Reviewer's comment on

"Generating synthetic fjord bathymetry for coastal Greenland"

by Christopher N. Williams and coworkers

submitted to The Cryosphere Discussions

General comments

In this paper, the authors present a method for generating synthetic, but realistic fjord bathymetries in a scarce-data environment, where "realistic" means that topography represents many important aspects of reality even if it cannot reflect the true situation exactly. Improvements compared to previous methods are shown and demonstrate the ability of the method. A pan-Greenland application is envisaged.

The paper makes a reviewer's life very easy. The topic is interesting, the method obviously very useful, results are meaningful. Structure of the manuscript is clear, figures are useful, presentation in general is very pleasant. I particularly liked the review of past approaches to synthetic channel geometries in (not only) Greenland DEMs. I have a couple of specific comments that may help to improve the manuscript even further. I recommend to accept the paper for publication, encouraging minor revisions.

Specific Comments

1. page 2, l. 5-6: The "physically unrealistic morphologies" in the Bamber et al. (2013) dataset have also been recognized by Schaffer et al. (2016) when putting together RTopo-2 – although the approach to overcome the issues there was much more heuristic than what is presented in this paper. Still, you may want to add the Schaffer et al. (2016) work to the list of studies aiming for an improved representation of Greenland fjord topography in a bed-to-bathymetry DEM.

2. page 3, l. 9: I couldn't do much with the word "acknowledged" here.

3. page 3, l. 25: I suspect that the "and," at the end of the line was not intended to be there. I think this can nicely be two separate sentences.

4. page 4, l. 18: I suggest to make it "low-resolution" (because it makes it easier to see that the "large" belongs to "datasets", not to "resolution")

5. page 5, l. l 27: "a flat spectra" sounds wrong to me

6. page 7, l. 5: It's actually a path integral of a constant number (most likely One), isn't it? "Along-track distance"or just "length" would be simple words for it.

7. page 7, l. 16: I'll have to admit that I could not do much with the word "transform" here.

8. page 7, l. 24: manor -> manner

9. page 7, l. 30-34: It is clear that some of the potential paths have to be removed along the track, but I'll have to admit I fail to understand the explanation why step 4 does this job the way it is supposed to be. Any chance to put this into some simple descriptive words illustrating the idea and the reasoning?

10. page 8, l. 7: I think the explanation for step 7 is easier to understand if the words "When considering the length of all complete paths," are removed and the sentence simply starts with "Where …".

11. page 9, l. 17: I think there should be no comma after "parameters".

12. page 13, l. 22: I suggest to remove the paragraph break here. Maybe the sentence in l. 20-22 can be rewritten to clarify that the improvement is an improvement compared to Bed2013, with OBS1516 as a reference what the targeted truth is.

13. page 14., l.1: I think "provided" or "presented" is better here than "illustrated"

14. page 15, l. 10: "_at_ a significant distance" ?

15. page 16, l. 21: "high-frequency" ?

16. page 16, l. 34: should it be "_for_ Bed2013" ?

17. caption to Figure 5: Even with the electronic version in front of me, the "Please refer to the online version of this article to make use of references to colour." bit fails to make sense to me.

18. caption to Figure 8: I suggest to make it "along-transect" at both locations

19. Figure 9: The figure shows that SynthIBCAO and SynthOBS give very similar results, which is good and demonstrates the ability of the method. However, I miss a possibility to directly compare to the OBS1516 data. Would it be possible to replace the grey area in panel a, which just indicates data coverage, by the OBS1516 elevation data? Keeping the extent / data coverage information of course (white areas remain white).

20. caption to Figure 11: I am sure the last sentence can be formulated in an easier way (still making the point to be made)

21. In general, I miss a statement (e.g. in the Summary) on how many manual steps are required during the procedure. Manual steps are mentioned at several locations in the manuscript, but I wonder how much work it would be to do this for, let's say, entire Greenland.

14.11.2016, Ralph Timmermann