

- line 90: “rational” should be “rotational”.
- For a non-simply connected domain, the Helmholtz decomposition (actually, the Helmholtz-Hodge decomposition) has a harmonic term that must be specified. See [Denaro \(2003\)](#) and [Bhatia et al. \(2013\)](#) for details. It is useful to here comment on the reason you drop the harmonic term. I suspect one can indeed ignore this term for global ψ and χ , yet it must be considered for basin diagnostics.
- line 132: “convex hull” should be explained with a picture.
- line 133: I do not understand the need for “a small number of $\epsilon = 0.1\text{Sv}$ on the boundary. Is that the geographic boundary? Watermass boundary? What is the need?
- lines 137-138: provide some motivation for the choice of bin sizes. What are the ideas to consider by the diagnostician?
- Figure 3 caption: “back and grey” should be “black and grey”.
- line 216: My understanding is that NEMO conserves volume and tracer content to within computer roundoff. So I am puzzled with the phrase “and imperfect ocean mass conservation.” Indeed, on line 238 you state “The model conserves volume”. Please explain.
- line 255-256: provide more explanation for “contain the subgrid-scale diffusive parameterisations as part of the advective velocities”. I do not wish to go to Wilson et al (2021) to see what you mean. This is a basic point for diagnosticians so you should provide an explanation here.
- line 258: “the the”
- line 267-268: I am unsure what you are talking about here. Please be more precise.
- line 285: “the the”
- Figure 4 is lower quality than some of the others, such as Figure 1. Perhaps resolution is too low.
- line 324: ”for in the NEMO” should read “for the NEMO”
- line 326: “Reynold” should be ”Reynolds”
- line 336: “date” should be ”data”
- equation (7): avoid a line break after equation (7) to avoid having L^AT_EX produce an indentation.

References

- Bhatia, H., G. Norgard, V. Pascucci, and P.-T. Bermer, The Helmholtz-Hodge decomposition—a survey, *IEEE Transactions on Visualization and Computer Graphics*, 19, 1386–1404, doi:10.1109/TVCG.2012.316, 2013.
- Denaro, F. M., On the application of the Helmholtz-Hodge decomposition in projection methods for incompressible flows with general boundary conditions, *International Journal of Numerical Methods in Fluids*, 43, 43–69, doi:10.1002/fld.598, 2003.
- Zhang, R., and M. Thomas, Horizontal circulation across density surfaces contributes substantially to the long-term mean northern atlantic meridional overturning circulation, *Communications Earth & Environment*, 2, 112, doi:10.1038/s43247-021-00182-y, 2021.