

text of referees in italics
reply from authors in plain text
changes in manuscript in red

Anonymous Referee #1

First, we should note that there are 3 types of terrestrial vegetation models: (type 1) big leaf models, (type 2) truly individual-based models, and (type 3) approximated models for a truly individual-based models. Each model has own strength and weakness. Type 1 models are the most computationally efficient. Since your model is type 3, what is your strength over type 1? You evaluated your results based solely on carbon balance. However, a well-parameterized big leaf model can reproduce carbon balance like this (or better). So, you must provide some aspects of your results that show the uniqueness of type 3 models over type 1 models. I suggest to show a map that describe plant type distributions.

In fact, technically one possibility would be to simulate vegetation dynamics with the LPJ-GUESS population mode (equals the LPJ-DGVM model, uses big leaf approach). For two reasons, with regard to contents it would not bring the paper much further. First, Smith et al. (2001) and Hickler et al. (2004) already demonstrated the advantages of the LPJ-GUESS cohort mode over the LPJ-GUESS population mode, which especially take effect in mixed forests, and drought affected or frequently disturbed forests. Second, the LPJ-GUESS disturbance function is not implemented in the population mode. Including the effect of small scale disturbances requires a gap model approach which only the LPJ-GUESS cohort mode is using.

To make more clear that we exclude the big leaf approach from the beginning on we replaced the sentence in the Introduction (Page 1537, lines 4-6):

"However, the first generation DGVMs did not take into account forest structure, and showed limitations in modeling competition and disturbances (Quillet et al., 2010)."

with

"The first generation DGVMs simulate the vegetation of one plant functional type or species in a stand aggregated in one individual (big-leaf approach).

Therefore, they do not take into account forest structure and show limitations in modeling competition and disturbances (Quillet et al., 2010), which might especially affect mixed forests and the vegetation growth under dry conditions (Smith et al., 2001).

Comparing against ED, you said "GAPPARD has a higher computational efficiency but on the cost of less precision on smaller time scales." I am very interested to see differences between your results and ED. Can you show us a case study?

We have to admit, that our assessment about ED at the moment cannot be proven. Unfortunately, there is no such case study. Therefore, we changed our formulation (Page 1538, lines 21/22):

"Hence GAPPARD has a higher computational efficiency but at the cost of less precision on smaller time scales."

to

"Hence, and also due to a lower spatial resolution in ED (Moorcroft et al. 2001), GAPPARD has most likely a higher computational efficiency. However, this increase in efficiency comes along at the cost of less precision on smaller time scales."

What is the ultimate goal of your model? A regional model only for Switzerland? Or for the entire Europe? Or to cover the whole globe? If so, what do you need to fulfill your intension in the future studies?

The main goal was to apply the GAPPARD method successfully on a country-wide scale. I think, we met this aim. From a technical point of view, one could easily apply the method to any scale and any model that uses the Gap Model approach and that does not include interactions between neighboring grid cells or patch-to-patch interactions. From an ecological point of view the biggest challenge would be to parameterize all relevant species in the modeled region.

To address this issue we added the following sentences to the end of the Conclusions and Outlook section:

"In this paper, we successfully applied the GAPPARD method to simulate climate change effects on forest dynamics over the whole of Switzerland. We are optimistic that it can be used for any scale and any model that uses the Gap Model approach and that does not include interactions between neighboring grid cells or patch-to-patch interactions. Regardless of whether using GAPPARD or not, if applying LPJ-GUESS to different regions one big challenge will be to parameterize all relevant species."

Hisashi Sato

(1) P1552, L20, "to forest" What do you mean?

Changed the formulation

"Still we favored these distributions to forest compositions derived from..."

to

"Still we tend to favor these distributions over forest compositions derived from..."

(2) P1552, L23_24, "the spatial representation of the plot based NFI-data is challenging" How challenging? Why it can be a reason to employ the data?

Changed the formulation

"the spatial representation of the plot based NFI-data is challenging."

to

"it would be challenging to extrapolate the plot based NFI-data in space."

(3) P1552, L24_27 I cannot follow the logic of this sentence.

