

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 #1

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Review of “About the consistency between Envisat and CryoSat-2 radar freeboard retrieval over Antarctic sea ice”, by S. Schwegmann et al.

Summary A comparison of the freeboard retrieval in Antarctic sea ice, between two different space-borne radar altimeter - the Envisat RA2 and Cryosat-2 SIRAL (in SAR and SARIn mode). The author attempt to show that during the overlapping period of 2011, results from the Envisat and CS-2 missions have a reasonable consistency. Thus, it is potentially feasible to construct a consistent time series of sea ice freeboard, thickness, and volume during the satellite radar altimetry and gain the knowledge of the Antarctic sea ice volume in recent two decades. However, as pointed out in the paper, due to different SSH (sea surface height) data used for the two products, I would argue

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that the current comparison are not valid, although they seem be compatible. Although they offer to use the DTU13 SSH products for both data in the future, I would rather them use DTU13 for this paper to assure a solid publication.

Some general comments: 1. A comparison of the radar elevation and local sea level measured from both sensors would be a good addition to the comparison of the freeboard, at least one can know which one, the elevation from satellites or the local sea level estimation from models, accounts more in the biases/variations between the two datasets. 2. Aside from the comparison with mean and model value, the root mean squared difference (RMSD) is also a good indicator to interpret the differences/biases between the two missions. And, a table listing the bias and the result of statistical testing in each sector/month would give a better and clear picture of the results 3. The authors could also consider to introduce some in-situ or airborne altimetry data as a reference to assess that in each month/sector, which sensor would have a better performance. 4. For the footprints with negative freeboard, does the echo waveform pattern of negative radar freeboard-footprints significantly differ from that with positive radar freeboard? – Specific Comments

Page6, Line 12: As both the CS-2 SAR and SARIn L1b data used, is there any significant different in retracking and freeboard retrieval between these two modes? Which data is really used for the freeboard retrieval?

Page 7, Line 21 and Page 9, Line 5: It can be seen that radar freeboard with extreme values ($<-0.3\text{m}$ & $>2\text{m}$ for CS-2, and $<-1\text{m}$ & $>2\text{m}$) are discarded. I hope you can provide some reasoning or citations why these values are selected. What is the reason that the CS-2 did not retrieved much negative freeboard on the inner ice pack? Should it be the result of the higher random error associated with the Envisat freeboard?

Page 9, the “Results” section: As presented by the manuscript, the Envisat and CS-2 sea ice freeboard are well consistent with each other, as there are only a very low overall bias. However, as the performance of Envisat and CS-2 differs in different time

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and location, can the authors recommend which one might be better in each of the specified sea sector and/or specified month?

Page9, line17-21, negative freeboard is discussed, but it is not shown anywhere in figure 2.

Page12, line 5-6, why Envisat has more negative freeboard than CS-2?

Page14 Line 17: The CS-2 freeboard near the Antarctic coast is mostly higher than that of the Envisat in almost all sectors and in all months. The author explained this as the higher error in the SARIn mode. However, it seems this is mostly a bias between the SARIn and Envisat. Also, could this be caused by the higher error or bias in the Envisat when measuring the coastal, fast ice, not by the CS-2 SARIn mode?

Page14, line25-29 about footprint size effect, please also see this paper for the Antarctic. Xie, H., A. Tekeli, S. Ackley, D. Yi, and J. Zwally, 2013. Sea ice thickness estimations from ICESat Altimetry over the Bellingshausen and Amundsen Seas, 2003-2009, Journal of Geophysical Research, doi: 10.1002/jgrc.20179;

Page 23: Table 2, I am not sure how the authors handled the situation when snow depth is lower than the pre-set penetration depth (be 5cm or 15cm), this could be the cause of the negative SIV? And, I am not sure if the SIV does include the snow volume.

Page 24: Fig.1, what is the measurement/unit of the "Echo power" represented in the plots? It could be DB? Also, the plots could be wide, as the leading edge is extremely steep and it is hard to see if the retracking points are located at the 40% threshold.

Figure 4, 5, 6. font size of the words are too small to see.

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