

***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.

wrightdan@mar.dfo-mpo.gc.ca

Received and published: 19 May 2010

Thank you for your comments. This manuscript certainly fills the required role of a user's guide as well as giving additional details on the reasoning that went into the library development. We hope that it will be a valuable and convenient reference for users of the SIA source code.

Your request for clarification regarding the relation between the gsw_ routines in the SIA library and the GSW library routines is obviously appropriate since even your thought-

C249

ful comments indicate some potential for confusion. You are right that the main body of the SIA library uses the IAPWS-95 Helmholtz function to effectively derive the Gibbs function for pure liquid water and adds the salinity contribution to form the Gibbs function for seawater and you are also right that the original GSW routines are both more computationally efficient and more restricted due to the use of a more standard form of the Gibbs function that is directly expressed in terms of salinity, temperature and pressure. However, we have obviously not been sufficiently clear that the Gibbs function formulation used in the GSW library is also used in the gsw_ routines included in the SIA library, so both sets of routines benefit from this efficiency. The differences arise in the details of the implementation. The SIA Gibbs function was implemented independently to provide a check on the original routines and is deliberately made easily compared with the IAPWS-09 Gibbs function documentation. In contrast, the GSW library routines have many terms combined and rearranged for additional computational efficiency. The gain is relatively small compared to the use of the Gibbs function formulation in place of the Helmholtz function, but the additional savings are still significant. Thus, the gsw_ routines included in the SIA library serve to i) provide an independent check on the GSW_ routines, ii) make it easy to check the code against the IAPWS-09 documentation and iii) provide convenient access to these routines for SIA users. However, if additional efficiency is required, the GSW library routines are recommended. We will make sure that these points are made clear in the final version of the manuscript.

Regarding numerical model applications, you are again on the right track but further clarification is needed. For deep ocean modelling applications, the GSW routines would be preferable to the SIA gsw_ routines due to the increased computational efficiency. Even for river inputs to the ocean, the GSW routines should be perfectly adequate. However, we do not recommend even the GSW library for numerical modelling purposes where the maximum possible computational efficiency is required. In this case, we recommend use of much more efficient special-purpose equations that are determined by fitting to the results of the SIA library over the param-

C250

eter ranges of interest. Routines covering the range of applications that you discuss have been developed previously based on earlier versions of the Gibbs function (Jackett, D. R., T. J. McDougall, R. Feistel, D. G. Wright and S. M. Griffies, 2005: Updated algorithms for density, potential temperature, conservative temperature and freezing temperature of seawater. *Journal of Atmospheric and Oceanic Technology*, 23(12), doi:10.1175/JTECH1946.1.) New versions of these routines based on the most recent formulations are in preparation and should be available soon. We will include discussion of this point in the revised manuscript.

Interactive comment on Ocean Sci. Discuss., 7, 649, 2010.