

Anonymous Referee #2

The authors have done an excellent job at responding to my comments. The VEG3D model is much clearer now. I have a few minor comments that would further strengthen the manuscript, but I leave it up to the authors to decide whether or not to include these revisions.

- Thank you very much for your positive assessment and constructive suggestions.

1. I am a fan of simplified models. In their response to comment 1b, the authors provide a strong defense for simplified models with the statements: "In order to get to the bottom of these fundamental processes, the use of a less complex model can even be beneficial. In such a model, the degrees of freedom are reduced and functional interrelations can consequently be deduced more easily." This is never said in the manuscript. What not acknowledge up front in that VEG3D is a simplified model? This could be added in lines 62-69. Or perhaps the authors do not think VEG3D is simplified?

- thanks for this suggestion. We added the following statement about the benefits of less complex models to the manuscript.

Lines (329-334):

"These different evapotranspiration responses must rather be caused by a fundamental mechanism, which is simulated in both, classic as well as complex LSMs. In order to get to the bottom of these fundamental processes, the use of a less complex model can even be beneficial. In such a model, the degrees of freedom are reduced and functional interrelations can consequently be deduced more easily. Therefore, by means of a sensitivity study with this less complex CCLM-VEG3D model, in which the surface roughness of forests was reduced to grassland (ROUGH), this fundamental mechanisms behind the varying evapotranspiration rates of forests and grasslands could be clearly revealed:"

2. In their response to comment 2a, the authors reference Table 1 of Breil et al. (2020) to justify parameter choices (comparable to those used in other models). Why not say this in the manuscript, too?

- we added the following statement to the revised manuscript:

Lines (123-124):

"The values of these six vegetation parameters in VEG3D are in line with the parameter values used in other state of the art LSMs (Breil et al., 2020)."

3. The revised description of the aerodynamic resistance is good. One minor suggestion is to change "reflected" to "included". A quick reading of the sentence might make readers think that the "transport of water vapor" is a reflection from the surface. What you are really saying is that r_a accounts for turbulent transport of water vapor. Also, it is not clear what (a) refers to following c_{veg} (line 91) and (b) following surface roughness (line 105). My reading of the equations is that three vegetation parameters affect r_a : LAI, c_{veg} , and z_0 , but that (citing Goudriaan 1977) z_0 is thought to be the most important. If this is the intent, it could be said more clearly.

- we changed "reflected" to "included", according to your suggestion. Furthermore, we agree that this paragraph could be written more clearly. This is done in the following way.

Lines (104-106):

"According to Eq. (4) and Eq. (5), r_a is consequently affected by three vegetation parameters, namely a plant specific parameter c_{veg} (a), the surface roughness z_0 (b) and the LAI (c). But out of these three parameters, the influence of the surface roughness (b) on r_a and thus, on the transfer coefficient c , is clearly dominating (Goudriaan 1977)."

Anonymous Referee #1

I would like to thank the Authors for replying and resending the paper.

- Thank you very much for your positive assessment and constructive suggestions.

However, at this stage I do have one main comment, which I found needed to the emerging results: This is with regard to the comment on the differences between observation and model outcomes in the large dry region. In their answer the authors commented that "...While observational data reflect the local differences between forest and grassland transpiration rates, in our simulation setup, large-scale forestation scenarios are applied to analyze the general transpiration responses to forestation in an idealized and isolated way. It is therefore very difficult to assess the model results quantitatively and qualitatively...".

Then that the: "... eddy covariance flux towers) reflect the local transpiration responses to forestation (Bright et al., 2017), in the CCLM-VEG3D simulation setup, large-scale forestation scenarios are applied to analyze the general transpiration responses to forestation in an idealized and isolated way ...".

And last (which was not much of clear for me) that: "...a physically consistent explanation for this phenomena, in which the evapotranspiration responses are described as an interplay of two factors, namely the reduced vapor pressure deficit in forests facing their evapotranspiration facilitating biogeophysical characteristics. ..."

These statements need explanations to what behind the differences and best, if exist, to provide evidences for screen (i.e., air at 2 m) not surface (i.e., skin; Fig. 6) temperature and humidity differences between forest to grass ecosystems in published papers.

- it seems that we were not able to satisfactorily demonstrate that model results and observational data are difficult to compare, regarding the effects of land use changes. Therefore, the corresponding section is rephrased and the included statements are underpinned by additional references.

Lines (383-388):

"However, it is generally difficult to assess the effects of afforestation by a direct comparison of the CCLM-VEG3D model results with observational data, due to discrepancies on the scale of processes considered in models and observations (Davin et al., 2020). In observational data (satellite data as well as data from eddy covariance flux towers) forests and grasslands in immediate vicinity are compared. Differences in the measured fluxes are therefore directly related to the local land cover differences (Bright et al., 2017). In contrast, differences in model results for forests and grasslands are additionally affected by large-scale atmospheric feedback processes (Winckler et al., 2017)."

Since part of the differences between the ecosystems are not included in the model I would even recommend to consider limiting the model to the seasons within the model capability to assess more directly the vegetation performance.

- the study is already focusing on the summer season

The sentences in lines 374-8 are unclear

- this paragraph is rephrased:

Lines (377-382):

"Since this weighting is model-specific, slightly different evapotranspiration responses of forests and grasslands are anticipated for different model simulations. Moreover, different evapotranspiration responses can also be expected within observational data, since the biogeophysical characteristics of forests and grasslands vary also in nature (Garratt, 1993; Henderson-Sellers, 1993; Schenk and Jackson, 2003). Taking these uncertainties into account

differences between the CCLM-VEG3D results and observations, as present in Southern Europe (Rohatyn et al., 2018), can potentially be explained.”