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Comment

***Interactive comment on* “Numerical
implementation and oceanographic application of
the thermodynamic potentials of water, vapour,
ice, seawater and air –
Part 2: The library routines” by D. G. Wright et al.**

D. G. Wright et al.

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Thank you for your comments. They will help us to avoid future confusion.

1. Regarding the use of SW to refer to "SeaWater" or "Salt dissolved in Water" our wording has obviously caused confusion. When we referred to "Salt dissolved in Water" we were actually referring to Sea Salt dissolved in water. No distinction between these two solutions was intended. To avoid future confusion, we will delete reference to "Salt dissolved in Water" in the revised manuscript.

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2. Regarding the use of the standard pressure (101325 Pa) in the definition of the quantity p_0 , we note that p_0 is an internal model parameter that is used only to specify vertical position in the determination of the small correction term associated with composition anomalies. These anomalies are sufficiently small that the error associated with the definition of p_0 is entirely negligible. For example, a 10% error in the North Pacific Intermediate Water anomalies (which have typically been ignored in the past) would result in an error no larger than 0.002 g/kg in Absolute Salinity. The error associated with using standard pressure in the definition of p_0 is far smaller than 10% so the inaccuracy that you are concerned about is negligible. It should be noted that except for the use of p_0 in the `gsw_` routines, the SIA library is formulated in terms of absolute pressure so that a user may always evaluate the functions with the correct atmospheric pressure specified at the ocean surface.

3. You state “In the presented paper, it is not clear what the procedure for numerical implementation and acceptance of the regional coefficients for the absolute salinity determination should be used.” Unfortunately, it is not clear what is meant.

One possibility is that you are wondering if there are region-specific counterparts to the global correction formulae that are used in McDougall et al. (McDougall, T. J., Jackett, D. R. and Millero, F. J.: An algorithm for estimating Absolute Salinity in the global ocean, *Ocean Sci. Discuss.*, 6, 215-242, 2009. available at <http://www.ocean-sci-discuss.net/6/215/2009/osd-6-215-2009.html>) to allow for composition anomalies in the estimation of Absolute Salinity. Although determination of the Absolute Salinity for regional applications is not considered in this manuscript, it is an important topic. Relevant additional information for the special case of the Baltic Sea is presented in

Feistel, R., Weinreben, S., Wolf, H., Seitz, S., Spitzer, P., Adel, B., Nausch, G., Schneider, B. and Wright, D. G.: Density and Absolute Salinity of the Baltic Sea 2006-2009, *Ocean Sci.*, 6, 3–24, 2010a.

Other special cases have not yet been considered.

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4. We are aware of the interesting history of salinity, but enjoyed reading the text from the referenced website and rereading the related papers by Dauphinee and by Lewis (IEEE, Journal of Oceanic Engineering, Vol. OE-5, 1980). As mentioned in previous publications (e.g., Millero et al. 2008), we agree with your sentiment that excellent work was done on the development of PSS-78. Nevertheless, we believe that the reasons given by Millero et al. (2008) for revision of the representation of Absolute Salinity are compelling. We also note that WG127 is recommending that Practical Salinity (and not Reference Salinity) continue to be archived in data bases in order to minimize the chances for serious confusion. Although some confusion will undoubtedly still occur, there will also be both short and long term benefits associated with adopting an SI-compatible representation of salinity. We hope that TEOS-10 will serve present and future generations of oceanographers as effectively as PSS-78 and EOS-80 have served past and present generations.

5. Thanks for the reminder that we should reference UNESCO Technical papers in Marine Science #37. It does indeed provide relevant background information and we will add reference to it.

Regarding the use of PSU, we note that members of the oceanographic community, including the developers of PSS-78 and of TEOS-10, have always been divided regarding this issue, and the discussion has sometimes even been quite emotional, although generally lacking a metrological foundation. The latest comment on this apparently never-ending debate was given by F. Millero, History of the Equation of State of Seawater, Oceanography, in press. It is one of the aims of the introduction of Reference Salinity in g/kg to put an end to this fruitless debate and to return oceanographers into the international SI family, to which PSS-78 has never belonged; see Seitz, S., Feistel, R., Wright, D.G., Weinreben, S., Spitzer, P. and de Bievre, P., 2010: Metrological Traceability of Oceanographic Salinity Measurement Results, Ocean Sci., to appear in this special issue.

In the SIA library, we use PSU only in the ASAL-to-PSAL conversion routines where

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a numerical value and units are required inputs since a number without units is meaningless. We have four choices '1', 'ONE', 'PSS' and 'PSU'. Since our goal is to make the library easily used by all members of the community, we will modify these routines to allow all four options as valid inputs for the units of practical salinity.

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