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Climate of the Past Discussions

Interactive comment on "Uncertainties in modeling CH_4 emissions from northern wetlands in glacial climates: effect of hydrological model and CH_4 model structure" *by* C. Berrittella and J. van Huissteden

Anonymous Referee #2

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This manuscript presents an attempt to quantify the differences among modeling approaches in simulating wetland methane emissions on Quaternary timescales. The manuscript focuses on Europe during a less-studied period of the Late Quaternary, namely the MIS 3 interstadial, where a previous project has prepared databases of paleogeography and climate model scenarios. This period of time is interesting because it represents an abrupt warming of global climate, concurrent with an increase in atmospheric methane concentrations, during otherwise glacial conditions. The current study appears to build on van Huissteden's 2004 (QSR) paper, which used a similar

wetland methane emissions model and produced spatially distributed wetland methane emissions, albeit over a smaller geographic region than the one considered in the current manuscript. What appears to be new in this manuscript compared to the 2004 paper is that two different modeling approaches are tested, a simple parameterization and a more complex process-based model, and that the geographic extent of the wetland methane emissions now covers nearly the whole European (sub-)continent. While this study comes to some useful conclusions regarding the appropriateness of different methods for modeling wetland methane emissions for times of past climate and geography, unfortunately the manuscript is very badly presented. The text and figures both need revision to make them clearer to understand and more useful to the community. I strongly suggest the authors re-submit this manuscript only after a careful revision.

The manuscript is poorly written and needs a major revision after careful editing by someone experienced in scientific writing in English. The text is full of repetitive phrases, confusing sentence structure and poor style. While I realize that English is not the mother tongue of many scientists, and I don't blame the current authors for not being perfect, I beg the authors to get help with their scientific writing before submitting manuscripts. Much time is wasted by all parties when the reader has to read and re-read sentences to try to decipher their meaning. There is too much bad English in the manuscript for me to make detailed suggestions of how to improve the paper from a linguistic standpoint. Furthermore, the maps presented in Figures 1,2, and 10 are too small and in unsuitable and incongruous projections to make meaningful interpretation by the reader possible. The maps are presented in different projections, with different spatial domains and color scales. The authors may want to consider using a standard projection and spatial domain for Europe such as the EU-INSPIRE Lambert Equal-Area Projection. Excellent free software is available for making high quality maps (e.g., Generic Mapping Tools 'GMT') so there is no excuse for presenting sloppy, non-uniform maps in a manuscript these days. Furthermore, some of the bar graphs are presented as faux-3D charts – these are totally unnecessary in a scientific publication – while others are standard 2D charts. Please choose a clean, uniform

style, preferably without a background fill color, for your charts. I realize part of the bad presentation of your figures may be caused by limitations of the CP manuscript post-processing, but if possible larger maps and cleaner charts would greatly improve the presentation of this manuscript.

Regarding the scientific content of the manuscript, the results presented in this study are sound, if not particularly groundbreaking. This study will make future attempts to model paleo-wetland methane emissions more robust, because models used may include the most important processes and parameters identified in the current study. This appears to be a motivation of the manuscript, as the authors refer to another paper of theirs that is in preparation. The methodology appears to be thorough, though it is a limitation to this work that the authors have not tried to make a comparison of modeled wetland methane emissions with measurement at any larger scale than the individual plot. As much of the uncertainty in modeling continental- to global-scale wetland methane emissions comes not from uncertainty in the underlying processes, but rather from landscape heterogeneity (i.e., larger parts of wetland landscapes produce little to no methane while some small regions form "hotspots"), it would have been useful if the authors could have evaluated their models' performance relative to eddy-covariance, tall tower, aircraft, remote sensing, lagrangian back-trajectories, or other data sources on wetland methane fluxes that are spatially aggregated. References to studies using any of these techniques may be easily found in a literature search.

Finally, the authors appear to have missed one significant recent reference specifically on modeling LGM and late glacial wetland area and methane emissions and atmospheric methane concentrations (Kaplan et al., 2006, Global Biogeochemical Cycles, doi:10.1029/2005GB002590).

Interactive comment on Clim. Past Discuss., 5, 817, 2009.