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Interactive comment on “Appraising the capability of a land biosphere model as a tool in modelling land surface interactions: results from its validation at selected European ecosystems” by M. R. North et al.

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REPLIES TO REVIEWERS COMMENTS

We thank the reviewers for providing their comments to our manuscript. Their feedback comments have been very useful in further improving the manuscript. Responses to the comments are provided in detail below. We are happy to provide more details or incorporate any further suggestion in any aspect of our work, where it might be required.

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REVIEWER 3:

R3C1: P224L11-13: Considering the high temporal resolution of the model, maybe this line describing the SimSphere that represents "various physical processes" is a bit vague, and it also repeats with P226L5-6. For instance, there are various physical processes going on in the soil-plant-atmosphere component, but the model simulates water and energy fluxes (the SVAT component) as well as CO₂ (but not C explicitly, neither nitrogen). The leaf stomatal conductance (i.e. resistance) is the key parameter in coupled H₂O and CO₂ exchange in SVAT models, which controls the diffusion rate of H₂O and between leaves of plants and the ambient air. As it is assumed that stomatal conductance depends on the bio-physical-chemical properties of the leaves (C3, C4, CAM), and on environmental conditions (e.g. solar radiation, air temperature, water vapor deficit), how is this accounted for in the model, especially the former one? ANSWER: We thank the reviewer for the recommendation, the wording "various physical processes" has now been changed (throughout the revised manuscript as well). The model formulation section has now undergone several major revisions, and now better describes the model initialisation and also how various parameters are accounted in the model. The stomatal resistance is described and outlined in section 2 of the revised manuscript.

R3C2: P224L16-21: In relation to the above comment, it is difficult to understand how the model takes into account the vegetation in the physical component? Vegetation is too broad term and as such, to my opinion, is not very useful in climate change studies that focus on vegetation types and species responses. So, can user specify the type of vegetation i.e. is that an input parameter to the model? Because that determines many other parameters and state variables (LAI, root i.e. soil water content, etc). Because again on P229L24-25 the vegetation component is not explained well. ANSWER: So further details have now been added to the revised manuscript regarding the 'vegetation component' of the model. Major revisions have now been done in section 3.3 (p229-L24-25). Regarding p224 L16-21, Figure 1 shows the vegetation component

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under the 'horizontal' facet of the diagram. Figure 1 is merely a representation of all of the models considerations, and perhaps understates the importance of vegetation in its structure. However, I have amended the text to reflect the importance of vegetation and how the user can force the model under different vegetation conditions in this section, I hope it reads clearer now.

R3C3: Also from tab. 1 it seems that the model have "PLANT" module, but this is not explained well in the text. ANSWER: Yes, we agree with the reviewer. The plant parameters have now been defined and explained in the SimSphere Parameterisation and Implementation section (Section 3.3) of the revised manuscript.

R3C4: P228L1: which "above equation"? ANSWER: We thank the reviewer for highlighting this mistake, it has now been corrected in the revised manuscript.

R3C5: P229L11-12: How the models' horizontal domain refers to an area of undefined size i.e. how then fluxes are converted to meaningful units for policy-makers, e.g. per m² or ha? It would be good if authors have explained this better or reformulate the sentence. ANSWER: thank the reviewer for his comment; the related sentences have now been reformulated in the revised manuscript and also a sentence has been added which explains this point, thus making now much the meaning. Basically, it is the parameter of fractional vegetation cover which is defined that is providing the proportions of the % cover of bare soil and vegetation from which are then estimated parameters are scaled to the units of measurement provided.

R3C6: P237L2: but this study does NOT evaluate any water budgets?! ANSWER: This sentence was aimed at stating that we have successfully validated several key variables of the Earths energy and water balance (I have removed the word budget from text, sorry about this confusion). This error has been corrected throughout the revised manuscript.

R3C7: P237L15-until end of paragraph: it seems from fig. 3 that the model is much less accurate to predict Rnet for places where more energy is going out than com-

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ing in (negative net radiation). Maybe a comment on this-why would it be so? ANSWER: We thank the reviewer for this comment. We think this is in part related to the daytime/nighttime conditions and the way those are modelled in it, but it is certainly requiring a further investigation in the future.

R3C8: P240L1-2: Yes, but for the studied variables, we don't know if that is the case for CO₂ fluxes and also for the water within the SVAT system. Mention of the evapotranspiration has not been made, but that is the largest consumer of water and energy in the SVAT system (normally most water added to the (agricultural) system would evapotranspire from it). ANSWER: This has now been changed to reflect that there was good observed simulation accuracy for only the model outputs were chosen to validate.

R3C9: I think the last two paragraphs in the discussion are too long and repetitive and may be shorten on the cost of discussing other relevant points. e.g. how the present study contributes to regional-global climate change investigations, considering the model is detailed, point-scale, and requires hourly data that are arguably the most difficult to obtain. Also, how the simplicity in the representation of the soil reflects on the results? This is also in relation to the Kramer model criteria mentioned on P240L1-2. ANSWER: We have made an attempt to reduce the content included in the last two paragraphs of our manuscript; yet, we do feel that it is important to maintain the comments we have maintained in the revised manuscript. Also, we have made some comments related to the reviewer suggestions on what should be added at the introduction and we think it would be somehow a repetition to comment again on the same also in discussion. However, if the reviewer considers it as necessary we are happy to accommodate this request.

R3C10: Also, I think the conclusion is too long and repetitive, it may be shorten to the point and finish with the existing future research. ANSWER: This has now been addressed and the conclusion is now shorter. Future research is addressed within the penultimate and final paragraphs.

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