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The Cryosphere Discussions

Interactive comment on "A new 1 km digital elevation model of Antarctica derived from combined radar and laser data – Part 2: Validation and error estimates" *by* J. A. Griggs and J. L. Bamber

Anonymous Referee #1

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General Comments

The production of topographic datasets of the Earth's cryosphere of ever increasing quality and resolution is an important endeavour. This paper presents a validation and error analysis of a new Antarctic DEM, which undoubtedly will be a valuable resource for years to come. The rigorous error analysis that is given adds confidence to any results derived from this dataset and represents an excellent example of DEM quality analysis; something that is too often overlooked in terrain data generation.

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Interactive Discussion
Discussion Paper

The authors compare their DEM to 4 independently-acquired airborne altimeter datasets. While limited in extent compared to the DEM itself, these data do cover the major topographically-distinct areas of the continent, namely the interior plateaus, steeper margins and ice shelves. This increases confidence that the validation results are representative of the continent as a whole. It is also good to see that the authors address error in terms of both systematic and random error which are equally important and should be treated separately.

The main challenge of validating such a large DEM is simply that any independent check dataset that may be available are so often small compared to the data they are meant to validate. This case is certainly no exception. As a result, the generation of modelled error maps like that presented here is vital and will be extremely useful in future analyses that use this DEM. I think it would be worth emphasising this in the early paragraphs, and indeed in Section 4, of the paper.

My criticisms of the paper are significant but not fundamental and should be relatively easy to address:

Figure quality: In general, the information presented in the figures is not entirely clear though I believe this is easily remedied. Text is often to small and the data presented are often not very visible against the background. These are itemised in the following section.

Lack of a substantial discussion: This paper's Section 3 does not strike me as much of a discussion and really is only presenting the results of the comparison of the older Antarctic DEM to some of the check datasets. This section should form another results section with a more developed discussion following the results of the error map. To highlight the importance of such an error analysis it would be nice if a discussion included, for example, implications of using such a DEM without such an error map. The errors on the peninsula for example (upwards of 20 m) would have rather dramatic consequences on volume change or balance velocities, if these larger errors were wide

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spread, for example.

Understated conclusions: I also found that some of the conclusions are fairly obvious and perhaps a bit weaker than are warranted by the paper's content. That errors are a function of the underlying properties of the surface and satellite datasets, for example, is fairly obvious.

These addressed, I think it is important for this second part of the presentation of the new Antarctic DEM to appear in The Cryosphere.

Specific Comments

- P846L10 - As the choice of interpolation method is a fairly major issue, is it worth a sentence or two explaining the selection of bilinear interpolation?

- P846L21 - Why were the results so much better on a longer baseline? I think if you're going to make this comparison an brief explanation is required. Alternatively, the fact that it's a factor two lower is not relevant?

- Fig2 - There is a very strong and narrow spike in the histogram inset at about +15m and a smaller one around +5m. What are the causes of these? It suggests some serious systematic error either in the DEM or in the airborne data and presumably will be strongly affecting your error statistics. The histogram in Fig2 is more what I would expect for such a comparison. I think an explanation is required.

- P847L6 - It may be worth defining the root mean square? It's a dataset that will be used by many people not necessarily well versed in error analysis.

- P847L25 - the CECS/NASA were collected in Dec 2002 and the data for the DEM were collected over 'several years' but there is no indication of the temporal overlap between these datasets. I appreciate this is spelt out in Part 1 but a brief mention here would be useful.

- P849L25 - I do not agree that positive and negative differences would be indicative of

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airborne data measuring into crevasses. Would this not produce an offset error in only one direction?

- P851L3 - The authors often use the term 'good' to describe the accuracy and precision of their DEM on several occasions (P847L1, P847L26, P848L18, P848L27, P849L22). While this is not correct, I don't like the use of such qualitative and essentially meaningless descriptors when more useful alternatives are available. Consider rewording and providing a more meaningful context if possible. In the case of the discussion I would choose to say something like 'within expectations' or 'consistent with known instrument error' or 'is X times that where steeper slopes and poor data coverage'. This would be more useful to the reader.

- Table1 - As part of the summary of the comparisons, it would be useful to include the number of points in the DEM itself and perhaps the percentage of aerial coverage. I believe it's important to know if you are validation a DEM of 10 million points with an independent check dataset of only 1000 points for example. Also, if the areal extent of the validation data is only a small fraction of the aeral coverage of the DEM itself, it would be important to include this information in the error analysis.

Technical Corrections

- L5 - RMS should be spelt out in the first instance.

- Fig1 - none of the flight lines on this plot appear as dots as specified in the caption. Perhaps 'flight lines' would be a better term?

- Fig1 - text in inset is hard to read especially behind the CECS/NASA data.

- Fig3, 4 and 7 - red text in histogram is hard to read.

- Fig2 and 3 - CECS/NASA data lines are also hard to see... perhaps they could be make thicker? - Fig4 - I think the purpose of the red box should be explained in the figure caption as well.

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- Fig6 - the DEM in the background of this figure is different than the others... is it also shaded relief?

- Table1 and 3 - each needs a footnote defining FWHM. It is also not mentioned or defined at all in the text.

- P851L3 - This should read "... datasets are shown in Table 1."

- The authors alternate between the use of 'Figure X' and 'Fig. X' in the text. - All figures - it would be useful if the X and Y axes of the figures were Lat-Long as opposed to arbitrary distance.

- Fig9 - I'm not sure the text in this figure is big enough.

- Fig10 - I think this figure needs coordinates. Perhaps just a cross through representing the lines of longitude at 0, 90, 180 and 270 with ticks showing latitude would be sufficient.

Interactive comment on The Cryosphere Discuss., 2, 843, 2008.