

The Cryosphere Discuss., referee comment RC2  
<https://doi.org/10.5194/tc-2021-343-RC2>, 2021  
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## Comment on tc-2021-343

Anonymous Referee #2

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Referee comment on "The effect of changing sea ice on wave climate trends along Alaska's central Beaufort Sea coast" by Kees Nederhoff et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-343-RC2>, 2021

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This study investigates the wave climate change in Alaska's central Beaufort Sea coast based on high-resolution wave simulations. With ice decline, some wave climate change trends are identified. Before I can recommend the paper to be published, some unclear points should be addressed.

General comments:

I am not sure that I fully follow how model calibration was done.

- The authors compared the different friction formulations and coefficients. Even though, the authors have given references to those formulations. Instead of going to read the references, I strongly suggest that the authors give a general introduction about those formulations (like they did for the wave decay by ice). What is the main difference between those formulations?
- L194-197: Why do the authors give the calibration information in the caption of Figure 4? Is there any logical connection with Figure 4?
- L142-148: I suggest that the information about calibration here should be moved and merged with L230-235.
- 20% of the data were used for the ice season calibration, which is stated in L234. However, in L259, it said that "for all 13 observations". I am confused that how much data are used for the calibration.

The impact of air-sea temperature difference on wind growth is used in the model set-up. Which SST data did you use? ERA5? I would suggest that the authors give some discussion about the limitation of the SST in the marginal ice zone since it is an important data source for your simulations.

The finest model resolution is about 500m in the simulations. The wind forcing data from ERA5 is about 30km. Many small-scale wind variations cannot be captured by ERA5 in the marginal ice zone. I am wondering why did you use so coarse resolution wind data for so high-resolution wave simulations. At least some discussions about this issue should be added to the manuscript.

From my understanding, the wind sea is largely decayed by ice in the marginal ice zone. In the relative small domain areas, the waves are mainly dominated by swell during the ice season, is it true? If it is the case, I would assume that the accuracy of the simulations during the ice season is largely affected by the wave boundary conditions, right?

Detail comments:

Figure 1: it will be easier for readers to get the water depth distribution if you add the topographer information in Figure 1 or Figure 4.

Figure 2: Give the information that the location of the ERA5 is shown in Figure 1. L110: "110<sup>o</sup>N" to "110<sup>o</sup>"; "75<sup>o</sup>N" to "110<sup>o</sup>"

Figure 3: Are the data shown in the figure the area average?

Section 3.1.1: the authors use the ERA5 information in the previous section and figures. The introduction of ERA5 data is in the later section.

L120-121: the resolution of the wind field is not 0.5 degrees or did you use 0.5degree resolution wind for the wave simulations?

L125: Did you use mean wave direction or peak wave direction?

L129: Foggy island Bay -> FIB

L138: What are  $T_p$  and  $D_p$ ? Peak wave period and peak wave direction?

L145-149: Which domain is used for the calibration?

L175-178: Give more information about the  $\Omega$ . How does  $\Omega$  is used in the wind input term?

L213:  $n \rightarrow N$

L215: "wave height"  $\rightarrow$  "significant wave height"; "wave period"  $\rightarrow$  "mean wave period", etc

Figure 5B: What is  $T_{m0}$ ? You use  $T_m$  as the mean wave period in the above text.

L254: Table 2  $\rightarrow$  Table 3

L259: Table 2  $\rightarrow$  Table 3.

L260: In Eq 2, there are six coefficients. Here, why only two coefficients for the calibration?

L254: data in 2007 or 2019 (caption in Figure 6)?

L265: What is 5% PI in figure 6C?

L284: Figure 7B is wave period or wave height? The ylabel shows  $H_s$ , I think it should be  $T_m$ .

L285: I am confused about the data. In the title of the figure, they are 2020A and 2020B+C. In the caption, they are #0519-1 and 0519-2. If you check the Table1, 2020A is #0518.

L334: Table 3  $\rightarrow$  Table 4

L354: Table 3->Table 4

L370: How did you identify the storms?

L379 mean wave period or peak wave period?

L389: mean wave direction or peak wave direction?

L397: Table 3->Table 4

L400: How did you calculate the wave power? Based on wave spectrum or bulk parameters?

Figure 14: Please give the location of the transaction in one figure.

L408: Table 3->Table 4

L470: Liu et al. 2016 -> Liu et al. (2016)

L495: the in this study-> in this study the