

Interactive comment on “Surface velocity of the Northeast Greenland Ice Stream (NEGIS): Assessment of interior velocities derived from satellite data by GPS” by Christine S. Hvidberg et al.

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Dear Colleagues

General assessment:

This is a very interesting manuscript describing a unique data set on the ice motion in the interior of the Greenland Ice Sheet. The paper shows many interesting observations, and provides a extremely useful assessment on the accuracy of remote-sensing products.

C1

That being said, the focus of the publication is not entirely clear. There is some glaciology, but the major part is dedicated to the data products comparison. Since all of this hinges on the GPS measurements, this is not a problem, but maybe this should be made more clear by the structure of the paper.

Most parts read nicely, but especially towards the end (Discussion and Conclusions) it seems that the paper was hastily thrown together without much proofreading, or streamlining. So, these sections merit some more effort, mostly structurally and cosmetically. Also the abstract is longish and should be somewhat condensed.

Most figures also deserve some more love. Why is Figure 1 just a gray blob? Also an inset with the part of Greenland depicted is missing. Figure 3, which is central, should be much improved, mainly with less axes and larger content. Also Figure 6 seems to be a mixture of Excel with some random typesetting for the numbers, and should be redrawn.

Overall, this is a very interesting study, that I recommend for publication after the points below have been addressed.

Best regards,

Martin Lüthi

16 is this the coordinate of the site, or of EastGrip? Anyway, this should not be in the abstract

19 transverse strain rates? or longitudinal? please specify

43 coordinates could be given here

49 "induces"

55 the measurement site coordinates should be given here. This is more important than the coordinates of the EastGRIP field site, which can be looked up if needed.

C2

OK, after reading on, I see in Figure 2 that the EastGRIP site is the central site of the GPS network. This should be mentioned here, and in the abstract.

57 better called "elevation model"

75 I do not see any topographic undulation in Figure 2. Indicate which panel, and what to look for.

79 "which were drilled..."

80 Why was there no local GPS reference at EastGRIP which seems mandatory for meaningful strain measurements.

additionally: was there any GPS station running continuously to assess seasonal or episodic changes in flow velocity?

105 this sounds overly optimistic, since the stake tilt was not measured.

106 there seems to be the tacid assumption of steady flow without seasonal or episodic variability. If so, make this statement very clearly.

109 this is maybe the statement I asked about on line 106. But then this should be "displacement rate", i.e. velocity

117 spell out "Figure 2" in the running text, and abbreviate in parentheses (according to the journal style)

119 leave away "see" in figure references (please change everywhere). Also, I would put these references in the running text, since these are important major results of the study.

121 use words for ">", e.g. "for a flow band wider than 10 km"

121 abbreviate "meter" to "m" (SI units)

127 "a linear velocity field"

C3

130 maybe qualify "horizontal compression" etc.

131 should be "oriented at" (typo)

141 "Figure 3b"

141 "horizontal shear strain rate" (also 146)

144 "Figure S1"

187 Also say "Sentiel 1-A/B" (like ENVEO) (also 193)

193 why is [Strozzi] in square brackets??

196 Use just one way writing Sentinel-1A/B

205 It would be useful to clearly state products developed by the authors, as opposed to products from other groups. 7) seems to be one of them (?)

216 8) is quite confusing, as it starts with Measures, but the the description changes to "we"

227 It would be helpful to add a subsection here: "Assessment" and one before the product description starts: "Data products" or "Data sources" or similar.

228 well, we could argue that also GPS is "satellite-based"

234 "minimizes"

236 "Figure 6" (also 241...)

250 "provides"

260 you say "Both", but list three products: clarify!

262 "Measures" twice

273ff this section is the textual representation of the table, and therefore unreadable, the second part repeats the section before -> delete and streamline considerably

C4

290 should this be "SAR speckle tracking" (since all products use SAR)
292 "comparably"
296 "errors" instead of "uncertainties"
302 "Fig. 4" (capitalize)
305 This is a somewhat overly enthusiastic conclusion. If the velocity errors are of the same magnitude as the signal (outside the fast-flowing area) there are severe limitations on the usefulness of the products. I think that relative errors should also be discussed.
315 "by an order of magnitude"
316 "remarkably uniform"
317 "support the notion of" (I don't think you talk about the process here)
319 "an ... troughs" is inconsistent
320 compression would lead to ridges, so its likely extension due to flow acceleration, or side shear
321 "at an angle of"
356 These are important points, but I did not see any assessment of the flow direction derived from different products... (a next paper?)
Oh, I see you do exactly that, but these results (Figure 8) should probably be part of the comparison section. In any case Fig. 8 should be featured more prominently, and here the results should be discussed (but presented earlier).
365 Twice northeast in the same sentence. The Conclusions seem to be hastily written, but should be carefully crafted.
368 "drop"

C5

392 "investigated" (everything else is written in the past tense) Also this paragraphs starts out of nowhere, like just thrown in hastily before submission.
396 A nice, general concluding statement would round off the paper better.
569 Caption should start right away (leave away "This table shows...")
Fig 1 would be better in color
Also it should contain an inset map of Greenland, since not everybody knows where NEGIS is
Fig 2 the black line of panel B should be shown in panel A for comparison.
Panel A:
Giving the heights in a greyscale map is not very useful. Better plot the points on a hillshade with suitable lighting. Alternatively use a high-contrast color map for the topography.
The red dot is not visible under the red arrow. Different color and Diamond shape would help
Fig 3 This figure is central to the paper, and should therefore be crafted with care.
Could the panels be better combined such that the content is bigger and the labels appear only where needed? E.g. distance along profile and surface elevation is the same for all panels and should only appear at the bottom and at right.
panel f (bedrock): please indicated *measured* bedrock depths at crossing profiles from Icebridge, seismic soundings, radar. Also indicate the position of the borehole in panels d-f.
[Morlighem is nice, but is heavily interpolated and is off by hundreds meters in places, depending on his assumptions on ice flow]
Fig 4 combine the plots with (sharex: looks like matplotlib)

C6

for better visibility vertical dotted or very thin lines would be useful

panel f (bedrock): please indicate *measured* bedrock depths at crossing profiles from Icebridge, seismic soundings, radar. Also indicate the position of the borehole in all panels, but especially here.

[Morlighem is nice, but is heavily interpolated and might be off by hundreds of meters, depending on assumptions on ice flow]

Fig 5 caption (last sentence) "Figure 3b" I don't know what the yellow dots mean, I don't see any in Fig. 3

Fig 6 Why is the plotting style so different? Gray background does not help readability and should be changed to white (like all other Figs)

label the panels with a), b), c) and adjust the caption

Why are these graphs on a logarithmic scale (vertically)?

References: For quite a few papers the DOIs are missing.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-103>, 2020.