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Interactive comment on “Sea ice thickness, freeboard, and snow depth products from Operation IceBridge airborne data” by N. T. Kurtz et al.

Anonymous Referee #2

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This paper reviews procedures and uncertainties of airborne sea ice thickness, freeboard, and snow depth retrievals from laser altimeter and snow radar measurements, and aerial photography. As these data from the OIB project are freely available and cover unique temporal and spatial scales, this is an important paper and should be published. The authors present a commendable, thorough description of the retrieval methods and uncertainties, such that this is a most valuable contribution to the already existing literature on airborne and satellite altimetry (both laser and radar). The paper is well written. However, some sections and in particular the descriptions of the freeboard and snow depth retrievals (Sections 3 and 4) are quite lengthy (for good reasons) and harder to understand. They would strongly benefit from a few additional illustra-

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tive examples to better clarify the text. I would encourage you to choose numerous examples demonstrating the individual steps involved. Even though there are some references for the snow depth retrievals described by other authors, none of those publications really addresses the key steps in (automatically and extensively) deriving snow depth attempted in the present study. Below are some suggestions and other specific comments.

Specific comments

Introduction P. 4774, l.19: Please define freeboard from the outset.

2.1 Laser altimetry data P. 4777, l. 12: What is the range of signal strength values? How much would they exceed 950? Show an example to illustrate nature and application of regression equation?

2.2 Snow radar P. 4778, l. 9-11: Please explain what pre-sums are? L. 13-27ff: I am not sure this paragraph is easily understandable if one has never heard of the FMCW principle and instrument. How is snow depth determined from radargrams?

2.3 Visible imagery P. 4779, l18: Are images overlapping or not? L. 22 ff: what are typical roll, pitch, and yaw angles?

3. Sea ice freeboard retrievals P. 4780, l. 23: resolve resolution? P. 4781, l. 21ff: mention spatial scale of these waves; this may be another reason that they don't matter in this context. P. 4782: Here too it would be interesting to mention the characteristic length scales of these corrections. P. 4785 and 4786 top: are these criteria applied for each lead individually? Or for a larger number of leads at the same time? P. 4787, l. 13: how is L determined? P. 4789, l 25ff: how large is the difference between fb_mean and fb_adj in general (value?).

4. Snow depth retrievals This section really needs some illustrative examples. P. 4792, l20: what is the vertical direction? The direction of travel time? L. 22: what does incoherently mean in this sense? Does this require a smooth snow surface to be

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successful (i.e. constructive stacking?). P. 4793, l. 17: is 5 m above before or after the maximum peak? L24 ff: Show an example! P. 4795, l1: is this two-way delay time? L 10-14: So does this snow depth represent mean snow depth then? Or some arbitrary snow depth? Unfortunately snow depth varies on much shorter length scales. Eqs 9 and 10: unclear. What are m and b? Is power (in dB) generally negative? Show an example. P. 4797, l1: power is near the system noise level? P. 4799, l 11: are needed

Table 5: How useful is it to list mean results if there must be some strong, regional variations along those long flight tracks? Figure 4: It would be nice to show two corresponding aerial photos for the two examples. More importantly, in 5b, why does the original Gaussian fit only encompass the right peak? I would have imagined that it encompassed the two big peaks, for example, and of course initially not providing a good fit at all? Fig 7: Provide better figure quality? Fig 9: Add flight numbers to figure to provide better link to table 5.

Interactive comment on The Cryosphere Discuss., 6, 4771, 2012.

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