

## Answer to Anonymous Referee #1 RC C81

black: referee

blue: answer

### General

This is a quite extensive article about a new computational methodology that can be used together with gap-models to cover a high number of sites, particularly for screening a large area for sensitive regions that then can be explored in more detail. One of the reasons why it is so extensive is that at the same time new parameterizations of a couple of tree species for the LPJ-Guess model are presented and evaluated with Swiss forest inventory data. I would have preferred if the parameterization had been done separately, although this is not a mandatory request.

For the evaluation, the new method has been implemented into two gap models and results are compared with runs not using the method. While it is a good proof of applicability, this further complicates the article. In fact, using the TreeM-LPJ model together with the GAPPARD methodology makes only limited sense (since a classical gap approach is not used), which is also apparent from the rather bad results (although I know that it is relative what 'good' or 'bad' means in a world of uncertainty and deficits). Therefore, it should be considered to skip this part of the model comparison (also, the description of the model refers to Scherstjanoi et al. 2013 which is only submitted yet).

We agree that for the GMD paper it would be better to skip the TreeM-LPJ-GAPPARD application. Therefore, we adjusted the whole article.

The authors first chose to include TreeM-LPJ-GAPPARD because it played an important role in the PhD thesis of the main author. There, a chapter similar to the first version of the submitted paper exists, so that the application of GAPPARD to TreeM-LPJ is scientifically still available. This facilitated our decision to remove it from the paper.

Having this mentioned, the papers topic is highly interesting and probably relevant to a number of gap-modellers who are running their models, i.e. LPJ, at increasingly larger regions. So it is principally also in the scope of GMD. I also couldn't find major inconsistencies or errors and apart from a few sections (mentioned below), it is relatively well written and outlined. As in many such cases, I got the feeling that the results are interpreted over-enthusiastically and some more care should be paid to a number of statements (also in the abstract, which is otherwise okay). Overall I got the feeling that some work had been put into it already.

### Specific

P1023, L5: add 'are' after 'surface'

changed

P1023, L24: there is a broad use of the term 'hybrid'. Being first use to combine yield models with community models (Dale et al. 1985), it has later on being mostly used for combinations of process-based and gap type models (Friend et al. 1993) or (mostly) process-based and yield models (e.g. Battaglia et al. 1999). So please define what you mean or (better) don't use the term here (and elsewhere).

replaced the term "hybrid model"  
by "second generation model"  
and adapted the introduction of these kinds of models

P1025, L25: delete 'therefore'

changed

P1025, L2ff: paragraph could be shortened. I am also curious how mortality is treated in undisturbed runs.

added explanation to section "Basic assumptions"

P1027, L6ff: The timestep of the model is one year, correct? So it doesn't matter at which season the disturbance occurs?

Yes this is correct. Same as in LPJ-GUESS. I added "yearly time step" to section "Basic Assumptions".

P1028, L20: There is probably one 'distribution' too many.

No it is not. There was an "individual" missing.

P1029, L6: delete the second 'starting'.

changed

P1030, L11ff: Reconsider wording at several places (e.g. 'bottom' instead of 'floor', input data for simulations but not 'stands' are derived from climate data, 'Modified' not 'changing' climate is applied). Some shortening is also possible.

Changed all suggestions but 'modified'. No, it is really 'changing climate' we applied. But maybe the term is misleading. Now we say 'climate change data'.

P1032, L17: What does RID stand for?

This line is to define RID. To what it stands for one can find right before the brackets. I added capital letters to make that more clear.

P1035, L14: Generally, the statements are a bit over-optimistic giving this statement (and looking at the figures)

Actually, we in fact were able to simulate the shifts of carbon mass over altitude. Maybe it has not been clear what shifts we meant. I made some changes on the previous sentence, and added "altitudinal" before "shifts" to avoid misunderstandings.

P1036, L7: 'pubescens' not 'pubescence'

changed

P1037, L10: 'The comparison ... shows' or similar

changed to "Our comparison..."

P1038, L9: 'speed' instead of 'times'?

I think 'simulation times' can be used. It is clear, that we mean 'per simulation run'. I would only use 'speed' if it is 'per run', 'per simulation period' or similar.

P1039, L4: Does 'using existing parameters' mean that the same set of parameters is used for all pine species? Or do you mean that the available processes in LPJ are sufficient to represent the behaviour of p. mugo and p. cembra – I suspect the latter.

changed to

'We were able to include both Pinus species without the necessity for an adaptation of existing model functions.'

Also, given the scope of the paper, I would avoid the term 'main achievement' here.

changed to

'One achievement of the parameterization'

P1040, L12ff: Here is a bit of a contradiction. If modelling fire is really important (as stated) you shouldn't be able to exclude it and still claim that the forest dynamics could be represented.

changed to '...could be important for area wide simulations of the modeled region.'

