Ocean Sci. Discuss., 6, C628–C631, 2009
www.ocean-sci-discuss.net/6/C628/2009/

Ocean Science Discussions

Interactive comment on "Thermodynamic properties of sea air" *by* R. Feistel et al.

Anonymous Referee #1

Received and published: 14 October 2009

Major comments

The paper deals with an important topic which is contained in the basic chapters of any textbook on ocean sciences: the thermodynamics of air and sea water. For the correct description of water in the states gaseous, liquid and solid the effect of sea salt is included. The paper is a dedicated contribution to theory, aiming to construct thermodynamic potentials, and is thus acceptable. The authors are claiming in the introduction the importance to have available thermodynamically consistent formulae giving a number of possible applications.

I recommend the introduction of a separate "discussion" section. It should clearly indicate the progress made with respect to the available formulae described in section 2. In particular, statements on improved validity and accuracy would demonstrate the success of the present theory. The presentation of the radiosonde profiles from section

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11 should also be placed there. At this point, I would like the authors to specify the assumptions on the salinity profile of these air parcels. As a suggestion, the discussion could be extended for the following practically relevant phenomena:

- salinity-dependent bulk formulae for latent and sensible heat: How big is the expected error of clear water formulae are used instead of sea water?

- salinity effects in coastal fog or sea smoke: How changes sea salt the dew point, for example?

Minor comments

page 3, line 7: write out "VB" (Visual Basic, I guess)

page 5, line 10: add a temperature and pressure range to the accuracy statement of Jacobson (2005)

Peer review

1) SCOPE: The paper deals with basic thermodynamic relations for the description of air and sea water including ice. This topic fits into the scope of OS, just like the six preceding papers of Rainer Feistel.

2) NOVEL: The paper aims to construct thermodynamic potentials fitting scattered new data. This approach unites classical thermodynamics and modern data over a wide range of scales. This approach is recognised in international agencies and thus of general importance.

3) CONCLUSIONS: The value of the paper is in the complete review of a theoretical subject meeting the experimental findings. The application of these formulae to specific cases is generally matter of future work. However, as suggested, it would increase the value of this review if some estimates on the impact of salinity on moist air would be given.

4) OUTLINE: The theory is clearly presented, combining classical textbooks with more

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modern work. Maybe, it could help the reader to include for sections 4 through 8 pictograms for dry air, vapor, sea water and ice in order to see at one glance the composition under study.

5) RESULTS: The paper demonstrates the theoretical results for realistic ranges of marine applications. This is adequate for a paper of such a wide scope. For detailed studies concerning the derivation of the four involved thermodynamic potential functions, correct reference is made the specific papers.

6) TRACEABILITY: The documentation is almost complete. It contains the formal derivation of general formulae, and in the appendix every detail which is necessary to reproduce the formulae. Only for appendix H I would like the authors to add a recommendation for the temperature-dependent heat capacity.

7) CREDIT: The authors correctly refer to own and others contributions to the subject.

8) TITLE: The title is as general as the paper.

9) ABSTRACT: Adequate.

10) PRESENTATION: The paper is well structured into main text including formal approach and application and appendix containing numerical details. This is adequate to this theoretical review. It is suggested to make up a "discussion" section.

11) LANGUAGE: OK.

12) MATHS: correct. The only thing I did not keep immediately was the use of A = 1 - q for the mass fraction of dry air. But this is acceptable because it is clearly stated. In the figures, however, the mass fraction of moist air (q) is used - as it is common in meteorology.

13) STRUCTURE: The structure is adequate, but could possibly extended for a "discussion".

14) REFERENCES: appropriate.

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15) SUPPLEMENT: not present.

Interactive comment on Ocean Sci. Discuss., 6, 2193, 2009.