

Reviewer 2

Thank you reviewer 2 for your time and efforts to review this manuscript! We think your suggestions have improved this work and we have responded inline to each of your comments below with indents.

This manuscript presents a new open-source geometry inversion tool (Invert4Geom) for recovering sub-ice-shelf bathymetry from gravity data, together with a comprehensive suite of synthetic tests and Antarctic ice-shelf survey analysis. The authors demonstrate the algorithm's behavior under ideal and realistic conditions, investigate the influence of key parameters (data noise, survey spacing, regional field strength), and quantify uncertainty via Monte Carlo sampling. They conclude with practical recommendations for future airborne gravity surveys and bathymetric constraint collection.

The topic is timely and the open-source implementation will benefit the glaciological and geophysical communities. The manuscript is generally well structured, and the figures are clear. However, some areas require clarification or rephrasing to improve readability and scientific rigor. In particular, I list some minor comments to help strengthen the manuscript.

L7 & L24 & L293 Definition of “real” vs “synthetic” bathymetric data

We will replace "real" with "high-resolution multibeam" to be clearer.

L313 The description of the four ensembles (especially the parameter ranges and sampling strategy) remains too general.

We will add additional descriptions to each of the bullet points for the ensembles, describing them in more detail.

Figure 8 The thick grey line in the profile panels can be misinterpreted as an uncertainty envelope. Replace the thick grey line with a thin black line for the profile of the inverted bathymetry, and show the starting model with a dashed line.

Good point, we will update this.

Figure 12 Use a slightly darker color for the “true regional” field so it is distinguishable from the estimated field.

Yes will do.

L524 You introduce “RMSE” and then immediately write it out (“root mean squared error”). This is redundant.

Fixed.

Figure 16 The red and black colors in the ice-shelf names denote previous versus new inversions, but this could be repeated in the figure caption for clarity.

Added.

Section 3.9 presents results that the authors acknowledge are “expected. You could move the detailed maps and synthetic summaries of Section 3.9 to the Appendix, and condense the main text to a short paragraph highlighting only the key findings.

While the results may have been expected, we think they are still informative and worth including in the main text, but agree that this could be a good place to remove some length. We will move the central column of Figure 17 (Ensemble 3) to the supplement, and consolidate the text to be more brief.

L590 Change to “resembles those of Ensemble 2”.

We will fix this.

L675 Do you mean “dense constraints”?

No, we are referred to the general poor performance of inversions where there is a strong regional field a few (sparse) constraint points.

L683 Change “Gravity inversions in Antarctica...” to “Gravity-based bathymetry inversions...”

Here we are referred to the fact that topography/bathymetry derived from gravity inversions is currently constrained to sub-ice shelves, but we are suggesting this method may work for non-bathymetry purposed, i.e. grounded bed topography.

Recommendation:

Once revised, this work will be a valuable resource for the bathymetry- and ice-sheet modeling community.