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Geoscientific Model Development Discussions

# *Interactive comment on* "Assessing bias-corrections of oceanic surface conditions for atmospheric models" *by* Julien Beaumet et al.

**F. Gallo (Referee)**

florian.gallo@metoffice.gov.uk

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General comments This paper proposes a way to evaluate bias-correction methods for SST and SIC for future climate projections, using a perfect model approach and a real-case application. There has clearly been a large amount of work in this study and this is clear when reading the paper. The analysis is thorough and the discussion honest, with the main caveats being highlighted and explained (at least, an explanation is proposed). The conclusion is clear and includes potential other methods to investigate. However, the presentation of methods and results might be a little bit confusing, given the amount of data. Some extra introductory sentences explaining the point of using a perfect model approach would be welcome, as it might not be obvious to a reader that is not a specialist but wants to learn more. This could be done in section 2.4, where the



description of the evaluation method (which is a main point of the paper) is a bit short. More generally, it would be interesting to provide some examples of the use of a perfect model approach in the literature. If the language is usually clear and understandable, the wording can be unusual and the authors are encouraged to have (another?) correction by a native speaker (which the reviewer is not. . .). On a more specific point, onw might wonder why were the GCMs CNRM-CM5 and IPSL-CM5A-LR chosen? Was this a choice based on availability or were these models selected based on their respective performance for representing SST and SIC? It would be nice to have information on this point. Finally some caveats and issues are treated too lightly and would require a more thorough description and explanation (see specific comments). Overall, the proposed paper describes an interesting and detailed work that should be of interest to many users in the climate modelling community. I therefore propose this manuscript to be accepted after the minor changes described in this review document.

Specific comments P1 L12: the part about RCPs is not needed, isn't it? The sentence is a bit long L17 bracket missing somewhere L19: Would it be possible to have some other examples from the literature? Surely a list of 4 or 5 references should be easy to find L19 "For example, it has. . ." L20 the seasonal cycle and the trend P2 L24 describe "AMIP" as "Atmospheric Model Intercomparison Project" if it is not done anywhere else P3 L25 Is there a reference for the Hann box filter? Why did you choose this filter? P5 L13 Any information on the number / proportion of GCMs that were dismissed? What does "poorly" mean for the selection process? L13 AOGCMs and remove"overly" P7 L12 "We assume that an ideal bias correction method should reproduce the same change in mean and variance between the observations and the estimated future SST and SIC as between the used coupled GCM historical simulation and the climate change experiment." That seems obvious but is there any reference regarding this issue? Is there any discussion among the scientific community? L23 What is the point of applying the perfect model approach for SST, as we use only "regular" bias correction? You highlight this issue, but you might want to shrink this section a bit. P8 Fig4 Are you sure about the color? There seems to be a very large initial

bias between the obs and the historical simulation for North Atlantic, is that expected? Moreover the RCP4.5 looks quite cold compared to the corrected values. If this is correct, can you highlight and explain that in the text? L11 “methods” L12 delete “in” P9 L9 This comment is valid for the whole paper, but is the use of “biases” valid when describing the results of the perfect model experiment? It is a bit confusing with the original bias that we are trying to correct. Again, if it has been used previously in the literature in that context, I’m ok, but maybe “difference” or “error” would be clearer, as it is a bias created by the method, and not a bias originally in the data P10 L12 “more or less” – can we find a more scientific term please? L14 “is easy to explain” – Is it? Cand you develop, please? L29 Should an ideal method apply the same statistical changes? It sounds right, but what about skewed distribution (precipitation) where the BC would change the distribution, therefore changing the distribution of changes? I think there is quite a discussion about that topic, so, if I agree with you, I would change to “We consider here that an ideal method. . .” P11 All text – Would it be possible to have some correlation value in order to quantify the error among the different methods? Maybe a correlation coefficient, or the value of the minimum, maximum and mean error for each graph? Fig8 and 9 It is difficult to see which point correspond to what – Maybe adding a letter to each of them to point to the region would help – Please try but it might make the figure impossible to read. It would be nice to be able to navigate alone within the points

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