

Interactive comment on “Brief communication: Pancake ice floe size distribution during the winter expansion of the Antarctic marginal ice zone” by Alberto Alberello et al.

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This manuscript uses shipboard camera images taken over a transect of the Antarctic MIZ to describe the pancake floe size distribution in that region. The manuscript sets out its goals, and accomplishes them concisely and straightforwardly, and so I recommend its publication in short order: this information is valuable and interesting to those who are trying to evaluate and understand sea ice models that incorporate the physics of small floes.

I do have some relatively minor issues, mainly related to presentation and data processing, that I would like to see improved upon before publication. These are listed

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below - if any comments are unclear please contact me with questions.

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Line 10 - I believe the paper of yours truly you mean to cite is H+T 2015, as that is the model paper.

Line 11 - While it is true early results show the importance of the FSD at the edge, only floe breaking by waves and floe melting has been put in models, so it isn't true that this is the place where floes are most important as we don't have a handle on their evolution deeper into the pack.

Line 12 - Please cite either Steele, 1992, or Horvat et al, 2016 when making the statement about floe melting.

Line 13 - I would delete "formed ... currents" as you also mention the importance of waves for pancake formation, and winds and currents can significantly alter the formation mechanism of sea ice in the MIZ.

Line 15 - change "exhibits" to "resembles" as you argue below the inapplicability of fractal scaling.

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Line 3 - add citations to Herman 2014, 2017 here as it is important for readers to know there is really not much evidence of a multi-decadal power law.

Line 5 - Both papers cited here really argue *against* the adoption of FSD power laws, not for them!

Line 16 - "the *Antarctic* sea ice annual mass budget"

Line 18 - I'm not sure the statement about pancakes being more common is supported by the Roach et al paper as it is a point measurement.

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Fig 1 - I would like to see this visualization improved, and the caption more descriptive. For example, it isn't clear that (a-b) and (c) are on different axes immediately, and isn't mentioned that (c) is the cutout in (a-b). Also, are the measurements you are making the dark line in (c)? Could you add the green dash to (a-b) as well?

Line 8 - explain what you mean about statistical independence.

Line 8-15 - generally, please explain the operation used to compute the pancakes as this is very important information for reproducing or building from this work.

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Line 5 - please explain why one might decline an image

Line 8 - you explain why AMSR might *overestimate* concentration, but for many points along the track it underestimates concentration - explain.

Line 18 - "prone to error" - what kind of error? why?

Line 19 - why were the welded floes excluded? Isn't this the process by which these pancakes are said to form? What criteria is used to pick floes to exclude, and how does this affect the tail of your distributions in Fig 3?

Line 20 - area = 1.55 km² - I thought the swath was 28 m, which would mean you traveled 55 km into the ice, not close to 100 km.

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Figure 3 - You have extra space in this figure - could you please also plot the area-weighted FSD rather than the number size distribution? The area size distribution is what appears in the Roach et al model and so would be good to see.

You can estimate how much spread there is in (a) by taking D_1 and adding white noise to it and calling that D_2 , then re-sorting in the instances $D_2 > D_1$. the magnitude of the white noise that is required to get the fit line would tell you how much error there is

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in assuming a circle.

Line 2 - why the mode = peak probability? Why not the mean, and could you report the "roundness" of the floes?

Line 4 - That the probability of exceedence hides the fact of a non-power-law distribution is extremely interesting and while some have discussed this in model papers, to my knowledge this is the first time this has been evidenced *on purpose* in an observational paper. I would like to see this highlighted!

Line 12 - I don't think you can say that there is a different physical mechanism to make larger floes as you only have a point observation of welding.

Line 25 - The point about dropping a priori assumptions is good, I would add that using a KDE is in some ways equivalent to fitting distributions to power laws: both are not derived from first principles and so both give little insight into the actual physics governing the distribution.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-155>, 2018.

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