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Interactive comment on “Improving a plot-scale methane emission model and its performance at a Northeastern Siberian tundra site” by Y. Mi et al.

Anonymous Referee #1

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Y. Mi et al. Improving a plot-scale methane emission model and its performance at a Northeastern Siberian tundra site. BGS discussions (bg-2013-525):

Overall: Improvements of CH₄ parameterization are vital for our understanding of the Arctic and how environmental change in the region affects production of this important greenhouse gas. It is also an important tool, to be able to scale plot measurements in both time and space, and may potentially increase the usage of historical flux data and put these measurements into a wider geographical perspective. From this perspective I certainly appreciate the authors efforts to improve the functionality of the Peatland-VU CH₄ model, and make use of a long time series of measured CH₄ fluxes going 10 years back in time. Where I do get a bit reluctant, is when it comes to testing of the improvements to the VU model against a dataset that the authors repeatedly

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express their doubts about the quality of. This leaves the reader with the impression that the test is inconclusive, and that it is uncertain if it is the changes that have been made to the model are actually improving the performance or if it is the dataset which those are tested against, that holds the problem. Scientifically, a negative result is as valuable as a positive, but if the result is both negative and uncertain, I am not sure if the community can benefit substantially from the present paper, despite that it is well written and otherwise sound.

In this perspective I would suggest that the authors change the focus of the manuscript from testing overall modeling results and the GPP module against the questionable CH₄ flux measurements, towards the two other improved factors of the model, namely the dynamic water table and the soil freezing scheme if field measurements are more certain of these two model additions. I do realize that this change of focus will require a major revision, but as it appears now the GPP module and the lack of verification of the overall CH₄ exchanges, leaves the reader inconclusive with respect to the main focus of the MS. Alternatively, the overall performance of the model could be tested against a higher quality flux dataset, if available.

Specific: P:20007 L:7 ; the other way around I suppose.

P:20012 L:2 ; It's unclear to me how C_{fresh} is obtained.

P:20012 L:5: Eqn. seems to suggest that R₀ and T_{ref}, refers to CH₄ production at a temperature of -14 C – is that correct? Has any flux measurements at all been obtained at those conditions? This may add to the uncertainty.

P:20012 L:20: How well do these models resemble the actual vegetation composition and GPP at the sites?

P:20014 L:10: It seems to me, that it makes a difference if values are optimized through measurements or found in literature. Which are found where?

P:20015 L:7: Words missing?

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P:20017 L:1: Difficult to understand, please explain in more detail

P:20018 L:19 and figs. 6+7: it is very difficult to assess from text or figs. if the model captures any of the measured variation at all.

P:20019 L:13 + fig 8: I am not sure that I understand the intention with this figure and accompanying text without any measurements to support model findings.. The parameters used to explain development in CH₄ emission is exactly those used to drive the model, and the connection is therefore not surprising. We're left without any clear idea if the model is improved or not.

Figures 9+10: it is difficult for me to see, that we'll gain much from a sensitivity analysis of individual model parameters, when we're still uncertain of the overall model performance.

P:20020 L:9: How did you select the high quality data from low quality data? And shouldn't the latter be discarded entirely?

P:20020 L:18 and 22: Confusing: model performs better without GPP module or improvement is insignificant (no change)?

P:20022 L:2 and L8-9: I suggest that you put emphasis on these aspects.

P:20023 L:14: it is unclear to me how this conclusion can be drawn because the measured data cannot confirm or reject if the model is capable to investigate spatial or temporal flux patterns. The uncertainty in the measured static chamber fluxes and the role of ebullition,. Is well known to scientists in the flux community, but is unfortunate here because the data is used to verify a model.

P:20025 L:15-17: The whole idea of the MS becomes unclear if you have nothing to validate against.

P:20026 L:3-5: I don't get this; if more (good) data makes the model perform worse, it must be the model, which is inadequate.

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