

Interactive comment on “Simulation of the satellite radar altimeter sea ice thickness retrieval uncertainty” by R. T. Tonboe et al.

Anonymous Referee #1

Received and published: 31 August 2009

General comments

The paper investigates the error budget for sea ice thickness retrieval from Cryosat-2 with a focus on the variability of snow and ice parameters within a measurement footprint. This is of importance for the upcoming Cryosat-2 mission and the paper should be published in The Cryosphere with minor revisions. Unfortunately, the authors have not touched existing altimeter data which they could have used for the study. The paper is in general well written. There should be a small modification in the structure: the introduction includes the description of the scattering model which deserves an additional section. The abstract should include the main conclusions with some numbers.

Specific comments

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The title is too general. The term "satellite radar altimeter" should be replaced with CryoSAT because the authors do not investigate the performance of other altimeter systems.

513/4 replace "are still unknown" with "not well known"

515/4 add Farrell, S. L., S. W. Laxon, D. C. McAdoo, D. Yi, and H. J. Zwally (2009), Five years of Arctic sea ice freeboard measurements from the Ice, Cloud and land Elevation Satellite, *J. Geophys. Res.*, 114, C04008, doi:10.1029/2008JC005074.

516/11 total error 0.76m: where does this number come from?

516/21-517-13 Put this in an additional section about the model description.

518 Use of SAR imagery: What are the errors due to the choice of the experienced observer? Maybe it would be worthwhile to use different realizations of the classification for an error assessment.

520/2 Eq. (2): It is common to use c for the speed of light.

525/15-25: I can not pick the 26 cm underestimation from Fig. 8. Please indicate by a line. The backscatter is not shown in the Figure.

527/528 Please give a motivation for this section. It should probably be discussed before section 4.1.

All figures: Histogram like data should be displayed in a histogram style, not as continues lines. If applicable, theoretical distributions should be fitted, i.e. a Gaussian for the snow density.

Fig. 3 (A) the ice, not the snow density is shown.

Fig 12a-d: It is very difficult to understand the meaning of the images. Perhaps, it would be better to exemplify the process within one footprint for a selected set of situations, i.e. to show the influence of ridges and leads.

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