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Climate of the Past Discussions

Interactive comment on "The importance of Northern Peatlands in global carbon systems during the Holocene" *by* Y. Wang et al.

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First of all, we thank the reviewer for his/her time and for providing constructive comments. We agreed with the reviewer that our main conclusion about the primary carbon source from the ocean is not a BIG surprise. However, we think it is important that our approach, as developed in the paper, illustrates an arguable terrestrial carbon source and/or sink in that it makes clear that over the past 8000 years, the land ecosystem becomes completely a carbon sink. Previously, there have been significant debates regarding whether land has been a net source or sink of carbon (to the atmosphere) in the Holocene. Our approach includes the small carbon release (source to the atmosphere) from mid-latitude semi-desert regions, although as pointed out by Dr. Ruddiman, we do not consider the anthropogenic land cover and land use changes from the

mid-Holocene on.

Furthermore, we agreed with the reviewer in that a marine carbon model component is urgently needed to further elucidate the different roles of biological, geological, and geochemical pathways in contributing the total marine carbon source. This critical carbon cycle component is now under intensive model development and tests.

"The model description in Section 2.1 is extremely short. In fact, it is so short that the reader is not able to get an idea of the model used without referring to other publications. Since the model is documented elsewhere, the description need not be long, but I am sorely missing two sentences summarising what kind of atmosphere and ocean models are used in the MPM."

Response: We have revised our model description Section 2.1 so that readers could understand the main components of the "Green" McGill Paleoclimate Model. In particular, we have added two sentences to brief the atmosphere and ocean components of the "Green" MPM.

"In Section 2.3, the authors mention that they reduce NPP in VECODE to compensate for peatland development. Unfortunately it doesn't become clear, what exactly the authors have done here, and how exactly the b and g cases differ. Is the reduction proportional to the area fraction covered by peatlands? Is it based on total NPP, i.e. C mass? This doesn't become clear in the manuscript, and while this issue has no qualitative effect on results, it would improve the manuscript if this were clarified."

Response: We have made the procedure of this compensation much clearer in our revised paper. The peatland development consumes the NPP in VECODE in that the NPP value is reduced correspondingly by a negative perturbation (unit PgC/yr/area) in VECODE based on the corresponding land area in the model. The main difference between AOVI_b and AOVI_g cases is the flux rate of NPP compensation (reduction). The AOVI_b case employs a slightly larger rate of compensation based on the proportional flux estimated over the boreal region in the model, while the AOVI_g case

uses a smaller rate of compensation based on the proportional flux estimated over the entire model land domain. The area-integrated NPP compensation corresponds to the prescribed developing rate of the northern peatland in unit PgC/yr.

“In Section 4, page 1240, and Fig. 6, the authors mention the global terrestrial carbon. The order of magnitude makes it clear that this is the sum of biomass and soil carbon, but a sentence clarifying this would again make this clearer for the uninitiated reader.”

Response: We have revised our paper accordingly in both the figure caption and text.

Interactive comment on Clim. Past Discuss., 5, 1231, 2009.