



EGUsphere, referee comment RC2  
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## **Comment on egusphere-2022-870**

Anonymous Referee #2

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Referee comment on "Feasibility of retrieving Arctic sea ice thickness from the Chinese HY-2B Ku-band radar altimeter" by Zhaoqing Dong et al., EGU Sphere,  
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Review of the MS: "Assessment of Arctic sea ice thickness retrieval ability of the Chinese HY-2B Radar altimeter" by Dong et al.

The HY-2B satellite is carrying a dual frequency Ku- and C- band radar altimeter. The data are used for deriving the sea ice thickness and it is compared to similar retrievals from CryoSat2 and airborne campaign data (Operation Ice Bridge). This is an urgent and welcome topic. However, important details are missing from the MS about the instrument and data and discussion of the processing steps and choices made. I did not see it stated clearly, but this study is not using the dual-frequency capability of HY-2B when deriving the freeboard? Only Ku-band? I think that the answers to these questions are important for evaluating the MS and the novelty of it.

The snow data used in the processing are the same as the AWI snow depth (line 224). This is logical when HY-2B data are compared to AWI CS2 data. Are all the other processing steps and auxiliary data used in the processing identical to the AWI processing so that a proper comparison can be made? In line 24 it is mentioned that some of the differences were due to the applied sea surface height anomaly extraction method. Is it due to differences in the methodology or sensor specific differences? Please clarify.

A number of studies focused on Ku- and Ka-band radar altimeter applications from AltiKa and CryoSat and for preparation of the planned CRISTAL mission. This MS does not continue that discussion using C- and Ku-band radar altimetry for sea ice applications. Anyway, I think that some justification of the choices made in this paper are needed, for example, it is implicitly understood that radar scattering is at the snow-ice interface. Is that a good assumption? And how would that differ for Ku- and C-band. Would the different foot-print sizes at the two frequencies have an impact for the derived ice thickness?

The snow depth dataset is a strange combination of retrieved snow depth over first-year ice and snow depth climatology over multiyear ice and some smoothing and filtering. What does the different snow depths and ice densities in first-year ice and multiyear ice areas mean for the retrieved ice thickness? How does this compare to the variation in derived freeboards for the ice thickness variability? What is the impact of the fixed ice densities and the ice type classification with its different snow depths etc.? Is the snow depth needed at all? To me it seems that the snow data are massaged until the "right" ice thickness is achieved.

Some specific comments:

Line 13: "... it is of great significance..." this is a subjective statement without real justification. Please reformulate.

Line 14: delete "values"

Line 15: "... ice growing cycles" replace by "winters".

Line 17: delete "recorded".

Line 18: replace "verified" with "compared".

Line 40: delete "effect".

Around line 45: It is confusing and inaccurate what is written about AMOC. Please reformulate or delete.

Line 52: add "and extent" after "density".

Line 57: use "derive" instead of "estimate", also line 61.

Line 75: "few reports" please list these few reports as references.

Line 77: delete "as a supplementary means"

Line 79: delete sentence starting with "Therefore...".

Line 90: Add some details about the HY-2B altimeter.

Line 91: delete "successfully".

Line 168: "Snow depth" it is unclear which snow depth dataset is actually used. Please clarify this and explain if you are using AWI snow depths or IS-2/CS2 snow depths.

Line 224: delete "depth".

Line 226: Eq. 3 units in meters? Please add units, sometimes [m] sometimes [cm]... use the same units throughout.

Line 230: Eq. 4, what is the sea water density? Sometimes units are [kgm<sup>-3</sup>] sometimes [kg/m<sup>3</sup>], stick to one form. Multiplication is sometimes a dot and sometimes x?

Line 322: I think that I know, but this is confusing: what is a "deviation"? standard deviation? or bias? Throughout the MS.

Line 324: replace "independent" with "OIB"