

Interactive comment on “Contributions of advection and melting processes to the decline in sea ice in the Pacific sector of the Arctic Ocean” by Haibo Bi et al.

Anonymous Referee #2

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Review of paper by Haibo Bi et al., “Contributions of advection and melting processes to the decline in sea ice in the Pacific sector of the Arctic Ocean,” submitted for publication to The Cryosphere.

This is a solid but not a groundbreaking study. I recommend for publication with minor revisions.

Page 1, line 13 and elsewhere: Say “Pacific-Arctic sector of the Arctic Ocean” as in your title, not “Pacific-Arctic Ocean:” the latter does not exist. Same for “Atlantic-Arctic Ocean.”

A major comment is the suggestion that you strive for consistency in your text and

graphics. IE: a) consistent units: i) Abstract uses 10^3 km^2 for PA \rightarrow AA outflow, and 10^6 km^2 for melting. Just use 10^6 km^2 for all, so that a reader can clearly compare eg 0.173 vs 1.66. ii) /yr vs /a: Sometimes you use “per year” and sometimes you use “per annum” and sometimes you do this in the same sentence! Just pick one and always use this. iii) /de vs /yr: I don’t know if /de is a standard way to write “per decade” but in any case you mostly use /yr (or /a) so I suggest you translate the /de to /yr or /a. b) consistent terminology: Is the distance along your flux gate (2840 km) the WIDTH or the LENGTH? Sometimes you use one, sometimes the other. I think it should be the length; the width is 25 km ie the grid size, yes? c) consistent graphics scales: Figures 2 and 8: Use same vertical scale for left and right panels

Page 2, line 27: You could also include this reference for faster ice and changing drag, internal stress: Zhang et al. (GRL, 39, doi:10.1029/2012GL053545, 2012)

Page 2, line 31: There are a number of model studies that have considered dynamic vs thermodynamic forcings separately. One example is Figure 9 in Lindsay et al. (J. Clim., 22, doi: 10.1175/2008JCLI2521, 2009).

Page 3, lines 15-16: Just say “NSIDC.” It is “University of Colorado” not Colorado University, but NSIDC is enough.

Page 3, lines 23-24: Please provide a reference for these unrealistic buoy velocities. Are you referring here to Szanyi et al. (Geophys. Res. Lett., 43, doi:10.1002/2016GL069799, 2016)?

Figure 1: a) Please give the lat/lon coordinates of each endpoint of the flux gate line. b) There is no need for the compass rose, and in fact it is inappropriate on a map with the North Pole included. c) Is there a southern boundary of the PA? maybe at Bering Strait? This should be noted with a blue line, just like for the southern AA boundaries. Equation 1: The units of F are $\text{length}^2/\text{time}$, yes? Please note this here.

Table 1: Please provide the units for ice area flux. Also, it’s “length” not width, I think

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(see comment above on consistency.)

Page 5, line 17: Your English is generally quite good, but there are numerous minor errors in spelling and grammar. EG here it is “annual” not “annul.”

Bottom of page 5: Is it possible to provide a better estimate of the error in your calculations from the neglect of ice deformation (eg from numerical model studies)? Further, this error should be noted in the rest of your paper. EG if you find that there is a trend in total melt in the PA of X%, but this is smaller than the error from neglect of deformation, then do you have a significant result? Please discuss.

Page 6, lines 10-11: Is this DA index publicly available? Could you provide a link? AGU journals require a discussion of data availability; The Cryosphere may not, but it is all of our responsibility to discuss data availability so that our results can be independently reproduced.

Page 6, line 14: “precipitable”

Figure 3: It is not immediately obvious to me that there is more blue on the left and more red on the right. Some nice further analysis is provided in subsequent plots, but for this one, I might suggest the addition of the annual mean anomaly on a new bottom row, which could more clearly summarize the trend.

Page 9, line 2: This is very interesting. Any thoughts on why the extremes are not changing?

Figure 8: Use same vertical scale for both panels. Note that the line goes from N. America (left) to Eurasia (right).

Figure 9: It is nearly impossible for me to see these panels clearly and thus to interpret this figure. Could you try to make a better one, maybe with fewer panels?

Page 13, lines 6-9: Are you saying that melting in the AA is of similar magnitude to that in the PA, but that the AA ice is getting replenished by PA ice? This would be a major

new result if true. But I kind of doubt that it is true, given that the AA is (in the mean) farther north than the PA, and so probably there is more melt in the PA.

Section 4 Discussion re climate indices: The Arctic community went through a phase in which everything was correlated with climate indices. This fad has faded as ice continues to decline independently of climate indices. Further, climate indices don't provide predictive skill. It is unclear to me what they do provide, specifically in the present context of this paper. I might suggest that you write some introductory words to this section that explain why you are correlating your results with these indices, and then at the end, what your significant correlations provide in terms of new insight.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-11>, 2019.

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