Minutes of Joint Meeting with TPSW/SCSW

Chair: R. Feistel
Clerk of Minutes: R. Pawlowicz, Kyoto, Aug 2017.

Agenda approved.

These minutes include agenda items in the joint TPWS/SCSW/IRS agenda that are specifically oriented to SCSW. For other agenda items consult the minutes of the other WG.

.1. Opening remarks, adoption of Agenda. The session was opened by Allan Harvey. Agenda was corrected with the addition of 12.2 (BIPM/IAPWS collaboration) which somehow got deleted. Also the addition of 13.1b, due to a mixup with the 13.1 speaker.

11. Report of Task Group on Extension of Range of Formulation for Thermodynamic Properties of Sea Water: Feistel is still hoping for a Gibbs function over a wider range for industrial purposes. New soundspeed data now available. Density measurements (perhaps) also will be available. but there may be some inconsistency with the new and old data. Numbers were promised for last Christmas but a paper still in preparation…so wait until next year.

12.1 SCOR/IAPWS/IAPSO Joint Committee on the Properties of Seawater (JCS) including updates to TEOS-10. Pawlowicz reports Web site accesses and software downloads have reached a steady state. Relative humidity work has now proceeded so that cooperation from other societies is required, details in the next talk. Some questions about TEOS-10 software and how best to organize it.

12.2 Report on BIPM/IAPWS collaboration – Feistel reports on recent progress, including his attendance at a recent BIPM meeting. has been coopted as member of BIPM/CCT WG-RH. An update was provided on downloads of the Metrologia papers, two parts of which received a "Highlight of 2016" award, with an extension of open-access. A brief outline was provided of the proposed RH definition based on fugacity ratio rather than partial pressure ratio. A proposal was put forward to BIPM/CCT WG-RH and was received with mostly positive comments. Suzanne Picard is appointed to by official point of contact with IAPWS at ICPWS workshops., which can now officially say they are "officially endorsed by BIPM".

There are some options to get BIPM to take up RH (and "change the SI") – but it will be difficult (although not impossible). 2 companion papers planned. Robert Wielgosz has been informed about efforts and has passed this on to CCQM and EAWG but cooperation not so advanced there as for RH matters.

Questions – does BIPM have anything like RH? (dimensionless variable). Yes, angle and dB (also under discussion). Is fugacity too advanced a concept for teaching people? Yes, but…so was Gibbs functions. Should it be called something like "relative fugacity" instead of "relative humidity"? The question is still open. Would RH depend on IAPWS formulations? Not as a definition, but it would be important as (for example) a mise en pratique. A note – it will be important to get the meteorological community on board, and right now they aren't.

13.1 Absolute Salinity measurements by a vibrating tube densimeter and a refractive index salinometer. Uchida has a refractive index salinometer for the lab (in a constant T bath). In theory the setup has a resolution about 1 order of magnitude smaller than is needed for the "salinity/density problem", but (as always) and equation for the refractive index of seawater is needed. Also tested – the linearity of Anton Paar density meters. First, SSW test of 8 density meters showed offset of 4 to 11 ppm. Low-salinity seawater was tested with a different offset. So diluted SSW was used – negative offset at all salinities except very close to zero. Theory is that isotopic composition of water used for dilutions was to blame!

Discussion – some skepticism about whether there is a real effect from a single source, or just the sum of many tiny effects.

13.1b Current situation of the absolute density measurements of sea water: Kayukawa described his hydrostatic weighing machine for density. Uses an Si sinker with a thermal oxidation layer to prevent dissolution. Updates for this year – has calibrated sinker, made some other modifications. New measurements give good results for ultrapure water (and MilliQ), but seawater measurements are also a little low. Perhaps because of evaporation?

Q: Hruby wonders about the effects of surface tension on the wire. Issue is not resolved.

13.2 Surface tension of seawater: Nayar provides overview of the topics of the Lienhard research group of which he is a part (practical desalination interests, software for seawater properties). He explained that surface tension is important for membrane systems, esp. at high temps and high salinities. He ran tests on pure water, artificial seawater, some kind of standard seawater. Proposes to work towards a new IAPWS release on surface tension (as per the ICRN 16).

Discussion on dependence on IAPWS pure water surface tension.

Since paper published – needs a task group and an evaluation task group.

Task group for the Surface Tension of Seawater: Nayar, Hruby, Harvey. Wait until December in case of new measurements at low temperature by Hruby. Eval task group Rainer Feistel.

13.3 Isothermal compressibility of seawater. Nayar explains that there is a lack of high salinity/high pressure data – but this is the range needed for desalination. An extrapolation was developed to get SOMETHING in this range. Proposes to use this to improve the industrial formulation.

Q: Various questions about usefulness of high S/P measurements?

This is a topic for the new task group to prepare result for the existing task group on extended Industrial Formulation for seawater. This is best done by adding Nayar and Lovell-Smith to the existing task group.

13.4 – Progress on pH-related topics Seitz explains that there are pH measurements in seawater at $S<5$ and $S>25$, but there is a gap between them! Explanation of Harned cell measurements. Some preliminary results are shown, but there are differences with previous measurements that MAY be explained by composition differences with the artificial seawaters used (different workers use different recipes for the artificial seawater)

13.5. Improving the metrological traceability of seawater pH measurements Pawlowicz presented some slides from Dickson describing the upcoming Harned cell measurements and Pitzer model development in SCOR WG 145 which will help towards improving the pH problem identified by JCS.

14.1 Report on Guideline for Electrical Conductivity of Seawater Pawlowicz reports that there have been some setbacks in progress, but a plan has been made to work around them.

14.2 Report of Task Group on Supplementary Release for a simplified density equation for oceanographic use Task group is closed due to lack of interest in converting an existing publication to an IAPWS document.

14.3 Report of Task Group on Advisory Note on IAPWS documents contributing to TEOS-10 Advisory note written – task group closed.

15.1 Report of Task Group on Covariance in IAPWS work – two papers published, to be described in 15.2 and 15.3

15.2 Unleashing empirical equations with "Nonlinear Fitting" and "GUM Tree Calculator" Lovell describes the history of uncertainty models developed for measurements of relative humidity using a two-pressure humidity generator. The error depends somewhat on the correlation of errors at different temperatures. Uncertainty tends to drop once correlation taken into account. Also described 'GUM TREE' – a software package to simplify the application of GUM.

15.3 GLS Uncertainty Propagation of Systematic Error. Systematic error has been added to covariance matrix as applied to IAPWS95, but uncertainties are still somewhat smaller than seem believable. A hypothesis is that "GUM uncertainty" is a measuring a different thing than "IAPWS uncertainty:.

Vigorous discussion about what this means. Great controversy! Standard IAPWS uncertainties are (roughly) held to explain the degree of scatter about the fit (the "model"). The GUM propagation approach (roughly) shows the uncertainty of the fit. The two disagree. The clerk's theory is that a disagreement between a priori and a posteriori statistics suggests that the model is in error and should be improved. However, there remains the question of what to do when the "model" is taken as fixed.

20. Membership

Proposed members for SCSW: Yohei Kayukawa, Kishor Nayar, and Aina Wu, and Jeremy Lovell (already member of TPWS). Unanimously approved.