TEOS-10
Thermodynamic Equation Of Seawater - 2010

The Intergovernmental Oceanographic Commission (IOC), with the endorsement of the Scientific Committee on Oceanic Research (SCOR) and the International Association for the Physical Sciences of the Oceans (IAPSO), has adopted the International Thermodynamic Equation Of Seawater - 2010 (TEOS-10) as the official description of seawater and ice properties in marine science. All oceanographers are now urged to use the new TEOS-10 algorithms and variables to report their work.

Notable differences of TEOS-10 compared with EOS-80 are :

(1) the use of Absolute Salinity S_A to describe the salinity of seawater; Absolute Salinity takes into account the spatially varying composition of seawater. In the open ocean, the use of this new salinity has a non-trivial effect on the horizontal density gradient, and thereby on the ocean velocities calculated via the "thermal wind" relation.

(2) the use of Conservative Temperature Θ to replace potential temperature θ. Both of these temperatures are calculated quantities that result from an artificial thought experiment (namely, adiabatic and isohaline change in pressure to the sea surface). Conservative Temperature has the advantage that it better represents the "heat content" of seawater by two orders of magnitude.

(3) the TEOS-10 properties of seawater are all derived from a Gibbs function (by mathematical processes such as differentiation) and so are totally consistent with each other (in contrast to the now obsolete EOS-80 approach where separate polynomials were provided for each thermodynamic variable and they were not mutually consistent).

To enable oceanographers to implement TEOS-10, two software packages are available,

(i) the Gibbs SeaWater (GSW) Oceanographic Toolbox (MATLAB and FORTRAN) and,

(ii) the Sea-Ice-Air (SIA) (FORTRAN and Visual Basic).

Both are freely available from www.TEOS-10.org.

Version 3.0 of the GSW Oceanographic Toolbox is now available for download. The GSW toolbox has undergone extensive improvements and in addition it contains several new functions since the release of version 2.0 in October 2010. The major improvements are :

(1) an improved routine to calculate Absolute Salinity which takes into account ocean dilution and evaporation;

(2) many of the functions in the GSW Toolbox are based on the 48 term computationally-efficient expression for density. The use of this equation ensures consistency between the different branches of oceanography, namely observational, theoretical oceanography and ocean modelling;

(3) freezing temperature and latent heats of melting and evaporation; and

(4) minor bug fixes.

We strongly recommend that everybody upgrade their software to version 3.0.
Note that we do not plan any significant changes of the codes apart from minor bug fixes.

A brief introduction to TEOS-10, "Getting started with TEOS-10 and the Gibbs Seawater (GSW) Oceanographic Toolbox", is available on the TEOS-10 web site (www.TEOS-10.org). This lists all the functions in the GSW Oceanographic Toolbox and also illustrates the differences associated with using Absolute Salinity and Conservative Temperature compared with Practical Salinity and potential temperature.

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