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Ocean Science Discussions

Interactive comment on "Thermophysical property anomalies of Baltic seawater" *by* R. Feistel et al.

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1. The concept of the absolute salinity, leading to the consideration of the importance of the sea water composition anomalies, is one of the most important advances in theoretical oceanography, allowing for the derivation of thermodynamic properties taking in account compositional variances. This paper deals with the composition anomalies of the Baltic Sea, where the abundance of the fresh water discharges affect the sea water composition. Especially important is variation in the calcium concentrations. Because in the northern part of the Baltic Sea, the rivers run through granite bedrock and in the southern area, through calcite bedrock, the areal variations in the calcium concentrations, with respect to the SSW proportions, are large and lead to erroneous results in the calculated thermodynamic properties. Therefore it seems to me that the paper addresses a relevant and up-to-date subject in theoretical oceanography, having also impor-

tant practical consequences. While the geographical scope of the paper is the Baltic Sea, the analysis is probably useful in all areas where the sea water ion composition is affected by river discharges. Rating: Excellent.

2. The paper is based on the concept of standard seawater and numerical models of aqueous solutions (FREZCHEM model is used to derive a Gibbs function for Baltic seawater and the LSEA DELS model to provide estimates for the conductivity anomaly relative to SSW). Thus the concept is known, but on the other hand, the real novelty (and the importance) in the paper is the actual developing of the differences in the thermodynamic properties of coastal sea water with compositional variance. Rating: Excellent

3. A Gibbs potential is derived for Baltic Sea water. This is done with the assumption that the composition anomaly is due only to calcium carbonate inputs. The assumption is valid, since the different bedrock materials (granite and calcite) in the different parts of the Baltic Sea drainage areas lead especially to varying calcium concentrations in the sea water. Several other anomalities in the Baltic Sea water properties are calculated and described as functions of salinity and temperature (absolute salinity, density, thermal expansion, salt contraction, heat capacity, sound speed etc.). In addition to theoretical oceanography, all these also have important practical significance in many marine applications. Rating: Excellent

4. The deduction of the formulae proceeds logically. The deductions are detailed and based on clearly defined starting points and documented models.

5. The results need no interpretation; the aim has been to derive formulae for the Gibbs function and use the Gibbs to derive further thermodynamic properties as functions of temperature and salinity, and this has been done.

6. The derivation of the formulae has been carried out in a rather detailed way.

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This makes the paper a bit lengthy and patience-demanding to read, but, on the other hand, the logics and the results are traceable for an average reader. The introduction contains a very well written overview of the previous work and the characteristics of the models, giving a solid basis for the reading.

7. It seems to me that credit to earlier work and parallel efforts is clearly given, and the original contribution is evident.

8. The title is concise and clear.

9. The abstract also is concise and clear.

10. The presentation is excellent. The introduction gives a solid starting point (and can be recommended as such for quick reference in the development of TEOS10 and the use of models to describe thermodynamic anomalities. The basis of the compositional anomalies is then reviewed in an clear and concise way. The derivation of the Gibbs function and the anomalities is detailed enough for the average reader to allow understanding the logics. The results are also given as graphs, which makes it easy to visualize the differences with respect to SSW.

11. As far as I can see, the text is clear and fluent.

12. Formulaes, symbols etc. are clearly defined and easy to follow.

13. The text seems to be written as concisely as possible, being however detailed enough to allow the average reader to follow the logics.

14. References are ok.

15. I do not see any “supplementary material”? What is included is necessary belongs directly either to the introduction of the problem, or to the derivation of the equations and to the presentation of the results.

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