The Cryosphere Discuss., 4, C1285–C1288, 2010
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The Cryosphere Discussions

Interactive comment on "An improved bathymetry compilation for the Bellingshausen Sea, Antarctica, to inform ice-sheet and ocean models" *by* A. G. C. Graham et al.

S. Benetti (Referee)

s.benetti@ulster.ac.uk

Received and published: 7 December 2010

The paper presents in unprecedented detail the bathymetry of the southern Bellingshausen Sea and the technique used to produce it. It also addresses scientific questions relating to the observed and future changes in the West Antarctic Ice Sheet. Substantial observations are made in relation to the possible consequences of this newly obtained shelf bathymetry on the stability of this particular ice margin and the final results are discussed in the context of the entire West Antarctic Pacific margin. These data and discussion are all relevant and within the scope of TC.

The scientific methods are valid and in most cases clearly outlined. The problems

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pertaining to the quality of the bathymetric data derived from different sources are acknowledged and discussed throughout the manuscript, but more information on the QC of the data could have been given as suggested below. The authors give proper credit to related work and their own original contribution to producing an improved bathymetry for the SBS is clear.

The title well indicates the contents of the paper and the abstract provides a concise summary. Overall the manuscript is well structured and reads well.

My main concern is with regard to data processing and the quality check of the data, which are not always clearly stated. The following comments are referring to specific parts of the manuscript that pertain to the data quality and methods, as well as their interpretation.

Section 2 Approach and method: It is not clear if any of data used are already cleaned of inaccurate soundings. Perhaps MBES data have already been somehow checked for accuracy, while others may not be because of the different type of data. Anyhow, this is not stated anywhere.

Pg. 2083, lines 13-16: Why was a 10-km radius used for the interpolation? Were different averaging radii tried (e.g. 5 or 20 km)? If so, why it was decided in the end to use 10 km? It is obvious that in certain locations this may provide the best compromise, but within the MBES data this may create an artificial smoothing of real features. Or was it a dynamic interpolation, up to 20 grid cell only where there is not enough data?

Pg. 2085, lines 27-30. The authors discuss a smaller fan at the mouth of Latady Trough. Looking at Fig. 3 it appears that there is a third bulging in the contours suggesting a third fan. This is centred at 80°W and is connected to what seems to be a secondary opening of the Latady Trough (ca. 79°W).

Latady Trough also shows a quite prominent sill (shallows) at the shelf edge, which is not outlined in this section or discussed later. Is this sill real or due to data resolution

TCD
4, C1285–C1288, 2010

and quality?

Pg. 2086, lines 8-9: Although trackline artefacts are common in bathymetric compilations, they can be greatly improved with the aid of specialised software for processing MBES data (e.g. CARIS Hips & Sips). I realize this software may not be readily available for research purposes due to costing, but there are ways to improve the merging of different datasets that should perhaps be suggested at the end of the discussion section (where possible areas to investigate further are also indicated) as possible further improvement to the data.

Pg. 2086, line 20: A vertically accuracy of 1-2 m for MBES data is reported here, but in Table 1 is 1-8 m.

Pg. 2088, line 4: The authors claim that the sill in the Belgica Trough shown in figure 4 is an artefact. A 700 m high artefact across the width of the Belgica Trough is quite impressive and difficult to ascribe exclusively to inaccuracies within the datasets. Especially as it appears, comparing figures 2 and 1c, that there are quite a few MBES data in this area. The data distribution, as well as the data resolution and type (MBES, SBES, etc.) at this location should be commented on in a little more detail to explain this 'feature'.

Pg. 2088, lines 13-15: Again the sill apparent on the data at the mouth of the Latady Trough is not mentioned.

Pg. 2090, lines 7-8: Are these unpublished MB data included in the new grid?

Table 1: The error estimate reported in the table for most of the MBES data are very generic (e.g. 5 m horizontal error is the standard GPS error). Reference (a) used for most of these errors is a paper on Greenland. Although Dowdeswell et al. (2010) used MBES data for their research, this does not mean that the error they stated applies to all of the different shipboard systems that acquired the data used within this work. Also the numbers they report are different from those in table 1 and the actual data

TCD

4, C1285–C1288, 2010

resolution may change between cruises of the same ship. The errors reported in Table 1 should be based on ship reports and MBES specifications. The table would also be more transparent in terms of data quality if it reported the multi-beam and single-beam systems that were used during the different cruises.

Finally, some more generic observations.

The authors used two acronyms throughout: SBS for southern Bellingshausen Sea and BS a few times for Bellingshausen Sea. It is not clear at times if these are used interchangeably or if BS is referring to the larger area. Using the full wording for 'Bellingshausen Sea' where required within the paper would not make it any more difficult to read and actually improve clarity.

Pg. 2082, lines 18-20: The technique described in these lines refers to a rather old way of using bathymetric data in order to infer the morphology of the seafloor. In the last 15 years at least, hydrographers have used specialized software to both acquire high resolution echo-sounder data and to obtain contour lines from bathymetric data (bar a few manual edits).

Pg. 2082, line 25: the paper by R. Macnab (2009 'Houston, We have a Problem: Satellite altimetry skews ocean depths' EOS vol. 90, no. 36, p.312) may be a good reference to add here.

Pg. 2088, lines 11-13: 'In contrast, for GVIIS models indicate. . .' or 'In contrast, GVIIS models indicate. . .'?

Interactive comment on The Cryosphere Discuss., 4, 2079, 2010.