Ocean Science Discussions

Ocean Sci. Discuss., referee comment RC1
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Comment on os-2021-37

Anonymous Referee #1

Referee comment on "Regional imprints of changes in the Atlantic Meridional Overturning Circulation in the eddy-rich ocean model VIKING20X" by Arne Biastoch et al., Ocean Sci. Discuss., https://doi.org/10.5194/os-2021-37-RC1, 2021

General comments

The authors use the NEMO ocean model to carry out a set of simulations that have ¼ degree horizontal resolution across the entire globe, as well as some which feature AGRIF nests to achieve 1/20 degree horizontal resolution within the Atlantic Ocean. These simulations are then compared against observations that span the North and South Atlantic Ocean. Observed AMOC transports at multiple locations are compared against the model output, identifying certain features. The authors find that surface freshwater restoring influences the AMOC transport.

The manuscript is well thought out, covers a much larger expanse of the Atlantic than we normally read about in AMOC-related articles, and provides a lot of information that modellers, observationalists, and climate scientists may find useful.

Specific Comments:

L135-137: Is this free/no slip change for both the parent and nest, or just the nest? If only the nest, I'm curious why no-slip isn't included everywhere in the nest as it helps generate eddies. Perhaps include some text in the manuscript on why only use a small region with no-slip.

L150: I find it intriguing that the spatial multiplier is 5 between ORCA025 and VIKING20x,

but you were able to get away with a time multiplier of 3. I always thought AGRIF required the same spatial/temporal multiplier even though you set it. I might have to try this later. No response needed here, I just wanted to express I learned something.

L229-236: It isn't clear what the INATL20-JRA-long simulation will provide. Assessing nested boundary condition issues is useful, but this simulation has different restoring, slip conditions, and tides. Please provide more justification here on why this simulation is included, particularly in reference to any anticipated AMOC changes suspected due to nested boundary conditions.

Figure 9: The spatial area of the MLD is much different between these runs. But I don't see how their MLD volume (d) is so similar. This is addressed in L403-413, but I still have an issue with the MLD plots, I would have expected to see a larger change in fig 9d. Perhaps it is because the spatial max MLD is plotted. Perhaps try plotting a mean of the annual max MLD?

L355: Any suggestion why this pathway is not seen in your simulations?

Technical corrections

Figure 2c- My PDF viewer shows horizontal white lines on the AVISO figure, but they are only over land and do not make the figure difficult to view.

L21-22: Grammar issue clouds this sentence.

L23: 'The RAPID array at 26.5N is …'

L120: I'm not sure what an 'eddy-present' configuration is. Do you mean eddy-permitting or eddy-resolving? It isn't clear here or in the later parts of the manuscript

L386-389: awkward sentence that could use a rewrite.

L618: extra space before a period.

L639: ‘Only Besides’ is confusing, seems like the authors meant to write ‘Besides…’ and forgot to remove ‘Only’.

L676: bit awkward “… does equal the one …”