

Interactive comment on “Distributions of mixed layer properties in North Pacific water mass formation areas: comparison of Argo floats and World Ocean Atlas 2001” by F. M. Bingham and T. Suga

Anonymous Referee #3

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The paper compares winter mixed layer properties in the North Pacific ocean, observed from ARGO floats in 2004 and 2005, with the mixed layer climatology of the World Ocean Atlas 2001 (WOA2001). It is in essence a comparison between data from individual stations with a strongly smoothed field of the long term mean.

WOA2001 is a derived product of the World Ocean Database 2001 (WOD2001), which contains the individual stations from which OA2001 was produced. In principle, a comparison similar to the one presented in this paper could be made between WOD2001 station data and WOA2001 climate means. The special aspect that makes a comparison between ARGO data and WOA2001 useful is ARGO's higher data density and the

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possibility to detect departures from the climate mean for particular years after the start of the ARGO project.

The paper contains some preliminary remarks on the differences between the years 2004 and 2005 against the climate mean but does not focus on this aspect. Its main aim is an investigation into the representativeness of WOA2001 for various mode waters of the North Pacific. Its main finding in that respect is that WOA2001 captures all mode water properties well with the exception of Central Mode Water (CMW). It ascribes the difficulty of WOA2001 to represent CMW to the CMW formation process, which is intermittent in space and time and thus suppressed by the heavy smoothing procedure employed in WOA2001.

Ideally the sequence of investigation would be to establish the departure of 2004 and 2005 oceanic conditions in the North Atlantic from the climate mean first, before proceeding to a discussion of mode water properties. The paper does not follow this approach but contains sufficient information to make its results worth while. In my view the paper should be published after modification.

The three major aspects that require attention are the discussion related to Figure 5, the interpolation scheme used for the ARGO data, and data quality control.

The last four paragraphs of section 3 address the question of the differences between the years 2004 and 2005 against the climate mean but do not go into depth. This issue really requires much deeper study into the causes for the observed differences, and the paper does not do justice to the problem. It would be better to delete this text and the associated Figure 5 and replace it by a brief remark that the authors did a preliminary analysis of the differences between the years 2004 and 2005 against the climate mean that explains the different character of Figures 4 a and b and Figures 4c and d. The last part of the abstract, which relates to the analysis of Figure 5, should be dropped.

The question of the interpolation scheme is not a trivial one. As Figure 1 of the paper shows the spatial distribution of the ARGO data is not uniform, and filling in large

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regions by interpolation is bound to have consequences. There may be better alternatives to the interpolation scheme employed by the authors. Whether the repeat of the analysis with a different scheme is warranted is doubtful, but a minimum requirement for the paper are maps for 2004 and 2005 that show the degree of confidence one can have in the interpolation. This would allow readers to draw their conclusions based on how much they trust the interpolation in any particular region.

Finally, a basic property of a science paper is that it describes the work in sufficient detail to allow others to verify it by repeating the same analysis. A detailed description of the data set, processing and quality control are essential for that purpose. The paper only offers “personal communication” for this. (There is much to frequent referral to personal communication in the paper generally.) As a minimum the paper should give a reference that allows readers to find details of how the ARGO data were treated before they were used by the authors.

Minor comment:

1. The text "Often, the mixed layer boundary condition relaxes to that given in the some version of the World Ocean Atlas" should either read "Often, the mixed layer boundary condition relaxes to that given in the World Ocean Atlas" or "Often, the mixed layer boundary condition relaxes to that given in some version of the World Ocean Atlas".

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