**Ocean Science
Discussions**

Interactive comment on "The influence of temperature and salinity variability on the upper ocean density and mixed layer" *by* R. W. Helber et al.

Anonymous Referee #1

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My overall critism is that the paper is not structured clear enough and the significance of the findings or their contribution to the scientific understanding of mixed layer dynamics is not well presented. In their summary and conclusion section the authors claim that the manuscript provides 'a fundamental description of the upper ocean ...'. But the paper mainly presents a statistical analysis of mixed layer properties to explain differences in SLD and MLD.

Specific comments:

It is necessary that the authors explain the reasoning behind their choice of a bulk Turner angle which represents in their study the difference of values at 8 and 208 m.

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The parameter was meant for small scale variations that arise from turbulence in the ocean. What is the meaning of this parameter when it is calculated over 200 m and how is it going to represent the mixed layer.

The calculation methods for the SLD and MLD are not explained in the paper but details about the methods are referred to published literature (Lorbacher et al., 2006 and Helber et al., 2008). It would be much easier for the reader if the authors could either include the respective formulas in their paper or give more details about the method.

What is the percentage of profiles discarded from your calculations because the unstable density stratification?

Is it possible that the cases in which large differences between the SLD and MLD arise are mainly a cause of an unsatisfactory determination of these depth by the automated software algorithms? Figure 5 shows a 234 m difference between the detected MLD at 83 m and the SLD at 317 m. The vertical profiles of sound velocity show a strong gradient of sound velocity coinciding with the temperature jump at the base of the mixed layer and it only seems to be the algorithm that places the SLD artificilly at the much deeper level. It could be that the computation of a parameter as the Turner angle helps to detect where the algorithms fail, but I am unconvinced that they help in terms of mixed layer dynamics.

Figure 6 to me seems to be another example of an unsatisfactory determination of mixed layer depth by an automated algorithm. In this case the MLD algorithm seems to fail to detect the proper mixed layer depth because of the low temperature stratification.