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Biogeosciences Discussions

Interactive comment on "Modelling CH_4 emissions from arctic wetlands: effects of hydrological parameterization" *by* A. M. R. Petrescu et al.

Anonymous Referee #2

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General

To estimate the present and future methane emissions from northern/arctic wetlands, modeling tools are needed. The development of the models for general purposes is very demanding because of the high variability in the physical, chemical and biological characteristics of the microhabitats typical for these ecosystems. The present work is a step forward attempting to improve the modeling of methane emissions by considering especially the hydrological part needed in the models. It is well known that water table is even more important than temperature in the regulation of methane release from northern wetland. However, actual data on water table is not generally available and the hydrological regimes have to be modeled from the climatic data as done here. The specific comments are listed below.

Specific comments

Abstract

Page 3196/lines 21-23 It is rather clear that hydrology has to be included in the models predicting methane emissions from wetlands. Here the point is that the hydrology, i.e. the position of water table, can be predicted by "a relative simple model" (this means that the other models, if available, are more complex than the model applied here?) from the weather data, which then can be used as a part in the methane model.

Page 3196/lines 23-24 The sentence would be "Our results support the generalization in literature that methane fluxes in northern wetland are regulated more tightly by water table than temperature"

Abstract is ending by the discussion on "parameter uncertainty". See the last comment below.

Introduction

Page 3197

The text in the beginning of the Introduction (first three paragraphs) is a bit loose. Especially the paragraph on nitrous oxide is not tightly related to the key aims of the study. The text could concentrate more on methane, and just refer to other greenhouse gases if needed.

Page 3199/lines 2-3 The sentence "We study these sites because the hollows nutrient-rich and often saturated river delta (lawns) have CH4 much higher than the other microlandscapes" is not associated logically in the previous text, and the message of the sentence is not clear.

Materials and methods/Results/Discussion

Optimizing /calibration of the model: Was is so that the model was optimized using all the measured data? A way to test the power of the model would be that only part of

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the data is used for the calibration, and the rest of the data is then used to test the calibrated model. This would be possible for the Stordalen data but not for the Kytaluk where the data pool is very limited..

The oxidation fraction is a critical factor to model methane emissions. This fraction surely varied between various microhabitats depending on hydrological and vegetation characteristics. How the factors were selected here (0.6 for Siberia, 0.7 for Stordalen) considering the differences between the two sites including their microhabitats? (values were probably based on the optimization of the model but were in the proper range for the particular habitats?)

Page 3208/lines 5-10 The sentences "The mean soil temperature at the Stordalen site, for the years 2004-2006 was 3.76 oC. This is in accordance with the known sensitivity of methanogens to temperature ... However, methane formation may occur at subzero etc. " This text does not form a logical message?

Fig 7 Is there some explanation why the model simulated better the WT in 2004 and 2006 than in 2005 at the Kytalyk site?

Fig 9 The model predicted rather well the maximum methane emissions at Stordalen mire in summer 2004 and 2005 but not in summer 2006 when the model underestimated the emissions. Is there some explanation for this?

There is a statement in the conclusion that "parameter uncertainty at site level in wetland CH4 process models is an important factor in large scale modeling of CH4 fluxes". Some sensitive analyses could be given how the model output will change using a range of values for the key parameters. If the model needs specific parametrization for every microhabitat and climatic regions there is little hope that it can be used in proper large scale modeling? Now there is some qualitative text on the sensitivity on the page 3208 but real examples of the output could be given when changing the values of various parameters.

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