Ocean Science Discussions, 1, S16–S17, 2004
www.ocean-science.net/osd/1/S16/
European Geosciences Union

Ocean Science Discussions

Interactive comment on “Numerical implementation and oceanographic application of the Gibbs thermodynamic potential of seawater” *by* R. Feistel

Anonymous Referee #2

Received and published: 30 December 2004

Thermodynamics, and by extension oceanic thermodynamics, is rarely among the most popular course embraced by physics students, so that most of the time what physical oceanographers know about ocean thermodynamics is often restricted to the basic concepts of salinity, temperature, density, potential temperature, potential density, and the adiabatic lapse rate. To add to the problem, computational routines available to physical oceanographers to compute the above quantities, and based on the available UNESCO formula, have always been a somewhat heterogeneous mix in terms of methods and approaches. For this reason, the approach of ocean thermodynamics by means of the thermodynamic potentials advocated by Dr. Feistel for the past decade or so must be regarded as a fundamental significant progress that is bound to considerably simplify the exposition of the field to students as well as to established oceanographers who lacked the motivation to do so, as it furthermore opens up new possibilities by providing easy access to entropy, chemical potential and so on in a unified conceptual and computational way. The present completes the previous theoretical exposition of the thermodynamic potential previously published by the author and collaborators, by presenting a numerical implementation of the Gibbs thermodynamic potential of seawater. Numerical routines accompany the paper in the forms of Fortran, C++, and Visual Basic subroutines which should allow physical oceanographers (and other interested scientists) to use the Gibbs thermodynamic potential with little effort, and without fear to make typing mistakes in attempting to reproduce the numerous coefficients that form the basis of the implementation. I therefore strongly support this work, and I have only minor suggestions for improvements detailed below.

Minor corrections: ——————

1) page 4, line 22: Style problem, the sentence has no verb. 2) page 11, eq. (20) and related: I would prefer to see z vary upward, as is conventional is most oceanographic textbooks. 3) page 11, eq. (21): In most computational codes, this is not the equation used. Rather, an approximate depth-pressure relationship is assumed, e.g., p = -rho_0 g z, with rho_0 some reference density, which makes the hydrostatic equation formally independent of pressure, i.e., dp/dz = -rho(T(z),S(z),-rho_0 g z). It would be of interest that the author discusses also this case, i.e., what is often referred to as the neglect of the thermobaric effect. 4) page 12: Equation (25) follows from the assumption div(rho u)=0 which should be explicitly mentioned, as oceanographers often make the further simplification div u = 0 5) page 13: Eq. (27) seems to make the implicit assumption that geostrophic flow is associated with zero vertical velocity. This is a special case, which seems furthermore requires the assumption of the f-plane. If the variations of the Coriolis parameter are retained, there is a nonzero vertical velocity, and the discussion needs to be modified. 6) page 13, line 12: intial => initial

---

Interactive comment on Ocean Science Discussions, 1, 1, 2004.