

Joint SCOR/IAPWS/IAPSO Committee on the Properties of Seawater (JCS)

Report to IAPSO on JCS Activities June 2017- Jun 2019

JCS Executive	
Rich Pawlowicz (Chair)	Canada
Rainer Feistel (Vice-chair)	Germany
Steffen Seitz (Vice-chair)	Germany
Salinity/Density Taskgroup	
(Rich Pawlowicz) (Chair)	
Frank J. Millero	USA
(Steffen Seitz)	
Hiroshi Uchida	Japan
Stefan Weinreben	Germany
Youngchao Pang	China
Ryan Woosley	USA
Yohei Kayukawa	Japan
pH Taskgroup	
Andrew Dickson (Chair)	USA
Maria Filomena Camoes	Portugal
Daniela Stoica	France
Simon Clegg	UK
Frank Bastkowski	Germany
Relative Humidity Taskgroup	
Olaf Hellmuth	Germany
Jeremy Lovell-Smith	New Zealand
(Rainer Feistel)	
Stephanie Bell	UK
Export subgroup: Thermodynamics	
(Rainer Feistel)	
Expert subgroup: Numerical Modelling and Applications	
Trevor J. McDougall	Australia
Expert subgroup: Software	
Paul Barker	Australia
Industry Representatives	
Richard Williams (OSIL)	UK
Barbara Laky (Anton Paar)	Austria

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Background

The Joint SCOR/IAPWS/IAPSO Committee on the Properties of Seawater (JCS) is a permanent group with limited membership whose purpose is to act as an international “point of contact” for seawater questions. It is jointly sponsored by organizations directly concerned with the properties of seawater: the Scientific Committee on Oceanic Research, The International Association for the Properties of Water and Steam, and the International Association for the Physical Sciences of the Ocean.

JCS acts as a permanent source of expertise to its parent organizations, maintains a repository of knowledge and software for the scientific community (via a web-site, www.teos-10.org), and is also a conduit for any desired communications between its parents, and out to other international organizations like the BIPM (Bureau International des Poids et Mesures), the WMO (World Meteorological Organization), and IUPAC (International Union of Pure and Applied Chemistry). In addition, JCS may from time to time summarize progress in seawater-related issues to the community at large, and suggest areas where gaps exist in the available knowledge.

Meetings

JCS does not meet annually as a full group. Over 2017-2019, 6 JCS members did attend the 2017 IAPWS Annual Meeting in Kyoto, Japan (Sept 2-7, 2017), and 3 members attended the 2018 Ocean Sciences meeting (Portland, Feb 1, 2018).

However, at a five year interval from the time of a full set of workshops that initially formed the committee, JCS held a second series of workshops at the 17th International Conference on the Properties of Water and Steam (Sept., 2018, Prague, Czech Republic). These included a) a workshop on the aims and purpose of JCS, as well as meetings of a) the Salinity/Density taskgroup, b) the pH Taskgroup, and c) the RH Taskgroup, with an attendance of 14-19 scientists for each.

As a result of these discussions, JCS recommended to SCOR, IAPWSO, and IAPWS that JCS continue as an organization sponsored by these organizations, that the JCS Terms of reference remain unchanged for the next cycle, and that the membership of the various JCS taskgroups, which are largely independent of one another, be increased slightly to assist them in their work, by including a number of scientists who are currently contributing to the tasks of JCS. Taskgroup chairs were also appointed. These recommendations were accepted and the current membership is listed above. In addition, a series of goals was developed to guide taskgroup activities over the next few years.

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Web site

JCS maintains a web site at www.teos-10.org. This site gets 1600-2300 visitors per month (8574 in the past year, with 64304 “unique views¹” since Oct 2010). Annual downloads are stable.

Web site Item	Unique downloads June 2011-June 2013	Unique downloads June 2013-June 2014	Unique downloads June 2014-June 2015	Unique downloads June 2015-June 2016	Unique downloads June 2016-June 2017	Unique downloads June 2017-June 2018	Unique downloads June 2018-Apr 2019
Manual	920	360	535	552	418	427	349
Getting Started	879	362	558	547	427	475	349
Slides	704	284	374	318	219	248	204
Primer	584	197	289	297	222	217	187
GSW MATLAB_v3_0	1920	1102	1485	1814	1235	1552	1233
GSW FORTRAN_v3_	366	222	171	162	127	116	82
GSW_C_v3_0	202	84	133	151	85	96	59
GSW_PHP	-	55	61	43	29	60	28
SIA_VB	72	100	46	45	45	48	43
SIA_FORTRAN	59	118	58	44	36	42	37

Other Progress

- 1) A new “European metrology network” (EMN) on Climate and Ocean has been formed, with a number of JCS members involved (however, the network is open to all to participate). First AGM will be 20-21 June 2019 at National Physical Laboratory (UK). In essence this is a network for creating and disseminating knowledge, and building coordinated infrastructure. It has Sections dedicated to atmosphere observation, ocean observation, and land and earth observation, and will have activities in these areas.
- 2) Progress in the pH taskgroup is being carried out under the auspices of SCOR WG 145. An effort is being made to identify the limitations of Harned cell measurements through an intercomparison exercise between AD’s laboratory and the national standards laboratories in France, Germany, Japan and USA; a new postdoctoral researcher is involved in making these measurements.
- 3) SC has almost completed coding of a speciation model that will allow for the estimation of uncertainties in pH.
- 4) TEOS-10 is now the equation of state in the two main community climate ocean models (MOM6 and NEMO). It is also optional in two other widely used models (MITgcm and ROMS).

