

Second review for Gabarro et al. : **Estimating sea ice concentration in the Arctic Ocean using SMOS**

Submitted to *The Cryosphere*

I thank the authors for answering my questions clearly and taking into account my comments about the structure. The manuscript has improved a lot since the last version. The story is much clearer now and reads much more fluently.

I still have some minor comments. Overall, however, the manuscript is nearly ready for publication.

### **Thematic comments**

#1 L335: “most of the values are in agreement at about  $2\sigma$ ” is very vague (mostly because of “most” and “about”). I would suggest reformulating this more carefully. Maybe you could briefly discuss winter and summer results separately, as in summer they fit less, as expected.

#2 L380-384: Something is not right here. You mention a likelihood function  $L$  and a likelihood function  $\Lambda$ . And you mention “Recall that the likelihood is the logarithm of the probability density function”. So,  $L = \ln(N)$  ? But then Eq. (18) says  $\Lambda = \ln(L)$ . I suggest checking this again.

#3 L413-414: I am wondering if you are basing “since this period is the one with the minimum ice extension and minimum thin ice expected” only on this figure or also on other results? I wonder if, with this explanation, we should not also see effects in July and August as well. It does not seem obvious to me that they agree so well in September but that the disagreement is higher in the other summer months. But maybe I understand something wrong. Could you comment on this?

#4 L463: This is a bit vague. I suggest adding numbers, for example by replacing “is almost zero” by “is between 20 and 30%”. Also note that you use “very high” (without mentioning 0.7 to 0.8) and “notably high” (with mentioning 0.9). This might be misleading without numbers.

### **Style/Typos**

L38-39: I think you should add an information about the area of ocean considered in the definition of SIC. “the total area at a given ocean location” is a bit vague. For example : “the fraction of ice relative to the total area of a given ocean domain”.

L101: Replace “filtered” with “filter”

L103: Replace “averaged” with “average”

L116: Replace “used” with “use”

L118: Replace “used” with “use”

L125: Replace “transmitivity” by “transmittivity”

L144: Delete “will”

L158: Replace “imagenary” with “imaginary”

L179: Insert “is” in “c is the speed of light”

L184: I do not understand why there is a circumflex accent on `eps_ice`

L225: I would suggest saying: “Hereafter, we introduce...” so that it is clear, that this is your result

L303: Replace “selected” with “select”

L305: Replace “selected” with “select”

L310: Replace “calculated” with “calculate”

L329: Remove “group”

L377: Replace “used” with “use”

L378: Replace “means” by “stands for”

L435-436: Use “we have estimated” and “we have compared” instead of passive voice to make clear that you did this and it was not done before.

L449: Add “it” in “whereas at the OSI-SAF frequencies (...), it is...”

L455: Replace “seas” by “sea”

L462: Add “also” in “This also implies”

L473: “improveS”

L481: Replace first “is” with “are”

L497: Add “as” in “such as flat surface ice”

All of Section 5, you use perfect tense. I suggest being consistent with other sections and using present.

## **Figures**

Fig. 1: I suggest replacing “for a set of” with “to a set of”, because it is a sensitivity **to** something.

Fig. 5: I suggest adding the unit to the x-axis label

Fig. 6: Replace “multy” with “multi”

Fig. 9: Replace “tecniques” with “techniques”

Fig. 11-12: I still suggest changing the colorbar to “blue to white” as it is more intuitive.