Response to editor:

Thank you for taking into account the suggested changes. I am generally satisfied but have gone through the manuscript and spotted a few typos which I indicate aside.

Thank you very much for your careful review of the revised manuscript. We appreciate the time and effort you devoted to evaluating our work. Your comments greatly improved the quality of the manuscript.

*Please see our point-by-point responses to each of the comments below in **blue and italic**, and suggested implementations in a revised manuscript in **green**.*

In addition, there is one issue with which I am still a bit concerned. In my previous review of the manuscript I indicated that "positive surface pressure anomalies of up to 5.7 hPa are found between 50 and 70 S in the Indian and Pacific basins". Your response is that this is related to the large shift in the descending branch of the southern Hadley Cell. I believe this to be the ultimate reason. However I don't think that the link is so obvious. I see large changes going on at mid-high southern latitudes of the SH that are not discussed. For instance, Figure 4b shows anomalous subsidence around 45-50S, where there was ascent in the control run. The same (but weaker) happens in Figures 4a, c and d.

I would really like to see a deeper explanation of what is happening here, because this seems to be a very robust feature. I look very much forward to seeing this discussed in the manuscript. This way the paper will dive a bit more into the mechanisms and be less descriptive.

Thank you for the suggestion, we have added more discussion about this feature in the revised manuscript. We believe the positive anomalies in JJA arise from the large southward expansion of the SH HC, which shifts the high pressure systems southwards. We have included a figure here with 49ka_control and 49ka_shutdown mean state patterns for MSLP and 850 hPa wind circulation. The subpolar low-pressure belt is also pushed southward and enhanced, particularly in the South Pacific and Indian basins. The positive MSLP anomalies thus, indicate more of shift in the position rather than intensity of the Hadley circulation in the HS simulation.

Changes in the upper-level jet, as discussed in Lee et al. (2011), are related to the weakening of the JJA SH HC strength. Our simulation shows a weakened subtropical jet at around 30° S and, a weakening of the subsidence in the descending branch of the Hadley Cell and Ferrell Cell in the HS simulation. A more detailed explanation will be investigated in future studies.

