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Interactive comment on "Oceanic response to changes in the WAIS and astronomical forcing during the MIS31 superinterglacial" *by* Flavio Justino et al.

Anonymous Referee #1

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Review of the manuscript "Oceanic response to changes in the WAIS and astronomical forcing during the MIS31 superinterglacial" by Justino et al.

The manuscript by Justino et al. aims at investigating the response of the ocean and sea ice dynamics due to the exceptional astronomical forcing of MIS 31 as well as due to the grealty reduced elevation of the MIS 31 West Antarctic Ice sheet. To investigate those impacts, Justino et al use the coupled AOGCM ICTP-CGCM at broadly 3° of horizontal resolution. They perform a serie of simulations aiming at isolating the impact of MIS 31 astronomical forcing, of the absence of the WAIS and of a combination of both (most realistic simulation of MIS 31 global climate). Results show that the topographic effect of the absence of the WAIS does not have a significant impact on the ocean heat

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Discussion paper

transport but affect the extent of the sea ice cover. On the contrary, both the ocean heat transport and the sea ice cover extent are greatly influenced by the astronomical parameters values representative of the warmest epoch during MIS 31.The main impact is that the increased ocean heat transport contributes to a significant reduction of the sea ice extent in the Northern Hemisphere, both in the Atlantic and in the Pacific due to an enhanced meridional ocean transport.

The questions investigated in the manuscript are certainly interesting and timely with the research of Antarctic tipping points under various different climate states. However, to me, the manuscript has been written too fast, many sections are confusing some parts are repetitive and not very well written and structured. I am not a native English speaker my self but it seems to me that the English can be largely improved by the co-authors of this manuscript. I detailed further about the weaknesses of the structure of the manuscript. About the results, most of the Figures have not been done with care, with colorscales that induce lots of confusion during the reading. Most of the signals discussed in this manuscript are small, and no statistics has been performed to understand if most of the signal results significant at 95% (for example with a t-test). In addition, the areas where most the changes occur, so with large anomalies are located in the areas where the model displays the strongest biases for present-day. Moreover, most of the manuscript deals with ocean heat transport, which, the authors admit, is largely biased in their present-day control simulation. I therefore question the impact and significance of the results presented in the manuscript. I list in the following, some suggestions on how to improve the structure, the figures and the interpretation. For specific comments and minors tipoes, I annotated the manuscript directly.

Based on the comments and on the general statement written above, the manuscript is not ready for publication unless a substantial work is done to strengthen the overall results. I recommend major revisions for this manuscript.

***General comments:

- I found the manuscript very superficial in the explanations of the main processes in act. It is very descriptive but never really explain why changes are happening from dynamical point of view between all the experiments. - plot on each Figure when possible, the areas that are statistically significant at 90% and above and only interpret those in the manuscript. - show that the model biases do not significantly impact on the results themselves and their interpretation with supportive material. - The paper would need a proper discussion section to analyse the limitations of this approach and oft he model. - Similarly, the authors should show the impact of the low resolution on location of the deep water convection site,s in particular in the southern ocean (never shown). Because it is well known that some models at low resolution do not capture the weddell sea deep water convection site (and others, like in the Labrador Sea). Very often, most of the meridional circulation happens then in the Pacific sector. - The Figures have to be improved by changing the colorscale, centered the values around zero etc. . . - The use of the literature references is sometimes approximated and sometimes erroneous

****About science: - Perform t-test or other, on all the Figures and Tables (in particular) to understand the real significance of the differences. - Put a figure of oceanic heat transport for the CTR run, in comparison with observations in the supplementary material. - Insert a frame of density changes also for southern ocean in the main manuscript - A figure of stream function showing the deep water formations sites in the Atlantic and in the Pacific sector of the southern Ocean

The rest of my comments have been directly annotated in the pdf of the manuscript in attachment.

Please also note the supplement to this comment:
http://www.clim-past-discuss.net/cp-2016-113/cp-2016-113-RC1-supplement.zip

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