Ocean Science Discussions, 3, S10–S12, 2006
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European Geosciences Union

Ocean Science Discussions

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 #2

Received and published: 23 March 2006

Temperature and salinity in the winter mixed layer are preserved upon being subducted in the permanent thermocline in the subtropical gyre. The total amount of water subducted into the thermocline depends on other mixed layer properties such as its depth and density (their horizontal gradients, in particular), in addition to wind-induced Ekman pumping. The authors compared temperature, salinity and volume of winter mixed layer waters observed by new Argo profiling floats with the WOA2001 climatology in the water mass formation regions in the North Pacific subtropical gyre. They found a general agreement except in the formation region of the Dense Central Mode Water, suggesting that its formation is intermittent with eddies playing a significant role. The mixed layer volume census, while not straightforward to relate to subduction volume, is inter-

esting and may find some further applications in the future. The authors' discussion of water mass analysis in relation to recent model studies is a strength and useful given that GCMs are being analyzed in terms of water mass formation and their results are adding new dimensions to traditional water mass analysis by exploring the role of water masses, as carriers of varying potential vorticity, in circulation and climate variability (e.g., Kubokawa and Inui 1999, JPO, 1303-; Xie et al. 2000; Hosoda et al. 2004, J. Oceanogr., 865-).

I recommend the publication in Ocean Sciences after some minor revision. My specific comments follow.

1. Section 2. The mixed layer depth is determined with different methods for Argo and WOA datasets, using individual profiles for the former and monthly climatological profiles for the latter. Please discuss effects of this method difference in reference to published studies.

2. Line 21-24, page 6. It may be worth mentioning that most GCMs have difficulty simulating this dichothermal water in the subpolar gyre, a robust feature in observations. Endoh et al. (2004, JPO, 360-) discuss the simulation and formation mechanism for this water mass.

3. The spatial sampling of Argos is still quite poor, and I would suggest combining data for both 2004 and 2005 winters together for pdf distributions in Figs. 4 and 6. Minor differences between the years may be mentioned in words.

4. Line 2, page 13. Please add "eddy-resolving" in front of "most general circulation models". In coarse-resolution (dx $>$ 1 deg) models, mode water simulations are highly sensitive to resolution (Hosoda et al. 2004), which limits the horizontal gradient of the mixed layer depth important for lateral induction.

5. Line 5-8, page 13. A major problem of restoring GCMs to observed SST and SSS is that it double counts the heat/salt transport by the western boundary currents and

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their extensions, leading to warm biases in the western/central mode water formation regions (e.g., Qu et al. 2002).

6. Remove "Column 1/2" in the first row of Table 2.

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