

Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on **essd-2021-393**

Anonymous Referee #2

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-RC2>, 2022

This study provides a processing chain for Sentinel-1 TOPS mode data. Authors have used a modified module of autoRIFT to generate ice velocity global products. This paper is successful in demonstrating the processing chain and efforts in overcoming associated errors. This study also demonstrated improvement in terms of accuracies and resolution of velocity products. The paper is methodologically well organized. However, I have a few comments. Authors may include these comments from the reader's perspective. My sequential comments are;

Abstract: Authors should re-write the abstract clearly indicating quantitative improvements when they say **higher accuracy**, **finer resolution**, **improvements**. In the present abstract, the reader cannot find what level of improvements, how much accuracy, and what resolution authors refer to. In general, this abstract reads very generically as a project report. To attract a wider audience, this abstract should be heavily revised to clearly state main achievements quantitative, limitations of the current product, and comparative analysis with existing data.

Introduction: This section only focuses on operational velocity product generation attempts. Authors should enrich this section by providing literature on glacier velocity generation in general, the use of glacier velocity in glaciological studies, various ways of deriving velocity fields and uncertainties, and the strengths of different methods. Currently, this introduction section does not discuss existing regional attempts using a variety of methods. After the literature review, the authors should provide gaps in current knowledge and what additional knowledge this study provides to the scientific community.

2.1 Product and methodology overview

2.1.1 Input dataset: This section provides only example input datasets for the Greenland case study. I will suggest including other reference input datasets used for other regions. This can be added in the supplementary information as a table or description. Reference velocity for the Greenland ice sheet is mentioned in the study but I am wondering which stable reference velocities are being used for other parts of the globe. Similarly, input DEMS for other regions should be included in the supplementary information. The impact of varying resolution of DEMs in different regions should be discussed. Have you tried Arctic DEM?

2.1.2 ITS_LIVE Sentinel-1 Image-Pair Data Product

Authors should elaborate *offset tracking success* for readers. What criteria do they use for deciding offset tracking and do they calculate it quantitatively?

"Hence, the selection of the appropriate sensor combination is dependent on the actual use case including data availability, quality, study area, etc." Such statements are made a couple of times without actually providing clear guidance on these criteria. The authors should clearly state how did they estimate such criteria for different regions on the globe. Authors should provide practical challenges in deciding these criteria while selecting input datasets.

The output glacier velocity maps are generated in 120 m spatial resolution. Is this specifically because computational resources or authors have used a specific criterion for choosing this as the optimal resolution.

How have authors calculated the magnitude of errors? The authors have discussed thoroughly geolocation and ionospheric errors introduced in the analysis and how they tried to overcome these errors. However, the final product error magnitude calculations seem to be missing. If I am not wrong, can you re-direct to the existing literature for elaborating this process?

"This sparse/dense combinative searching strategy substantially improve computational efficiency". I would like to see numbers on efficiency and improvement.

General comments: Authors have demonstrated the processing on Greenland but state that the products are global. I am wondering if they can describe practical implementation challenges in processing global datasets and how uncertainties associated with other regions are dealt with. This is important because the research community will use these datasets for their research in the coming years and they would like to see practical challenges in the Arctic, Antarctic, mountain areas in the Himalayas, Alps. Also, the major

limitation of this paper is that the authors have only focused on Greenland. I will suggest including a good distribution of test sites covering different parts of the globe.

Validation: As we know that there are multiple velocity products are being generated both using SAR and optical methods. This study does not provide any guidance on comparing the present product with existing velocity products. This will be very useful for researchers as they would like to know reliable velocity products for their studies. Similarly, new algorithms are being developed for improvement in velocity products. This study does not comment on state-of-the-art methods and the comparison with other algorithms. Eventually, the scientific community will be benefited from such inter-comparison experiments.

Ground validation: Authors have not mentioned about validation of velocity products with in situ measurements. Have they attempted such validation?
