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Climate of the Past Discussions

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 #3

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In their study, Ringeval et al. present new approaches for wetland and CH4 emission modelling during the LGM and a generic D-O event. They compare two models of different complexity, and highlight sensitivities in paleoclimate modelling in general. The manuscript is suited for a publication in cp, and I support a publication after addressing a few points of improvement.

General points:

i) The orbital configuration i.e. the distribution of insolation at different latitudes is hy-

pothesized to be an important factor for CH4 emissions at glacial-interglacial transitions and D-O events (Flückiger et al., 2004; Loulergue et al., 2008; Guo et al., 2012). Especially for D-O events the actual precession cycle regulates the amplitude of atmospheric CH4 concentration changes (Flückiger et al., 2004). An explanation and discussion of the actual setting used in the simulations is needed for the understanding of the simulated CH4 changes. In addition, are the orbital parameters only used for the climate simulations or are they also used to modify the light competition in plant growth for the two DGVMs?

ii) The terms to describe "changes/decrease/increase/transition" are inconsistent in the paper. In general they are associated with a time information running forward towards present. I thus suggest to modify terms like "LGM-PI decrease" to "PI-LGM increase", which makes it much more easier to follow the logic in comparisons between different time periods. Of course values in figures would change sign and would have to be updated. In addition, when comparing models the term "difference between model A and B" is better than "decrease between model A and B". See also specific comments to this point.

Specific points, suggestions for revision:

p3096, l16, l17, l20: use "glacial-interglacial" consistently in the MS

p3097, l26: there are earlier studies for northern wetland emissions by vanHuissteden et al., 2004 and Berritella et al., 2011, although not in a transient simulation.

p3098, l17: "PI-LGM difference" instead of "LGM-PI transition" as it is not a transient run.

p3102, l1: replace beginning with "In order to prevent ..."

p3102, l5: Is the wetland fraction of 4% of global area also recalibrated for LGM conditions?

p3102, l11-12: repeting sentences with repeated citations is not necessary, please

simplify.

p3103, l10: Is the WTD calculated monthly or annually? Please clarify.

p3105, l5: "CH4" instead of "CH40".

p3108, l2: Please indicate the turnover time of the labile carbon pool: is it in the porder of 1 yr, 10 yrs, 100 yrs?

p3109, l12: With the publication of Baumgartner et al., 2012, the Dällenbach et al. 2000 data and conclusions for LGM have been updated and partially proven wrong. Thus cite Baumgartner et al., 2012 here.

p3110: What is the role of lower CO2 during the LGM, are both models equally sensitive to CO2 levels? You mention CO2 effects on p3119, l5: is wetland NPP equally reduced in the two models?

p3110, l13: which figures?

p3111, l6+l7: change is from LGM to PI, so it should be an increase?

p3111, l21: again isn't it an decrease from LGM to PI

p3111, l12: correct sentence: "The substrate sensitivity to climate change between LGM and PI explains the different behavior of the two models."

p3112, l5: singular: "event"

p3112: Please mention already here that changes in CH4 emissions of 25%-50% are expected from ice core data and that you will discuss this in section 4. So, one knows that simulations are underestimating emission changes during D-O events.

p3113, l16+l18: change to "... we computed the annual CH4 emission anomalies ..."

p3113, l23: use different words for "plot areas"

p3113, l27: symbol in brackets is unknown, it is not clear that it refers to figure 8.

p3117, l9: Baumgartner et al., 2012 find that the interpolar difference was bigger than estimated previously in Dällenbach et al., 2000, but this does not necessary mean that boreal wetland CH4 emissions were very active. It could also mean northern low latitude wetland emissions were productive.

p3117, l15: Please note that parameter values for Eq. 9 might change from the BGD to the revised BG version of Baumgartner et al., 2012. Please adapt accordingly to be consistent with the formulation.

p3131, Fig. 2: Were the LGM ORCHIDEE-WET distributions corrected to SDGVM PI or LGM?

p3132, Fig. 3: differences as PI-LGM would be much more intuitive in terms of chronology.

p3137, Fig. 8: "dividing" instead of "divinding".

p3142, Fig. A3: To my knowledge C4 grasses are more competitive at lower CO2 concentrations as during the LGM. Thus I'm surprised to see C3 grasses dominating the PFT distribution during the LGM. Can you confirm that this is the case?

References not in the manuscript:

Flückiger, J., T. Blunier, B. Stauffer, J. Chappellaz, R. Spahni, K. Kawamura, J. Schwander, T. F. Stocker, and D. Dahl-Jensen (2004), N2O and CH4 variations during the last glacial epoch: Insight into global processes, Global Biogeochem. Cycles, 18, GB1020, doi:10.1029/2003GB002122

Guo, Z., Zhou, X., und Wu, H., Glacial-interglacial water cycle, global monsoon and atmospheric methane changes, Climate Dynamics, Volume 39, Number 5 (2012), 1073-1092, DOI: 10.1007/s00382-011-1147-5, 2012

Berrittella, C. and van Huissteden, J.: Uncertainties in modelling CH4 emissions from northern wetlands in glacial climates: the role of vegetation parameters, Clim. Past, 7,

1075-1087, doi:10.5194/cp-7-1075-2011, 2011.

van Huissteden, J.: Methane emission from northern wetlands in Europe during Oxygen Isotope Stage 3, Quaternary Sci. Rev., 23, 1989–2005, 2004.

Interactive comment on Clim. Past Discuss., 8, 3093, 2012.