

Response to Reviewer-1

Title: Ocean circulation, sea ice, and productivity simulated in Jones Sound, Canadian Arctic Archipelago, between 2003-2016

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We would first like to thank the editor and two reviewers for their detailed and constructive comments that have vastly improved the manuscript. Please find a point-by-point response to each comment that was raised below. Reviewer comments are presented first and our response is written beneath as indented-bulleted text.

Reviewer 1

I am excited to see this type of model developed for investigating circulation, sea ice, and productivity in the Canadian Arctic Archipelago (Jones Sound in this case). I would like to share my own experience with modeling flows through the CAA. Previously, I used a coarse-resolution model to investigate these flows, but I have since recognized the critical need for a high-resolution model to accurately capture detailed current patterns and better understand the circulation and water properties in this region. The authors have done an excellent job in developing this high-resolution model. **It is generally understood that the variations of transports through CAA are mostly controlled by changes in the large-scale circulations, and it would be beneficial to mention this.**

- Thank you! We agree that mentioning this within the text would be helpful, so we added it to the beginning of the introduction where we introduce the CAA (L21-23)

While acknowledging the impressive work, I believe there is still potential for further model improvement. For instance, addressing the warm bias and resolving the model crash issue within the biogeochemical component would enhance its accuracy and reliability. The authors did not investigate the cause of this biogeochemical model crash. While not strictly necessary, providing some insights into this issue would be valuable for the scientific community.

- The Atlantic Water warm bias in our model is unfortunately sourced from the ANHA12 NEMO run which we took our boundary conditions from (rather than from an issue with our MITgcm model). Addressing this would require us to redevelop the model from scratch, which unfortunately is too large of a task. However, we purposefully limited analysis of the model outputs to circulation, volume transport, sea ice, and near-surface biological productivity, which should be minimally impacted by the warm bias. However, we agree that fixing this would improve the reliability of our model and flag this as an important step in future work. Furthermore, we highlight that the boundary conditions are the source of the warm bias in both the Results Section (L139-142, L161,) and

Discussion Section (L379-384).

- We agree that investigating the reason for the crash in the biogeochemical model would be valuable to the scientific community and for those using N-BLING on other polar regions. We dug into this issue and found the exact location and cause of the model crash. We included a new paragraph in the discussion section that fully describes the reason for the crash and ways to avoid this in future studies (L369-3798).

Line 65: “?” is needed at the end of the (2)

- Done.

Lines 132-33: 2m air temperature is used in driving the model, but why 10 m air temperature is used here?

- Thank you for catching this, we corrected this here and in other places in the manuscript.