Biogeosciences Discuss., 10, C9140–C9143, 2014
www.biogeosciences-discuss.net/10/C9140/2014/

Biogeosciences Discussions
Open Access

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

Y. Mi et al.

y.mi@vu.nl

Received and published: 10 March 2014

Comment: Improvements of CH_4 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 CH_4 model, and make use of a long time series of measured CH_4 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 express their doubts about the quality of. This leaves the reader with the impression

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

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 CH_4 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 CH_4 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.

Reply: We would like to thank Anonymous Referee #1 for the detailed and constructive comments on our manuscript: Improving a plot-scale methane emission model and its performance at a Northeastern Siberian tundra site. Here are our responses to the general comments. Responses to the specific comments will be provided after we have received all the reviews.

With respect to the data for comparison with model simulations, we are trying to pass on the message that the spatial and temporal variability in the data is extremely high instead of doubting the quality of the measurements. This is not so much a matter of poor data quality, but we think it is inherent to the nature of the system and the measurement methods. Measurements of CH_4 flux on similar vegetation but at various locations – with otherwise the same conditions – show high variability, although there

BGD
10, C9140–C9143, 2014

are consistent differences between vegetation types. In addition, temporal variability of measurements on the same spot is high. Besides, abrupt release of CH_4 such as ebullition from wet sites is not well captured. These are general drawbacks of CH_4 flux measurements using chambers and are inevitable. We do realise that wordings in certain sentences of our text might be misleading, such as line 9 in page 20020. We will rephrase this and make it clearer. However, we fully agree with the referee that a better dataset, such as eddy covariance measurements, to test against the model performance is preferable when available. Although such a test is not straightforward, it is described in another publication using the same site and model (Budischchev et al., submitted). We also would like to stress here that all plot scale CH_4 flux models, that we are aware of, have been tested using chamber flux measurements.

Furthermore, this study aims to improve the mechanism of the model. The simulations show realistic patterns in terms of magnitudes and seasonal fluctuations in sites with different vegetation types. Some mismatch in long-term comparison should not compromise the capability of the model. Nevertheless, the Nash-Suttcliffe efficiencies in the sensitivity analysis section demonstrate that the model captures part of the variance in data. Previous model tests with the same method, using a much smaller dataset of one or two years (Van Huissteden et al., 2009, Parmentier et al., 2011) have shown that better model fits (Nash-Suttcliffe efficiencies up to 0.65) have been achieved with shorter datasets. This is the first time that this model, or similar CH_4 flux models, has been tested on a longer dataset. There are no differences in the measurement method; it may simply be caused by the intrinsic temporal and spatial variability.

The advice from the referee on stressing on the improvements of the model performance introduced by incorporation of water table and soil freezing scheme is very helpful and important, we will revise the related sections in the manuscript and

BGD
10, C9140–C9143, 2014

illustrate the results better. On the other hand, as the reviewer says, a negative result is also a scientifically valuable result. The conclusion that this type of model may have reached the limits of its use, given the nature of the data on which it is validated, is also an important message to the community. We would like to keep this message intact.

Interactive comment on Biogeosciences Discuss., 10, 20005, 2013.