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Interactive comment on "Multisensor validation of tidewater glacier flow fields derived from SAR intensity tracking" *by* Christoph Rohner et al.

Anonymous Referee #2

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General comments

The present study presents ice velocity estimates derived from an intensity tracking algorithm using Sentinel-1a and Radarsat-2 SAR images compared to independent measurements at Eqip Sermia. The independent dataset comes from in situ measurements from differential GPS, Terrestrial Radar Interferometer (TRI), UAV surveys, and from operational ice velocity products, NASA MEaSURES and ESA CCI. The study reports good agreement when compared to the field data, and shows 10%-20% difference compared to operational ice velocity products. The comparison of ice velocity derived from satellite missions and in situ datasets is extremely important, it makes a useful contribution to the field, and presents interesting results. However, the processing chain used to derive ice velocity from the satellite images, as pointed by Reviewer1,

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lacks detailed description, and then affects the majority of the results in this paper.

For these reasons, and the specific comments listed below, I recommend the manuscript requires Major Revision before publication.

Specific comments:

P1L21-23: Any reference?

P2L7-8: A lot of efforts have been made to derive velocity with optical instruments.

P2L13-15: Add some more details about the Sentinel-1 mission, or at least some more references.

P3L7: “high-resolution”: Spatial? Temporal? Both?

P3L14-17: It is hard to follow. Rewrite the sentence please.

P3L29: “RS-2” was not defined before.

P4L5: Which version of GIMP do you use? 30m, 90m? How does the DEM oversampling affect the uncertainty in the velocity products?

P5L19-21: Reword this sentence. Looks like meteorological conditions does not affect the velocity estimation, which is not true.

P5L6-7: As pointed by Reviewer1, how does your velocity results have resolution of 5x5m if S1 spatial resolution is 5x20m?

P5L9-12: From where, and how long is this “long-term flow velocity average product” ?

P7L10-11: Please give a brief description of the three-step approach.

P9Figure4: It’s hard to see the colour range on the map behind the arrows. The arrows are great, however there is no scale and they are too small. Please add a scale bar, just to make it easier to the reader.

P10L8: The date 2016/08/13. Typo?

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P11Figure6: Same as Figure 4. It's hard to see the colour range on the map behind the arrows. The arrows are great, however there is no scale and they are too small. Please add a scale bar, just to make it easier to the reader.

P12Figure7a: I'd include the Sentinel 2 image in the background as a reference for the masked areas.

P14Figure9a: Again, it's very hard to picture the excluded areas.

P16L9-10: Again, what is the spatial resolution of the DEM?

P16L3-5: "Due to the large spatial coverage . . .". I suggest the authors to rewrite this sentence. NASA MEaSURES and ESA CCI are the two main operational centres that deliver velocity products. If the authors look carefully, they do provide high temporal velocity products to specific glaciers.

P17L21-24: I suggest the authors to rewrite the sentence. It presents a strong argument, taking in account that this work only provides measurements of a couple of seasons.

P20: "Finally, we were able to demonstrate..." : Other studies have already demonstrated the ability of Sentinel-1 to estimate ice velocity near the ice front (e.g. Nagler et al., 2015; Joughin et al, 2018; Lemos et al., 2018). These studies also demonstrated improved results using shorter temporal baseline provided by Sentinel-1 (6 days) since Oct/2016, and the potential of Sentinel-1 to extend existent ice velocity time-series.

References:

Joughin, I.; Smith, B. E.; Howat, I., 2018: Greenland Ice Mapping Project: Ice Flow Velocity Variation at sub-monthly to decadal time scales. The Cryosphere., 12, 2211–2227.

Lemos, A.; Shepherd, A.; Mcmillan, M.; Hogg, A. E.; Hatton, E.; Joughin, I., 2018: Ice velocity of Jakobshavn Isbræ, Petermann Glacier, Nioghalvfjerdsfjorden and Zachariæ

Isstrøm, 2015-2017, from Sentinel 1-a/b SAR imagery. The Cryosphere., 12, 2087–2097.

Nagler, T.; Rott, H.; Hetzenecker, M.; Wuite, J.; Potin, P., 2015: The Sentinel-1 Mission: New Opportunities for Ice Sheet Observations. Remote Sensing., 7, 9371–9389.

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