

Interactive comment on “A new 100-m Digital Elevation Model of the Antarctic Peninsula derived from ASTER Global DEM: methods and accuracy assessment” by A. J. Cook et al.

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Received and published: 7 August 2012

Thank you again for your detailed and helpful review. We hope we have answered your main comment in our General Response, so now we will go through your specific and technical comments:

- Regarding downloading the DEM from the NSIDC website, we will ask for the description to be edited to specify that the 3m refers to the mean bias and the RMSE must be added here. It is possible that these values will be different once we have carried out the accuracy assessment of the whole DEM and it may be worth including the values using the slope categories here. By ‘no-data value’ do you mean that we

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should include a reference to the limit of the original GDEM?

- P. 366: we would argue that including the RMSE from the original GDEM in the abstract may be misleading. The original GDEM values are +1 m bias, and ± 35 m RMSE. We explain in section 6 of the paper that this is not necessarily representative of true accuracy, as the ICESat footprints are unlikely to be situated directly on a pit/spike and so the result may be biased. Without further explanation the values look similar to the improved version of the DEM and may be misread.

- P. 367, L9: We will add more references here, although our justification for these particular ones is that we refer only to ‘Peninsula-wide’ glacier studies (and not ice shelves) so as far as we could see these are the only three that cover this specific definition (and Pritchard is not connected to this research).

- P. 367, L10: we do mean for all individual basins, rather than regional studies – we will re-word this sentence.

- P. 367, L17: thank you for pointing out these references – we will include them

- P. 367, L19: the DEM will enable automated basin delineations, from which we can extract area. For the size of glaciers we are interested in, a coarser DEM would not give sufficient detail. We will try to make this clearer.

- P. 367, L26: Ok

- P. 368, L3: We don’t claim that GDEM is widely used specifically for glaciology, but we would argue that it is now one of the primary DEMs used globally. We can quote an example reference here.

- P. 369, L19: we will re-word this sentence and include geolocation accuracies of the Landsat scenes used (Bindschadler et al, 2008) and remove the subjective word ‘accurate’.

- P. 370, L5: it is true that the SPIRIT horizontal accuracies must be taken into consid-

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eration. We will reference the horizontal precision of 30 m here. We will also include this in Section 6.1.4.

- P. 370, L12: Ok

- P. 370, L17: the documentation associated with RAMPv2 (Liu et al, 1999) states that the vertical accuracy of the DEM is estimated at 100-130 m over rugged mountainous regions. No vertical error assessments were made specifically over the AP so there is no associated RMSE value given for this region (whereas it has been calculated for other regions).

- P. 370, L24: thank you, we will make sure we consistently use 2009 when referring to GDEM1 and 2011 for GDEM2.

- P 371, L16: thank you for suggesting the reference – we will insert this and search for others

- P372, L19-24: thanks for the useful point – we will remove the sentence

- P373: the reasoning behind making two separate methods sections was that Section 4 describes the principle behind the theory and Section 5 is a detailed description of the procedure. We think that these should be made distinct so that the reader can easily find what they need. Perhaps the section titles should be re-worded, or both put in one methodology section with two sub-sections?

- P374, L5: the word 'remaining' here refers to contours that remain once the erroneous ones have been removed. We will re-word to make this clearer.

- P 374, L8: We can add the percentage of the total area that was edited on P.375, L8

- P. 374, L15: we will specify that GDEM is an integer grid.

- P. 374, L20-22: we will re-word to read '...to visually assess how well the contours fit the terrain features'.

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- P374, L26: 'generalised' refers to the DEM that has been resampled and smoothed with a simple filter. We will replace it with 'filtered'.

- P 376, L14: we have given reasons in our general response to explain why this method is unlikely to work in the AP region. We intend to remove the statement that 'ICESat elevation points cannot be used for a horizontal accuracy test...' and to reference Nuth and Kääb (2011) but explain why using mountain peaks are the best option in this case.

- P 377, L11: we will emphasise that 14 cm is for very low slopes and will refer to the paper that the reviewer has helpfully suggested for different slopes. We found references by Brenner et al. (2007) and Bamber et al. (2005), both of which quote ICESat precision and accuracy at various slope angles.

- P 377, L12: the sentence states that 2007 corresponds with the year that SPIRIT scenes in the sample region were acquired, not with all SPIRIT scenes across the Peninsula. We can add the dates of each scene in Figure 8.

- P377, L29: regarding SPIRIT DEM accuracies:

i. We admit that we misunderstood the SPIRIT accuracy values so thank you for highlighting this. We did not recognise that the referenced value of ± 6 m vertical different from ICESat for Jakoshavn Isbrae (Korona et al., 2009) was after the interpolated and cloud-pixels had been removed. This will indeed make a difference when comparing the datasets. Therefore when we re-run the accuracy assessment, we will mask out those pixels, show the percentage of the region that is non-interpolated and use these more accurate results for comparisons. We should say that the final SPIRIT products do include the interpolated data, so a direct comparison should also be made with the non-masked result to show whether the new DEM is better overall.

ii. We will include all SPIRIT DEMs in the error analysis

- P 378, L3: Ok

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- P 378, L8: we will re-word “file” as “this layer”
- P. 378, L15: Mean difference is 5 m (table 1c)
- P. 378, L24: we will explain in the same way as we do in our comment for P 376, L14 (above).
- P 379, L9: Ok, thanks for the reference
- P 379, L19: our statement was intended as a reference to the fact that there are inaccuracies within the dataset (rather than what those are, or what improvements have been made) and the reader can refer to the Korona (2009) paper for more information. We can add the suggested sentence if thought necessary.
- P 380, L5: Thank you for the reference
- P 380, L19: Ok, will do
- P 381, L13: Thank you for the useful comment and reference – we will re-write the description accordingly.
- P 381, L14: by ‘topography’ here we mean ‘shape of the surface’ rather than ‘relief’ (quantitative measurements of elevation change)
- P 381, L21: thanks for noticing this – we will reword the sentence
- P 382: we take your point about the conclusion and will make it more concise. We will reword topography as ‘surface shape’

Table 1: thanks, these are all good suggestions and we have taken them on-board. We’ll create a new table with the overall stats and with SPIRIT data separated as you suggest.

Figure 4: the white areas are regions absent from GDEM due to the mask they used, plus Alexander Island which was not included in the new DEM.

Figure 6: this makes sense – we will include only profile 1 and its inset. We think it

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would be worth including the others in supplementary materials as we still think that visualising the profiles is a clear way to see differences in datasets.

Figure 7: we can remove this coastline

Figure 8: we will add SPIRIT image dates to the figure.

Interactive comment on Earth Syst. Sci. Data Discuss., 5, 365, 2012.