¹ The method of computing “unique views” changed in 2019.

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- 5) HU has carried out density anomaly measurements in the Bering Sea and Gulf of Alaska (2017), HU/FJM are carrying out an interlaboratory comparison with measurements in the Arabian Sea (May/June 2018).
- 6) FJM/RP continue analysis of East Pacific Rise density anomaly data.
- 7) RP is working on understanding the diffusion of seawater and possible fractionations that result from this (MSc thesis scheduled for completion fall/2019)
- 8) SS is working towards making high-pressure measurements of conductivity traceable to the SI.
- 9) RF and JLS continue working towards procedures for making systematic error estimates.
- 10) RW is continuing with development of the 'best practices in density measurements' document.
- 11) The 2016 Metrologia papers have now been downloaded 15422 times (Overview 4587, Salinity 2371, pH 2387, RH 6067)
- 12) OH has written 2 book chapters to appear in a textbook on meteorological measurements, and is working on a long paper: Real-Gas Effects in Humid Air: Possible Implications of the Advanced Seawater Standard TEOS-10 for Hygrometry at Atmospheric Pressure (authors OH, RF, JLS and 3 others).

Papers published

- 1) H. Schmidt, S. Seitz, E. Hassel, H. Wolf, The density-salinity relation of standard seawater, *Ocean Sci.*, 14, 15-40, (2018), doi: 10.5194/os-14-15-2018
- 2) Y. Li, Y. Kang, H. Yu, Y. Pang, Linearity corrections for laboratory salinometer measurements: IAPSO Standard Seawater linearity pack vs. weight diluted samples, *Deep Sea Res I*, 137, 13-19 (2018) doi.org/10.1016/j.dsr.2018.04.011
- 3) R. Feistel, Thermodynamic properties of seawater, ice and humid air TEOS-10, before and beyond, *Ocean Sci.*, 14, 471-502 (2018) doi.org/10.5194/os-14-471-2018 [*Invited paper by winner of EGU Fridtjof Nansen Medal 2018*]
- 4) Bárbara Anes, Ricardo J.N. Bettencourt da Silva, Cristina Oliveira, M. Filomena Camões, Uncertainty evaluation of alkalinity measurements on seawater samples, *Measurement*, Volume 129, (2018), 395-404. <https://doi.org/10.1016/j.measurement.2018.07.042>
- 5) R. Feistel, (2019), Defining relative humidity in terms of water activity. Part 2: Relations to osmotic pressures. *Metrologia*, Volume 56, Number 1, 10.1088/1681-7575/aaf446
- 6) W. Ebeling, R. Feistel, H. Krienke (2019), On statistical calculations of individual ionic activity coefficients of electrolytes and seawater. I. Basics (researchgate preprint) 10.13140/RG.2.2.18591.20640
- 7) S. Seitz, P. Tonnes Jakobsen, M. Mariassy (2019), Metrological advances in reference measurement procedures for electrolytic conductivity. *Metrologia* 56, 1pp., 10.1088/1681-7575/ab1527
- 8) Müller, J.D., Bastkowski, F., Sander, B., Seitz, S., Turner, D.R., Dickson, A.G., Rehder, G., Metrology for pH measurements in brackish waters – part 1: Extending electrochemical pH_T

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measurements of TRIS buffers to salinities 5 – 20, *Front. Mar. Sci.* 5:176. doi:
10.3389/fmars.2018.00176

- 9) Vancoppenolle, M., Madec, G., Thomas, M., & McDougall, T. J. (2019). Thermodynamics of sea ice phase composition revisited. *Journal of Geophysical Research: Oceans*, 124, 615– 634. <https://doi.org/10.1029/2018JC014611>
- 10) Hellmuth, O., Shchekin, A.K., Feistel, R., Schmelzer, J.W.P., A.S. Abyzov, (2018), Physical interpretation of ice contact angles, fitted to experimental data on immersion freezing of kaolinite particles, *Interfacial Phenomena and Heat Transfer*, 6(1):37–74.
- 11) Anes, B., da Silva, RJNB, Oliviera, C., Cameos, MF (2019) Seawater pH measurements with a combination glass electrode and high ionic strength TRIS-TRIS HCl reference buffers - An uncertainty evaluation approach, *TALANTA*, 193 (2019) 118-122, 10.1016/j.talanta.2018.09.075

R. Pawlowicz

JCS chair, Jun 8, 2019