Ocean Sci. Discuss.,
https://doi.org/10.5194/os-2019-12-EC1, 2019

Ocean Science
Discussions

Interactive comment on "The seasonal and interannual variabilities of the barrier layer thickness in the tropical Indian Ocean" *by* Xu Yuan and Zhongbo Su

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Received and published: 20 December 2019

In this manuscript the authors examine the seasonal and inter-annual variation of the barrier layer thickness (BLT) in the Equatorial Indian Ocean, using output from the SODA v3 reanalysis. They consider the seasonal variation of BLT and its correlations with changes in SSS and thermocline depth. They then consider the inter-annual variability of BLT, and its correlation with the Indian Ocean Dipole (IOD) and the El Nino Southern Oscillation (ENSO).

Firstly, I am not entirely happy with the focus on the SODA reanalysis. It seems to give fields substantially different to ARGO, and I am suspicious of the positive BLT over the

whole domain given that substantial parts of the domain (esp to the NW) are areas of net FW loss where salinity should increase towards the surface and there should be no BL. I would like to see further validation of the SODA fields before I can accept this analysis. Also, the figures need to clearly differentiate areas of no BLT from no data; currently both are white, which is confusing.

It is interesting to see the seasonal variation of the BLT, but there is little discussion of the mechanisms driving it e.g. discussion of why does the SSS change should be linked to freshwater budget changes, while discussion of thermocline depth change should include e.g. details of changes in Ekman pumping. A couple of figures showing typical vertical profiles would also be useful.

The discussion of the interannual variability is a little sketchy, but is reasonable. In summary I would like substantial revision validating the data and emphasising more the mechanisms.

Detailed Comments

The English while readable, is still not great, and could do with reading by a native English speaker. E.g. "composting" actually means allowing vegetables to decay! I think you mean "compositing" or "composited"

p1, l28–36. Simplify to just stating that previous definitions in terms of temperature difference have been replaced by new definitions in terms of density difference; leave the details (0.2°, 0.03 kg/mˆ3 etc) to section 2.

p2, l23–24. Please explain why zonal SSS gradient is important. Is it to do with Ekman drift?

p3, l1–8. Please define much more carefully what your definitions of MLD are, and actually write them out as equations. Also, you should mention Kara et al. (2000), as the first paper to use a density criterion based on a temperature criterion: Kara, A. B., P. A. Rochford, and H. E. Hurlburt (2000), An optimal definition for ocean mixed layer depth,

J. Geophys. Res.-Oceans, 105(C7), 16,803–16,821, doi:10.1029/2000JC900072.

p3, l11 "reduced systematic errors to a level" What level?

p3 l30–35. BLT is zero in the western Indian Ocean in ARGO but not in SODA. SODA BLT see generally excessive. Please compare more fully with ARGO.

p4 l 3 and below. "winter' is confusing. Please use "boreal winter" or "northern winer" (at least the first few times).

p5 l 21–25. Please spent some time describing the IOD. A figure would help.

p6 l 1–10. Explain how developing and decaying El Nino are defined: it seems you are just considering El Nino and La Nina years.

p9, Fig. 1. Please differentiate between missing data and zero BLT.

p11, Fig. 6. Are green shaded areas 95% limits for all years? If so please state this clearly.

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