

Interactive comment on “On the permeability of barrier layers” by J. Mignot et al.

Anonymous Referee #2

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On the permeability of barrier layers Mignot, de Boyer Montegut, Tomczak

Review for OSD

General Comments:

This paper uses an extended data set and a modified computation method, as compared to earlier work by the authors, to determine the distribution of barrier layers in the global ocean. The main revision to the technique requires that the median of only those profiles which display a barrier layer are included in the computation of barrier layer thickness (BLT). This means that BLT is a truer representation of this quantity in any given geographical region. The paper also discusses the computation of a new quantity – permeability – that is essentially a measure of the barrier layer persistence in a given region. Global maps of barrier layer, BLT and permeability are presented and also available on at a given website.

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Specific Comments:

The paper is very clearly and concisely written. It largely builds on previous work by the authors, although I think that the notion of barrier layer permeability is clearly a useful measure for characterizing the persistence of a barrier layer, albeit with no real information as to whether this is persistence in space or time. The authors do a very nice job of addressing this dichotomy in the conclusions. Although it is important to identify regions where barrier layers exist in the ocean, it would also be interesting to determine on what time scales we think barrier layers are important to air-sea heat flux exchange?

I have only a few specific comments and issues that I think the authors should address (in no order of importance):-

1. Data: Were the complete vertical-resolution CTD profiles from WOD2005 used or the standard depth casts? This should be specified, as the standard depth profiles (I think) have a vertical resolution of ~ 10 m and so this would impact the detection of barrier layers less than this.

2. Methodology: The 5 m criterion for the barrier layer detection is at the limit of the vertical resolution of the data set (certainly of the Argo profiles). Were there any sensitivity tests conducted for the choice of minimum BLT and requirement for it being at least 10% of the temperature-defined MLD? Wouldn't at least 10 m be a more realistic requirement? Isn't there some statistical test that can be applied to determine whether in each bin the BLT is statistically different from zero, given the number of casts in each bin?

3. Results and Discussion: page 805: Significant BLT is found in the south-east Pacific where the SubAntarctic Mode Water (SAMW) is formed. The authors note that this is due to water mass layering rather than air-sea physics. What are the water masses involved here? Many recent studies point to this region and this water mass as carrying signatures of climate change through direct air-sea interaction and subduction of

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gases, so this probably requires further discussion. Especially because in the conclusions, the authors suggest that low permeability (such as found in this region during winter – Fig. 3) suggests a significant influence on air-sea interaction and climate.

Page 808: I don't understand why the new computation retrieves many more observed barrier layer than when all stations are used to compute the median? It results in a thicker barrier layer (because the casts without barrier layers are omitted in the calculation), but the number of casts where a barrier layer is observed remains the same (allowing for those more recent casts in the new WOD2005).

Page 808, line 21: I do not see significant differences in the Bay of Bengal during May in Figure 5. The differences seem to be ~5-10 m.

4. Summary and Conclusions:

Page 812, last para: I don't think this paragraph contributes much to the paper or fits in the conclusions without further discussion. What do the authors mean by "intensity"? What measure/quantity/definition are they thinking of? Why is this important – this issue needs further discussion in the context of the paper's results.

Technical Corrections:

Page 801, line 10: From Fig. 1, it looks like the S216 cruise was in the central Pacific Ocean (as noted on page 804, line 5) and not the eastern Pacific Ocean as noted here.

Page 806, line 5: Period missing at the end of second sentence, i.e. ... in boreal summer. This value ...

Page 809, line 3: I think it should read 150-200 m, not 1500-200 m.

Page 810, line 1: Spelling mistake: should read ... different permeability indexes.

Page 812, line 2: Sentence should probably read ... salinity stratification is probably a crucial parameter for ...

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