

Interactive comment on “Development of thermodynamic potentials for fluid water, ice and seawater: a new standard for oceanography” by R. Feistel et al.

Anonymous Referee #1

Received and published: 22 September 2008

General comments

A new seawater standard based on the Gibbs thermodynamic potential has been developed by the SCOR/IAPSO WG 127. It will replace the UNESCO equation of state. It combines

1. The Helmholtz function for pure liquid water and water vapour IAPWS-95 (Wagner and Pruss, 2002)
2. A Gibbs potential for the saline part of seawater (Feistel, 2008), which is presumably added to the Gibbs function for pure water derived from the Helmholtz

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



function to give a net Gibbs function for seawater.

3. The Gibbs potential for salt-free ice, set out by Feistel and Wagner 2006 and apparently with coefficients recently updated in Feistel et al., (2008).

The description of the full implementation of the new seawater standard thermodynamics, in particular the new *total* Gibbs potential, is deferred to two papers in preparation^{1 2}

This new seawater standard is very important work.

However, the scope of this particular contribution seems rather limited. It does give an overview of the new seawater standard, but the (so far) unique material here simply

1. improves the definition of the ice-water-steam triple point, giving its value in quadruple precision and correcting the value of the 11th place of the g_{00} term of the Gibbs function for ice.
2. sets out quadruple precision numerical values for the properties of the reference states of pure water and of seawater.
3. summarizes a report (not referenced) of an IAPWS task group that concluded that the Helmholtz function for pure liquid water, strictly valid only above the freezing point of pure water, was in fact an adequate description of supercooled water below pure water freezing point (as is necessary to generate the Gibbs function for salty water, whose freezing point is depressed).

¹ Feistel, R., *et al*: Numerical implementation and oceanographic application of the thermodynamic potentials of water, vapour, ice, and seawater, *Ocean Sci. Discuss.*, in preparation, 2008a.

²McDougall *et al*: Oceanographic application and numerical implementation of the Gibbs function of seawater, *Deep-Sea Res. I*, in preparation, 2008.

There is nothing wrong with the quality of the work described here, but I feel it is marginal whether this material merits publication in a separate contribution, or whether it would be better included in one of the more definitive papers in preparation. Certainly, if it is to remain a separate contribution, the title could be changed – the present title *‘Development of thermodynamic potentials for fluid water, ice and seawater: a new standard for oceanography’* gives the impression of a much more substantial piece of work, and will be of no help to anybody looking for the specific points that *are* here.

Specific comments and technical corrections

p376,l6. ‘are’ should be ‘will’

p377 l1 perhaps insert ‘pure’ before ‘water’

l13 delete ‘to’ in ‘to conditions’

p378 l15 Define ‘IAPWS-08’

p379 l6 should be ‘the ITS-90 temperature scale’

l6-7 replace ‘improve the representation of’ by ‘better represent’

p383 l11 Not clear what 657(10) means – does this mean that 7 is the last certain digit?

p385 l21 The T_t and p_t differ from the experimental values, particularly p_t , which differs in the 6th place. Perhaps my interpretation of your notation for accuracy is not right.

p387 eqs 4a,b. You do not state here that $s^W(T_t, p_t) = u^W(T_t, p_t) = 0$. Surely this motivates the choices for 4a and b, as it gives $s(S_{SO}, T_{SOt}, p_{SO}) = h(S_{SO}, T_{SO}, p_{SO}) = 0$. Why not state this; otherwise these choices seem mysterious.

p388 l18 Delete ‘do’ from ‘do depend’

p389 l 25 delete ‘Given is’ from the start of the sentence and insert ‘is given’ after ‘water’

p390 l20 replace ‘way’ by ‘method’

p393 Eq (6). need to state where power series comes from – e.g. from Eq (6.3) of Feistel (2008), DSR.

[Full Screen / Esc](#)
[Printer-friendly Version](#)
[Interactive Discussion](#)
[Discussion Paper](#)


Interactive comment on Ocean Sci. Discuss., 5, 375, 2008.

OSD

5, S168–S171, 2008

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

S171

