

***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.***

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The manuscript provides a detailed bathymetry of the Bellingshausen Sea that is compiled from a broad number of research cruise datasets. The paper provides a novel and improved bathymetric dataset for a globally significant and key region of Antarctica that has implications for, and will greatly inform, past, present and future changes in the West Antarctic and Antarctic Peninsula Ice Sheets. In addition, the paper also comes to robust and substantial research conclusions with regards to identifying and discussing the significance of the cross-shelf troughs as well as the application and implications of the bathymetric compilation for past ice sheet behaviour and modern

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and future regional ice-mass stability. The paper utilises fairly sound and robust techniques based on valid assumptions that are used to obtain the regional bathymetry from ship-based soundings in combination with other datasets, and the methodology is adequately and clearly outlined. The paper is well structured, well written and the scope and data of the paper and the discussion of the implications of the data are relevant to The Cryosphere. There are a number of issues of concern.

Firstly, the authors should avoid the use of acronyms such as SBS, BS, CDW, WAIS, GVIIS etc. as they can be a bit repetitive and unclear at times. Use the full names to avoid the lack of clarity. This should not really add a significant amount to the length of the paper.

Secondly, the authors state that the vertical and horizontal accuracy of MBES data is 1–8 m and 5 m, respectively, after Dowdeswell et al. (2010). The accuracy estimates are fairly ambiguous and not specific enough for each cruise listed. It is unlikely that the accuracy stated will be the same for all the cruises as the cruises used different research ships where the shipboard systems that acquired the data used in the bathymetric compilation are different. In fact data resolution/accuracy may even change between cruises of the same ship depending on the parameters and conditions prevailing during data acquisition.

Thirdly, the authors in general give credit to related work underpinning the bathymetric compilation of the Bellingshausen Sea as well as the consequences and implications for past, present and future ice-mass stability and behaviour in West Antarctica and Antarctic Peninsula. However, the paper also widens out its scope by showing and discussing a compilation of the bathymetry for the entire West Antarctic Pacific Margin, identifying slope and rise bathymetry and cross-shelf trough morphology and pathways of palaeo-ice streams as well as detailing the palaeo-ice stream troughs in Pine Island Bay but is selective in their reference to published work underpinning them. The authors refer to the cruises that bathymetric data was acquired from the region (e.g. JR84, NBP9902 etc) but no mention is made of the papers that originally published

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the data that is used in the compilation. This is relevant as the authors state on page 2086, line 21 onwards that basic error estimates for the gridded data is provided in table 1 and go on to suggest that readers should consult with the original data sources and related publications for further information of their accuracy. Therefore, the authors must reference and refer to the work of Anderson et al. 2002 (Anderson, J.B., Shipp, S.S., Lowe, A.L., Wellner, J.S., Mosola, A.B., 2002. The Antarctic ice sheet during the last glacial maximum and its subsequent retreat history: a review. *Quaternary Science Reviews*, 21, 49-70); Evans et al. 2006 (Evans, J., Dowdeswell, J.A., Ó Cofaigh, C., Benham, T.J. and Anderson, J.B., 2006. Extent and dynamics of the West Antarctic Ice Sheet on the outer continental shelf of Pine Island Bay, Amundsen Sea, during the last deglaciation. *Marine Geology*, 230, 53-72); Dowdeswell et al. 2006 (Dowdeswell, J.A., Evans, J., Ó Cofaigh, C. and Anderson, J.B., 2006. Morphology and sedimentary processes on the continental slope off Pine Island Bay, Amundsen Sea, West Antarctica. *Geological Society of America, Bulletin*, 118, 606-619); Lowe and Anderson 2002 (Lowe, A.L. and Anderson, J.B., 2002. Reconstruction of the West Antarctic ice sheet in Pine Island Bay during the Last Glacial Maximum and its subsequent retreat history. *Quaternary Science Reviews*, 21, 1879-1897) and any other relevant papers that underpin the bathymetric compilation in the Amundsen Sea (including Pine Island Bay) and western Bellinghousen Sea and observations of cross-shelf troughs.

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