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The Cryosphere Discussions

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

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General comments

The authors present results from two airborne campaigns of the over Arctic sea ice. The Operation IceBridge provides a very impressive dataset of freeboard and snow depth on Arctic sea ice. Some of the results (2009) shown in this study have been presented before (Kurtz et al., 2011, GRL). But since hardware specification and instrument configuration have changed in the follow-up campaign in 2010, the authors present their findings of a consistency study between the two datasets. Subsequently the paper is more an investigation of retrieval uncertainties than a detailed geophysical

interpretation of the data. This is a useful contribution to sea ice research, since it can be expected that the IceBridge data will be widely used by the community. This is due to the rare nature of large scale snow depth measurements over Arctic sea ice, the expected time span of the IceBridge flights of several years and the exemplary access to the datasets. The paper is well written and gives a very detailed description of the uncertainties of each sensor and the processing techniques, which are used to create higher level data products. The weak point of is the lack of in-situ validation data, both for snow depth and ice thickness. Unfortunately this data simply does not exist over the vast study area to my knowledge and the authors state correctly, that determination of the absolute accuracy is an ongoing process. But since this uncertainty and consistency study allow the use of the IceBridge data products by the larger scientific community, I recommend this paper for publication in The Cryosphere, given that the authors address a few minor issues and requests, which are described in my specific comments.

Specific comments:

P4776 L25 Is this the footprint of each shot (caused by beam size and divergence), an integration over a certain time, or the point spacing of adjacent pulses? Please clarify.

P4777 L12 What is the range/distribution of the signal strength? Which percentage of the data does the correction apply to?

P4780 L13+ Are all ATM pulses off-nadir? Line scanners show only signal losses over open water in the outer part of the swath. My suggestion would be to tilt the ATM, if applicable, to get a higher data output over areas with specular returns.

P4783 L9 How are the thresholds determined, for a flight or for each scene?

P4783 L15 Do the authors use the mean or modal of the thin ice freeboard values?

P4784 L4 See comment to P4776 L25: Footprint of points spacing?

P4795 L19 What percentage of the data is discarded?

P4797 L7 Is there any substantial in-situ data in the following years? The CryoVEx 2011 dataset might be suitable for at least a small scale validation data set for the snow depth radar.

P4802 L17 (Figure 9, Figure 10) Can the authors include an ice type product (OSI-SAF) in the map background. See also next comment.

P4803 L7+ Besides the mean snow depth for each year and ice type, I also would like to see the snow depth and ice thickness distribution for FYI and MYI in this section to improve the assessment of the data products. Given that the authors already have the classification into ice types, this should not be much work.

P4805 L21 What are the sampling rates? To my knowledge the minimum sampling rate is 1 Hz, at higher rates the temperature uncertainty will be too high for lead/thin ice discrimination. At usual aircraft speed, 1 second is already a larger patch of open water.

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