

Interactive comment on “Spatiotemporal Distributions of Icebergs in a Temperate Fjord: Columbia Fjord, Alaska” by Sarah U. Neuhaus et al.

Anonymous Referee #2

Received and published: 22 January 2019

Review of tc-2018-230 Spatiotemporal Distributions of Icebergs in a Temperate Fjord: Columbia Fjord, Alaska by S. Neuhaus et al

General comment

The paper analyzes the distribution of icebergs within the Columbia fjord using high resolution (0.5 m) visible satellite images (10 covering a 8 months period in 2013). Classical image processing tools (from Matlab) are then used to detect and estimate the size of the icebergs within the fjord. The results are validated by comparison with manual analysis for selected scenes. The results of the images analysis are then used to compute the time/space distribution of iceberg and the evolution of the distribution

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of the icebergs' size in time and location within the fjord. The analysis reveals the complex distributions of the iceberg within the fjord as well as the seasonal variability related to the glacier calving rate.

The results are of interest and are worth publishing. However, the motivation of the study should be stated more clearly and if the implication for the future of Greenland icebergs (if kept) should be better justified.

The study is also limited to 8 month and 10 images where certainly much more are available. I know that image processing is quite hard and fastidious but at least the authors should justified why they limited their study to this short data set. Paragraph 4.3 and 4.4 need to be better focused on real results and not on quite shallow general discussions. The distribution of volume and the evolution of the size distribution are important results by themselves. I think that the study could also be improved if simple computation of freshwater flux using ice volume and classical melting law were conducted and presented.

Specific comments

Page 1 line 8 outlet=> outlet

Page 1 line 20: Coloumbia==> Columbia

Page 1 line 20 Considering the difference of temperature between Greenland and PWS water and the different conditions of the Greenland fjords this remark is certainly way to general.

Page 3 lines 15-20. For people not familiar with WorldView Satellite explain why there are sometimes two images from the same satellite at the same time. The sentence on the hundredths of second separation is quite useless.

Page 3 line 23 and following; As the study fully relies on the detection and analysis of the WW1 images, it is important to at least present an example of detection (on an image detail) at best to provide the analysis of all images in Supplementary Information.

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Page 4 lines 23-26. It is not explain what is the difference between a and b images (see my previous comment). If this is related to different viewing angle it is important to precise it as it might explain the different result (that could be due to a difference in effective resolution). I don't understand the November 19 case (not enough information). There again it could be related to viewing angle and specular reflection on open water (wild guess as we don't have the data and there are not freely accessible).

Page 4 line 32. Why May 06 (a b) is not included? Provide explanation. reference to figure 4 should be included.

Page 5 line 13-14, The sentence is not very clear. The pdf is computed on the following bins.

Page 5 &2.4. This paragraph presents two methods of estimation of the iceberg volume from the satellite iceberg area (which might be different from the waterline cross-sectional area if the water is very clear). A is not a proxy.

Page 6 line 7-. I think the authors recompute the albedo using fixed ocean and ice value to eliminate solar angle and atmospheric influence but it is not stated.

Page 6 lin18-20 Where is the 95% coming from. Figure 4 and 5 don't present proportion but numbers and area. Figure 4 should use a log colorscale to reveal more details of the distribution within the fjord.

Page 6 line 20-24. I don't understand the purpose of this remark. It is part of the detection and analysis method and should be treated there.

Page 6 line 25. Please mention figure 6 from the beginning of the &.

Figure 6. For May 6 b and Jul 11 there are only estimates for the proximal zone certainly because of the partial coverage. Is it really necessary to keep those two images as they don't really bring any special information/results.

Page 7 line 13-15. The comparison of the thickness for a given A using 2 and 3 explains

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completely the difference observed in Table 3. What is important to note here is that the variations of the total volume, and percentage of volume for large icebergs are very similar using the two formulas although they give very different iceberg thickness (this is certainly due to the strong impact of the power-law distribution of the distribution of the ice volume).

Page 7 line 19. The summer increase of albedo could implies that the fragmentation is increasing in warmer waters.

Page 7 line 21-25. It is important to explain in detail the computation of the residence time.

Page 8 line 23-25 In fact power-law and lognormal are quite similar and power-laws (which do not converge (tend to infinity in 0)) can be used to approximated the tail of lognormal distributions.

Page 9 line 7-17 Two recent studies one from Bouhier et al (<https://doi.org/10.5194/tc-12-2267-2018>) and one from Crawford et al (<https://doi.org/10.1029/2018JC014388>) presented size distributions of pieces resulting from icebergs fragmentation with slope close to -1.5 (i.e. the mid_fjord summer slope). The two studies mentioned that this -1.5 slope is in general associated to fragile fragmentation and could in this case indicate that during summer month the main driver of the size distribution within the fjord is the fragmentation.

Page 9 line 26-27 In fact when computing power-law distribution there is always some problem with the tail of the distribution just because the numbers of samples is too low.

Page 9 line 30. This is a direct consequence of the power law distribution.

Page 9-10 &4.3 This paragraph is not very clear and don't present any significant results. It could be of interest if the volume of ice and melting law were used to estimate the fresh water flux from each image.

Page 10 &4.4 There is no data in winter in your study.

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Page 11 line 1 Where is 11% mélange coming from (not from Table4).

Page 11 line 14-15. The computation of the iceberg surface is not obvious. It should be given (in annex).

Page 12 line 4-6. The -1.5 slope could indicate that there is more fragmentation during summer.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-230>, 2019.