

We are grateful to the Editor and Reviewer #2 for carefully reading the manuscript, and for reporting some mistakes and issues. As in the point-by-point answer here included, we have proceeded to clarify and correct the manuscript where suggested. Please note that the line references are relative to the revised marked-up manuscript.

EDITOR

-Experiment setting of SPEEDY runs: Based on the description in line 165, the SPEEDY is run in perpetual-winter mode (200 January and 200 February months). However, in the description of “control integration”, it is said in line 170 that the model is run with “evolving SSTs 1979-2008 from HadISST”. Thus it is not clear to me how the surface SST is set for the perpetual-winter mode (200 January and 200 February months) in the SPEEDY experiments.

Please note that « the LST of the control experiment corresponds to the climatology obtained from a SPEEDY 10-member ensemble, run with a freely evolving LST scheme and with prescribed climatological SIC and evolving SSTs 1979–2008 from HadISST », as in the text. This means that the control is run with fixed climatological Jan and Feb LST, while the 10-member ensemble from which the climatological LST is computed is run with evolving LSTs and prescribed observed SSTs 1979–2008. Following the editor’s comments we revise the text to clarify (**lines 147-148**).

-Line 175: what is the meaning of “lat” in the formula where describing the setting of cold integrations?

In **lines 154 and 300** we have corrected the smoothing function to $\exp \{ - (\varphi - 38\text{degN})^2 / (2(5\text{deg})^2) \}$, where φ latitude is greater than 38degN.

-Line 202: For the definition of EKE, it might be better to use the form $[(u^{\text{HF}})^2 + (v^{\text{HF}})^2] / 2$.

We thank the editor for the suggestion, and have included the new form in **line 180**.

-Footnote 1: the definition of θ_{cl} should be explained.

We have expanded the footnote to explain.

-Equations in line 201: if using z denoting the geopotential height, it should be z^{HF} instead of Z^{HF} , and the meaning of z^{HF} should be explained.

We have corrected to upper-case Z . The meaning of the HF superscript is defined in **lines 183-184**.

-The authors use 6 models' output (out of the 37 CMIP models) to make the “cold TP composite” which are actually from three modeling groups (CNRM, CanESM5 and FGOALS). It is possible that the “cold TP composite” still includes a considerable part of the inter-model difference. I suggest the authors at least add some discussion on the possible caveat of such composite.

We expand our comment on this caveat in **lines 124-129**, noting that a cold TP composite based on a selection of 1 model per institution shows consistent results.

REVIEWER #2

-L111: I assume these are the coupled simulations. Please make this clear.

This has been specified in **line 112**.

-L111: Why did you choose the years 1979-2008 for your analysis? Is this to have a 30-year period? Please add a sentence of clarity here.

The years constitute 30-year period representative of a recent climate. A brief explanation has been included in **line 113**.

-L190-193: I found this sentence very long and not worded that well. Please split into two sentences and rephrase to aid readability.

We thank the reviewer for pointing out the issue, and have reframed the sentence to aid readability. See **lines 199-203**.

-L191: 'especially'.

This has been corrected.

-Throughout degree symbols are missing when you refer to latitudes and longitudes.

We thank the reviewer for noting this, and have added the degree symbol where missing.

-L274/275: I believe you mean to reference figure 7 here.

We have corrected the mistake.