

Reply to reviewer 1

1 Minor comments

(S=Section, P=Page, l=Line)

- *Abstract* : The authors call the general protocol as a “twin experiment”. It is not a classical way to define realistic data assimilation experiments using real data. In the scientific literature, the expression “twin experiment” defines, generally, data assimilation experiment based on simulated observations. This is not the case here, and I think, like that, it is confusing for the readers.

I strongly suggest to modify this presentation of the experiment protocol.

Answer: Thanks for pointing this out. We have changed “twin experiment” to “hindcast experiment”.

- *Abstract* : “The SIC innovation (model minus observation)”. In data assimilation paper, the innovation is defined as the opposite (Observation minus model). In addition, after in the equations, the author present the correct expression or formulation. I suggest to correct this sentence.

Answer: Thanks. It is corrected.

- *S.2.2, l.200* : Please, define \bar{h} .

Answer: We have added \bar{h} before the equation, which denotes the estimated actual SIT.

- *S.3.1.1, l.224* : “...being about 0.25 when SIC = 0 ...”. I am agree for oceanic areas which are very close to the marginal zone, but I think the uncertainty should be more precise for location which are very far from the sea ice extent. The authors should say something about that.

Answer: we have added the following short discussion after the sentence:

It is noted that the uncertainties calculated here are fully based on the AMSR2 radiometric properties, the tie-point variability and the atmospheric opacity. For the open water and MIZ close to the sea ice edge, the high uncertainty is generally realistic and implies that the observed ice edge may be not very accurate. However, for the ice-free areas far away from the sea ice edge (Fig. 3b), the uncertainty should be much lower due mainly to the much higher SST. Such impact is not considered in the present study. Nevertheless, the high uncertainty in these ice-free areas

should generally be of little effect on the assimilation of the sea ice cover, as the warm ocean surface would enhance the maintenance of the ice-free situation.

- *S.4, l.324 : “A twin experiment...” Same discussion as before*

Answer: corrected.

- *S.4, l. 327-332 : The discussion about the Anomaly Correlation Coefficient is not necessary. The authors explain obvious things and basic statistics with an example. In addition, this metrics is not showed in the paper so why do the authors talk about it? I suggest to remove these comments.*

Answer: removed.

- *S.7, l. 573: “A twin experiment...” Same discussion as before*

Answer: corrected.

2 Other Comments

(S=Section, P=Page, l=Line)

- *S.2.1, l.83 : “parmaterized” should be “parameterized”*

Answer: corrected.

- *S.4, l.324 : “squre” should be “square”*

Answer: corrected.

- *S.4, l.373 : “the” is written twice*

Answer: removed one “the”.

- *Reference : the reference for Wang should be timely ordered.*

Answer: The references here follow the TC template in Latex. The first Wang has only 2 authors, and the second has more than 3 authors, so the order does not follow the time.

Others: we have also added the units for Figures 6, 8 and 9.