncertainties and assumptions

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regarding functional relationships and (iv) there is no critical discussion of the main limitations of the model. Hence, I think this manuscript requires substantial revisions and is not yet acceptable for publication.

For a manuscript submitted to GMD, I would expect that the objective of this manuscript would be something like “formulating a vegetation model which considers the effects of spatial structure and adaptation”. To evaluate if this objective is achieved, one would need to see that the model does a reasonable job in reproducing observations, which is currently lacking (point ii from above, rather critical!). Adaptation is (presumably) dealt with in the manuscript with the maximization approach, but this has not been made quite clear and it is not being discussed in the discussion and this aspect lacks completely in the conclusions. Since objectives and conclusions are rather important parts of a manuscript, these need to be sharpened in the revision.

I am also confused about the maximization approach. Throughout the manuscript, the authors refer to maximized water use efficiency, fractional cover, biomass and carbon gain. These aspects are clearly related, as shown in Fig. 3, but it appears the authors only deal with maximizing biomass. In the revision, it is important to clarify which aspects are maximized (i.e., the goal function) and which variables are optimized (i.e. values that are associated with the maximization of the goal function). Also, it would be really helpful to already describe the relationships (Fig. 3) in the introduction because it is central to the formulation of the model.

Minor comments:

- Why did the authors chose to maximize biomass rather than NPP or carbon profit? Are these attributes related in the model output?
- An overview at the beginning of the methods section would be very helpful that describes the main state variables of the model, the goal function, and the parameters that are being optimized.

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- It would be very helpful if the variables in the equations are single letters, and use subscripts to differentiate these. At present, some variables, e.g. $C A$, look like the product of two variables, C and A .
- The description of the surface energy balance in the appendix uses different symbols for the same fluxes, which is confusing. Please use the same symbols throughout the whole manuscript!
- Eqn A1 is referred to before it is explained. Also, a reference is made to Appendix A in Appendix A, which is rather strange...
- Note that "effect" is a noun, while the verb is "affect" (in most cases). There are a couple of places in the manuscript where this is misspelled.

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