Changed the formulation

"Furthermore, since the existing LPJ-GUESS parameterization was built to simulate a PNV, it would mean more substantial changes to LPJ-GUESS if actual forest dynamics were modeled (e.g. changed effects of seedling chilling parameters if trees are planted)."

to

"Furthermore, the existing LPJ-GUESS parameterization is according to a PNV. Hence, a comparison to actual forest dynamics would require to take into account management effects and would most probably cause additional changes to the LPJ-GUESS parameterization (e.g. reduced sensitivity of seedlings to chilling if trees are planted, i.e. surpass the seedling stage)."

(4) P1555, L6, "und" It should be replaced by "and".

Changed that!

(5) P1557_1558, Appendix A Please refer tables A8 and A9.

Added

"A summary of all used parameters is given in Tables A8 - A10."

to the end of Appendix A

(6) P1557, L23 "However" I think this is not an appropriate conjunction here.

Replaced

"However, Migliavacca et al. (2008) also found that..."

with

"This is also in accordance with the findings of Migliavacca et al. (2008) who reported that"

(7) P1558, L3, "pheno(t)" For reader's convenience, I request some more explanations for this variable. Such as "It becomes nearly and 1.0, respectively, when 'tls' is 0.0 and 'dls'".

Added after the equation

"so that phen(t) is close to 1 when the ratio of t1s to d1s is approaching 0, and close to 0 when the ratio is close to 1."

(8) P1558, L11_16 Why you changed the establishment function? I want to know the brief reason with some related citations ideally.

I had to change the establishment function, because the original threshold function of the seedling chilling prevented certain boreal species from growing in temperate stands. For two reasons, we found this threshold character not be an adequate way to include seedling chilling: First, the Swiss boreal species grow in temperate stands if you plant them. Second, Swiss boreal species also naturally appear in temperate regions, although with reduced success. Unfortunately I cannot give any citation that favors a sigmoid curve over a threshold function.

Additional changes

Page 1542, lines 4/5

" , which lead to a simulation setup containing more than 32.000 cells stands."
replaced with

" , which led to a simulation setup containing 32.214 cells."

Page 1543, lines 17-20

For better readability we replaced

"In the following we will refer to it as the adjusted parameter set. To this set, we additionally added the three new species *Larix decidua*, *Pinus cembra* and *Pinus mugo* as described in Scherstjanoi et al. (2013). This includes..."

with

"To this set, to which we will refer to as the adjusted parameter set, we additionally added the three new species *Larix decidua*, *Pinus cembra* and *Pinus mugo* as described in Scherstjanoi et al. (2013). The fine-tuning of LPJ-GUESS includes..."

Page 1547, lines 23-26

"The two newly parameterized species appeared at higher elevations. *Larix decidua* biomass increased gradually from the lower montane vegetation zone up to the subalpine zone. The occurrence of *Pinus cembra* was restricted to the subalpine zone."

replaced with

"Two of the three newly parameterized species appeared as main species:

Larix decidua with gradually increasing biomass from the lower montane vegetation zone up to the subalpine zone and *Pinus cembra* restricted to the subalpine zone."

Page 1550, line 21

"32 214 grid cells"

replaced with

"more than 32.000 cells"

Page 1551, line 23

added "when "

Page 1551, line 23

"leads"

replaced with

"led"

Page 1552, line 20

added citations for InfoFlora and NFI

Page 1554, line 6

Instead of "tc_max" we now use "the maximum 20-year coldest month mean temperature for establishment" to avoid a mix-up with the variable name tc_max_e.

Page 1555, lines 14-16

deleted the sentence: "In contrast, *Quercus robur* and *Pinus sylvestris* benefited from the reduction of *Fagus sylvatica* biomass in the lower and the decrease in the higher elevated part of the Central Plateau." because it was out of context.

Page 1557, line 1

"on a large scale"

replaced with

"on a larger scale"

Table A.10

Made some changes to caption and fixed entries in row tc_max_f.

Text, Figures and Tables

replaced

"Southern, Southwestern, Northern..."

with

"south, southwest, north..."

(except "Northern Europe" and "northern treeline")