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Ocean Science Discussions

Interactive comment on "High frequency fluctuations in the heat content of an ocean general circulation model" *by* A. M. Huerta-Casas and D. J. Webb

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The main goal of the paper is to estimate errors that arise when mean datasets are used to estimate the advection and diffusion of heat in the ocean. The authors use instantaneous (snapshot) and five-day averaged ("mean") data from high resolution OCCAM model from tropical Pacific. They show that processes with a period shorter than five days can significantly impact the heat budget introducing errors from both advective and diffusive terms of the same order of magnitude as the estimated heat content.

1. This paper is potentially very important to users of ocean GCMS particularly as increasing numbers of new observations make it important to close model water property

budgets on the basis of archived GCM fields. Model fields are often archived before subsequent analysis has been fully planned and only then may be found to be lacking a crucial element. Calculations in the equatorial region, where high frequency waves may be energetic, are evidently particularly prone to error if carried out with 5 day mean fields.

2. The paper is not crystal clear about what fields are archived. Surely 5 day means (<>) of individual fields e.g. <u>, <T> are archived , . . .but are also 5 day means of nonlinear fields such as <uT>, or the nonlinear term in eq 20 archived? This leads to possible ambiguity in the caption of Figure 5 (below).

3. With regard to the analysis of Section 4.2, figure 5 shows a sudden onset (bottom panel) of difference between heat flux calculated from instantaneous data sets and five day means. Just what has been computed is somewhat unclear on account of the foregoing comment, yet the result shows that the difference between these quantities is very intermittent, an important fact to know. The text suggests that the difference might be associated with waves. One would like more statistics about the difference.

4. The appendix suggests that the snapshot values u_e and T_e archived at the end of each averaging period may be used to estimate the rms amplitude of eddy temperature flux u'T' meant over the averaging time and over a number of grid cells (eq A9). This assumes a great deal about the statistic of the snapshot values – and is also probably about the best thing one can do if one has only e.g. 5-day means and snapshot values.
5. Unfortunately what is needed for closure of water property budgets are not the fluxes but their divergences. So the most important question that author need to answer is how badly in error the divergences of the 5 day mean fluxes may be if the fluxes themselves are in error by an amount quantified by (A15).

6. It would be very helpful if the authors could provide an independent measure of the strength of processes with a period shorter than five days i.e. by showing temperature and velocity spectra to see how much energy is associated with these shorter period

OSD
9, C233–C235, 2012

fluctuations (which cannot be estimated from data analyzed here – snapshots that are five days apart and time averaged data).

Overall, this paper is significant and could be usefully left as is, the foregoing comments suggest further work, but that may be for another paper.

Interactive comment on Ocean Sci. Discuss., 9, 25, 2012.