Earth Syst. Sci. Data Discuss., referee comment RC1
https://doi.org/10.5194/essd-2021-393-RC1, 2022

Comment on essd-2021-393

Anonymous Referee #1

Referee comment on "Processing methodology for the ITS_LIVE Sentinel-1 ice velocity products" by Yang Lei et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-393-RC1, 2022

This paper presents a detailed methodology of processing Sentinel-1 radar data (TOPS mode) using an updated module "autoRIFT '' of ISCE platform in order to generate ITS_LIVE Sentinel-1 ice velocity products. The paper walks through the different elements of the sequential processing chain and highlights key points that improve the resolution and accuracy of the velocity products. The paper is clear and generally well-written. I have a few comments and suggestions which may be incorporated for more clarity.

MAJOR COMMENTS:

- The products will be openly available. The module of ISCE platform will also be publicly available. These free resources will be used by many folks across the globe for their scientific analysis or processing data over areas other than polar regions. This paper limits the presentation and analysis of ITS_LIVE velocity products to Greenland, but the products will be available for mountain glaciers as well. The title should reflect this aspect; maybe by adding "polar regions'' in the title. Alternatively, more insights based on presentation and analysis over mountainous regions (e.g. European Alps, High-Asia) should be added in the paper. It is obvious that ITS_LIVE products and associated uncertainties are different in regions other than polar ice sheets.
- We have a number of ice velocity products based on Sentinel-1 radar data and it is increasingly challenging which product is the best way to carry out a scientific analysis without processing the raw GRD/SLC data. Boncori et al., 2018 compared ice velocity products from several international research groups, highlighted different strategies on the processing and uncertainty estimation and found significant differences, also recommending a universal approach. This paper provides a new or updated algorithm (which is great) but needs to be compared with similar contemporaneous products (e.g. PROMICE). Otherwise, the scientific users will have to do this exercise or cherry-pick one of the available products. Both will not serve the ongoing efforts of establishing standard method development, ice velocity product generation and documentation. It would be nice to compare Sentinel-1 ITS_LIVE products with previous ITS_LIVE products obtained from optical remote sensing data (e.g. Landsat).

- If this paper serves only a method development, there should be some more test cases (e.g. ice shelves in Antarctica, debris-covered glaciers in Alaska/high-Asia) to present the applicability of the algorithm other than Greenland Ice Sheet.
- So finally these products will not be average over a certain time-period like PROMICE 21-day ice velocity mosaics? Please clarify and highlight, if this is the case, in your paper as this is a unique aspect.

MINOR COMMENTS:

L40: Several satellite derived regional ice velocity products are released annually

L45: As described in Lei et al., 2021a (CHECK ELSEWHERE)

L55: 6 days repeat is not everywhere but limited to polar regions and Europe or some key areas of the world.

L70: Revise " We do …… Greenland"

L90: Have you ever considered 2m Arctic DEM instead of GIMP DEM? That may be a better choice for transformation between radar and geographic coordinates.

L95: There is no reference velocity for mountain glaciers. What will be the approach for those areas?

L100: What do you mean by "successful match"? Based on cross-correlation or similarity function value?

L130: ..the extent of..

L140-145: Repetitive

L175 or elsewhere: "autoRIFT" should be clearly distinguished – italic?

L180-200: I strongly recommend a graphical representation of an algorithm – clearly distinguishing chip size, overlapping region, search size etc. on images.

L220-230: It was not very much clear why it was done that way. A lot of parameters with equations break the flow of writing here. Simpler writing with rationale might help us better understand.

L290: Is this subjective? Any insights?

L305: 7>>seven

L450: Maybe I miss something, but the slant range displacement component contributes to ground range (East-West (your x) and North-South (your y)) and vertical movement (z) and the azimuth displacement component contributes to x and y only. Your equations don't consider vertical velocities. It is known that the vertical velocities exist as well due to slope/elevation changes in the flow direction or ablation. Please clarify.