

## ***Interactive comment on “A global high-resolution data set of ice sheet topography, cavity geometry and ocean bathymetry” by J. Schaffer et al.***

**J. Schaffer et al.**

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"Dear Dr. Jakobsson,

thank you very much for careful reading and your truly helpful comments! Below you find your comments and our responses (in quotation marks). Regarding our changes you find a revised marked-up manuscript in the supplement.

Best regards, Janin Schaffer & Ralph Timmermann"

Interactive comment on “A global high-resolution data set of ice sheet topography, cavity geometry and ocean bathymetry” by J. Schaffer et al. M. Jakobsson (Referee) martin.jakobsson@geo.su.se Received and published: 23 July 2016 Overall quality: This paper presents a new global gridded compilation that contains bathymetry, upper

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and lower ice surface topographies and global surface height. This follows from the RTopo-1 compilation and the resulting new compilation is released under the name of RTopo-2. This is an important contribution which most certainly will be useful for broad range of geoscientists in the need of a coherent global dataset with merged bathymetry and under-ice topography. In addition, an updated useful global surface type mask is provided. For these reasons alone, I believe the paper warrants publication. Beyond discussing the scientific needs for the kind of gridded data compilation in focus, “data release papers” of this kind serve a couple particularly important points: 1) presenting the data sources and compilation methods 2) discuss errors and data limitations 3) making it possible for the data users to cite a peer-review publication. Do I believe this paper fulfill these points? Yes, but it could be improved on some aspects. In particular, I miss a more technical and detailed description on the compilation methods used. What software/algorithms were involved? Flow charts of the procedures would be much welcomed. This information could be presented in supplementary material if it proves difficult to include in the main paper, as long as it is accessible for the reader somehow.

- "We have added information about the software used and the algorithm applied in the new section 2.2.

Flowcharts are not straightforward to provide here, because the data sets used for RTopo-2 have little in common; they all differ in terms of the variables covered and uncertainties. The choices we had to make are mostly about what to do in order to ensure consistency – do we trust the bedrock and adjust the thickness of grounded ice? Vice versa? Do we trust both equally? Or one slightly more than the other? Do we go for locally exact rendition of source data or for a global map with continuity and consistency valued over exactness? (Note that “exact” does not mean “correct” for many places). These are choices that could not be made in an objective way; they are indeed largely subject to an “educated intuition” of the first two authors of the paper and were largely guided by the question which choice would entail the smallest risk of

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causing damage to an ice or ocean model. So, we decided not to come up with an overly schematic view of what we did. Instead, for each of the data sets included, we tried to report on the choices we made and the reasoning behind them."

Specific comments:

The main component missing in this paper is a section including the technical details on the compilation procedures. I propose adding such a section. For example, it is now written on page three under the main section Data sets and processing: "Interpolation of the source data sets from their different projections to our geographic grid was done by triangulation; a careful smoothing was applied to avoid artefacts." How was this done? One can go from a TIN to a grid in many ways. What is a careful smoothing? Was the smoothing applied all over the resulting surface? What algorithms were used, and in what software?

- "We expanded that sentence into new section 2.2, providing much more detail than before."

I believe it is not made crystal clear that this is "RTopo-2" in the abstract, it is just written briefly and assumed that the reader understands. Perhaps something like: "We followed the spirit of the global RTopo-1 data set and compiled an update referred to as RTopo-2 using consistent maps of global ocean bathymetry, upper and lower ice surface topographies and global surface height. RTopo-2 is comprised of a spherical grid with 30-arc seconds cell spacing. . . . ." (I suggest using cell-spacing rather than "resolution" since the latter may confuse some that source data actually exist consistently on the resolution of 30-arc seconds).

- "We modified the way "RTopo-2" is introduced in the abstract. We use the term grid spacing instead of resolution throughout the whole manuscript now."

The bathymetry near the Greenland coast, specifically in the fjords, is extremely poorly constrained even if a few more data sets are included in this compilation. I think this

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should be stronger high-lighted in the main paper. On the same subject it is written in the abstract: "In particular, we aimed at a good representation of the fjord and shelf bathymetry surrounding the Greenland continent." This is fine, but it is followed by "We corrected data from earlier gridded products in the areas of Petermann Glacier, HagenBræ and Sermilik Fjord assuming that sub-ice and fjord bathymetries roughly follow plausible Last Glacial Maximum ice flow patterns." Even if this certainly is an improvement likely closer to the truth, it is another assumption not based on real bathymetric data. For this reason, I do not think it is appropriate referring to it as a "correction". Instead "modified" is more appropriate.

- "You are totally right. Change applied."

Could this modification be shown graphically? It is not made fully clear how this assumption is technically making its way into the gridded compilation.

- "As examples we showed our modifications for Petermann and Ryder Glacier (Figure 4a-b) and Sermilik Fjord and Køge Bugt (Figure 4c-d). We explain the modification carried out in Section 2.3.3 (Data Modifications) and added more details on our proceedings to be more explicit."

On page 6, please clarify the last part of the sentence: ...."each other; combining surface elevation and ice thickness maps yields an ice bottom topography that even for grounded ice is not identical to the bedrock topography grid provided.". . .

- "... each other: combining surface elevation and ice thickness maps yields an ice bottom topography that is not identical to the bedrock topography grid provided for grounded ice areas."

On page 2 it is written: "This is particularly true for the northeast Greenland continental shelf, where a system of troughs provides a flux of warm water towards the floating ice tongues of Nioghalvfjærdsfjorden Glacier (also referred to as 79 North Glacier) and Zachariæ Isstrøm (Arndt et al. (2015), Wilson and Straneo (2015)). " Why is

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this particularly true here, troughs of western Greenland seems equally pronounced and the same problem apply? We know less about the coupling between the fjords and the glacial troughs along the northwestern sector of the Greenland coast, north of Upernavik), but this does not exclude them as being sensitive from influx of warmer subsurface water.

- "We agree and modified this passage, now referring to the northeast Greenland Shelf as "One of the key regions""

- "We did not include additional trough bathymetries yet because we are not aware of any other existing available bathymetric maps for the Greenland coastal regions yet. We are ready to include further data in revised/updated future versions of RTopo-2 though."

Please also note the supplement to this comment:

<http://www.earth-syst-sci-data-discuss.net/essd-2016-3/essd-2016-3-AC2-supplement.pdf>

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