

The Cryosphere Discuss., referee comment RC1
<https://doi.org/10.5194/tc-2021-170-RC1>, 2021
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Comment on tc-2021-170

Anonymous Referee #1

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-RC1>, 2021

This is a very interesting paper that uses satellite-derived observations of ice sheet surface velocity to study the seasonal evolution of basal conditions for three land-terminating outlet glaciers in West Greenland. I think the paper is well-written and understandable, and the conclusions seem generally supported by the results. I have some minor comments/suggestions that I think might help improve the manuscript.

- l. 9 - are these modelled or observed water pressure variations? Might be worth specifying here.
- l. 84 - "observed geometry" - the problem is, most velocity observations aren't contemporaneous with surface observations - it would be good to show that the impact of this is low.
- l. 122 - suggest alternative terms to "master/slave - see, e.g., <https://comet.nerc.ac.uk/about-comet/insar-terminology/>"
- l. 132 - v_x/v_y or v_x/v_y (l. 157)?
- l. 138 - presumably the MWS map is the median of January/February/March?
- l. 141 - what are typical values of n here?
- l. 161-167 - this seems like a reasonable (and interesting!) explanation, but wouldn't these changes also have an impact on the magnitude of the velocity vector?
- l. 180-184 - it would be good to back this up using citations/example data, if possible. Are there any GPS observations for the area that demonstrate this (e.g., from Maier et al. 2019)?
- l. 201 - why 0.9 m?
- Eqn. 5, elsewhere - assume this is meant to be a centered dot indicating a dot product? (i.e., " $\text{dot}(u,n) = 0$ ")
- l. 266-268 - I understand what you're saying here, but it seems circular to say "our choice of input is consistent with our output (which somehow depends on the choice of input)" - maybe just use the reference to Meier?
- l. 284 - might be good to include references for this statement.
- Fig. 3 - why not show the mismatch here, instead of in the appendix?
- l. 353 - what do you mean by "relatively" short distances?
- l. 368-372 - I'm not sure I completely understand these lines, and I think part of my

confusion might come from calling the 24 datasets "time steps". By "restart from the optimal solution" do you mean that you use the parameters from the optimal solution as a starting point for each of the 24 datasets?

- l. 380 - why only the early half of each month? If there aren't significant differences between the early and late halves of each month, it would be good to mention that here.
- Figures - it would be good to have some scale bars to help readers connect the text (e.g., "10-15 km from the margin") with the locations in the Figure
- l. 417 - how significant a change is this 2%? Would be good to have some idea of the variation here.
- l. 465-466 - this is an interesting observation - is there a physical interpretation for why this might be the case?
- l. 497 - could you (briefly) describe the differences between Eqn 12 and the "similar expression" proposed by Zoet and Iverson (2020)?
- l. 510 - this seems like it would be an issue?
- l. 536 - supplementary materials? I don't see Fig. S9 or Table S1.
- l. 634-636 - I'm not sure I understand what you're saying here.
- l. 638 - missing reference
- l. 718 - missing reference
- l. 731 - this is probably true for satellite observations, but ground-based radar interferometry potentially provides a way to do this (e.g., Caduff et al., 2015)

References

Caduff, R., Schlunegger, F., Kos, A., & Wiesmann, A. (2015). A review of terrestrial radar interferometry for measuring surface change in the geosciences. *Earth surface processes and landforms*, 40(2), 208-228.