

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2022-47

Anonymous Referee #2

Referee comment on "Simulating the Holocene deglaciation across a marine-terminating portion of southwestern Greenland in response to marine and atmospheric forcings" by Joshua K. Cuzzone et al., The Cryosphere Discuss.,
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Cuzzone et al. present have simulated the deglaciation of the Godthaðsfjord region using different climate forcings (temp, precip.) including a calving laws. Their results show that the Holocene deglaciation was primarily dominated by changes in surface mass balance, whereas calving is less important. The simulations are compared to geological reconstructions of the deglaciation. Overall, the paper reads well and presents some new and interesting aspects on how to simulate ice sheet evolution (as far as I can tell as a none-expert in ice sheet modelling). I only have a few major comments and some additional minor comments to the manuscript.

Major comments:

I am surprised that it is not quantified how much of the deglaciation is forced by SMB and calving. Most places it is vague formulated like "significant influence", "strongly impacted by" or "less important contribution from". Is it possible to be more specific i.e. say xx% from SMB and yy% from calving?

It is unclear to me if they account for changes in sea surface temp in the fjords? Changing SST should influence the calving rate, but it is unclear to me if this is accounted for in the model. It is known from paleoclimate data that the SST changes significantly during the Holocene and this could have played a significant role on the ice retreat in particularly in fjord settings like the Godthaðsfjord region (see review by Axford et al 2021).

The 9.3 ka and 8.2 ka re-advance events have been recorded north of the study areas around Jakobshavn Isbræ (e.g. Young et al 2011). In the Godthaðsfjord region there is no evidence of a readvance during these two cold events – neither in the geological data or in the simulations (as far as I can tell from the figures). It would be interesting if it

could be discussed why the ice sheet in this Godthaðfjard region did not react to these events. One possibility is that the ice sheet retreated far inland during the Early Holocene and that the 9.3 and 8.2 ka re-advances was minor and did not pass the LIA extent. However, according to the simulations the ice margin did not retreat far inland of the present extent. How could this be explained?

Minor comments:

Line 26 delete "novel"

Line 29 change bedrock with fjord

Line 29 what do you mean with "above sea level"?

Line 34 and throughout the manuscript: capitalize "early", "middle" and "late" Holocene.

Line 47: capitalize smb and use consistently in MS

Line 63, 86: (s)outhwestern

Line 264:) is missing.

Line 287: . is missing after et al

Table 1 is not really needed.

Line 481: Format reference.

Line 630: Both "Isbræ" and "glacier" have been used.

Line 633: change "ford" to fjord.

Line 642-656: Mostly not conclusions and could be omitted.

Line 741-744: check format

Line 783-786: check format

Line 793-802: check format