

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-304

Anonymous Referee #1

Referee comment on "Novel coupled permafrost–forest model (LAVESI–CryoGrid v1.0) revealing the interplay between permafrost, vegetation, and climate across eastern Siberia" by Stefan Kruse et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-304-RC1>, 2021

The manuscript presents the coupling of an extended version of the model LAVESI, which addressed Siberian larch forests but now can also include further species, with a permafrost model, CryoGrid. The developers of both models are in the authors team. The question addressed is how forest structure and permafrost soil features might change under climate change. The authors show that the coupling with the CryoGrid improves the realism of LAVESI.

The topic addressed is important, the manuscript well prepared and written, and the design of the models, their parameterization, and application look sound. I was a reviewer of the original version of LAVESI and was happy to see its improvements.

Both models are complex and getting them parameterized and then linked was a major effort. Describing this effort takes a lot of space and has been done in all detail.

Nevertheless, it might be worthwhile to start the Methods section with a short characterization of both models, for LaVESI including the original one and the revised one. One way to do so could be filling in a Table for both models with the information required by the Overview part of the ODD protocol for describing models. This would allow readers who are less interest in technical details, at least upon first reading, to get a complete overview of the scales, entities, state variables, and processes included in both models. A detailed description of the scheduling of the combined models process would also be helpful, to better see via which variables both models interact, and how the different temporal resolutions was dealt with. (If all this is described in the Supplement, please refer to the Supplement more explicitly, and more specifically).

The only thing I stumble over while reading with the 20 cm resolution of the

"environmental grid" - where does this resolution come from= From the original DEM?

There are some general comments on the the quality of the model predictions in terms or realism (i.e., validation, corroboration). I think this should made more explicit, and more specifically linked to the results. While there might be no single data set allowing for a comprehensive validation, putting different aspects together might help convincing readers that this not only a technical exercise, but indeed improved the predictive capacity of LaVESI. Perhaps, in the sense of pattern-oriented modelling, another Table might make sense which list which aspects of the model output match observations - even if only in the widest, or qualitative way.

Overall, I think this is a great contribution to the modelling of Siberian forests under climate change and, hence, to improving predictions relevant for assessing the global carbon cycle.