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Interactive comment on "Numerical implementation and oceanographic application of the Gibbs potential of ice" *by* R. Feistel et al.

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Hajo Eicken is right when he hints on the fact that at lower temperatures certain sea salt components begin to precipitate, thus changing the chemical brine composition and its related thermodynamic properties. In fact, the sea ice description given in our paper by combining the Gibbs functions of ice and seawater relies on the validity of both of them. While the new ice potential is considered to be reliable for any pressure-temperature conditions under which sea ice may be found, this is not the case for the brine fraction.

Brine is described here as seawater with standard chemical composition up to practical salinity 50 psu. Under normal pressure, this brine salinity appears aleady at about -3°C. Sodium sulfate starts to precipitate out of seawater at about -8°C, or at brine salinities of about 150 psu (Schwertfeger, P.,1963, The thermal properties of sea ice. J. Glaciol. 4, 789-807).

Thus, the first limitation of our sea ice formulas is salinity, even with standard composition. Only few measurements are available for seawater at low temperatures and higher salinities, e.g. Herut et al., 1990, The role of seawater freezing in the formation of subsurface brines, Geochim. Cosmochim. Acta 54, 13-21, and are not converted yet into an appropriate extension of the Gibbs function of seawater. This situation is improving now because the reliability of the actual Gibbs potential of ice allows a better conversion of measured sea ice properties into conditions for the Gibbs function of brine.

At temperatures below the precipitation threshold the situation is more complicated since not only one sea salt concentration, but several constituents have to be involved explicitly as independent variables into a Gibbs function of seawater with non-standard composition. Studies like the paper of Marion & Farren (1999) will be very helpful for this purpose in future, which again is simplified now by the availability of an accurate thermodynamic description of pure ice.

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