

Interactive comment on “The impact of early Holocene Arctic Shelf flooding on climate in an atmosphere–ocean–sea–ice model” by M. Blaschek and H. Renssen

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We have gratefully incorporated all suggested changes and answered all questions in detail in the replies to the reviewers. In particular the two points raised by reviewer 2 are addressed as follows.

(1) Please compare the spatial distribution of the sea ice production with the present day values given in the introduction. The influence of the shelves on the sea ice production is of key importance in this publication so a comparison of the modelled present-day values with the presented observations would help putting the results into perspective.

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We agree that sea-ice production is a key aspect of this paper and that it would be interesting to compare modelled sea-ice production to mentioned estimates from the introduction, but there are considerable differences like the areas considered or type of sea-ice production between studies. In combination with our relatively low resolution model it will be quite complicated to address all these issues at local scales for present-day. Another reason why we focused on quantities like the Northern Hemisphere sea-ice extent or volume that rely on large-scale dynamics and assume that the underlying processes produce reasonable quantities of sea ice. Regarding the spatial distribution of this sea-ice production we show in Figure 8 where most sea-ice is produced at 9ka BP, this map is mostly true for our pre-industrial simulation (0kOG) as well.

We propose to add the following sentence to clarify in section 3.1.1 right after previously added sentence: “...in our model. The distribution of sea-ice production in the model is different from observations, because in our model the transpolar drift transports sea-ice from the western to the eastern side of the Arctic (Goosse et al., 2001; c.f. Fig.8, 9kOG, distribution is similar to present-day). This model bias results from the low resolution of the atmospheric component (Goosse et al., 2003; Goosse and Renssen, 2001), although Goosse et al. (2001) found that the atmospheric circulation in the Arctic and the position of Icelandic and Aleutian low is relatively close to observed ones under present-day conditions. The opposite wind direction is a result of an overestimation of the Aleutian low. Despite this deficiency we conclude that our model is able to produce sea-ice quantities at larger scale in a reasonable range under pre-industrial conditions, suggesting that our model is suitable for a study of the impact of early Holocene shelf flooding on sea ice (c.f. Fig.2).”

(2) Please address the impact of the rather low resolution atmospheric model contained in LOVECLIM on the reliability of the model outputs (and implications on the modelled reduced sea-ice export through Fram Strait).

We explain and highlight the low resolution of the atmospheric component of our model and its impact on sea-ice production in section 3.1.1 (previous reply).

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We hope that the reviewers and the editor agree with our explanations and find the changes to improve the manuscript and answer the questions.

Please find an overview of all changes to the manuscript in the attached PDF.

Please also note the supplement to this comment:

<http://www.clim-past-discuss.net/9/C2363/2013/cpd-9-C2363-2013-supplement.pdf>

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