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Interactive comment on "A multi-year timeseries of observation-based 3D horizontal and vertical quasi-geostrophic global ocean currents" *by* Bruno Buongiorno Nardelli

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I do thank the reviewer for the positive comments and constructive suggestions, all of which have been considered in revising the manuscript. Specifically:

"Section 2.4: Are there guarantees that the solving procedure actually converges toward the correct solution? Is this procedure standard? Why not using a classic, iterative procedure of the Gauss-Seidel or SOR type?"

The Loose Generalized Minimal RESidual (LMGRES) is one of the standard algorithms provided within SciPy library to solve sparse linear systems (see also

https://docs.scipy.org/doc/scipy/reference/generated/scipy.sparse.linalg.lgmres.html). It has been clarified in the revised text that the tolerance for LMGRES convergence was set here to 1e-7. The convergence to tolerance was achieved in all runs. Many other algorithms provided by SciPy have been tested together with LMGRES, and LMGRES outperformed them in terms of computational speed. Indeed, a large number of matrix inversions is needed to build the full timeseries over the global oceans, which would have made the adoption of simpler and slower iterative algorithms unfeasible (if aiming to reach the same accuracy).

"Section 3.4: Figure 4 shows that OMEGA3D velocities are more biased than DUACS geostrophic velocities close to the tropical band. It is to my opinion necessary to investigate this and provide some explanation."

QG approximation implies that Omega equation cannot be solved at the Equator, and increased errors are expected within a much larger latitudinal band close to the equator. This is due to the fact that Omega is derived in the f-plane, and the forcing cannot be correctly estimated there by definition (as accurate horizontal velocities are needed to compute all forcing terms). This has been now explained also in the revised section 3.4 as suggested by the reviewer.

"L294: "Mean biases computed. . .": please modify the phrasing to make the sentence more explicit"

This sentence has been rephrased in the revised manuscript to make it more explicit as requested by the reviewer.

"All datasets present negative biases wrt SVP, and positive biases wrt YOMAHA. Any comment on that? Are there known biases in the observations? Or missing processes in the models?"

Thanks for highlighting the need to comment on this. For sure there's differences in the data representativeness, as in situ velocity estimates are obtained from Lagrangian

drifters' displacements, which provide local estimates that cannot be fully representative for grid points (considering space/time sub-grid variance). In situ data also need specific processing (e.g. to remove inertial oscillations), which may lead to biased estimates. Then, of course there's also missing processes (or only partially parameterized processes) in models (e.g. sub-mesoscale processes, effects of waves on vertical mixing), as well as potentially inaccurate (or too low spatial resolution) fluxes in input. A short comment on this has been added in the revised Conclusions.

"Please check the URLs."

All URLs have been checked and corrected in the revised manuscript.

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