

Interactive comment on “Impact of assimilating a merged sea ice thickness from CryoSat-2 and SMOS in the Arctic reanalysis” by Jiping Xie et al.

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Thank the review for the constructive comments. We would like to answer the points one by one as follows.

General comments The authors present impacts of assimilating CS2SMOS sea ice data on the TOPAZ4 system. Although the impacts of both CS2SMOS and Cryosat-2 ice thickness on the ice-ocean coupled model have been addressed by Mu et al. (2018), this MS has its new focuses and advances, e.g., extending the study period from one cold season to one full seasonal cycle, and besides the sea ice thickness themselves, also the impacts on sea ice drift fields, SIC, SSH, SST and T-S fields have been examined. It finds that CS2SMOS assimilation partially improves the sea ice drift

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Discussion paper



fields (in the pack ice area) and has not degraded the other ocean fields. The influence of CS2SMOS is also quantified with DFS. This is a very well written MS. It is may be of interest for a large community of users in the Arctic sea ice numerical modeling, data assimilation and prediction. Results are clearly presented. The paper has 1 table and 13 figures, which all have appropriate captions and legends. I recommend this paper for publication after a minor revision, considering the above statement and the comments made below.

Minor comments: 1) For the independent sea ice thickness comparison, the 3 mooring ULS sea ice draft observations in the Beaufort Sea should also be used. The ULS observations can provide the seasonal evolutions of local ice thickness, which are well agreed with the study period. -A: Thanks, the mooring buoys are used for additional evaluation in Section 3.3.2

2) The CS2SMOS is a purely statistics merged product, while data assimilation can blend the SMOS and Cryosat-2 SIT after considering physics (at least partially), and this benefit has been illustrated by Mu et al (2018). The authors are encouraged to assimilate the SMOS and Cryosat-2 data directly in their future research or operational work. -A: We fully agree and this is discuss in the Conclusion and discussions: See P26 L842-850: “An alternative to using the scheme CS2SMOS data would have been to assimilate the two data sets CryoSat-2 and SMOS SIT separately and let the EnKF merge them together rather than relying on optimal interpolation, as successfully demonstrated by Mu et al (2018). This would for instance avoid assimilating observations in places where they are the pure result of interpolation/extrapolation but would not resolve the offset between the two satellites, which is arguably the most worrying issue as of the present state of the SMOS and CryoSat-2 data. The assimilation of the separate datasets will be attempted in the future when their consistency is further improved.”

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-101>, 2018.