

***Interactive comment on “Response of methane emissions from wetlands to the Last Glacial Maximum and an idealized Dansgaard-Oeschger climate event: insights from two models of different complexity” by B. Ringeval et al.***

**Anonymous Referee #1**

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Review of "Response of methane emissions from wetlands to the Last Glacial Maximum and an idealized Dansgaard-Oeschger climate event: insights from two models of different complexity" by B. Ringeval, P. O. Hopcroft, P. J. Valdes, P. Ciais, G. Ramstein, A. J. Dolman, and M. Kageyama.

In their manuscript, Ringeval et al. investigate the response of wetland methane emissions from the ORCHIDEE-WET model to simulated Dansgaard-Oeschger and Heinrich events and compare the response to previously published results obtained with the Sheffield SDGVM.

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Their manuscript provides substantial insight into the causes of the different responses of the two models to identical climate forcing, thereby facilitating the further improvement of models for wetland methane emissions. In large parts the manuscript is well-written, though some passages could be formulated clearer. I therefore recommend publication with minor revisions.

Overall I do not have any major points for improvement of the manuscript, though several minor points do remain.

In a substantial number of places, plural has been used instead of singular, which would have been correct, for example “wetlands emissions” instead of “wetland emissions” – I realise it’s tedious to check such things, but it would be a substantial improvement.

Page 3102, line 7: There is no discussion of Fig. A2, therefore the effect of resolution is just shown in the figure, but not discussed.

Page 3103, line 11: "its" instead of "is".

Line 24: "density" instead of "densities".

Page 3104, line 3: "estimated from by" seems funny – I assume you want to remove either from or by?

Page 3105, line 5: CH40 should be D0

Page 3106, line 1-3: the reader is left wondering what the effect of static / dynamic vegetation is...

Page 3107: There is no mention at all of the "opt" model configuration. Instead it is introduced much later. It should be mentioned here.

Page 3107, lines 25/26: You mention a bias in ORCHIDEE without really explaining what exactly you mean. Please elaborate.

Page 3107, line 27 – page 3108, line 12: the moisture dependence of decomposition

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is hinted at by the reference to precipitation changes, but not mentioned explicitly in eq. 3 or in this paragraph. This will strongly confuse the uninitiated reader... I suggest you rephrase and clarify this paragraph.

Page 3110, line 10: SDGVM, not SGDVM...

Page 3111, line 3-25: This section is rather difficult to understand, and it takes quite a while for the reader to discover that it's NPP that has the strongest effect. Please rephrase and clarify.

Page 3115, lines 1-24: It took me quite a while to understand what you mean, the passage is rather difficult. Please rephrase and extend the discussion of Fig. 8.

Page 3116, line 11/12: Do you mean a reduction in wetland area or in wetland emissions? "LGM wetland reduction" could be wither or, though I assume it's a reduction in emissions, since area couldn't be diagnosed via atmospheric modelling and ice cores...

Table 1: ORCHIDEE-WET-opt should also be mentioned in the corresponding paragraphs in the text.

Fig. 1: "Proxy for substrate" would be better than "substrate's proxi"

Fig. 2 and 3: The normalisation of emissions is rather problematical, especially since emission units are still listed as Tg. If you normalise, I suggest you use a 0-1 scale instead, since the normalised plots do NOT show emissions in Tg any more.

Fig. 4: Are you sure you used the right plots? I would assume the greyed-out areas would be identical for a and b, as well as c and d, but they aren't. b) rather looks like LGM instead of PI, since all areas covered by ice sheets appear to be greyed out... For c) it's rather interesting to see that there is no vegetation in the Hudsons Bay Lowlands, supposedly one of the major methane emission areas... Please check.

Fig. 8: What's the difference between the two SDGVM plots? "divinding" by  $f_{wtp}$  is mentioned in the figure, but this is rather uninformative... Should be improved along

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with the discussion of Fig. 8.

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