

Interactive comment on “Strength of forest-albedo feedback in mid-Holocene climate simulations” by J. Otto et al.

Anonymous Referee #3

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Reviewer Comment

In this manuscript, the authors focus on the strength of snow masking effect of vegetation and examined a sensitivity experiment in the mid-Holocene using an interactive atmosphere-vegetation general circulation model and extract a pure atmosphere-vegetation response due to the snow masking effect. The result of experiments indicates that strong snow masking effect causes larger warming in high latitude in spring than weak snow masking effect. This reviewer recognizes that the snow masking effect of vegetation and vegetation-snow-albedo feedback in spring is important. However, jump of logic is seen in the discussion and conclusion. In this manuscript, the authors compare the result of AVGCM with reconstruction data and result of previous researches using AOVGCMs and conclude “We show that the parameterisa-

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tion of the albedo of snow leads to uncertainties in the temperature signal but does not explain the strong spring warming suggested by previous simulations (Page 810, line16-18)”. This reviewer regards they are fundamentally incomparable because result in this manuscript does not include the ocean feedback and previous reconstructions/simulations include the ocean feedback. This reviewer recommends a reconstruction of the manuscript or a same sensitivity experiment by using an interactive AOVGCM in order to compare the impact of the snow masking effect in the climate system with these previous studies. The other conclusion in this manuscript “We rather suggest that studies with coarser resolved representation of vegetation than in ECHAM5/JSBACH overestimated the increase in forest at the mid-Holocene and thus the strength of the vegetation climate (Page 810, line 18-20)” and related discussion about EMICs are not directly based on the result in this manuscript because it can only explain the effect of strength of snow masking. As the authors noted Page 823, line 8-9, different framework of experiment should be introduced (e.g. comparison with the ECHAM5/JSBACH result without the tiling approach and/or with the lower resolution ECHAM5/JSBACH result) in order to discuss this hypothesis. However, this hypothesis is not a logical conclusion from the experimental setting and result in this manuscript.

Minor Comments

Page 814: Please describe the horizontal and vertical resolution in The Simulation Protocol.

Page 814, line 4-5: The sea surface temperature and sea ice cover used in this manuscript is not clearly described. Are they 0ka AOGCM results or from observation?

Page 815, line15-16: The explanation of Figures 1a and 1b is “simulated snow cover” in the text, but Figures 1a and 1b show snow depth. This reviewer recommends the authors to refer snow cover fraction because not snow depth but snow cover fraction directly affects land surface albedo.

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Page 816, line8-9: “With the simulated weak snow masking [of both deciduous and evergreen forest ?] at lower end and the simulated strong snow masking of evergreen forest at the upper end, . . .”

Page 817, line 19-20: Please clarify the definition of “snow depth” in Figure 3g and Figure 3h. Do the authors mean snow water equivalent (SWE)?

Page 818, line8-10: Please clarify the definition of “snow depth” in Figure 4d. This reviewer guesses change of snow depth do not show the change of snow melt correctly because snow melt(=snow mass) is equivalent to the product of snow cover fraction and snow depth. The authors want explanation of the relation among snow depth, snow cover fraction, snow melt and snow mass in ECHAM5/JSBACH.

Page 820, line 1-8: In which region the change of temperature averaged?

Page 820, line21-22: “For Eastern Canada, reconstruction suggest that the tree line was further south than present.” Please refer some paper. It seems there is not such result in MacDonald et al. 2000 and Bigelow et al. 2003. This reviewer could not find an appropriate reference.

Figure 4: In which region are these four variables averaged?

Interactive comment on Clim. Past Discuss., 7, 809, 2011.