

## ***Interactive comment on “The sub-ice platelet layer and its influence on freeboard to thickness conversion of Antarctic sea ice” by D. Price et al.***

### **Anonymous Referee #2**

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#### General Overview

The main comment on the paper as a whole is that the theory and approach seem sensible and robust. The work carried out will benefit the community, by highlighting uncertainties in sea ice freeboard measurements from altimetry. This is especially important in the Antarctic, where sea ice radar altimetry is already complicated. It would be great to extend the region of interest beyond McMurdo Sounds in future work.

The main conclusions of this work are:

1.) Layers of platelet ice form beneath Antarctic sea ice as a result of seaward advection of supercooled ice shelf water. Although this layer does not contribute to the

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mechanical integrity of sea ice, it has a buoyant effect. The ice freeboard will increase, leading to an overestimation of ice thickness from altimetry measurements.

2.) The influence of the sub-ice platelet layer on sea ice freeboard and thickness measurements will be most prominent in close proximity to ice shelves

The standout issue with this paper is:

The description of the method. There are a few inconsistencies, and the methodology could be clearer and better structured. The paper would also benefit from a little more justification as to why things were done a certain way. This is mostly in relation to the authors' measurements of  $i$ , and the selection of a  $i$  value for the equations used in the paper.

#### Specific Comments

Page 1003, line 27 – Page 1004, line 1

“Given this information, and considering the uncertainties we use a value of  $i = 925 \text{ kgm}^{-3}$  in our calculations. . .”

This doesn't seem an adequate justification for using a  $i$  value of  $925 \text{ kgm}^{-3}$ . It is not explicitly stated why the authors have selected this  $i$  value from the numerous values they present. It would be informative to state here the justification presented on Page 1011, line 7-8 (“We used  $925 \text{ kgm}^{-3}$  for  $i$  as it represents the middle range of expected  $i$  in the study area”), which confirms that the value has been selected as more of a ‘common sense’ value, rather than through statistical analysis of  $i$  values from this and previous work.

Page 1005, lines 13-14

It would be interesting to know which sites were used for snow density measurements, and to have a justification as to why it was only measured at half of the sites.

Page 1006, lines 1-2

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“The mean sea ice thickness as derived from all 39 drill-hole measurement sites. . .”

Previously the authors have stated that there were 40 drill hole sites (Page 1004, line 18: “Measurements were undertaken at 40 sites”), not 39. Fig. 1 and Fig. 3 only shows 39 drill hole sites (there is a site number 40, but not a site number 24). This inconsistency is confusing, and if there is a reason for it, it should be explained.

Page 1011, line 23

“...our estimate [of  $i$ ] is an average of 35 separate drill-holes”

It is not clear why only 35 drill holes were used, rather than all 39. If  $i$  was not measured at every site, this should be stated in section 3.1. As it stands, there is no mention in section 3.1 of the method or locations of  $i$  measurement. This should certainly be included.

Page 1003, line 25-27

“Using an amended method at seven of our drill-hole sites in 2011 where no sub-ice platelet layer was measured we obtain a mean value [of  $i$ ] of 927 kgm<sup>-3</sup>.”

This relates to the uncertainty discussed above regarding the authors’ measurement of  $i$ . It is not clear from this statement whether  $i$  was measured at all sites, but with a different method used at the seven sites when the sub-ice platelet layer was absent, or if it was only measured at the seven absent sites. From Page 10011, line 23 it becomes clear that the former is the case, but this should be clearly stated in this section.

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Interactive comment on The Cryosphere Discuss., 8, 999, 2014.