Clim. Past Discuss., 10, C1637–C1643, 2014
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Climate of the Past Discussions

Interactive comment on "Using results from the PlioMIP ensemble to investigate the Greenland Ice Sheet during the warm Pliocene" *by* A. M. Dolan et al.

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General comments

The manuscript by Dolan et al, describes a thorough examination of the influence of the modelled climate over Greenland on the Greenland ice sheet during the warm Pliocene. The manuscript is a follow-up of the PLISMIP paper by Koenig et al. (CPD, 2014b), but here one ice-sheet model (the model BASISM) is used with 15 different realisations of the Pliocene climate performed in the PlioMIP ensemble. I think the paper is well written and the analyses performed are thorough and complete. This manuscript describes a good addition to the ice-sheet modelling work performed on the

Pliocene and is of a good quality. The manuscript is well structured and the analysis performed on the ice-sheet model and the climate models (e.g. the discussion of the albedo) is clear. I accept this manuscript with minor revisions. Most comments given below are minor and are on rewording of the text.

I have one major point, and that is the low influence of the different parameter values on the pre-industrial simulations (Fig. 5). As given in Table 2, the parameter space is quite sufficient to get a nice spread for the Pliocene (Fig. 7), but it is striking to me that this does not occur for the pre-industrial. I think a lower sensitivity could be expected, but no differences at all, whereas mean climatology (Table 3) is quite diverse between models, is something that needs some additional investigation of model output.

Specific comments

Page 3485

Line 2: In recent literature this time period from 3.264 to 3.025 Myr ago does no longer apply to the mid-Pliocene but rather to the mid-Piacenzian (e.g. Dowsett et al., Scientific Reports, 2013) or the Late Pliocene. This should be changed throughout the text.

7: warmer-than-modern could be changed to warmer than present-day climate.

12-14: Mention here that you have used 15 models from PlioMIP.

18: the surface albedo

21: Be more specific, mention which data.

25: Replace these two references with the IPCC AR5 chapters.

Page 3486

13: You could also refer here to Rovere (EPSL, 2014).

Ref: Rovere, A., Raymo, M. E., Mitrovica, J. X., Hearty, P. J., OÊijLeary, M. J. and Inglis, J. D., 2014. The Mid-Pliocene sea-level conundrum: Glacial isostasy, eustasy

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and dynamic topography, Earth and Planetary Science Letters, 387, 27–33.

14-18: Mainly due to insolation changed (for the previous interglacial, the Eemian). One could also refer here to Van de Berg et al. (Nat Geo, 2011) on the importance of insolation on melting of ice on Greenland.

Ref: van de Berg, W. J., van den Broeke, M., Ettema, J., van Meijgaard, E. and Kaspar, F., 2011. Significant contribution of insolation to Eemian melting of the Greenland ice sheet, Nature Geosci, 4, 679–683.

Page 3487
8: Why not refer to Koenig, 2014b here?

11: Replace 'and' before GENESIS with a comma.

18: Replace 'ice sheet model' with ISM (this should be replaced a number of times in the text).

29: Here, it is first mentioned that 15 different models are used, this could also be mentioned in the Abstract.

Page 3488
6: Replace ice sheet model with ISM.

15-16: Acronym of PlioMIP is already mention in page 3486, change sentence to: "... mPWP, PLIOMIP (Haywood et al., 2010, 2011) was initiated ..".

Line 23 and line 1 on page 3489: Throughout the text you refer to the AGCM as 'Experiment 1' and the AOGCM as 'Experiment 2'. I understand that this originates from the PlioMIP paper as described in Haywood et al. (2010, 2011a). But in this manuscript it is a bit confusing since you do not run the climate-model experiments but use the output to force one ice-sheet model. I think in this manuscript it is sufficient to just mention the two separate experiments shortly in this section (2.1) and then in the remainder of the text state either AGCMs or AOGCMs and not use Experiment 1 or 2.

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Page 3489
14: Replace ‘ice sheet model’ with ISM.

Page 3490
8: Acronym of BASISM already given on page 3487, just state BASISM, without brackets.

19-20: What do you mean with ‘following Hill (2009)’? Do you use the same methods as described in that study? Please explain and rephrase sentence.

Page 3491
23: Remove ’atmospheric’.

25: Replace ‘ice sheet model’ with ISM.

Page 3492
27: “.. for each model simulation.”

Page 3493
1: Change to: “.. each simulation reconstructs the observations of ice thickness.”.

1-2: Add ‘the’ before ’normalised’.

2: Explain here what you mean with the normalised RSME.

19-25: In the discussion of the precipitation of the models, rather start with discussing all GCMs instead of only mentioning MRI.

25: Replace Experiment 1 and 2 with AGCMs and AOGCMs, respectively.

Page 3494
5-9: It is surprising to me that there is so little difference between all the experiments. I think this should be checked since the parameters in Table 2 are quite different and the Pliocene experiments do show this strong variability.

27: Replace ‘ice sheet model’ with ISM.

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Page 3495
7-9: Replace ‘No’ with Not’, rephrase sentence, perhaps last part first.

10-13: There are 2 metrics involved here, so also mention the difference in volume.

14: Missing Ritz, 1997 in reference list.

19: Change to: (Fig. 1 in Dowsett et al., 2010).

23: Please read the statement in Robinson et al., (2011): page 393, right column the second to last paragraph of the Conclusions (starting with “None of ..”), i.e. a realistic modern realisation does not necessarily mean a realistic Pliocene simulation.. A short discussion similar like this would be appropriate here.

Page 3496
10-11: Refer here to Fig. 7 (the red dots) as the model simulations that are used for these maps, as is also done in the caption of Fig. 9.

Page 3498
6: Change ‘balance of energy’ to ‘energy balance’.

6: Why mention global heat, rather point out how it changes over Greenland.

Page 3499
23: What do you mean with ‘differing degrees’, please rephrase.

22-26: Too long sentence, please rephrase to two sentences.

Page 3500
7-11: Looking at Figures 10,11 and 12 it seems to me the largest differences occur for the MRI models (both the AGCM and the AOGCM). This should be mentioned/discussed here as well.

9-11: Rephrase to: “Whereas using CCSM4, which ... summer, produces one of the largest predicted ice sheets”.

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Sections 4.2 and 4.3: Nicely written

Page 3504
19-21: There is no recent publication that could be used instead of 'personal communication'? Please comment.

26-27: An additional note could be added here on which kind of data, with appropriate references.

References

Page 3506; line 24: Capitalize: PA4213

Page 3515: Add Ritz, 1997

Tables

Table 2: Just wondering why you have chosen for the PDD factor of ice from 5,6,8 and 14 and not a linear rate (like the other two parameters) like 5,8,11 and 14? Please clarify your choice of parameter space.

Table 3: Explain in the caption the exact region used for these numbers, all land area or only all ice-covered area? Perhaps change the unit of mean annual precipitation to mm per year? (a bit easier to grasp for a meteorologist at least..).

Table 4: State in the caption that these are differences, and between what and what? Differences in the Maximum ice thickness (in km?) seem a bit odd to me, and are these actually used in the text? Please explain.

Figures

Figure 5: Perhaps check SMB In the same way? If I look at the precipitation and

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temperature in Table 3 and Figures 2, 3 and 4 this should be quite different. . .

Figure 5 and 7: Could you show the modern and PRISM3 volumes in these figures by e.g. a horizontal dashed line?

Figure 12: Replace Experiment 1 and 2 (Exp1, Exp2) with AGCM and AOGCM, respectively.

Interactive comment on Clim. Past Discuss., 10, 3483, 2014.