

Interactive comment on “A new bed elevation model for the Weddell Sea sector of the West Antarctic Ice Sheet” by Hafeez Jeofry et al.

Anonymous Referee #2

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Summary

This manuscript describes a new compilation of the bed topography of an important marine-based sector of the West Antarctic Ice Sheet. This compilation aims to supersede that of Bedmap2 by including more recent data into the same algorithm employed as that major compilation, and it considers the standard comparisons to that benchmark dataset. The physical implications of this improved bed topography are also considered, particularly in regards to subglacial hydrology and the bed elevation near the grounding line.

This is a straightforward manuscript with no significant flaws and a few minor strengths.

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The structure is clear and consistent. The authors do an admirable job of guiding the reader through the different datasets, the subtle differences and evolutions that distinguish this study from Bedmap2, and they have a clear overall picture of the physical value of what was accomplished. The value of such a dataset rests on the coherent integration of relevant raw data, an appropriate error budget and a complete description of the resulting dataset. This manuscript fully succeeds at the first of these aspects, but falls a bit short on the latter two. My comments are mostly aimed to improving the latter two aspects.

Comments

187: An instrument cannot make assumptions, only its operators and those who interpret its data can. Further, the velocity used is an uncertainty of the order of $\sim 1\%$, because it depends on the well constrained but imperfectly known real part of the relative permittivity of pure ice and spatially variable densification. The mention of this velocity raises two important questions: 1. How is its (unstated) uncertainty incorporated into the error budget for the new bed topography? 2. Was this velocity used to correct the traveltimes between the surface and bed reflections for all datasets in this study? That's never explicitly stated. It certainly should be, and if different studies used different velocity values, then it's up to the present authors to make that important and necessary correction.

210: I am a long-time MATLAB user and I do not know what is meant by MATLAB "standard format".

218: Again, what is the origin of this estimate? Further, an error map ought to be generated and shown for the bed topography.

243-4: Explicitly state here that this is the same algorithm employed by Bedmap2, because it is somewhat primitive compared to that typically employed in the slow-moving sectors of Greenland, i.e., ordinary kriging.

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252-3: Please reconsider significant figures here.

277: Where is the Pagano Shear Zone? It's not identified in Figure 1c.

292: The significance of a change in linear correlation coefficient can be easily calculated, and it ought to be done so if the term "significantly reduced" is to be used.

297-8: This statement contradicts the use of an outdated subaerial ice-surface DEM, i.e., the same as that of the Bedmap2. However, given the figures presented, the time to accomplish this task should not be significant. A newer Cryosat-2 DEM from Helm et al. (2014, The Cryosphere) ought to be employed, as it clearly demonstrates greater fidelity to high-resolution airborne altimetry than the ICESat/ERS-1/2 DEM that Bedmap2 employed (Table 2 of that study).

315-322: The geographic coordinates of the lakes do not need to be mentioned, and if a graticule were added to Figure 1c they would become even more unnecessary. Further, this paragraph doesn't really add much information about the lakes that is not available from existing inventories. It simply enumerates them. Reconsider.

332-333: This statement about Bungenstock Ice Rise being a good example of one is not very meaningful.

336-337: This statement is wrong. There are very clear metrics for measuring surface roughness, independent of FFTs. Shepard et al. (2001, JGR) summarizes them very nicely, and they have been employed in several glaciological studies of ice-sheet beds (e.g., Young et al., 2011, Nature ; MacGregor et al., 2013, JGlac).

Figures & Tables

All the figures in this study need significant improvements.

Figure 1. (a) Add a scale bar, the grounding line and a color bar for the surface velocity. (b) Add a legend for all the different surveys. (c). This panel is quite hard to read. The black labels on a dark gray background do not work well. Brighten MOA and increase

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the contrast. It is mentioned in the text that different grounding lines exist, and all should be shown on this figure. Also, a distinct symbology should be used for different types of features (e.g., lakes vs. troughs, rather than using the same white dot for everything).

Figure 2. It is very difficult to make out much of anything on the lower radargram. Adjust its color scale.

Figure 3. (a,b) I recommend using the USGS color scale for topography instead. demcmap in MATLAB. The bizarre irregular intervals for the color scale are unacceptable. Use simple, regular intervals, e.g., -2000:200:600 in MATLAB form. (c) Again, fix the weird irregular intervals. I'm not sure why the red/blue color scale with yellow was invented, but it should be replaced with one that has red/blue with white in the middle. Much more intuitive.

Figure 4. Add a legend. There's plenty of room for one. These figures aren't information-dense, so generate them closer together.

Grammar, etc.

121: C-130R or LC-130? 143: I do not understand why "chirp" is capitalized here
165: to be 7 cm 200: radar shot number that is used 210: MATLAB should be capital-
ized 279: Here and throughout the manuscript, capitalize all proper noun geographic
locations, e.g., Institute Ice Stream 345: Passive voice: "It is considered. . ."

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