Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., author comment AC1
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Reply on RC1

Trevor J. McDougall et al.

Author comment on "The interpretation of temperature and salinity variables in numerical ocean model output and the calculation of heat fluxes and heat content" by Trevor J. McDougall et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-426-AC1, 2021

The review by Remi Tailleux has provided us with a lengthy and strongly worded disagreement with our manuscript. The main disagreements that this reviewer has with our paper are based on the following three viewpoints with which we disagree,

- a concentration by the reviewer only on the terms that contribute to the globally volume-integrated heat content of the ocean, rather than also being concerned with errors in modelling temperature in specific geographic locations,
- a hope (that also pervades the Tailleux (2015) paper), that retaining potential temperature as a model's temperature variable could be made to be competitive, in terms of accuracy and practicality, compared with adopting Conservative Temperature in numerical ocean circulation models, and,
- what we believe is an error made in Tailleux (2010) and Tailleux (2015) in the choice of physical property that is assumed to be conserved under turbulent mixing.

The error made by Tailleux (2010) and Tailleux (2015), referred to above, underlie many of this reviewer's comments; in particular, his "Specific comments" numbered 4, 9, 10, 11, 17, 20 and 22. This error is the assumption that Total Energy, is a conservative variable. Because this issue underlies so many of the reviewer's comments and is central to both the Tailleux (2010) and Tailleux (2015) papers, TMcD directly addresses this issue in an Appendix to our Response to Remi Tailleux's review. This detailed Response is posted as Supplementary file here.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2020-426/gmd-2020-426-AC1-supplement.pdf