



Comment on **essd-2021-123**

Anonymous Referee #1

Referee comment on "Arctic sea surface height maps from multi-altimeter combination" by Pierre Prandi et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-123-RC1>, 2021

General comments:

The study describes the first multi-mission product from the Arctic Ocean with an impressive 3 days resolution. The whole concept of the paper is very interesting, but the manuscript is at this stage not mature enough for publication. I suggest it should go through a mayor revision. In most circumstances the manuscript can be improved by more information and better description about the procedures, but in some cases the writing is erroneous. The quality of the 3 days gridding is not validated. This is novel about this product, and should be validated. More specific comments: It would be nice with an image of the processing steps. This may be a personal opinion, but I do not like the chosen map projection. The map projection favors the interior of the map. It is difficult to see the data in the Bering Sea.

The method for estimating the noise levels are not very strong. I do not follow the method. It may be my lack of knowledge, but the section should be described in more details, and some steps seams rather doubtful. There are no perspective to other studies regarding the comparison results. There are several spelling/grammatical errors though out the text which should be corrected.

Abstract:

- Missing the objectives of why this study is interesting
- Include a sentence on how CS and S3A is processed

L7: "A much better performance" is a very weak comment in an abstract. How is it better. Be more clear and precise.

Introduction:

- Processing is a large part of this paper. I am missing a paragraph describing what others

have done in this area

L26: 1000km spatial resolution. This seems not correct! the whole Arctic is just about 4500 km wide

Data and methods:

L64: Please, explain what the CNES S3PP processing is, I am also missing a reference.

L71: Can you clarify how the different classifiers differs? As I can see S3A is not included in the Longépé et al. (2019) paper.

L81: The Adaptive algorithm...Please, summarize the importance of the algorithm

L84-85: "...no equivalent of the Adaptive retracking algorithm available..." This is not true! What about ALES+ and SAMOSA+. They are both designed to operate over both surfaces.

L90: Your ocean/lead selection comes after retracking, but you write (L85) that you retrack differently over ice and open ocean?

L95: How has this backscatter threshold been determined?

L99: Shortly, explain the method used by Poisson et. al. (2018).

L111: Please, explain "(and 2016)". Do you have a reference? I do not believe there exists a MSS DTU16

L121-122: I do not understand what you do here. What is the iterative process? Could you please explain in more details.

Fig1: How well are they correlating? It seems like C2 differs more than S3A og SRL, can you explain this?

Fig.2: There are a striping effect in the Norwegian Sea for SRL and S3A. Can you explain this? You have difference maps, but are not referring to them.

L152-153: This may be the striping you are referring to? What is it?

Fig. 4: Please, comment on the latitude striping south of Greenland.

L165-174: You are referring to equation terms in other papers. It is difficult to follow. Please, write the equation.

L178: Missing reference on high latitude errors in MSS

L188: Which SLR file?

L189: Why 5 cm^2 ? Please quantify.

Fig. 5: Why are there data everywhere, when they are separated in leads/ocean?

L194: Why choosing 10 cm^2 ?

Fig. 6: Please explain the latitudinal striping.

L198: It is very interesting with a 3 day product, but what is the data sampling in grid cells, ex. in the sea ice cover? I think this is the first time a 3 day product in the Arctic is available, but how is the 3 days quality?

Product Description:

L200: Missing a reference, and again what does "(and, 2016 means?)"

Data quality assessment:

L235-247: You should use the same MSS in the comparison, or else it does not make sense. All the differences you see could be from the MSS.

L54-: There is no information about removing dac to altimetry or adding it to the tide gauges? This should be done before comparisons. Are you correcting for GIA? How are your results compared to other studies?

L254: What does co-located altimeter data means? How are you comparing altimetry to the tide gauges? Closest grid cell or...?

L:257-261: How are your results compared to other studies? Both (Armitage et al., 2016; Rose et al., 2019) have better single mission correlation at Prudhoe Bay.

Conclusion:

L277: "...performs better than any single-altimeter analysis" I do not completely agree (See above), maybe it should be: "...performs better than our single-altimeter analysis"

Minor corrections:

L56: PDGS: What does this stand for?

L86: TFMRA: Abbreviation - spell it out

L87: MLE3: what is this, missing reference

L167: figure 4 comes before figure 3

L209: Error in ref (??)

L258: Fig ref error