

The Cryosphere Discuss., referee comment RC2  
<https://doi.org/10.5194/tc-2021-170-RC2>, 2021  
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## **Comment on tc-2021-170**

Anonymous Referee #2

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Referee comment on "Seasonal evolution of basal environment conditions of Russell sector, West Greenland, inverted from satellite observation of surface flow" by Anna Derkacheva et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-170-RC2>, 2021

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### **General comments**

This paper presents a study in which inversions for basal friction are performed using a series of surface velocity observations in order to identify seasonal variations. These results are compared to available observations, and known features of the subglacial system, in order to assess their accuracy and usefulness for validation of hydrological models.

I found the manuscript to be very interesting and informative. The scientific content of this paper appears to be sound, with conclusions backed up by a good set of results along with plenty of relevant analysis and discussion.

The paper is generally well-written, although I believe there is room for improvement in places, which I have detailed in the following section and I hope will be helpful to the authors. My suggestions are primarily focused on improving clarity, and the accessibility of the paper to a broader audience.

### **Specific comments**

- Line 1: I found this opening sentence a little unclear on first reading, I think because

modelling is implied by “better constraints” but never explicitly mentioned. I’d suggest something structured more like “Due to increasing surface melting ..., better constraints on ... are required by models”.

- Line 5: I’d expand this to say “using the ice-flow model Elmer/Ice”, as it’s possible some readers may not have come across it before.
- Line 23-4: Is this the authors’ own assumption, or are there other studies to cite?
- Line 122-3: It would be useful to add a brief explanation of the “master and slave” terminology.
- Line 123: It would be good to specify what x and y are, since this is the first mention of them (presumably polar stereographic north as in fig. 1?)
- Line 126: State what LOWESS stands for.
- Line 162: Assumed by who? Should be made clear if this is the authors’ own assumption, or citing another reference.
- Line 163:  $v_y$  is a velocity vector, not speed.
- Line 204: A brief explanation/sentence on kriging could be useful.
- Line 210-11: There are several acronyms here which could be fully introduced. I’d certainly specify Digital Elevation Model and Advanced Very-High-Resolution Radiometer. Perhaps expanding the names of specific models isn’t necessary, but ASTER and SPOT-5 should probably be given relevant citations.
- Line 267-8: It doesn’t make sense to justify the initial condition using the results it produces, which is how this reads to me. This sentence should be reworded to make the meaning clear.
- Line 273: What is the reason for this choice of friction law? Given the later focus on interpreting results using an effective pressure-based law, I think an explanation is needed for why that law wasn’t used in the inversions to begin with.
- Fig 3: I think a fourth panel is needed here, showing the difference from observed velocities. The mismatch is currently discussed without a visual aid.
- Line 332-3: State this more clearly:  $u_d = u_s - u_b$ .
- Line 380-1: What is the reason for choosing only the early halves? Wouldn’t it be useful to see the later halves as well, especially for the months where conditions change quickly?
- 417-19: Isn’t the limited effect of deformation at least partly a result of the choice mentioned previously to neglect deformation profiles when setting up the model? This could be a misunderstanding on my part based on what was said in lines 267-9.
- Fig 6: In the top row, it would be good to use the same scale on the y-axis in each case, and to include horizontal grid lines like in the bottom row.
- Line 470-4: Can this behaviour be explained? The other two points behave as I’d expect (ie. an inverse relationship between speed and friction), but this stands out as more of an anomaly.
- Line 621: Is there a reason for not showing a profile through point B? Since it displayed different behaviour from the other points, it could be interesting to see that here as well.
- Line 634-6: It’s not clear to me what is being said in this sentence. It needs rewording.
- Line 645-6: I think I understand the meaning here, but this sentence is unclear. Is it that conditions are the same/similar down the whole length of profile C’?
- Fig A5(b): What are the dotted lines? Mention them in the caption.

## Technical corrections

- Line 10: I think there's an "and" missing here, and a missing space after the full stop.
- Line 130: The end quotation mark is backwards.
- Line 132:  $v_x$  and  $v_y$
- Line 156 (also 159): Missing a space after degree symbol
- Line 157:  $y$  should be italicised in "y-velocity"
- Line 196: The numbers 60,000 and 30,000 should have commas, not apostrophes.
- Line 203-4: Citation should be in brackets.
- Line 261, Eq. 5: This should be a dot product (`/cdot` in LaTeX). Same for following equations.
- Line 341: "tongue".
- Line 530: This needs to be reworded slightly to make sense. Perhaps just "This corresponds to..."
- Line 638: There's a compilation error here, reference not displayed.
- Line 645: "assumed to have".
- Line 665: "in general".
- Line 718: Another reference not displayed.