

## ***Interactive comment on “High-resolution ice thickness and bed topography of a land-terminating section of the Greenland Ice Sheet” by K. Lindbäck et al.***

**K. Lindbäck et al.**

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We thank the reviewer for her/his valuable comments, and provide our responses below.

ANONYMOUS REFEREE #2

GENERAL COMMENT: This study presents already published datasets, covering about 25% of the total study area, combined with new, unpublished data by the authors of the manuscript and covering a total area of 12 000 km<sup>2</sup> in West Greenland. As the authors point out, the study area is one of the most studied regions in Greenland.

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However, in this study, the bedrock topography and ice thickness are given in higher spatial resolution (250-500 m) than in previous studies, and it is obvious, that many other studies can benefit from these data, and the data provides interesting reference data for future. The authors provide a detailed description of the previously unpublished data and appropriate references to the data already published, and discuss the error sources in detail. They do not make further interpretation of the data in this manuscript but their presentation is sufficient for data presentation. The dataset itself provided at Pangaea is not extremely large and it would be useful to provide the data also in ASCII format. I'm not a native speaker myself but the manuscript would benefit from a read-through by one.

RESPONSE: We are grateful to the referee for her/his positive comments. As suggested, we will provide the dataset also in ASCII format at Pangaea and will have a final read-through of the revised version of the paper by one of the English native speaking co-authors.

## 1. INTRODUCTION

COMMENTS: P. 130, L 23-25. Bamber et al. (2001) given in the reference list presents DEM over the Greenland, not bed elevation data. Please add: Bamber, J. L., et al. (2013), A new bed elevation dataset for Greenland, The Cryosphere, 7(2), 499–510, doi:10.5194/tc-7-499-2013 to the reference list. P. 130, L. 25- ...surveys have increased the data density,... P. 131, L. 1 ...filled in the gaps in the data in this grid, and an updated... P. 131, L. 9. Please start a new paragraph for clarity at: Recent high resolution... P. 131, L. 17-18. A higher resolution map of bed and ice thickness...

RESPONSE: We have implemented all the above suggested changes in the revised version of the paper.

## 2.1 GROUND-BASED RADAR SURVEYS

COMMENT: P. 133, L. 9-10 Trace spacing: I don't get the math work for the spacing

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of the traces. If the measuring rate was  $\sim 1000$  traces/s and the driving speed of the horizontal velocity of the radar was about 10 km/h, after stacking 3000 traces I get a smaller spacing for the stacked signal than 15 m. Please clarify.

RESPONSE: We have corrected the velocity of the radar to  $\sim 15$  km/h, which is the mean velocity.

COMMENT: P. 133, L. 15-17. What was the distance between the transmitter and receiver antennas? Was the GPS antenna moving relative to the common? Does the explanation for the error in surface elevation: “the placement of the antenna relative to the common midpoint” simply refer to the fact that the GPS antenna was following a certain distance behind the midpoint between the radar antennas? Please clarify.

RESPONSE: Yes, that is the correct interpretation. The GPS antenna was placed by the receiver along the travelled trajectory, 90 meter from the common midpoint. We have clarified this in the text in the revised version of the paper.

## 2.2 AIRBORNE RADAR SURVEYS

COMMENT: P. 134 L.6. ...include these data as they... Please re-formulate the end of the sentence on line 7.

RESPONSE: We have implemented the suggested correction in the revised version of the paper.

COMMENT: 2.3.1 Vertical resolution P. 135, L.2-5. Please clarify how the value 18.8 m for the system errors was obtained.

RESPONSE: The system errors are obtained from the bandwidth and the digitization frequency. We have clarified this in the revised version of the paper.

## 2.3.2 HORIZONTAL RESOLUTION

COMMENT: P. 136, L.19-21. Please clarify the logic of this sentence ie. the conclusion that the horizontal resolution is determined by the range resolution. In general,

the main factor defining the horizontal resolution along the radar profiles is horizontal spacing of the traces. Traces should be less than 1/4 wavelength apart (e.g. Welch and others (1998), also referenced in the manuscript) in order to avoid spatial aliasing. This condition seems to be well satisfied in this study. For a single trace, the theoretical horizontal resolution can be defined as the first Fresnel zone. And further: P.137, L. 3 .The size of a single reflector should be greater than half of the wavelength ( $\sim 34$  m in this case) to be resolved in migrated data as the authors also state, when the first condition about the measuring interval or spacing of the traces is fulfilled.

RESPONSE: We have clarified the paragraph and implemented the suggested correction in the revised version of the paper.

## 2.4. ASSIMILATION OF THE DATASETS

COMMENT: I. 16: The measuring interval is dense, not the datasets, I assume.

RESPONSE: We have implemented the suggested correction in the revised version of the paper.

## 3. RESULTS

COMMENT: P. 139, L. 13. The bed topography becomes smoother. . .

RESPONSE: We have implemented the suggested correction in the revised version of the paper.

COMMENT: P. 139 L. 20-25 Was the ellipsoid-geoid difference taken into account in the comparison? Bamber et al. use EIGEN-GL04C geoid (Forste et al., 2008). Please comment.

RESPONSE: We have only used the Bamber et al. ice thickness to be able to compare the DEMs, so we are independent of the geoid used by Bamber et al. We have clarified this in the revised version of the paper.

COMMENTS: Figure 1. Please insert a corner map. Figure 3. Please increase the

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size of the font for axes, legends, spatial scales, numbers and text in the figure.

RESPONSE: As suggested, we have inserted a corner map in Figure 1 and have increased the size of axes, legends, spatial scales, numbers, and text in Figure 2 in the revised version of the paper.

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Interactive comment on Earth Syst. Sci. Data Discuss., 7, 129, 2014.

**ESSDD**

7, C102–C106, 2014

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