

## ***Interactive comment on “Uncertainties modelling CH<sub>4</sub> emissions from northern wetlands in glacial climates: the role of vegetation” by C. Berrittella and J. Van Huissteden***

### **Anonymous Referee #1**

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Review of “Uncertainties modelling CH<sub>4</sub> emissions from Northern wetlands in glacial climates: the role of vegetation.” by C. Berrittella and J. Van Huissteden

In their publication “Uncertainties modelling CH<sub>4</sub> emissions from Northern wetlands in glacial climates: the role of vegetation.” the authors investigate the dependence of wetland methane emissions on various parameters affecting methane transport and oxidation by the vegetation cover.

Scientifically speaking, the paper is interesting, highly relevant, and no methodological flaws are apparent (supposing the experiments were designed with more care than the text was written, which is difficult to tell). In fact an investigation of the role of

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plant properties for methane emissions was overdue, making this publication particularly valuable. The presentation needs to be improved, though. I therefore suggest accepting the paper with revisions.

### Major remarks

Sections 2, 4 and 5, i.e. the experiment description and the results section need to be rewritten more or less completely. So far they are inconsistent and the presentation of results is somewhat confusing. In table 3, the authors imply they do experiments on four classes of vegetation, shrubs, Carex, Sphagnum and grass, while the text in section 4 mentions only three dominant covers, Sphagnum spp., Cyperaceae spp., and shrubs. What happened to Carex? What oxidation rate / shoot factor can be expected for Cyperaceae? In Section 5, Fig. 2, this finally becomes Eriophorum, Sphagnum, Carex and shrubs. This ABSOLUTELY needs to be done consistently, the current inconsistent mixture is confusing and makes the reader wonder whether experiments were performed as carelessly as their description. Similar problems plague the presentation of results in Section 5, for example the “plant types” mentioned in Fig. 5 are explained nowhere. Nearly all figure captions are extremely short, making it difficult to understand what is actually shown. It might be a good idea to combine section 2 with section 4, since section 2 explains some of the experimental setup, while section 4 describes the other parts. In addition, table 1 should really be part of the section describing the experiments, i.e. section 4, since these are the parameters that are varied in the sensitivity experiments and results can only be understood with table 1 in mind.

I therefore suggest to move section 3 in front of section 2 and to combine sections 2 and 4. Section 5 then would need to be checked for consistency with the experiment description. Much of section 2 and 5 is difficult to understand for someone who is not intimately familiar with the Walter/Heimann model, so some elaboration on the uncertain model parameters that are investigated would be warranted.

### Minor remarks

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Table 1: Move Shaver et al. reference to bibliography and just cite it in the table. Parameter max primary productivity: I don't understand the explanation. Is something cut off?

Q10 is not a temperature correction, but rather a factor describing the temperature dependence of the reaction.

Units should be set nicer, for example kgC/m<sup>2</sup>/day should really be kgC/m<sup>2</sup>/d, and MicroM/h should be  $\mu$ M/h.

Section 2: Lines 138-143: The climatic boundary conditions for the experiments are unclear. You compare what exactly to modern climate? "Stage 3 climate model runs" is not referenced, and a sentence clarifying that it is MIS3 interstadial conditions that are imposed would be really helpful. In addition, the reader is left wondering how much of a difference this different climate actually makes, so some numbers characterising the differences would be good, i.e. the change in annual mean temperature, summer temperature, winter temperature and annual total precipitation as a mean for the model domain.

Line 142: "the LG interstadial" is rather misleading, since there were more than one interstadial during the last glacial cycle.

Section 3: Lines 175-176: the authors seem to be implying that there is a systematic flaw in the concept of PFTs. Is that the case, or do you just mean that the PFTs, as they are usually defined, simply lack the information on CH<sub>4</sub> transport? Please clarify.

Section 4: Line 268: Fig. 1 does not contain a map of wetland distribution. Either add a map or remove the reference in line 268.

Section 5: Line 287/288: It would be preferable to have emissions in SI units, which in the case of Gt/yr would be Pg/a.

Line 301/302: Sentence unclear. Please rephrase.

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Line 330-333: Sentences unclear. Please rephrase.

More detailed remarks could be made on Sections 2, 4 and 5, but since these sections require rewriting anyway, this doesn't seem warranted.

Bibliography:

Formatting of the bibliography is not done consistently. Petrescu et al. 2010 is set single spacing, not double spacing as the rest of the document, the same goes for van Huissteden et al. 2009; for Valdes et al. 2005 the journal name is misspelled and should always start with capital letters (i.e. "Geophysical Research Letters" instead of "Geophysycal research letters"); Raghoebarsing et al. 2005 contains a spurious "]" character instead of a comma in front of the doi section.

Figures:

Figure 1: The colours appear not to be chosen optimally. Under less than perfect lighting conditions, it is hard to distinguish green from light blue, making it difficult to see the additional land area.

Figure 2: "Warm Climate" in the figure heading is misleading and is inconsistent with other figures as well. Why don't you change that to "ST3 warm" as in Fig. 1? Emissions units abbreviated as Gtons/Y for Gigatons/year is rather unusual. Usually that would be abbreviated Gt/yr, and the corresponding SI unit would be Pg/a. Since SI units usually are preferable, I'd suggest using the latter.

Swapping the land and sea floor fluxes (i.e. sea floor flux on top of land flux) would make comparison between ST3 warm and modern easier, since modern doesn't have the sea floor fluxes. "Scrubs" should really be "shrubs", I guess, and finally the reader is confused by the sudden appearance of Eriophorum, which is never mentioned in the text (except for Table 2 – it took me quite a while to find it...). Please do one of two things. Either call it "grass" in the figure, or mention Eriophorum in the text, for example in Section 4 and in table 3.



Figure 3 and 4: Emission units

Figure 5: Emission units, it should be “flux” instead of “fux”, and since the Walter/Heimann “plant types” shown on the x axis are never mentioned in the text, the figure cannot be understood by the reader. Please redo.

Figure 6: Units; it would be less confusing if the x axis showed the actual exudation value, not 10 times the value.

Figure 7: Flux units.

Figure 8: Flux units, “warm climate” should be “ST3 warm”. In addition, the values shown on the x axis will be confusing for the anglo-saxon readers, since they expect a decimal point, not a comma. “roots depth” is usually called “rooting depth”

Figure 9: Flux units, “Shrubs” instead of “Scrubs”

Figure 10: Flux units.

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