

We thank the editor Dr. Farneti in handling our manuscript, and Dr. Griffies, Dr. Bell, Dr. Hogg and Dr. Hirschi for their positive and constructive comments. We have acknowledged their work in the Acknowledgements section. Please find our point-by-point reply below in red text.

Referee #1 (Stephen Griffies)

This is an enjoyable piece of work that documents a tremendous and exciting advance in our ability to analyze ocean models. I fully support publication and offer only minor comments.

We thank the reviewer for his positive comments.

- Line 63: The phrase "we more often than not do not possess" is very awkward. How about "commonly, we do not possess..."

Adopted.

- Line 112-113: I did not find "absolute dynamic topography" in Gregory et al (2019) paper. Even if ADT is the name used by AVISO, please do connect directly to the now-standard nomenclature in Gregory et al. Furthermore, note that "dynamic topography" is a deprecated term listed in Section 8 of Gregory et al, with three recommended replacements depending on the context. So again, please move to the new nomenclature to avoid confusion.

While we understand the reviewer's concerns, the terminology of 'Absolute Dynamic Topography' is the one used by AVISO and the naming of their products so we have kept it in the manuscript to be consistent with the AVISO product we are using. (Please also see our reply below). We have strengthened the specific references to ADT and modeled SSH as approximations to the ocean dynamic sea level, to be maximally consistent with Gregory et al. (2019).

- Line 115: where precisely in Gregory et al (2019) are you pointing to? Again, I do not recall us defining "absolute dynamic topography" in Gregory et al, though perhaps I am missing something. And again, "dynamic topography" is not a recommended term since it has multiple meanings depending on the science community.

We have attempted to clarify the term by adding that 'absolute dynamic topography' is also referred to as ocean dynamic sea level. Specifically, we have changed the paragraph in lines 114-119 as: "In light of the SWOT mission, the primary variable of interest is the ocean dynamic sea level. The AVISO estimate of this quantity is called the Absolute Dynamic Topography (ADT), while the closely related model diagnostic is their Sea Surface Height (SSH) after correcting for the inverse barometer effect if atmospheric pressure variability was simulated. Technically, SSH is defined as the geodetic height of the sea surface above the reference ellipsoid, while ocean dynamic sea level (or ADT) is defined relative to the geoid, but in models where the geoid and reference ellipsoid coincide these two definitions are in practice the same (Gregory et al., 2019). Furthermore, in the specific comparisons made here, a regional average of the ocean dynamic sea level estimates is removed first, so that large-scale, slow changes (e.g., ice sheet contributions) are excluded from the comparison."

- Figure 2: Some model grid spacing is given in km and others in degrees. In the caption, or in Table A3, it would be useful to see a common approach. Additionally, please provide the number of grid points in the domain in Table A3; i.e., the "resolution" as it is normally meant, say, for a computer screen.
While we understand the reviewer's points, grid spacings in some simulations were indeed defined via km instead of degrees (e.g. GIGATL, FESOM-GS). We have kept the descriptions consistent to the simulations used.
We have added the number of grid points in Table B2.
- Line 133: "interesting". But I think it is "expected", right? If unexpected, then comment.
We agree with the reviewer and have added: "... while expected, it is interesting..."
- Figure 4: I failed to find information about the geographical location of this frequency power spectrum.
We have added in the caption: "The frequency periodograms were computed every ~10 km in Region 1 and then spatially averaged."

Reference

- Gregory, J. M., Griffies, S. M., Hughes, C. W., Lowe, J. A., Church, J. A., Fukimori, I., Gomez, N., Kopp, R. E., Landerer, F., Le Cozannet, G. and others. (2019) Concepts and terminology for sea level: Mean, variability and change, both local and global. *Surveys in Geophysics*. doi:10.1007/s10712-019-09525-z;