**“Small icebergs space-time distribution around Greenland and Antarctica” written by Marine Laval and reviewed by Emma Bent**

**Summarize the main results of the article in a few sentences:**

The two main results are:

**1)** Measurements in Greenland reveal two iceberg groups of distinct free-board, which are characterized by spatial distribution and vary with sea ice concentration.

**2)** The total spatial iceberg volume distribution of Greenland and Antarctica evaluated in this study is found close to results of previous literature.

**Answer the following questions about the structure of the paper:**

**Overall content:**

1. Is the overall purpose of the study and/or central question clear?

It is made clearly in this study that thanks to the altimeter Cryosat-2 it is now possible to directly measure surfaces and free-boards in free water and sea-ice. From the introduction one can understand that monitoring the freshwater flux on Greenland and Antarctica is necessary in a warming environment. Therefore the new data given by Cryosat-2 can be useful for this goal. But the authors don’t write clearly the overall purpose and/or central question of the study, the reader is left to understand autonomously.

1. Does the interpretation of the findings answer the overall question of the paper?

As the overall question is not written, the interpretation of the findings actually follows summary of the end of the Introduction (which states the different steps of the study).

1. Is every paragraph and sentence in the paper relevant to the overall question?

*If no, point to some examples:*

Paragraph 4 of Part 5 is not really relevant as the values taken from literature are in mass fluxes whereas the values from the study are in volume. It is not clear what the point is there.

1. Are there portions of the text that could be omitted?

*If yes, point to some examples:*

I believe no portion should be omitted as each part is necessary to get an overall understanding.

1. Is the overall organization of the paper clear and effective?

*Suggestions for improvement:*

The paper presents a Result section but lacks a Discussion section. The Introduction lacks a sentence to summarize the goal of the study.

**Individual sections:**

1. Does the title adequately represent the content of the paper?

The title talks about space-time distribution but the time variable is never studied here. It also does not present the major result.

*Suggestions for improvement:*

“Cryosat-2 altimetry data reveal different distribution of small icebergs around Greenland and Antarctica.”

1. Does the abstract clearly and concisely summarize the paper and state the main results? Does is contain all needed information (context, need, task, object, findings and conclusion)?

Context: missing

Need: missing

Task: “Cryosat-2, from 2010 to 2018, allowing to compute iceberg volumes” 🡪 from this sentence we can guess that the task is to study Cryosat-2 data to extract iceberg volumes but the sentence is not written in a clear manner to understand that this is really the task that has been done.

Object: “small icebergs”

Findings and conclusion: “Measurements in Greenland, reveal two iceberg groups of distinct free-board. Moreover each one have a characteristic spatial distribution and varies with sea ice concentration. In Greenland and Antarctica, the evaluation of icebergs total volume spatial distribution, is close to results we can found in scientific papers.”

1. Does the introduction provide enough context to the readers? Does it state the need for the work? Does it state clearly what has been done to address it?

Context is well explained. The first part of the introduction has the goal of showing the reader the challenges Antarctica and Greenland are facing in a warming climate. The mass loss comes from several processes such as calving, which emphasizes the importance of monitoring icebergs (work done in this study). The problem I had is that new words such as “free-boards” are not defined in the Introduction. In the Methods it says that “*he* is the free-board” but we still don’t have a clear written definition.

The need of the work is more or less described in this sentence: “Few direct iceberg measurements are available, especially for small icebergs (< 10km2)” but it is not specifically addressed afterward how the direct measurements help the study of mass loss in the poles, therefore the reader is left to guess exactly what it is.

Method is addressed: “In this study Cryosat-2 dataset was used to analyse surfaces, free-boards and volumes under sea ice concentration and backscattering, during 2010-2018, and their distributions were compared with other studies.”

1. Does this paper put the progress it reports in the context of existing published work? Is there adequate referencing and introductory discussion?

The Introduction references existing work to offer context to the study. There is adequate referencing.

1. Are the material and methods used in the study clearly explained? Can you point out what is special, unexpected, or different in the approach compared to existing published work? Does it contain too many technical details?

The method is clearly explained without too many technical details, but nothing special, unexpected, or different in the approach, is pointed out in comparison to existing published work (we know from the Introduction though that the Cryosat-2 data is the special thing about this study).

1. Is the results sections(s) clearly and concisely written? Are there logical and smooth transitions between sections, subsections and between paragraphs?

The Results are concisely written. There is a transition between Part 3 and 4: “For a better understanding of main parameters…” but not between Part 4 and 5. Within each part there are no explicit transitions between paragraphs which at times is not a problem as the parts are short, but at other times I find it is hard to follow the train of thought. For example I don’t understand what is the message of paragraph 4 in Part 5 (as explained above).

1. Does the conclusion clearly state the most important outcome of the work? Does it address the questions stated in the Introduction? Does the conclusion just summarize the results or does it interpret the findings and explain what they mean?

The particularity of the new set of data is stated again, which starts the Conclusion in a clear way.

The question in the Introduction was not clearly stated, therefore it is not answered in the Conclusion.

The authors in this part summarize the different results (2 different modes and 2 different clusters were found, they describe where calving occurs in Greenland) and also interpret each one of them in a short sentence.

I find that some sentences lack clarity such as: “In free water, small free-board and volume icebergs, thus higher backscattering, are melting indicator.” There are no transitions between paragraphs but it is not really necessary in a short Conclusion I think.

I find the Conclusion maybe too short and simple, it is hard to make links between the different parts and understand the overall message of the article.

