

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

Report to SCOR on JCS Activities May 2019-May 2020

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 (Chair)	Germany
Jeremy Lovell-Smith	New Zealand
(Rainer Feistel)	
Stephanie Bell	UK
Expert 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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Meetings

IAPWS did not meet as a full group in 2019-2020. However, discussions did take place at other meetings. 3 JCS members attended the 27th IUGG General Assembly (Montreal, Canada, 9-15 July); RP also reported on JCS activity to the IAPSO Business meeting. 6 JCS members attended the 2019 IAPWS Annual Meeting in Banff, Canada (Sept 29-Oct 4, 2019) and, in addition to the regular IAPWS business, held a half-day JCS session to discuss progress on JCS Tasks. Members of the pH subgroup also held a workshop (under the auspices of SCOR WG 145) at the Ocean Sciences Meeting (San Diego, USA, Feb 16-22, 2020).

Plans to meet at the 2020 IAPWS Annual Meeting (Turin Italy, September 2020) were abandoned as the meeting was cancelled due to COVID-19.

Web site

JCS maintains a web site at www.teos-10.org. This site gets 750-1300 visitors per month (9,007 in the

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	Unique downloads May 2019- May 2020
Manual	920	360	535	552	418	427	349	472
Getting Started	879	362	558	547	427	475	349	444
Slides	704	284	374	318	219	248	204	272
Primer	584	197	289	297	222	217	187	253
Thermodynamics Lecture Notes								22
Thermodynamics Overview								24
GSW MATLAB_v3_0	1920	1102	1485	1814	1235	1552	1233	1556
GSW FORTRAN_v3_	366	222	171	162	127	116	82	98
GSW_C_v3_0	202	84	133	151	85	96	59	81
GSW_PHP	-	55	61	43	29	60	28	52
SIA_VB	72	100	46	45	45	48	43	47
SIA_FORTRAN	59	118	58	44	36	42	37	42

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past year, with 73311 “unique views¹” since Oct 2010). Annual downloads are stable.

Other Progress

- 1) Both pH and salinity/density taskgroups submitted a proposal to the IAPSO ‘Best Practices’ Call. The Ph proposal was accepted. An initial meeting, of a subset of members, was held during the Ocean Sciences meeting.
- 2) Progress in the pH taskgroup is being carried out under the auspices of SCOR WG 145.
- 3) SC has completed a first draft for speciation model that will allow for the estimation of uncertainties in chemical speciation in seawater, and in the pH buffers used in the determination of marine pH (demonstrated at the Ocean Sciences meeting, see http://www.aim.env.uea.ac.uk/osm/main_page.html).
- 4) SC and SCOR WG 145 collaborators at GEOMAR (Kiel, Germany) have completed experiments that contribute to a thermodynamic characterisation of Tris pH buffers in media containing the components of seawater. A manuscript is in preparation.
- 5) AD and SC are finalising an agreement with the National Institute of Standards and Technology (NIST) to carry out Harned Cell experiments that contribute to a thermodynamic characterisation of Tris pH buffers in media containing the components of seawater. Complementary experiments will be carried out by FB at Physikalisch-Technische Bundesanstalt. The NIST scientists who will be carrying out experiments, and FB, are associate members of SCOR WG 145. The work contributes to the chemical speciation model of pH buffers and seawater being developed by the working group.
- 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 completed fall 2019, paper in progress)
- 8) SS is working towards making high-pressure measurements of conductivity traceable to the SI.
- 9) RF, OH and JLS continue working on introducing relative fugacity as a novel humidity measure of moist air, by Part 3 extending the former Metrologia papers in 2017 and 2019.
- 10) RW is continuing with development of the ‘best practices in density measurements’ document.

Papers published

- 1) W. Ebeling, R. Feistel and M. F. Camões: Trends in statistical calculations of individual ionic activity coefficients of aqueous electrolytes and seawater. Trends in Physical Chemistry (in press)
- 2) R. Feistel, O.Hellmuth: Zur Rolle des Wassers in der Energiebilanz des Klimasystems [On the role of water in the energy balance of the climate system] Sitzungsberichte der Leibniz-Sozietät Berlin (in press)

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

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- 3) O. Hellmuth, J. W. P. Schmelzer and R. Feistel: Ice-Crystal Nucleation in Water: Thermodynamic Driving Force and Surface Tension. Part I: Theoretical Foundation, *Entropy* 2020, 22, 50; doi:10.3390/e22010050
- 4) S. Weinreben, R. Feistel: Anomalous salinity-density relations of seawater in the eastern central Atlantic, *Deep-Sea Research I* 154 (2019) 103160, <https://doi.org/10.1016/j.dsr.2019.103160>
- 5) H. Uchida, Y. Kayukawa and Y. Maeda, Ultra high-resolution seawater density sensor based on a refractive index measurements using the spectroscopic interference method, *Scientific Reports*, 9 15483 (2019), <https://doi.org/10.1038/s41598-019-52020-z>
- 6) H. Uchida, T. Kawano, T. Nakano, M. Wakita, T. Tanaka, and S. Tanihara, An expanded batch-to-batch correction for IAPSO standard seawater. *J. Atmos. Oceanic Technol.*, doi: <https://doi.org/10.1175/JTECH-D-19-0184.1>.
- 7) Barker, P. M. and T. J. McDougall, 2020: Two Interpolation Methods using Multiply-Rotated Piecewise Cubic Hermite Interpolating Polynomials. *Journal of Atmospheric and Oceanic Technology*, 37, 605-619. <http://dx.doi.org/10.1175/JTECH-D-19-0211.1>

R. Pawlowicz

JCS chair, June 21 2020