The manuscript "Drift-aware sea ice thickness maps from satellite remote sensing" by Ricker et al. describes a new algorithm for aggregation of along-track sea ice thickness measurements using corrections from satellite-derived sea ice drift. The produced sea ice thickness dataset is thoroughly validated and supplied with an uncertainty estimate. The manuscript presents new results that are important for climate and cryosphere research. It is well structured and contains all the necessary algorithm details and dataset description details. Nevertheless, a few open questions need to be addressed in the manuscript. I believe it can be recommended for publication after a major revision.

Major comments

The text contains grammar mistakes, and a thorough check by a native English speaker is recommended. I marked as much as I could, but I'm not a native English speaker either.

It is good that a separate validation of ice drift trajectories used for tracking the parcels is included. However, the presented algorithm (a data-driven model) contains one more module that can potentially significantly affect thickness distribution: accounting for thermal growth. How accurate is that one alone? It seems important to show the RMSEs computed between the input SIT in the parcels (Line 163), and the fitted values (f_H, Line 165). It will probably be proportional to the presented growth uncertainty, but RMSE is a more robust method.

The authors used arithmetic mean (Line 207) to compute SIT from advected parcels. Given that the uncertainty of SIT increases with the advection time (both due to growth and drift), would it be more reasonable to use a weighted average with weights inversely proportional to the time of advection? Alternatively, a limit on trajectory length can be added to prevent points from drifting too far (see also comment below on thick ice blocks in MIZ).

It is not clear from the description how the ice drift is used for advecting parcels, i.e., how the ice velocity is integrated to obtain displacement? Is it a linear Euler method or a more accurate Runge-Kutta 4^{th} order, typically used for computing trajectories in inhomogeneous flows? What is the impact on the accuracy of the advection of the selected method (especially in areas with strong ice drift, e.g., Fram Strait).

Validation of a non-DA-SIT should be included in section 3.2 Validation with Airborne EM, to be consistent with Section 3.3 Validation with ULS, and illustrate the impact of data awareness. Expectedly, the impact will not be significant, but it needs to be documented.

It would be beneficial to homogenize presentation of the comparison – use either 2D histogram (like in Sec. 3.2), or a scatterplot with binning (like in Sec. 3.3). Additionally, the reference data (the independent variable) should be placed on X-axis, and the tested data – on Y-axis, following a common practice.

It is important to add Pearson's correlation or coefficient of determination to the provided RMSE and bias. It's expected to be quite high for the CS2 DA-SIT vs AEM-sit, for example, but nearly zero for Envisat, indicating that it may have low predicting skills for SIT over 2 m.

One of the applications of satellite-derived SIT is operational monitoring or assimilation into forecasting models. How efficient can the proposed algorithm be for such an application? Would advection over the last 15 days be sufficient (and important) for providing a more accurate SIT distribution in NRT? Can it be illustrated in the manuscript?

On the video supplement, in mid-January, I noticed some extremely high thicknesses in the MIZ in the Greenland Sea. What is the source of that? It should be either fixed or well presented in the paper with explanations.

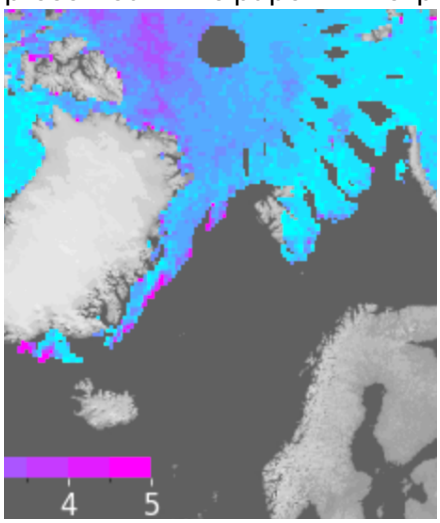
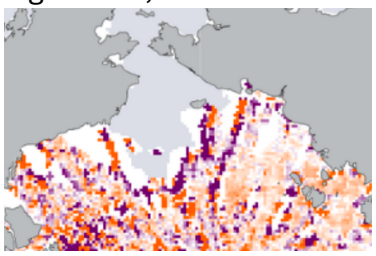


Figure 4. a, left.



