**Ocean Science
Discussions**

Interactive comment on "Sea surface salinity variability from a simplified mixed layer model of the global ocean" *by* S. Michel et al.

Anonymous Referee #2

Received and published: 9 February 2007

This paper presents useful results on variabilty of sea surface salinity using an interesting method of mixed layer depth determination. The linking of variability in SSS with underlying physical processes presents a valuable contribution in addition to simply mapping variability. However, I agree with the comments of the first referee that the paper is rather long. In particular there is much discussion of qualitative comparisons, which although valuable, should not be over interpreted.

Page 44, line 12: Concerning the the estimation of uncertainties for the error covariance matrix. Could the authors clarify whether this problem is due to lack of data, or some other reason, and why is this a particular problem for optimal interpolation?

Page 51: The semi-implicit numerical method may be unconditionally stable but this

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does not guarantee accuracy. Does the 1 day time step affect the accuracy of the MLD solution?

The comparison of the mixed layer depths in Fig. 3 shows some very large differences where the mixed layers are deep (e.g in the Southern Ocean) with the slab model much deeper than the T02 DeBoyer-Montegut depth. One might expect the T02 depth to be deeper than the actual well mixed depth (e.g if salinity stratification controls the depth of vertical mixing) but is it not clear how the slab depth can be so much greater than the T02 depth. Are the authors confident that these differences are not due to inacuaracies in the MLD inversion at high latitudes?

Page 57: I don't see how the lack or correlation in tropical areas can be attributed to the lack of a mixing mechanism in the model. As I understand the slab model it has no knowledge of specific vertical mixing processes but infers the amount of vertical mixing from the SST observations. The other explanations offered seem more likely.

Page 59 Line 24: The implication seems to be that the choice of a small horizontal mixing co-efficient (section 2.3) is having an impact rather than the absence of a particular mixing mechanism.

The description of the salinity balance at the start of section 4.1 does not apply to equation 2 as it is written (eqn 2 has only 4 terms) but seems to apply to equation 2 when equations 3 and 4 are substituted.

Page 68. The global SSS balance seems very sensitive to what happens in the poorly represented, ice covered regions and I am unclear what point the second paragraph on this page is making.

A number of technical corrections follow:

In several places: notations -> notation

consisting in -> consisting of

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can not -> cannot

Page 43, line 17: on board of research vessels or opportunity ships -> on board research vessels or ships of opportunity

Page 44, line 3: precious -> valuable

Page 44, line 23: 2-D mixed layer dedicated -> 2-D mixed layer model dedicated

Page 45, line 16 How does daily variations -> How do daily variations

Page 46, line 14: evolutions -> evolution

Page 47, line 47: Ekman depth is systematically lower -> Ekman depth is systematically shallower (?)

Page 48 line 11: referred as -> referred to as

Page 48 line 14: is included into -> is entrained into

Page 50 line 11: time resolution is now -> time resolution which is now

Page 53, line 7: which in marked -> which is marked

Page 58, line 28: inadequacy to the local -> inadequacy in the local

Page 59, line 11: cumulate -> accumulate

Page 63, line 3: gradient is particularly.

Page 66, line 15: useful to summary -> useful to summarise

Page 69, line 24: units on length scale of 100

Page 73, line 73: but it cam be compared -> but it can be compared

Page 76, line 12: which bas been -> which has been

Page 78, line 11: sensible -> sensitive

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Page78, line 15: antagonist -> opposing

Interactive comment on Ocean Sci. Discuss., 4, 41, 2007.

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