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Climate of the Past Discussions

Interactive comment on "Large-scale features and evaluation of the PMIP4-CMIP6 *midHolocene* simulations" *by* Chris M. Brierley et al.

Anonymous Referee #3

Received and published: 17 February 2020

The manuscript presents the recent simulations of mi-Holocene performed within the PIM4-CMIP6. It is a valuable and interesting work as it will be one of the main references for the future studies. The text is written and structured well, and the storyline is what would be expected from such a paper but I have few main critical and some major/minor comments as are listed below. Overall, I think it should be published in Climate of the Past, after a minor-moderate revision.

Main comments: As one of the important components of the climate, I wonder why the sea ice story was not included except the short sentence at line 193. I suggest to add the 2-D maps of sea ice concentration in the Arctic (for both summer and winter) which would also be relevant to the AMOC story. For instance, when there is sea ice covering part of the deep water formation (DWF) region in the Labrador Sea (due to model bias),

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DWF is reduced. If the model has too much sea ice over the Labrador Sea in both PI and midHolocene, then that can partially explain why the AMOC does not differ much between the two periods, as any freshening or cooling cannot influence the DWF.

With regards to AMOC, it would be nice to say something (few sentences) about the regions where deep water formation happens based on mixed layer depth values in March. It could be that if there is sea ice over the Labrador (recalling my previous comment), then the region of deep water formation might shift. . .

Again about AMOC, I know that normally 30°N (models) or 26.5°N (observations) are chosen for calculating the maximum AMOC value. Since this latitude of maximum AMOC can differ between models as well as the two periods of study, I would not pick one latitudinal point. Instead, I will define a range e.g., 25-35°N to calculate the maximum AMOC. I also suggest to add the observations to your plot (RAPID-MOCHA array observations Smeed et al., 2017 http://www.rapid.ac.uk/rapidmoc/rapid_data/transports.php).

My major and minor comments regarding the text and analysis are following:

Methods: The mean values, are they averaged over the entire simulated years mentioned in Table 1?

Line 86: Can you say in one sentence how is PaleoCalAdjust performing in general?

Lines 88-98: For the annual mean I understand you do not need calendar adjustment. But if you use your daily values from PaleoCalAdjust and make the annual mean, how much would it differ from the main annual mean? This can give you some ideas about the potential interpolation errors (if there is no original daily data).

Line 98: I do not understand “we have therefore...” so you use the method when you thin it is good?

Line 107: in this line and any other lines (line 219) please change “interannual variability” to → internal climate variability because the variability is not only interannual. . .

Lines 154-161: move these lines to after line 140.

Line 171: “...colder conditions over the Labrador current...” which figure you are referring to? And I assume you meant Labrador Sea and not current?

Line 174: not only in the tropics but over the oceans in general there is a better match

Line 234: “. . . change in precipitation” change between what?

Line 234-236: you used “change” three times in one sentence, modify please and combine it with the previous sentence.

Line 324: role

Line 374: “. . . need for improved physics and processes...”

Figure 3 caption: check the years where observation was used e.g., you wrote “1981-1900”. . . also check the rest of caption.

Figure 5: would it be possible to make the similar figure for the observation/reanalysis?

Please also note the supplement to this comment:
https://www.clim-past-discuss.net/cp-2019-168/cp-2019-168-RC3-supplement.pdf

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