

## ***Interactive comment on “Satellite retrieved sea ice concentration uncertainty and its effect on modelling wave evolution in marginal ice zones” by Takehiko Nose et al.***

### **Anonymous Referee #2**

Received and published: 16 January 2020

The manuscript examines the impact of observational uncertainty in sea ice concentration on numerical modelling of ocean surface waves in sea ice, using Wavewatch III. The most interesting finding, in my opinion, is that the effect of this uncertainty on wave modelling is large, and larger than the differences between various wave-ice interaction source terms currently included in WW3.

In general, I find the results to be well supported by thorough analysis. The manuscript is a little hard to follow in places (some instances of this noted below in ‘presentational comments’). As currently presented, my sense is that this work is of interest to a narrow section of the community (i.e. those working on spectral models of wave-ice in-

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teractions) and may be better suited to a more targeted journal. However, this could be addressed by revising the text to stress the aspects that could be interesting to a more general audience e.g. the differences between SIC products and their accuracy near the ice edge; that the sea ice coverage may be more important in determining ocean surface waves in ice than a detailed understanding of wave-ice interaction physics; the level to which waves in the open ocean are influenced by sea ice.

#### Major comments

‘Analysis of significant wave height uncertainty distributions for SIC forcing and wave-ice interaction source terms reveals that they are both sizeable; however, the study concludes the more dominant uncertainty source of modelling wave-ice interactions is the accuracy of satellite retrieved SIC estimates that are used as model forcing.’ The authors need to clarify that uncertainty in wave-ice interaction terms is an estimate based only on the various wave-ice interaction terms included in WW3, which as the authors note later in the manuscript are based on a limited number of field observations. It does not sample all possible wave-ice interaction terms, nor does it sample different parameter values.

It is well-known that SIC satellite observations underestimate concentrations for low thicknesses, less than 35 cm (Ivanova et al. 2015). This should be stated in the Introduction. I think the newer result here is how varied the satellite products are for these low thicknesses. This should be made clearer in the text.

Sec 2.3 This section needs more explanation to make it suitable for a more general audience - i.e. those not familiar with WW3 wave-ice interaction terms. What is the ISO switch?

What is the estimated of spatial domain of the sea-truth concentration observations? Are these comparable to the resolution of the satellite products?

Sec 3.2 - why are only three products considered here? Conclusions on which products

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perform best (or worst) for this region would be useful and of broader interest to the cryospheric community.

Minor comments

L22 'which are greater in the Arctic regions.' As compared to what?

L23 'sustainable developments of the Arctic Ocean' - this statement sounds strange

L28 'dispersion relation' -> 'the dispersion relation'

L32 Other recent work on wave-ice interactions could be cited here: Zhang et al. 2019 (<https://doi.org/10.1016/j.ocemod.2019.101532>), Roach et al. 2019 (<https://doi.org/10.1029/2019MS001836>)

L37 'Besides the model interior' What does this mean?

L37 'like SIC' -> 'in products such as SIC'?

L69 'generally' -> 'generally between'

L70 'Albeit the MIZ coverage..' - this sentence is unclear

L82 'mostly same' -> 'mostly the same'

L96 remove 'exhaustive' (this is an opinion)

L102 'most frequent' -> 'most frequently'

L102 'leading algorithms' leading in what? Perhaps you mean the most commonly used?

L152 'sanity checked' inappropriate language for a publication

L153 'leading packages' again, leading in what way? Most commonly used? Most skill?

L211 change to 'SSTs exceeded 0oC'

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L211 At what depth were the shipboard SSTs measured? Are they affected by the ship itself?

L212 No s after MIZ

L218 'forseeable' -> 'visible'

L223 'The sea ice tends to cluster, so it appears dense where the ice exists.' - reword

L230 'depict the' -> 'show that the' ?

L264. What does 'best practice wave models' mean? Perhaps replace with 'commonly-used'?

L266 'a bit over' - informal language

L277 'as uncertainty generally increased in the MIZs.' - unclear. No s after MIZ.

L299 remove the rest of the sentence after 'ongoing work' - not necessary.

L323 add 'that' - 'demonstrated that'

L338 'like a' -> 'as a'

L339 'effects...are' (not is)

L443 Reword

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-285>, 2019.

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