The Cryosphere Discuss., 9, C2028–C2030, 2015
www.the-cryosphere-discuss.net/9/C2028/2015/

The Cryosphere
Discussions
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Interactive comment on "About the consistency between Envisat and CryoSat-2 radar freeboard retrieval over Antarctic sea ice" *by* S. Schwegmann et al.

Anonymous Referee #2

Received and published: 30 October 2015

This paper discusses the comparability of sea-ice freeboard retrievals from two different satellite sensors as an initial step to eventually establish a long-term (up to 20 years) historical data record of Antarctic sea-ice freeboard – when data from ERS1 and ERS2 can be included. This is a very important step towards a better understanding of Antarctic sea ice and its variability. It is crucial research to be undertaken.

I am very pleased to see this issue being addressed, but I have concerns regarding the addition of sea-ice volume estimates into the manuscript. While the quantification of sea-ice thickness (and subsequently volume) is regarded as the holy grail by some researchers in the field, I would suggest to refrain from it here and stick to what the title describes: sea-ice freeboard retrieval. There are too many uncertain variables (snow

thickness, and snow, ice and water densities) required for the computation of sea-ice thickness from surface elevation (sea-ice freeboard above a reference surface, ideally local sea level).

I would suggest to show the common ground, i.e. the reference surface, from both sensors independently and discuss how well they compare. This will be an important light to shine on the negative freeboard measurements and discussion as well. I would like to suggest a more rigorous statistical analysis of the data at hand (rather than adding more derived variables, see above). Maybe the authors could show quantiles of differences (regional and temporal) in the sea surface height reference data and the freeboard data and possibly derive principle component analysis from that. This would yield a much better handle on when and where the data compare well, and provide the grounds for a discussion of why they compare well (or not). While satellite sensors are getting better constantly, the consistency of a long-term data set of sea-ice freeboard from multiple sensors and different missions is of vital importance. It might be worthwhile to consider degrading the more recent (presumably higher resolution, more precise) data set, in order to achieve a compatible data set of which the errors/caveats are well known. What would be needed to produce such a consistent data set?

Specific comments:

- p.4895 l. 25: GLAS on ICESat is not a current altimeter in space (ICESat was decommissioned in Aug. 2010);

- p. 4897 l. 23 sqq.: why the introduction the terms 'seasonal' and 'perennial' sea ice, when 'first year' and 'multi year' is widely accepted;

- p. 4899 l. 23 & p. 4901 l. 1: I would like to see a further justification for the radar freeboard cut-offs for the two sensors. How many values are actually discarded?

- Amundsen/Bellingshausen seas should be consistently abbreviated as 'ABS' (Figure 2 top-left and elsewhere);

- when referring to more than one sea it is <name1> and <name2> seas (no capital 'S');

- p. 4901 l. 18: I am not sure whether I see 'negative freeboard' in the marginal ice zone of Fig. 2. There are black areas, but the colour bar does not display negative values, therefore I am assuming it's just a cut off (at 0?);

- p. 4904 l. 19-20: spell out Weddell Sea and Ross Sea;

- p. 4905 l. 26 ssq.: what if the same sea surface height retrieval would be used for both altimeter data sets?

- p. 4906 l. 8 ssq.: what month is displayed in Fig.7? Appears to be winter, but how does the lead detection change throughout the months of the inter comparison?

- p. 4909 l. 4: what are the coastal effects that result in differences in the data sets?

Interactive comment on The Cryosphere Discuss., 9, 4893, 2015.