Review Beaumet

This paper presents a sensitivity study of ARPEGE-AGCM, a global climate model at a stretched grid such that it has a horizontal resolution over the Antarctic ice sheet comparable to typical regional climate models. This implies a high and original potential for high-resolution projection studies for this region, and its connections to global climate. However, the model incorporates far too many model deficiencies (most importantly the ice shelf biases (if you look at the impacts of SSC, then ice shelves are so important!) and the limited (surface) snow model) that in my honest opinion have to be solved first in order to warrant publication. In addition, the paper is already in its second review round and still does not fully answer the question raised in the title and is still poorly written.

I will not reject the paper as I understand that new simulations will be extremely difficult to perform. I do think that in order to warrant publication, more substantial results and conclusions should be presented and the outline of the paper should be restructured and have a stronger structure. If the main aim of this paper is to be an evaluation paper (as I think in principle this is what this paper is about) this should be the main focus, with a more substantial analysis evaluation and a comparison with other GCMs at coarser resolutions (as to strengthen the main advantage of ARPEGE, its resolution). If the approach is still to be to investigate the effect of changing SSC, I want to see more of it and a more thorough discussion of its implications.

Even though I did not have time or the motivation to tackle the text and do minor corrections to the sloppy writing, I summarize some of my main issues with the paper below:

P1, abstract, l7: The abstract should be readable and understandable without reading any of the other text. For me it was not directly clear what is meant with “diverging SSC”. Do you mean two extreme cases? Reword this sentence.

P1, abstract, l15-16: Same as above, what is meant with quantile mapping; completely unclear to me from the abstract alone. Make it more simple.

P1, abstract, l19-21: Same as above, unclear from just the abstract. What is bias-corrected SSC?

P2, abstract, l1-2: Is this not well known already? Of course circulation is extremely important (for what, by the way?)

P3, l23: “some advantages”. Which advantages? I want to know precisely why the model setup is preferential over others.

P3, l32: Again, I still fail to properly understand “bias-corrected SSC”.

P4, l14: -> climate of the Antarctic continent.

P5, Figure 1: Maybe highlight the models that you are going to use

P7, paragraph 3.1: This seems like a section that should be in data-methods, not in results.

P9, Figure 2: In the text you refer to latitudes, but no latitudes are shown on this figure. I had to check twice to see what you meant with 40 degrees S.

P10, l7: name the stations on the map that you refer to. Maybe a scatter plot also is more clear than this plot as the range of the colorbar is quite small.

P10, l10: “site effect”. What site effect? Do you think that a GCM can be compared with in-situ locations in general?

P12, l7: What is “2.8 interannual standard deviation?

P13, figure 5: I fail to properly see the significance lines; strange colouring is used for this figure.

P21,l21: I don’t understand this line. Thermodynamic is not related to circulation patterns?

Discussion: The discussion looks to me like a long monologue without any goal or clear structure and it is way too long. I therefore propose to restructure the results and discussion section and try to work towards the main conclusion of the study (which to me is still too vague). Start with a “Results: Evaluation” section, and end with a “Results: effects of SSC”, or something like that. Now, I had to reread several times before I understood your structure.