

## ***Interactive comment on “An enhancement to sea ice motion and age products” by Mark A. Tschudi et al.***

**Anonymous Referee #1**

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The paper provides a detailed and very well written description of the new ice motion and ice age product to be delivered by NSIDC. Importance of these products is justified by a comprehensive introduction. Changes in the production chain at all stages - from individual drift components to ice age computation - are properly documented. It is illustrated that the changes at the lower level (new optimal interpolation scheme) have impact at the higher level products (larger extent of older ice) but predominantly in the beginning of the observation period (before 1996).

Notwithstanding the high quality of the paper, in my opinion it fails to quantitatively prove that the ice motion and age products have been actually enhanced. The only evidence that ice motion was improved is qualitative - visual comparison of drift components on figures 3 and 4. Improvement of the ice age product is also illustrated only

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visually - a more homogeneous ice age distribution is presented on figure 6. Given the high demand for these products a proper quantitative validation is of vital importance. A section needs to be added where the ice motion is compared with other existing independent ice motion products including, for example, AMSR2 derived drift, SAR derived drift, drift of the buoys that were excluded from the optimal interpolation, etc. Although a direct validation of ice age product is probably impossible due to absence of a similar independent product, it can be validated indirectly by comparison of multi-year ice extent with products derived from passive microwave sensors or scatterometers in March - April. It is required to include in this section the widely used product quality metrics such as RMSE, bias, Pearson correlation coefficient, etc. (and preferably both for version 3 and version 4) in order quantitatively prove the enhancement of the products and illustrate applicability in different scientific domains (trend computation, assimilation in numerical models, etc).

Minor comments No grammar mistakes or typos were identified and the minor comments only concern few clarifications / corrections that are needed in the text.

P3, L23 and L25. Some authors distinguish feature-tracking (detection of individual keypoints on two images => description of keypoints by a binary vector based on => brute-force matching of keypoints, eg. SURF, ORB, etc) from pattern-matching (maximum cross correlation continuously applied to every n-th pixel) [e.g. Rublee et al., 2011, Berg et al., 2014, Korosov et al., 2017]. Maybe a consistent use of “pattern-matching” is preferable in these two cases.

P4, L18. How was the effectiveness of 4X oversampling estimated?

P5, L5. What is the criterion for omitting rogue vectors? Difference from median of vectors in the vicinity? What is the threshold for screening?

P5, L12. What were the thresholds used in V3 and V4 for filtering PMW vectors?

P5, L22. 1% seem to be quite an underestimation of ice drift speed. In addition,

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this relation cannot be constant in space and time. With the available large amount of collocated data on wind speed and observed ice drift it should be quite simple to illustrate validity of this 'constant 1%' assumption. It would be important to justify it, e.g. in the Discussion section where the relationship between ice drift and wind speed is illustrated spatially and temporally.

P7, L12. Is there a proof that the motion is "largely unbiased"? It is important to add a validation section (as explained in the general comment section above) to prove this statement.

P8, L5 and L6. What is the impact of values of C and D parameters on the drift speed quality (visual appearance) and accuracy (as can be retrieved from validation)? How sensitive are the motion and age products?

P9, L26. I'm confused by the phrase "...all parcels in the 12.5 km ice age grid are initialized with an age-class...". Does it mean that there are several parcels per grid cell? How many?

P10, L19. How much "substantially"? It would be nice to have a numerical characteristics to compare V3 and V4.

P11, L7. I don't quite agree that the difference between V3 and V4 is "fairly consistent over time". It grows from almost 0 (between 1980 and 1986) to almost 1 cm/s (between 2012 and 2017)! It clearly contributes to the difference in drift speed trends between v3 and v4. But which one is more correct? It is very unfortunate that proper quantitative validation is not provided. Maybe this difference is an indication of uncertainty of the motion product and the observed trends are actually statistically insignificant?

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-40>, 2019.