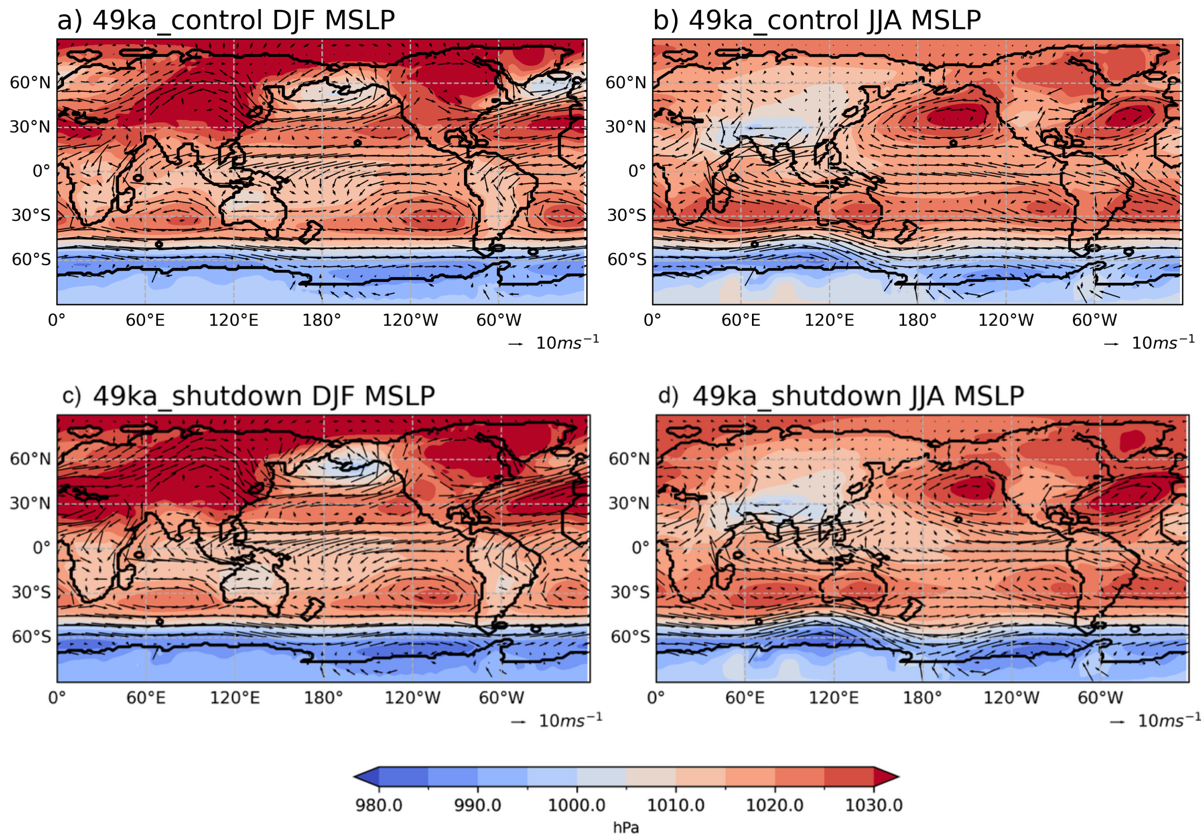

Figure. DJF (left column) and JJA (right column) MSLP (hPa) in 49ka_control (top row) and 49ka_shutdown (bottom row) experiments, with 850 hPa wind vector (m/s).

Lines 331-340:

In the shutdown simulation, the subpolar low pressure belt shows negative surface pressure anomalies, while positive surface pressure anomalies of up to 5.7 hPa are found between 40° S and 60° S in the Indian and Pacific basins (Fig. 6b). This increase in the positive anomalies is primarily due to a southward expansion of the southern HC, with its descending branch shifting to ~ 27° S, which then drives a southward shift of the high pressure systems in the HS simulation. The subpolar low-pressure belt is enhanced and pushed southward, particularly in the South Pacific and Indian basins. The 200 hPa subtropical jet around 30° S weakens due to a decrease of the southern HC (Fig. S5b). The mid-latitude jet is enhanced around 50° S to 70° S, with a weakened South Pacific split jet (Fig. S5b). This further leads to increased SH westerlies and Rossby wave propagation pattern anomalies around 40° S and 60° S (Fig. 6b). These responses are consistent with Lee et al. (2011) proposed SH circulation responses to North Atlantic cooling.

All simulations show a common response in Figs. 4b, 4d, 4f, suggesting strengthened Ferrell cell ascending branch and weakened descending branch. This change in the Ferrell Cell strength leads to similar response in the mid-high latitude pressure systems in Fig. 6b, 6d, 6f. However, the more intensified pressure response in Fig. 6b results from *the shift in the SH Hadley Cell descending branch in HS simulation, wihile the D-O stadial simulations show no shift. We have modified the relevant discussions. Similar and weaker response happens in DJF for Figs. 4a, 4c, 4d; however, the change is too small to affect the pressure systems. Due to the scope of this study, which mainly focuses on the Hadley Cell changes, we will not include the discussion for DJF southern mid-high latitudes responses.*

Lines 340-344:

The slowdown simulations display a broadly similar spatial pattern in the mid-high southern latitudes (Figs. 6d, 6f), resulting from a strengthening of the ascending branch and weakening of the descending branch of the southern Ferrell cell (Figs. 4b, 4d, 4f). The difference in pressure response between the shutdown and slowdown simulations is likely attributable to the large shift in southern HC descending branch in the shutdown simulation, while no shift is simulated in the D-O stadial simulations (Figs. 4b, 4d, 4f).

Minor technical details:

We are sorry for the technical errors, we have now carefully proofread the manuscript and corrected all of them, except for one of the comments below:

line 116: should be "the sea component"

We prefer to keep "the ocean component", because it is the terminology used in the original model description paper (Ziehn et al., 2020), and commonly used in other papers using the ACCESS-ESM1.5 model (e.g. Yeung et al., 2020).

line 340-344: In relation to my main comment above, the issue is not so much the differences between slowdown/shutdown but to try to explain a bit more why these positive anomalies appear. I believe the mechanisms are explained e.g. in the papers by Chiang et al you cite, as well as Lee and Chiang (2011).

We have now added some discussion of the mechanisms linking changes in AMOC strength to SH circulation responses, with reference to the mechanisms proposed by Lee et al. (2011), as outlined above.