

Review for the manuscript

Asymmetric changes of temperature in the Arctic during the Holocene

based on a transient run with the CESM

by Hongyue Zhang et al.

Submitted for publication in *Climate of the Past*

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Thank you for your suggestions on our manuscript. We do our best to address each of them.

Line 27. Replace ‘...verify...’ by ‘... confirm the occurrence of the ...’

Reply: Thank you for your suggestion. Fixed.

Line 28. Replace ‘...using unaccelerated simulations of ECBilt-CLIO, IPSL, and Trace21k.’ by ‘... in unaccelerated simulations using ECBilt-CLIO, IPSL, and in Trace21k.

Reply: Thank you for your comments. Fixed.

Line 163. The structure of the paragraph is not clear for me. You first state line 159 that only 5 simulations have been published and then line 163 that they are two more that are also published. Why not stating immediately that they are 7 that are published?

Reply: Thank you for pointing that out. Line 159 declares five simulations that completely cover the Holocene period (0-11700 ka BP), while the other two simulations declared in line 163 cover 6 ka and 8 ka respectively but not the entire Holocene period. We have modified the sentences as “Additional unaccelerated simulations, such as the simulations based on MPI-ESM (Bader et al., 2020) and IPSL (Braconnot et al., 2019) covering only part of the Holocene period (0-8 ka BP and 0-6 ka BP, respectively), have also been published in recent years.”

Line 204 ‘for each grid point’ instead of ‘of each grid’

Reply: Thank you for your suggestion. Fixed.

Line 205. You mention a small number of degree of freedom. One reviewer mentions several times the problems potentially related to serial correlation. If I understand well, this has not been taken into account. You must then mention at least in the methodology

that ‘The potential impact of temporal and spatial correlation is not taken into account in the analyses’.

Reply: Thank you for pointing out our oversight. We have added this description in the methods section.

Line 309. Replace ‘This suggests that orbital forcing plays a contributing role in generating this asymmetry more than other forcings’ by ‘This suggests that orbital forcing plays a dominant role in generating this asymmetry.’

Reply: Thank you for your suggestion. We've modified it.

Line 337. Please explain how you determined that ‘The first and second leading modes are significantly separated at 95% confidence level.’

Reply: Thank you for the comment. What we want to express here is that the first and second leading modes of the EOF are statistically independent of each other. So we can use the second mode of the EOF in SLP to represent the pattern of Arctic Dipole. We have modified ‘significantly separated’ to ‘statistically independent’.

Line 504. Change ‘Using the non-accelerated model to verify the Arctic temperature asymmetry’ by ‘Using no-accelerated simulations to test the robustness of our results the Arctic temperature asymmetry, we found that.’

Reply: Thank you for your suggestion. We've modified it.