**Geoscientific
Model Development**
Discussions

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 #1

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General comments:

This is a very interesting paper about the theoretical physical description of the impact of canopy patchiness on biomass production along aridity gradients. A new model able to represent key feedback mechanisms is presented. The F90 source code is provided as a supplement material. The model capitalizes on the LPJ dynamic vegetation model and on pre-existing land surface models (ISBA-A-gs and TESSEL). Although this work deserves to be published, many aspects of the model implementation, testing and validation need to be better described and justified. For example, the limitations of the approach are not sufficiently described. In the present version of the text, it is difficult to understand whether or not soil hydrology (2 layers) is consistent with a detailed

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root profile, radiative transfer within vegetation is consistent with patchiness (impact of clumping on light absorption ?), etc. Although the new model represents many feedbacks, other (biological / soil) feedbacks may be at stake in the real world. For example, what about competition between grass and trees ? Impact of the soil water holding capacity ?

Recommendation: Major revisions.

Particular comments:

PP. 4603-4604: Title sounds different from the contents of the abstract. Is the objective of the paper to present a new model or to propose an interpretation of the vegetation patchiness in semiarid regions ? "BOSVM" is used in the title only. For the sake of clarity, title should be modified.

P. 4606, L. 16: the work of Dardel et al., Re-greening Sahel: 30 years of remote sensing data and field observations (Mali, Niger), Remote Sens. Environ., 2014, could be cited as it shows that soil type is a key driver of the vegetation response to climate in Sahel.

P. 4610 (Sect. 2.2): It is not clear how plant growth is related to photosynthesis.

P. 4611 (Table 1): please check the Dmax units in Table 1.

P. 4611 (Eq. 9): The vegetation cover fraction changes with time. Is the (carbon) mass conservation ensured ? How ? Same question for soil water mass conservation.

P. 4612, L. 21 (Table 1): the gamma value for grass indicates that C3 grasses are considered, not C4 grasses. In west Africa, are C3 grasses frequent ? I would expect C4 grass species are more frequent than C3 grass species.

P. 4617, L. 11: "stomatal opening until very dry" ; I suppose that this depends on the parameters of the model and how the drought-tolerant parameterization is implemented ?

P. 4620, L. 19: It would be useful here to detail the time steps of the various processes

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(e.g. hourly for photosynthesis ? Daily for biomass ?)

P. 4620, L. 21: This is the first and the last time we see a map of west Africa. This is confusing. Were continuous model simulations performed over this area ? If yes, what do the simulated variables (e.g. LAI) look like ? Are they consistent with published satellite or in situ observations ?

P. 4621, L. 15: using CA/CAref in Fig. 6 (instead of CA) would be more appropriate.

P. 4622, L. 24: please explain why WUE increases.

P. 4626, L. 5: why 87 grid cells ?

P. 4627, L. 24: "fc-Rspace feedback" should be defined here. Do you refer to Eq. (25) ?

P. 4632 (A2, Table 1): why are the "defensive / offensive" columns omitted for grass ? The two parameterizations are considered in a number of figures. The corresponding parameters should be indicated in Table 1.

Figures 7-9: (a, c) why not exploring values of alpha higher than 0.5 ? (b, d) what is the meaning of the crosses ? Do they correspond to various values of D and alpha ? Please explain

Editorial comments:

Figures 6-9: the scale for D is quite strange. It seems that what is plotted is a complex function of D, not D.

P. 4608, L. 3: "Obkhov" ?

P. 4608, L. 19: "In stead" ?

P. 4610, L. 10: "exists of" or "consists of" ?

P. 4610, L. 12 (Fig. 1): please explain Fig. 1 more extensively. This figure could be split into 4 figures.

P. 4610, L. 17 (and Eq. 5): this is not "shoot-root ratio", Eq. (5) corresponds to the "shoot-total biomass ratio". This is confusing. Either change Eq. (5) or rename alpha.

P. 4611, L. 13 (and Eq. 8): is it "between relative LAI and relative CA" or "between relative LAI and relative CA" ? This is confusing. Either change Eq. (8) or rename D.

P. 4612, L. 2-6: this is difficult to understand as it was not explained in which order the variables are calculated. Refer to Figure 4 here ?

P. 4617, L. 11: "remaining" or "maintaining" ?

P. 4618, L. 15 (Fig. 3): please use colors.

P. 4622, L. 21: "coefficiences" ?

P. 4623, L. 11: "different with" ?

P. 4626, L. 23: "effect" or "affect" ?

P. 4627, L. 19; "addtion" ?

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