1. Are the interpretations and conclusions adequately supported by the evidence presented? That is, are the assumptions valid, is the methodology sound, is the evidence adequate, and do the conclusions logically follow?

Each interpretation and conclusion is well backed up by the method and the results. Therefore the conclusions logically follows. None of the assumptions made are clearly stated.

1. Are all parts of the text, references, graphics and tables necessary for the new results and main points to be understood?

I find that in Part 4 it is not well explained what back-scattering is and why it is important to study it as well as sea-ice concentration. Therefore I don’t think this part is necessary to understand the main points of the article.

1. Are the graphics and tables clear and their captions self-explanatory?

The text on the figures is written too small, some axes lack a name, the titles should be written on top of each graph to help with the reading instead of having it written just in the caption of the whole figure, acronyms such as “PDF” could be written in full letters, Figure 4 and 5 could be printed in the same sizes. Captions are not self-explanatory in Figure 4 and 5, for example I don’t understand if Figure 4c is cluster in free water OR sea ice.

* **Sentences and Wording**

1. Can you find grammatical mistakes?

There are some grammatical and conjugation mistakes such as:

🡪 “Moreover each one have a characteristic spatial distribution…”

Should be: “Moreover each one has a characteristic spatial distribution…”

🡪 “…is close to results we can found in scientific papers.”

Should be: “…is close to results we can find in scientific papers.”

🡪 “surface melting and sub-glacial play an important role”

Should be: “surface and sub-glacial melting play an important role”

🡪 “During 1970-2017 period…”

Could be: “From 1970 to 2017…” or “During the 1970-2017 period…”

🡪 “but can not in sea ice” 🡪 “but cannot in sea ice”

🡪 “… smaller icebergs (< 10km2) are responsible of melting and fresh water fluxes.”

Should be: ““… smaller icebergs (< 10km2) are responsible for melting and fresh water fluxes.”

🡪 “Sea ice concentration used, is store…” 🡪 “Sea ice concentration used, is stored…”

1. Can you point to sentences that loose you (too long/complex) and do you have suggestions for improvement?

🡪 “In free water, small free-board and volume icebergs, thus higher backscattering, are melting indicator.”

Suggestion: “In free water, icebergs of small free-board and volume (which thus produce a higher backscattering) are a good melting indicator.”

1. Are generally the action in verbs, characters in subjects and subjects near verbs? Can you find counter-examples? Can you point out misused nominalizations?

Counter-example of actions in verbs/characters in subjects:

“Iceberg volumes were obtained from surfaces and free-board.” 🡪 “We obtained the iceberg volumes from surfaces and free-board.”

Misused nominalization:

“Computation of free-board modes is done for free water, sea ice and total.” 🡪 “We computed the free-board modes for free water, sea ice and total.”

1. Is the writing cohesive? Does it flow well? Is the part of the sentence that links to the previous sentence at the beginning or the end?

The writing is not very cohesive (except for the Introduction which is very clear I find) as the article lacks some explanation and definitions (such as “free-board”, “backscatter” etc). Therefore it is hard to understand and to follow where the authors are taking us.

The part of the sentence that links to the previous sentence is usually at the beginning: “In AN, ice shelves fracturing, produce the majority (60- 80%) of icebergs. These icebergs…”

1. Are the paragraphs coherent? Do the first and last sentences of paragraphs match? Can you find counter-examples?

The first and last sentences of paragraphs usually do not match when each paragraph describes one idea (for example in the Conclusion one paragraph describes the 2 modes and the next describes the 2 clusters).

The paragraphs of the Introduction are more coherent. The last sentence of a paragraph usually matches the first sentence of the next paragraph such as here:

“A great part of ice caps mass loss is due to calving, this release of icebergs constitutes a fresh water flux toward ocean.

In AN, ice shelves fracturing, produce the majority (60- 80%) of icebergs.”

1. Is there an abusive use of passive voice?

The authors use the passive voice to describe the work done in the Method part but it is not used too much:

🡪” Iceberg volumes were obtained…”

🡪 “Computation of free-board modes is done… “

1. Can you find a lot of useless words/phrases?

There are not too many useless words or phrases, the writing is simple and concise. I find actually the opposite at times: the article would probably be clearer with more elaborated sentences.

1. Can you find complex words that could be replaced by simpler ones?

Overall the authors use simple words, understandable by most readers. The only things is that as said before, the article lacks some explanation of the technical terms such as “free-board”, “backscatter” or “calving”.

1. Can you find too complex subjects?

No, all subject are straightforward.

1. Can you find inadequately used adverbs/ repetition/ excessive hedging?

There is no excessive/inadequate use of adverbs or repetition or hedging.

1. Is the use of tenses (past/present/future) adequate?

The Abstract is written in the present tense as it should be. The present is adequately used for general truth and atemporal facts in the Introduction and to describe the results in the Results part. The present is misused in the Introduction (instead of the past tense): “…the mass deficit over last decade ~~is multiply~~ was multiplied by 6”. The past tense is used to report the work that has been done (Method, Conclusion). The future tense is not used to talk about future work that could be done as it is not presented in this article.

* **Other comments?**

I enjoyed learning about the remote sensing of icebergs and what tools are used to monitor them (PDFs, backscatter…). But I had a hard time understanding the take away home message of the article, which I found, lacked some explanations. The English could be improved; various conjugation errors remain and there are wrong grammatical sentence constructions. The figures were printed in a very small size and missed some information (name of axes for example), which makes the understanding of the study harder. The use of “I” can be replaced by “we”. The acknowledgment part appears but is empty. The presentation was really good though.