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Ocean Science Discussions

Interactive comment on "Density and Absolute Salinity of the Baltic Sea 2006–2009" *by* R. Feistel et al.

Anonymous Referee #2

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This paper examines a number of issues related to the determination of the density of the Baltic sea, building upon the recent theoretical work by the SCOR working group 127 that recently led to the adoption of TEOS-10 as the new standard for the seawater equation of state by UNESCO. This work is necessary in the case of the Baltic sea, since the composition of seawater may often differ markedly from the reference seawater that is used to define practical salinity. As a result of these differences, the density of the baltic sea estimated from practical salinity will in general differ from the true density. The study uses new measurements to compute the absolute salinity S_A, and to derive empirical relationships between S_A and practical salinity. These relationships show large scatter, so the practical use of these correlations is unclear. Moreover, it is hard to tell how robust these correlations are with respect to temporal variations, given that there is little physical understanding for the spatial and temporal variability

of the different elements responsible for the differences between absolute salinity and practical salinity.

Arguably, the problem is complex, and the paper clearly illustrates the nature of the difficulties to be addressed to ultimately achieve accurate measurements of density in the oceans, when we can expect that the composition of seawater in the various oceans may evolve as a response to climate change. Given the complexity of what actually enters the definition of absolute salinity, one may wonder, for instance, about the possibility to define a physically meaningful molecular diffusivity for absolute salinity. While absolute salinity is precisely designed to ensure that its use will yield the correct density, it does not appear to be designed to ensure that its use will also lead to the correct values for all other thermodynamic properties such as entropy, enthalpy, internal energy, chemical potential, and so on... or am I wrong here? Is there any reference addressing the latter issue?

Nevertheless, I believe that the study is very interesting and useful. I have only minor suggestions listed as follows.

1. Page 1762, Eq. (4): The definition of absolute salinity S_A makes it clear that S_A is actually a pseudo-salinity, whereas I had previously assumed (wrongly) that it was more directly related, unlike practical salinity, to the total amount of dissolved mineral constituents. Could the authors comment on the links between S_A and the "true" salinity? Has there be any systematic study of the precise link between S_A and "true" salinity?

2. Page 1763, lines 9-10: The absence [...] is evident [...] from the climatological [...]. May be I missed something, but I do not see why this is evident. Could the authors clarify this? How is the Baltic sea circulation best characterized then?

3. Page 1768, Eq. (11): I believe that this equation is probably valid for d up to a certain value. What is the range of acceptable d here?

4. Page 1771, Eq. (13): What is the K_{15} ratio exactly?
5. Page 1773, Lines 7-8: Not all quantities appear to be defined in these two equations
6. Page 1782, Lines 1-2: [...] in contrast with the results of Kremling and Whilhelm... Can the authors speculate on the reasons for the difference?
7. Table 1: What is the meaning of the numbers between parenthesis?
8. Fig. 7: I suppose the units on the y-axis are mg/kg, but this should be indicated clearly
9. Fig. 8: It would be of interest to see two separate fits for the filtered and unfiltered samples...

Interactive comment on Ocean Sci. Discuss., 6, 1757, 2009.