

Review of the manuscript “Interactions between the stratospheric polar vortex and Atlantic circulation on seasonal to multi-decadal timescales” by Dimdore-Miles et al.

The present manuscript analyzes the potential link between persistent extreme variations of the polar vortex and changes in the AMOC in a 1000-yr pi-control run of the UKESM1 model. The authors find an oscillatory response in the NAO and the AMOC after persistent extreme polar vortex intervals. Non-stationary variations of the polar vortex and AMOC at periods of 30 and 50 years seem to be related to these responses. However, AMOC variations at longer time periods (90 years) are found to precede changes in the polar vortex through modifications in the equatorial Pacific and the QBO.

The manuscript is well written, and the authors perform a thorough statistical analysis to identify the different non-stationary signals in AMOC, NAO and polar vortex and more importantly, the link between them. The topic is original as it has only been explored in a few previous studies. However, there are some aspects (most of them minor) that I think should be addressed. They are indicated below line by line.

L128: I think a “:” instead of “a” should be included after DM21.

L207-209: Baldwin and Dunkerton (2001) do not compute the NAM based on zonal mean geopotential height anomalies. It is Baldwin and Thompson (2009) who do that.

L213: It is written that after the central date of a NAM₁₀ extreme event, the NAM₁₀ must recover to westerly for a certain number of days. However, the NAM₁₀ is not a measure of the wind field. I would encourage clarifying this aspect of the definition.

L263: We → we

L281-282: I would not describe the SLP pattern for the -1-0 months before extreme NAM₁₀ events as a positive phase of the NAO. Strong centers of action in the Pacific and Siberian regions. In contrast, the anomalies over the Atlantic are very weak.

L308: I think a reference for the mechanism in which the SSTs respond to anomalous ocean-atmosphere heat fluxes is needed.

L309 and bottom row of Figure 1: Since a reference to the PDO is included in the text, I would recommend showing the whole Pacific in SST plots of Figure 1.

L371: Figure 4b

L373: Figure 4c “shows”

L386: I would change the title section and include something about the non-linearity of the response.

Figure 5: Figure caption and plots do not match. Panels’ titles should also be corrected.

L414-416: The double peak in the sub-polar North Atlantic heat flux response to persistent polar vortex events is not that clear as in the AMOC.

L526-545: The authors relate the 90-yr vortex variability to a variability of the similar period in the QBO through a driving mechanism involving changes in the Pacific SSTs. However, no signal is detected in that field but in the East Pacific OLR. Can the authors explain this discrepancy?

L563: (Manney et al., 2005).

L582: Figure 11b.