

## ***Interactive comment on “Modelling CH<sub>4</sub> emissions from arctic wetlands: effects of hydrological parameterization” by A. M. R. Petrescu et al.***

### **Anonymous Referee #1**

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#### **# General comments**

The paper addresses the interesting topic of CH<sub>4</sub> emission from (sub-)arctic wetlands. To improve our understanding of climate change processes and to predict future changes in atmospheric greenhouse gas balances, it is needed to quantify terrestrial carbon exchange. It is recognized that northern wetlands may play a significant role in terrestrial emissions of CH<sub>4</sub>. Modeling these emissions may be done for several reasons, e.g. providing spatial and temporal coverage (including prediction of future emissions) or studying the relative importance of various processes and factors. The paper focuses on the latter and shows us the sensitivity of CH<sub>4</sub> emission from two northern wetlands to water table variations. This stresses the need to include hydrology in ecosystem models to improve simulations of CH<sub>4</sub> emissions, especially for larger

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spatial scales.

# Specific comments

Abstract and Introduction

The purpose of the study is introduced not before the end of the introduction. This may be done for the specific research question, but for the reader it would be helpful to have some idea of the scope of the paper right from the start. Why are the two sites compared? What is the reason to model the emissions? In other words: what is the big picture? The purpose itself (page 3199, lines 14-17) may be rewritten. I think that the purpose is not to test a model or to compare two sites, but to quantify/study the effect of water table, temperature etc. on CH<sub>4</sub> emission, by means of field measurements and a modeling approach.

Materials and methods

Why are the CH<sub>4</sub> measurements at the Kytalyk site limited to the lower terrace and the floodplain (ombrotrophic to minerotrophic) and at the Stordalen site to the minerotrophic mire area?

Model description

Model optimization and parameter calibration is mentioned (page 3203, line 7 and 16), but it is not clear what method is used. Which parameters are calibrated and what model output was optimized (what was the objective function)? Are the mentioned parameter values resulting from the calibration? In that case the values should be moved the **Results** section. Why are two different Q10 values used for one site? The sensitivity analysis is not described, although later on in the paper results and conclusions about parameter sensitivity are described. How was lateral inflow of water described in the MMWH model? The water table at a given position in the landscape is also depending on hydrological processes in the upstream area. Sites with the same soil characteristics, precipitation and evapotranspiration may experience

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different water tables, due to their position in the wetland. Drainage is also important (see page 3205, lines 24-28). Because WT is an important factor in the paper, some more words on the choice for the MMWH model, the strengths and weaknesses would be helpful. What parameter values were used in the MMWH?

## Results

In general: some assumptions and methodology are mixed with the results. For example: page 3205, lines 5-8, 10-11, 13-14; page 3206, lines 16-22.

Page 3205, lines 16-20: the numbers in table 2 and figure 7 (not figure 8!) do not correspond to each other. Why are only the measurements of the floodplain used and not of the lower terrace? I do not understand what is meant by the interpolation of the water table. Is this done to obtain a continuous record for input in the model? How is seasonality applied in the interpolation of summer measurements? Figure 7 shows the WT of the floodplain(?). In line 27 (page 3205) it is said that there is a better agreement between measurements and modeling results at the lower terrace. A figure may support this.

Page 3207: figures 10 and 11 belong to the floodplain site? Or is it a combination of floodplain and lower terrace? For both WT and CH4 I am a bit confused about what belongs to what site. I expect the two sites to differ from each other, due to differences in WT dynamics and vegetation.

## Discussion and Conclusions

Page 3208, lines 17-24: the sensitivity of the model parameters is not supported by numbers or figures. Therefore the conclusions are not as strong as they could be. There could also be some words to physically explain why WT is more important than temperature, vegetation type and NPP.

## # Technical comments

Figures: the axes are not consequent: time-axis of figures 5, 6, 8 and 9; WT-axis of

figures 5, 6 and 7.

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