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Climate of the Past Discussions
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Interactive comment on "Interannual Variability in the Tropical Atlantic from the Last Glacial Maximum into Future Climate Projections simulated by CMIP5/PMIP3" *by* Chris Brierley and Ilana Wainer

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Dear Author,

The reviews process of your manuscript it taking a long time, which is due to recurrent difficulties to get a second review. I am very sorry about it.

Since time is running I propose that you go for a major revision of your manuscript, taking into account the important comments of reviewer#1 who raised important issues on the clarity and organization of the paper, including methodological questions. I also

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include below my own expertise of the manuscript, focusing on major aspects. If you decide to provide a revised version of the manuscript it will be sent for a second round of reviews, with the hope that we do not have to face a long delay similar to the one of the first round.

Best regards

Pascale Braconnot

Comments on the manuscript.

The subject is quite ambitious and timely, and the methodology used to discuss the two major Atlantic modes seems appropriate. As far as I know this has not been done yet, and providing systematic diagnoses to assess how the modes of variability are affected by climate change is a valuable task. In its present form however the paper is too descriptive and key aspects on precipitation are lacking. In particular :

- The introduction and first section highlight the fact that AMM and Atl3 modes have fundamental impact on South American and African monsoon, but this linkage is not discussed any further when considering the different climates. This limits the interest of the manuscript and is a major concern.

- The discussion on physical and dynamical mechanisms should be enlarged. This concerns both the anomalous circulations associate with the SST modes and the changes in these circulations associated with changes in mode patterns in the different climates

- One of the difficulties with the analyses of paleoclimate simulations is that both the background climate mean state and the variability change. How the pattern of the changes in variability is connected with patterns of the changes in the mean state should be discussed in more depth. A question out of this is does mode patterns only follow the mean state patterns? In other words if there is shift in the mode pattern is it directly reflecting a shift in the mean state pattern or is there other feedback that could explain that new areas become affected by the mode?

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- The outline of the paper is also a little bit “boring”. This feeling is due to the fact that the discussion section could include additional analyses to explain when possible part of the rationale behind model responses (which may be different from one period to the other). The discussion section could thus be enlarged and have a more appealing title and content. It could compare relationships as it is done as well as mechanisms. A few questions when reading the manuscript: it is interesting to see that the AMM mode is reduced at mid Holocene. Is it because the seasonal cycle is stronger and that a dipole-like pattern emerges in summer when comparing mid-Holocene with PI? Is there a reason why a colder climate would have increased variability? Could the non-symmetrical differences between LGM and future results from non-symmetrical responses in mean change in Hadley Walker circulations between these two climates (related for the Hadley circulation to a dynamical or cooling effect induced by the ice-sheet)?

Other comments

- Please, provide error bars on the different bar plots

- Table 1 mentions past1000 simulations, but they are not used in the text.

- Make sure the color scales are identical for all the plots with the differences. Some of the values are so small that they should not be plotted. Would there be an interest to also show separately the results for models for which the difference is an increase in the index and the models for which it is a decrease? which would require that statistical significance is defined to tell for which models it is different from 0.

- For the maps of differences you could add isolines showing the pattern for PI to better highlight where the changes are located compared to the reference.

- Section 2 should be more informative. Details would be welcome to make sure we understand well how exactly the anomalies are computed for each of the periods, how the regressions are computed to provide the ensemble mean map, and also for each

model what is the level of significance for the regression and should nonsignificant values excluded (or set to 0) when computing the ensemble mean map? The estimates of the changes in variability are done using the ensemble mean value. Since the sampling is limited given the size of the model ensemble would it make any difference to consider the median valued?

- In section 3 tell why the observations look so noisy in figure 2.

- In section 3.1 PIcontrol should also be considered with historical to show the differences between this two close periods and discuss the limited length of the simulations. Some of the Pi Control experiments are long enough to be subsampled for an uncertainty analysis.

- Make sure the modes are discussed in the same order in all sections and figures.

- Even though the modes are extracted using an index and not EOF you could compute and provide the percentage of variance they represent. Previous studies Jolly et al. 2007 or Zhao et al. 2008 suggested that ENSO dominate variability in most models and thereby the teleconnection with the African monsoon, which is not the case in the observations. Is it valid here?

- P12 l230. The sentence is incorrect. Pausata et al. 2017 didn't simulate vegetation better they impose a mid-Holocene extreme reconstruction of the vegetation cover. So it should read something like when imposing mid Holocene vegetation reconstruction as boundary condition to the model.

Suggested references

- Joly, M., Voldoire, A., Douville, H., Terray, P., and Royer, J. F.: African monsoon teleconnections with tropical SSTs: validation and evolution in a set of IPCC4 simulations, Climate Dynamics, 29, 1-20, 2007.

- Zhao, Y., Braconnot, P., Harrison, S. P., Yiou, P., and Marti, O.: Simulated changes in the relationship between tropical ocean temperatures and the western African mon-

soon during the mid-Holocene, Climate Dynamics, 28, 533-551, 2007.

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