

## Review of “Review article: the false-bottom ice”

This paper gives a brief background on the history of studies on false bottoms beneath sea ice. The formation of false bottoms beneath sea ice is an interesting and potentially important topic. Where false bottoms are present, they will have a significant impact on the local heat and mass budgets. However, there is little information on how prevalent false bottoms are.

While I personally found this article to be quite interesting, mainly as a reminder of topics I have read about at one time or another, I’m afraid that I do not recommend this paper is accepted for The Cryosphere. This is because:

- (i) the scope of the article is too narrow to be of interest to a wide readership. This could be addressed in principle by discussing the impact of false bottoms on the large scale heat and mass budgets of the ice cover, ocean and atmosphere but there is currently insufficient information available on this topic, either from observations or from models;
- (ii) good review articles are not merely collections of existing literature, they demonstrate original thought and insight through the analysis and synthesis of previous work. Such analysis is almost entirely missing from this article;
- (iii) the literature on the subject is small; the excellent laboratory work and analysis of Martin and Kauffman in the early 70s has not been bettered and contains most of the insights concerning the heat and salt budgets, which are slightly clumsily repeated in this paper (in fairness, this is likely to be due to the Russian to English translation). The work by Notz provides a first order analytical treatment and Eicken (1994) tackles the field work aspect. There are not many additions to this, except for the much quoted, but not clarified, work by the lead author;
- (iv) the description of many of the processes is a little obscure, seeming on a first reading to contain errors. This is not helped by the fact that the authors use the term mushy layer and mushy layer theory in a way inconsistent with my understanding of mushy layer theory. The authors suggest on line 27 that a mushy layer is a two phase region in a parenthetical definition. This misses the point that a mushy layer is a two phase region of a substance containing two (or more) components; in the case of sea ice these component are pure water and salt (e.g. Convection in mushy layers, Worster, *Ann. Rev. Fluid Mech.* 1997; Sea ice is a mushy layer, Feltham et al, *Geophys. Res. Lett.* 2008). Thus, for example, the reviewers talk of the ice/water mixture between the sea ice and false bottom as a mushy layer. While this is almost certainly true, as some salt will be present, it rather misses the point that the sea ice and false bottom are also mushy layers.

Example problems

Pg 5664, around line 5. Most of sections 3 and 4 are not really quantified and so the impact of false bottoms on the many processes mentioned is largely speculative.

Pg 5666, Around line 5. The water at the freshwater – ocean interface cools down and its density increases, not decreases. The water may be (is likely) supercooled but this has no impact on density. More likely, the supercooled water forms starts to freeze as frazil and the frazil crystal rise under buoyancy, accrete to the sea ice bottom, and start to grow downwards.

Pg 5668, line 10: false bottom interfaces move proportional to time. I have a hard time believing this and the statement should be properly justified.

Pg 5670: this discussion is highly specific and fairly meaningless without knowledge of the ambient conditions in those situations. The point seems to be that the ocean heat flux can be positive and negative. This is known and has been discussed already (Notz et al, 2003).

Pg 5673, Conclusions: while I strongly agree that estimates of the fraction of ice with false bottoms is needed, many of the other conclusions, e.g. regarding the friction velocity, impact on albedo are rather anodyne and insipid.