

Review for revised version of “Using observations of surface fracture to address ill-posed ice softness estimation over Pine Island Glacier” by Surawy-Stepney et al.

Thanks to the authors for the effort taken to thoroughly and thoughtfully address the comments made by myself and the other reviewer. The scientific content is as good as before, and the manuscript now appears better organised and easier to follow. I think it is very interesting work and entirely appropriate to The Cryosphere. I am satisfied with the changes and happy to recommend publication.

As picked up on by the other reviewer and the editor, the results in this paper are more qualitative than quantitative, but in this case I don't think that's a weakness. I am of the opinion that outputs from inversion processes are often better judged by looking at the distribution of output fields (such as those shown in Fig. 5) than by quantitative measures (as long as the misfit is reasonable, which it seems to be here). The authors are careful to point out the limitations of the methodology and do not overstate their findings, giving a realistic view of when the method would be most usefully applied.

The addition of the 'Next Steps' section in the discussion to explicitly explain the authors' reasoning should aid readers in understanding decisions made in devising this work, and opens the way for other interested modellers to explore the idea further with synthetic experiments. However, it does also emphasise a remaining small complaint I have with the manuscript. The authors refer a few times to what they would 'expect' to see (e.g. lines 118, 352, 385) but without explicitly stating *why* they would expect that. The manuscript is fine as it is, but these points would be stronger if the reasoning behind these expectations were made clear, and I think the authors should consider this.

I will make one further comment, although this is not something which would necessarily need changing. It's down to personal preference and I mention it for the authors to consider at their discretion. When presenting misfit as in Fig. 2, I find it more useful to either present the misfit as a proportion of the measurements, or to see the measurements plotted alongside. In this case I know that the speed of Pine Island means that maximum misfit on the order of 200-300 m/a is not unreasonable, but others may not be so familiar with the glacier.

Below I list some minor typographical errors I noticed while reading through, which the authors may wish to correct:

Line 42 – “constitutive”

Line 110 – “functional”

Line 240 – “snapshot”

Fig 2 & Fig 3 – Here you use the American “regularization”, while you use the British “regularisation” in the text

Line 287 – “from” is repeated

Line 348 – “principal”