Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
https://doi.org/10.5194/gmd-2021-422-RC1, 2022

Comment on gmd-2021-422

Anonymous Referee #1

Referee comment on "Tree migration in the dynamic, global vegetation model LPJ-GM 1.1: efficient uncertainty assessment and improved dispersal kernels of European trees" by Deborah Zani et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-422-RC1, 2022

Deborah Zani et al., Tree migration in the dynamic, global vegetation model LPJ-GM 1.0: Efficient uncertainty assessment and improved dispersal kernels

The manuscript by Deborah Zani et al. presents the implementation of different seed dispersal kernels into a global vegetation model. It extends an earlier study published in GMD describing the tree migration element of the model, and provides a detailed assessment of parameter uncertainties for the newly incorporated migration functions.

Overall, the description of the implementation and the metrics to assess model performance are rather technical, but I think that this is fine for a journal like GMD. It provides a good documentation of the assessed improvements, but the design of the artificial setup used to perform the assessments leaves some open questions – see my major comments below.

Overall, the manuscript is interesting and introduces the reader in a good way to the challenges surrounding the studies (and modelling) of seed dispersal. It is well-structured and well-written, and I would recommend its publication once my comments below have been accounted for.

Major comments:

The study appears to focus on migration of European tree species, but this geographical focus is not mentioned very explicitly. E.g., in the review of literature and observational data (2.1), there appears to be a focus on Europe, but this is not presented until the methods section. I would recommend to mention the European focus early on, also in the abstract and probably in the title.

The choice of the simulation setup is not described in great detail, and is not justified in the text. Does the resolution in the simulation (pixels of 1x1 km) fit with the dispersal distances? Intuitively, my feeling would be that this would require a higher resolution to be resolved, in particular regarding the substantial differences in the tested kernels in the range 0-400 m (Fig. 3), and also in the light of the expected migration rates (Table 1) and the resulting dispersal distances (Fig. 6). I welcome the authors to comment on that and justify their choice of the resolution in the methods section. Apart from that, the authors should explain how the "static suitable climate" (l. 254) was determined. Is this the same climate for all species?

And finally a question about the numbering of model versions: In my understanding, the original publication (Lehsten et al. 2019) presents version 1.0, and the current manuscript describes version 1.1 (l. 129). For clarity, I would recommend to use the new version number in the title, rather than referring to it as an update of version 1.0.

Minor comments and typos:

l. 19 remove comma after "DGVM"
l. 80 "set" is singular, I recommend to alter "minimize" to "minimizes"
l. 97 replace "little" by "small"
l. 98 explain what "seed limitation" means in a dispersal context
l. 163-168 Are examples 1-4 all originating from MacDonald (1993)? This is not entirely clear.
l .196 replace "above-mentioned" by "mentioned above"
l. 297 explain the computation of SI – Is delta y computed as difference of all combinations of 2 points (out of the 5 points sampled)? And how does this match with the 25% value change of delta x? Or is it only the difference between subsequent points? In case of the latter, it would be enough to compute the difference between the outcomes of minimum and maximum of the distribution, divided by the full range of the distribution.
Eq. 5 Equation appears to lack a summation in order to compute residuals. Also, it is unclear why only integer values (l. 329) are used here – migration rate is a continuous variable, right? In more general terms, the use of all integer values between lower and upper boundaries appears to assume a uniform distribution between these extremes. I would suggest that this assumption is mentioned explicitly.
l. 345 are the fat-tailed kernels implemented to represent the long-distance dispersal only (so only the second pdf in Eq. A3), or do you use them to represent both? And are the results displayed in Fig. 3 and Fig. 6 representing the LDD part only, or the combination of both?

l. 353 ensure that you mention earlier that you have selected five kernel functions – it is only clear from the table which five functions are meant here.
Eq. 6 Add a reference for the equation, or explain the equation in more detail (e.g., where the square root of 2 comes from).
l. 391 replace "variable" with "variables"
Eq. 8 and its explanation (l. 391) ensure that subscripts are corrected – p and r appear to be functions of both i and l
l. 411 replace "lead" with "leads"
l. 574 replace "high leptokurtosis" with "high kurtosis" or "leptokurtic"
l. 590 replace "fat-tail" with "fat-tailed" for consistency