

General Comments:

This work is a good contribution toward addressing some of the challenges expressed in the cited 2016 *Metrologia* paper by Pawlowicz et al. The idea of using density as a measure of salinity, and/or as a measure of changing seawater composition, is attractive. But there are many difficult details, especially because the measurement uncertainty needed for this to be successful is of similar magnitude to several small corrections (such as air saturation and isotopic composition).

This work combines careful density measurements on standard seawater with careful analysis of small corrections to develop a relationship between density and salinity. At least in principle, deviations between this relationship and salinity determined by conductivity could give an indication of changes in seawater composition. Other valuable contributions of this work include the data themselves, which are probably more accurate and better documented than any previous measurements of seawater density, the analysis for how dilution of samples with fresh water of different isotopic composition can affect the density, and the apparent finding that the density data most important in fitting TEOS-10 in this region were not as accurate as has been assumed (and may have a systematic deviation).

Overall, I recommend publication with minor revisions. Some scientific comments and comments about the clarity of the writing follow.

Specific Comments

1. The isotopic composition of their reference water is given at the top of page 5, but it is not stated whether that is measured before or after degassing. This could be important, since degassing by boiling could change the isotopic composition (if more than a few percent is boiled off).
2. On page 7, the use of the survey of Darling to estimate the isotopic composition of dilution water for SSW. Is it known how the dilution water was purified? If it was purified by distillation, that would change the isotopic composition. Of course it would be even better if the actual tap water used by the supplier could be analyzed, but the authors do not control that.
3. On page 7, the description of VSMOW preparation is incorrect; melted ice is not involved (the ice is used for the related SLAP standard).
4. I like the suggestion that density should be measured on each new seawater batch. Are there other measurements that should be done at that time in order to give information that might be useful (perhaps even useful decades later)? I would think isotopic composition might be such a measurement. Maybe silicate concentration? Are there other key ions where knowledge of concentration would be useful?
5. I wonder about the unusual slopes at low salinity in Fig. 10. These suggest that the initial variation of density with salinity follows a different function in TEOS-10 compared to Eq. (13). Is there more the authors can say about this? Is the correct behavior known from theory? Intuitively I would think the initial dependence should be linear, but my intuition may not be correct (some things involving electrolytes have square-root terms in their concentration dependence).

Technical Comments

1. Some of the writing is unclear what the authors mean by “composition.” It took me some time to figure out that the authors do not mean change in the salinity itself (which would qualify as a composition change in normal chemical terminology), but only a change in the relative proportion of dissolved species. I do not have a specific suggestion for making this more clear, but the authors should look for some way to do so. Perhaps there should be a footnote similar to the one for “salinity.”
2. Page 2, line 11, instead of “silicon” it should probably be “silicate”.
3. Page 10, line 11, I don’t think “gassing” is a correct English word here.
4. Page 12, line 25, “for safety reasons” makes it sound like they were worried about an explosion or something. Probably should say something like “to be certain”.
5. Page 16, line 16, “cylindring” is not an English word; it probably should be “cylindrical”.
6. Some of the writing on page 16 about examining possible sources of error in Millero’s magnetic flotation densimetry is unclear. It is not clear whether they are describing checks that were done by Millero in the paper being discussed, or checks that the authors of the current paper are making for the first time. I think it is probably the latter, in which case it would greatly help the clarity if, for example, line 15 said “we carried out a representative calculation”.
7. In Tables 3 and 4, it would be helpful to the reader if the caption stated the number of the equation to which the coefficients correspond. This could be simply be done by adding “in Eq. (X)” at the end in both cases.