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Earth System Science Data Discussions

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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- As regards the choice of DEMs for comparison, we chose to consider only those DEMs of 200m or better grid spacing. In the revised version of the paper we will give a more detailed explanation that the two DEMs mentioned by the referee (DiMarzio ICESat/GLAS 500m and Bamber ICESat/ERS DEM 1km), although widely used (and some may argue, currently the most reliable surface elevation datasets for much of the continent), they are less reliable specifically in the Antarctic Peninsula, with significant problems caused by the steeper topography. RAMPv2 was chosen as it is one of the most commonly used DEMs for the AP region (and from which vector data has been

derived and included in the ADD). Although it was created through interpolation of, and between, various data sources, much of these data were at a higher resolution (such as topographic data derived from maps) than those currently available at a coarser resolution. They are therefore more suitable for the purpose of comparison with the 100-m DEM.

- R. Bindschadler's data consist of points at 15-m spacing along the grounding line. We downloaded these data but did not include them in the list here as they are point shapefiles that were derived from DEM sources, whereas we only list DEM datasets here.

- The RAMPv2 does not contain ICESat tracks. The other two DEMs (DiMarzio 500m and Bamber 1km) as explained above were not considered for comparison to the new DEM. The DEMs we used for comparisons in the accuracy tests do not contain ICESat data so the ground-truth data are independent.

- We will create a table of abbreviation definitions as suggested

- P.369, line17: we only list DEMs with a pixel size of 200m or less, therefore we did not include the DiMarzio or Bamber DEMs here.

- P. 372, line7: we will add the point that Aster GDEM was one of the DEMs from which elevation points were derived for the ASAID grounding line shapefiles.

- P. 368, line 25 and P. 373, line5: we will make it clearer that the 'recognized techniques' that we refer to in Page 373, line 5 are those that we mention in the paragraph on p.372. We will also include a sentence that explains why a median filtering method does not work.

- P.373 line 10-13: the reason we put the description of the RAMPv2 data sources here is that it leads on to the explanation that these data types were used in the interpolation technique. We think that it is not so relevant to list these in the more broad description of RAMP earlier in the paper.

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- P.374, line 7: the contour interpolation method was first tried when myself and a colleague produced two new topographic maps for two regions of the AP, as referenced. Although these are published maps, this is the first document that describes the method. We will re-word this to make the point more clear.

- P.374, line 15: by using a floating point DEM rather than a signed integer (i.e. the raw GDEM) it will reduce errors caused by rounding-up of integer values during processing. We will make this clear in the text.

- P. 374, line 24: the reason was to try to keep the description concise but we can add a sentence describing the ArcGIS tools

- P 375, line 10: the grounding line is the Bindschadler et al, 2011 ASAID grounding line for the ice shelf regions – we will reference this. The ASTER GDEM raw data product was poorly masked in this region, hence some regions of the coast are missing and it emits almost all of the iceshelves.

- P.375, line 20: the blend method is based on a weight-based algorithm, dependent on distance from the pixel to the edge of the overlapping area.

- P. 375, line 28: the Filter tool in ArcGIS performs a low pass filter which smoothes the entire raster and reduces the significance of anomalous cells. Regions along the coast that were clearly erroneous were simply removed (using the 'Clip' tool in ArcGIS).

- P.377, line 4ff: yes, covered in the general comment

- P.377, line 15: by 'taken into account' we mean it as a warning that if the reader uses the data they must 'bear it in mind' rather than we have done this in the error analysis. The reason that it cannot be quantified is because the GDEM tiles (and individual pixels) are made up of Aster scenes from a wide range of dates, unspecified in the final product.

- P.378, line 22: I produced the DEM using photogrammetry software, which resulted in an RMSE report from which I extracted these accuracy values. This is not a pub-

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lished DEM however so we are unable to provide a reference. The vertical accuracy is deviation from the mean, which we can state here.

- P.379, line 14ff: figure 8 shows the extent of coverage of SPIRIT DEMs. The coverage of the Peninsula is incomplete, and it was decided from the start that we would create a DEM using only one dataset for consistency. Merging different elevation datasets can introduce additional problems. The sentence in line 16 that 'SPIRIT products are likely to be better suited....' does not mean that they are necessarily better in all regions, so perhaps this needs to be re-worded. We explain near the beginning (P.370) that SPIRIT DEMs do not cover the whole Peninsula, and Table 1 gives evidence of the relationship between SPIRIT and the new DEM vertical accuracies. We will also reference Figure 6 here. The second reviewer has drawn to our attention the SPIRIT masks that could be applied to remove less accurate interpolated data used to produce SPIRIT. When we re-run the accuracy tests we will separate these into the two SPIRIT categories.

- P.380, line 6: we will re-word this as we mean the consistency across the whole DEM, rather than specifically from north to south.

- Figure 1: we will add arrows

- Figure 2: we can re-colour the map, but perhaps the Editor can decide if this is necessary?

- Figure 3: They are very close but do not cross, which isn't apparent at this scale. However we do not think, for the purpose of this figure, that it would be necessary to produce an enlargement.

- Figure 5: we will move the ICESat track details to a footnote

- Figure 6: These profiles are for visualising the topography as well as the elevation differences, e.g. it can be seen that where the topography is low-slope and smooth, GDEM has pits/spikes - this would not be apparent on a differencing plot, so we think it is useful to keep the profile. However, we have taken on-board the comment by Re-

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viewer 2, who suggests displaying only one profile rather than all five. We will remove 'HASL' and put it in the Figure header (all DEMs are corrected to HASL). We will also refer to the abbreviation table in the figure header.

- Figure 7: we will make all the changes the reviewer suggests to improve this figure.

Technical corrections

- We will ask for both the 'Mean' and 'RMSE' to be stated on the NSIDC website

- Our reason for using the dash in '100-m DEM' is that it is a compound adjective before the noun (otherwise it could be misread). This is subjective however and we hope we have been consistent with this throughout the paper.

- Thank you for pointing out that the URL addresses need to have details added - we will correct accordingly

- P. 365, line 5: by 'neighbouring' we mean glaciers that are next to each other. We believe that this requires no clarification.

- P. 369, line 14: Thank you, we will include the reference

- P. 374, line 18: we can use 'ArcGIS' to be consistent

- P. 375, line 16: Ok

- P. 376, line 21: this section is a more detailed description of ICESat so we thought it helpful to state the full title again at this point.

- P. 378, line 7: Ok

- P. 378, line 23: we would argue that the grammar makes sense without repeating the words 'has been', as it already says this earlier in the sentence

- P. 379, line 9: Ok

- Figure 4: this was a typo – thank you!

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