Ocean Science Discussions

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Comment on os-2022-2

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Community comment on "Technical note: TEOS-10 Excel – implementation of the Thermodynamic Equation Of Seawater – 2010 in Excel" by Carlos Gil Martins and Jaimie Cross, Ocean Sci. Discuss., https://doi.org/10.5194/os-2022-2-CC1, 2022

The authors have developed an Excel spreadsheet with VBA macros that implements a small subset of the TEOS-10 software library availabled as the Gibbs Seawater (GSW) toolbox.
This is a great thing to have around, and something that has been on a 'wish-list' by the Joint Committee on the Properties of Seawater (JCS) for a long time.

In general, I would be happy to see this published. But I do have some concerns, as well as minor corrections.

1) My first concern is related to the fact that only a small subset of GSW is implemented. Obviously the whole tooblox is immense and (mostly) not needed, but I suggest adding a table to the paper listing exactly which GSW functions are implemented in macros. I could puzzle this out by opening up the macros (and sections 3.1-3.13 cover this material),
but this information is then scattered over many pages.

2) Also I note that what you apparently call 'SP_from_C' is not at all gsw_SP_from_C. I see
from your reply to an earlier comment that you want to 'leave this for the future', about which I am not really very enthusiastic. I'd rather this was fixed now, as it is unlikely that a future software update will be matched with a future documentation update like this paper.

Part of my reasoning for suggesting this get fixed now is that I can see an important audience for this EXCEL sheet are limnologists, many of whom are not very computational,

but may want to see if TEOS-10 will help them. However, for them the low-frequency correction is pretty important.

3) So, in particular, I think you need to note explicitly in the text that the practical-salinity-from-conductivity algorithm is NOT as in GSW, and exactly how it is different.

4) This point is less of a concern with the work itself rather than a suggestion. I can see that one very useful target audience for this are people (e.g., lab technicians) using salinometers, as they are much more likely to be familiar with EXCEL than with programming
languages. A salinometer does not actually calculate the conductivity, instead it calculates a conductivity ratio (see gsw_SP_salinometer), which should then be the 'entry point' into calculations.

I urge you to consider adding this functionality - perhaps in another tab somewhat like the 'surface data' tab but which takes salinometer readings.

5) I am not sure how difficult this is, but in many cases it is actually useful to set the salinity anomaly to zero and essentially use Reference Salinity to compute density. In many coastal areas, for example, the look-up table is not at all accurate as it contains no information on river salts, and so its probably better to ignore anomaly calculations completely. This is also true for inland waters.

One might, for example, set up the sheets to do this if no Lat/Long is entered, or if some explicit value (e.g., 999) is entered.

Minor points:

L8 "in EXCEL to estimate Absolute Salinity...."

(also note that TEOS-10 definitions like Absolute Salinity, Conservative Temperature, etc. should be capitalized - I think this is just repeating an earlier comment.)

L27 "to facilitate the efficient calculation of the properties...."

L30-33: the GSW software is available in many programming languages other than MATLAB, so
your statement is not quite correct. However, it is true that many practitioners might not be familiar with ANY programming language, so this EXCEL implement is definitely fuilling

a need.

L42-44. It is NOT CORRECT that the properties related to the chosen variables (salinity, temperature,
and pressure) must be conservative for thermodynamics to apply. In fact, they are not! It is
certainly useful for numerical modelling purposes if chosen variables can be written in such a way
that they are conservative under mixing, but this has nothing to do with the thermodynamic
state of the fluid itself.

In fact, the choice of S/T/p as state descriptions is useful in that these are measureable variables and are natural for a Gibbs function description of the state.

This sentence should probably be removed.

L46: this is a little trivial, but temperature standards have also changed over
time - before IPTS-68 there were a number of other standards - so it is not true that
the concept has remained 'unaltered over time'.

L47-48. Technically, absolute salinities (lower case) are mass fraction definitions. However,
Absolute Salinity S_A (capitalized as defined in TEOS-10) is actually "the mass fraction of dissolved
material in Reference Composition Seawater of the same density as that of the sample" (it is in fact a density salinity). Yes, this is complicated and confusing.

L53: S_A and CT are natural arguments into a simpler and more computationally efficient 75-term
density/specific volume equation by Roquet et al. (2015), which can be used to derive some (but
not all) other thermodynamic properties, although the best reference is still the TEOS-10 Gibbs
function.

L101: Maybe clarify that pressure is "sea pressure, i.e. absolute pressure - 10.1325 dbar".

L203: the [Alt-F11] is probably a Windows-specific command. It doesn't work for Excel on Macs.

L210: It is not exactly true that the conductivity of SSW at standard conditions is 42.9140 mS/cm.
This is in fact a number which a) has never been replicated, and b) is more accurate than we
can realistically measure conductivity. So, it is perhaps more true to say that the software is designed so that by definition the conductivity of Reference Composition Seawater with S_P=35 is 42.9140 mS/cm at standard conditions.