There are lines with alternating very high and very low growth rates along the CS2 orbits. Is that an error in the estimation of the growth coefficients or divergence/convergence of sea ice? More light needs to be shed on these cases (e.g., actual time series of advected SIT, divergence estimate from drift fields). It influences a lot the RBF-gridded SIT growth fields at a later stage but doesn't look as convincingly accurate data.

Specific comments

Line 2. Operational products are averaged over 2 weeks period, “one-month period” need to be rephrased.

Line 5. The acronym DA is very often used for Data Assimilation. May authors consider some other abbreviation for the product name to avoid confusing the users who have not read the paper. “Advected SIT” maybe?

Line 10. “enables” -> “facilitates”

Line 15. “to a state more closely to” -> “to a state similar to”

Line 17. “on a large scale”

Line 26. “one month” is not a standard for, e.g., operational products.

Line 41. “might get lost” -> “is neglected”

Line 44. “observer” -> “observe”

Line 45. Either “single-synchronized orbits” or “a single synchronized orbit”

Line 98. Improve sentence consistency, e.g.: “Location of parcel centres is selected using the NSIDC EASE-Grid 2.0 (Brodzik et al., 2012) with spacing of10 km in both x and y directions.”

Line 108. What is the uncertainty of the interpolation? Can it be added to the total uncertainty budget in Sec. 2.4?

Line 116. It is not clear how the position is adjusted. Please clarify in the text.

Line 117. “Consequently, subsequent” -> “Subsequent”

Line 128. -> “some parcels have drifted for more than 200 km.”

Line 193. “Python”

Line 211. “swapping” -> “sliding”

Line 223. How reasonable is the assumption that the uncertainties are uncorrelated? In principle, the same (or very similar) sea ice is sampled by an altimeter in one parcel. With the same roughness that largely contributes to the uncertainty.

Line 225. Is the uncertainty of the interpolation procedure taken into account?

Line 261. Previously the product was called “drift-aware SIT”, which sounds better than “Drift-Awareness SIT” (although, as mentioned earlier a better name can be found to

avoid confusion with data assimilation abbreviation). Please check that the product and the algorithm are called consistently.

Line 341. The sample sizes for all bins on Fig. 9 should be provided.

Line 359. “Proves” seems to be an overstatement. Fig. 9b indeed illustrates that in some cases, there is a coincident increase of thickness in both products. However, it also shows that in some cases, it is the opposite (e.g., 10 – 20 Dec 2008). For proving, it is crucial to include r, or r2 scores for the comparison of ULS and DA-SIT, as mentioned earlier.

Line 367. “latitudinal” -> “meridional”

Line 373. “on mainly three factors” -> “mainly on three factors”

Line 375. “~~been~~”

Line 383. It is not very clear. Does the conventional product use “parcel positions at the time of the satellite overflight”? Please rewrite.

Line 386. Quite often “mean difference” is called bias, and “standard deviation of differences” is called RMSD (or RMSE). I would suggest using these terms here and below.

Line 390. I would not agree with “In fact, the results for March 2020 appear to be representative overall.”, especially for the biases. Maybe this sentence can be simply excluded? As well as the next one, which doesn’t bring any useful information.

Line 392. The peak on Fig. 1.a looks quite sharp, more typical for a Laplace distribution. Is the actual type of the distribution important or just the fact that it is symmetrical? Maybe “Gaussian” can be avoided?

Figure 11. Please add bias and RMSE for the entire Arctic.

Line 393. “, the higher the mean differences.” -> ““, the higher <u>are</u> the mean differences.”, or rather “, the higher <u>are</u> the <u>biases</u>.”

Line 394. Do you mean the Barents Sea instead of the Beaufort Sea? The Barents Sea has the second largest bias, and the mean bias in the Beaufort is very little.

Line 395. “longitudinal” -> “meridional”

Line 418. Not only “redistributed”. What about the ice growth in the advected parcels? I guess the standard product does not account for that. Does it add a bias in the new product?

Line 423. “Future altimetry missions”, as the authors also mention S1 SAR in this bullet point.

Line 429. “As an outlook” -> “In future”