P1040, L17-18: Very strange wording.

I replaced 'are' by 'may be'.

P1040, L23ff: Does that mean you think spruces are currently suppressed by management? This seems very unlikely to me.

Spruces are not really suppressed, but Larches were promoted more. I also proofed this with literature.

P1041, L1: delete 'here'

changed

P1041, L25: Either the model underestimates drought events or the climate input has been wrongly scaled to the landscape. The underlying data are probably correct.

replaced

" suggesting that the climate data that we used may underestimate drought events"

by

" suggesting that the downscaled climate data that we used may underestimate the climate variability, and thus drought events"

P1043, L4: Why does the paragraph start with a summary?

It is a key section. The paragraph is to give the reader an introduction and also to name similar approaches.

P1044, L8: avoid expressions such as 'acceptable' or provide an objective means of what is acceptable.

replaced by

'However, using this simplification concerning extreme climatic events, we nevertheless met our goals,..'

P1044, L13: 'specific' instead 'certain'

changed

P1044, L20: what does this mean 'were treated as if they were'?

replaced by

'...but with our method we assume they were.'

Also the following sentence is quite unclear.

replaced

'while in LPJ-GUESS in every spinup year again the same potential exists to randomly draw more extreme values out of the reference period (first 30 yr of 20<sup>th</sup> century), which then can influence succession after disturbances, with our method only conditions of the first year of the SWD are responsible for the establishment.'

by

'while in LPJ-GUESS in every spinup year again new climate data randomly are drawn out of the reference period (first 30 yr of 20<sup>th</sup> century), with our method the conditions of the first year of the SWD

are most responsible for the establishment. Thus, chances to draw extreme values out of the reference period are higher in LPJ-GUESS, which then can influence succession after disturbance.'

P1047, L20: Equation A1: If md (the number of days with full leaf cover) is a species specific parameter and the function is only used for Larch, then you will either use the above or below equation and don't need both – correct? If md is somehow calculated please indicate how.

The number of days with full leaf cover is not a parameter. Leaf cover or leaf phenological state is an auxiliary variable in LPJ-GUESS. It mainly depends on the climate.  
I added 'due to the LPJ-GUESS leaf phenology function' to make this clear.

P1050, L18: I don't get it. 'Leaves of all species are equally distributed vertically' – do you mean within a size class? Certainly different size classes have different access to light?

I mean that the leaf area of one individual is equally distributed vertically - from ground to treetop. Different height classes have a different access to light, due to shading from other trees and self-shading.

replaced

'We did not use a bole height to calculate the daily fraction of incoming photosynthetically active radiation. In other words, leaves of all species are equally distributed vertically.'

by

'We did not use a bole height to calculate the daily fraction of incoming photosynthetically active radiation (PAR). In other words, the leaf area of all species and the foliage layers to calculate the PAR for are equally distributed vertically from ground to treetops.'

P1060, Table 2: units of latitude and longitude?

added projection method and units

P1061, Table 3: Does that mean newly parameterized species perform particularly bad? Why's that?

No, it is mainly *Larix decidua* and *Quercus pubescens* that vary most from the data. This is also the message of the table. Why both species perform badly is analyzed in the discussion chapter.

P1067ff, Table D4ff: Indicate 'site number' or similar above a-h.

changed

P1063, Fig. 4, 5, D1, D2: Difficult to read and I don't see the usefulness for the article here.

We found the content of Figs. 4, 5, D1 and D2 to be important, to present detailed inventory data and LPJ-GUESS simulation results on each plot. In contrast to the other figures it also includes information of the data range of the NFI data.

However, as Figs. D1 and D2 contain the whole information we found Figs. 4 and 5 to be redundant and decided only to keep D1 and D2.

We increased the line width of the plots to improve the readability.

Furthermore we changed the x and y axes range due to a decimal error.

## Additional changes

Changes due to the comments of Anonymous Referee #2 RC C199

We included the former sections 2.1 and 2.2 into the introduction, because they only sum up existing methods. Moreover, some of their content already was included in the introduction, and thus redundancy occurred.

Abstract, p.1022, line 10  
deleted ",and to explore patterns of spatial scaling in forests"

Abstract, p.1022, line 24  
replaced " With GAPPARD applied to LPJ-GUESS results were insignificantly different from the output of the original model LPJ-GUESS using 100 replicate patches, but simulation time was reduced by approximately the factor 10."  
by " We obtained results insignificantly different from the output of the original LPJ-GUESS model that uses 100 stochastic replicates, but simulation time was reduced by approximately the factor 10."

Abstract, p.1023, line 1  
replaced " and comparisons with large-scale datasets and forest models"  
by " and comparisons with large-scale datasets and results of other forest models"

replaced  
'Pinus Montana' by 'Pinus Mugo' in figures and tables

renewed AppendixC