

Dear Reviewer #1,

We are very thankful for the positive feedback and the valuable comments.

We revised our manuscript accordingly and tried to address your comments carefully. Please find our responses to your comments in blue below.

Thank you again and best regards,

Anja Rösel on behalf of the co-authors.

Major comments:

-My main concern has to do with the writing of some sections of the paper. Indeed there are several confusing long sentences throughout the manuscript that challenge the overall understanding of the paper. I have to point out paragraph 2.2 (Groundbased measurements), which is really dense and needs to be re-written. I suggest that the authors add sub-sections.

Thanks a lot, we revised the manuscript accordingly, created subsection in the 2nd paragraph and re-wrote the discussion/conclusion part. We think it will help the overall understanding of the paper.

-The notation used for the different observation techniques and instruments is confusing. This results in equations using variables with too many subscripts (equation 6 for example). I suggest that the authors use only the name of the instruments in the definition of variables. This should greatly improve the quality of the paper.

We revised the variable naming according to the table here. This was also suggested by the 2nd reviewer.

old name	new name	alternates	what it means
ht	ht		combined snow depth + sea ice thickness
ht1em	ht _{EM}		combined snow depth + sea ice thickness measured by EM
Total (snow + ice) freeboard / snow freeboard			
hfbs	hfbs	F	generally
hfbs2is	hfbs _{IS}		...from drill holes
hfbs3atm	hfbs _{ATM}		...from laser scanner (ATM)
Sea ice thickness (the total ice component)			
hi	hi	Zi	generally
hi2is	hi _{IS}		...from drill holes
hi1is	hi _{EM,SP}		...estimated from EM and snow probe
hi4atm,sp	hi _{ATM,SP}		from ATM total freeboard, snow probe depths and densities
Snow depth			

hs	hs	Zs	generally
hs2is	hs _{is}		...from drill holes or snow pits
hs1sp	hs _{sp}		...from snow probes
hs3sr	hs _{sr}		...from radar
Ice freeboard (no snow)			
hfb		Fi	generally
hfb2is	hfb _{is}		...from drill holes
hB3atm,sr	hfb _{ATM,SR}		...from ATM and snow radar
hfb1is	hfb _{EM,SP}		...estimated from EM and snow probes
hfb4atm,sp	hfb _{ATM,SP}		...estimated from lidar and snow probes

Minor comments:

P2L39-42: the sentence” On the other hand : : . melting” needs to be rephrased.

Perhaps add parenthesis between “compared to” L40 and Perovic, 1996).

- Rephrased to “On the other hand, in spring and summer, snow reflects with its high optical albedo in the range of 0.7-0.85 short-wave radiation and prevents the underlying sea ice with an albedo of about 0.6 from melting (Grenfell and Maykut, 1977, Perovich, 1996).”

P2L41: Remove capital letter on “Snow reflects”.

- done

P2L56: Replace “snow/sea ice” by “snow/ice”.

- done on several places throughout the document to keep it consistent

P3L75: Please specify which freeboard you are referring to (snow/ice).

- we changed it to ‘ice freeboards’

P4L101: I suggest adding a link or reference to Snow-Hydro.

- We think this is here not necessary, the company is known in the community.

P11L265: Add a comma between “site” and “the snow distributions”.

- done

P13L289: Replace “0.00” by 0.

- done

P14L305: Replace “asfor” by “as for”

- done

P14L311: Avoid using “result” twice in the same sentence, I suggest to remove “the resulting”.

- Done

P14L311-311: Please revise:” Our results suggest : : . two-layer snow situation”.

- rephrased to: ‘Our results suggest that the resulting bias is approximately 0.4 m. This is consistent with the result shown in Figure 6, which indicates a bias of approximately 0.03 m in FB1. This bias

might be caused by the same reason (i.e., eqn. 2 also does not account for the two-layer snow situation).’

P16, Figure 7: Please correct the legend: FB3 and FB4 are the same.

- Typo in the caption corrected and changed according the new labeling scheme.

P17L345: replace “about the R/V” by “from the R/V”.

- done

P18L352: Seems to be an extra space between “undergo” and “absorption”.

- solved

P18L364: Remove “of” in “of > 11 psu”

- done

P18L371-372: Seems to be an extra space between “thereby” and “impacting”.

- solved

P20:L415: replace “should to be” by “should be”.

- done