The Cryosphere Discuss., 8, C1919–C1923, 2014
www.the-cryosphere-discuss.net/8/C1919/2014/
© Author(s) 2014. This work is distributed under
the Creative Commons Attribute 3.0 License.

The Cryosphere Discussions
Open Access

Interactive comment on "Glacier topography and elevation changes from Pléiades very high resolution stereo images" *by* E. Berthier et al.

Anonymous Referee #1

Received and published: 2 October 2014

In their TCD manuscript *"Glacier topography and elevation changes from Pléiades very high resolution stereo images"* Berthier et al. generated high resolution DEMs of five glacierized study areas from recent Pléiades acquisitions. The accuracy and precision of the derived DEMs were tested by comparing the DEMs with recently collected GNSS data. Further, they determined the applicability of the new Pléiades DEMs to derive seasonal, annual and multi-annual glacier elevation changes by comparing the DEMs with GNSS data, a multi-temporal Pléiades DEM and an older SPOT DEM respectively.

Overall I find the manuscript is well written and interesting to read. I also think the data processing is clean and the derived DEMs are of high quality. Therefore I suggest publication in the Cryosphere after some revisions although the manuscript would also fit in a more technical remote sensing journal. However, I have some general remarks

and a few specific comments as listed below.

General remarks:

In the manuscript little is said about the behavior of Pléiades data in the accumulation area of glaciers or in the relative featureless and white terrain of Antarctica which is the main drawback of optical stereo photogrammetry of glaciers and which is probably interesting for researchers working in Greenland and Antarctica. On Page 4854 line 4 you mentioned that the wide radiometric range of Pléiades improves the image contrast significantly, but looking at Figure 2 (Astrolabe) I wonder how well is Pléiades really working in the upper part of the glacier, which seems to be mostly white and featureless and where no reference data is available (the spatial limitations of the reference data need to be mentioned in the discussion). I am not asking to compare the DEM with CryoSat-2 tracks as this is probably behind the scope of the manuscript, but a quantitative approach could be a visual interpretation of a zoomed shaded DEM in comparison with the original satellite images, as the interesting thing of Pléiades is its great detail. Another idea would be to compare zoomed parts of a Pléiades hillshade with a hillshade of the upper parts of the Astrolabe SPIRIT DEM published in Le Meur et al. (2014) in order to show the superiority of Pléiades against SPOT in featureless terrain.

Specific comments:

Title: I think "Glacier topography and elevation changes derived from high resolution Pléiades stereo images" would be more correct?

Abstract page 4851 line 5: I think it is important to work out the actuality of the study. You could mention that Pléiades is a very recent satellite mission (not sure if this is clear to all TC readers) and that little work has been done so far to derive glacier topography from Pléiades data. This would clearly increase the importance of the manuscript and justify publication in TC.

TCD
8, C1919–C1923, 2014

Page 4852 line 3: here you could state that geodetic mass balances are also included in the new IPCC report (Vaughan et al., 2013). I think for the first time, double check. This would also underline the importance of the study.

Page 4853 line 1: maybe you could mention the launch dates of the Pléiades satellites already here?

Page 4853 line 8: I am not so happy about the structure of this chapter. Would it not be clearer to make one chapter for "Datasets" and one for "DEM generation"? Subsection "Study areas" could also be included in the introduction.

Page 4854 line 12-15: why not include a schematic figure of the triplet mode? I find it a bit confusing to go to such a long URL in the continuous text.

Page 4854 line 21: extra subsection for the GNSS data could be included in the Data section. The same applies for the Lidar DEM and the SPOT DEMs (which also should be described shortly).

Page 4855 line 28-29: "Some tests were also performed with a pixel size of 2 m that did not improve results and are therefore not reported here." This sentence could probably be deleted.

Page 4858 line 5: typo: "prominent", such as?

Page 4858 line 10: here you state that no GCPs were available for Astrolabe (Antarctica) and Mera (Nepal). However, in Table 4 you say that 22 GCPs were available for Himalaya – Mera from SPOT. Somehow inconsistent.

Page 4866 line 15: "...can reduce the percentage of data voids and slightly improve precision." Is not this an added value?

Page 4867 line 1-2: What about problems in featureless accumulation areas? How is the improvement compared to other optical sensors such as SPOT or ASTER?

Page 4871 line 12: typo: "Kropacek"

TCD
8, C1919–C1923, 2014

Figure 2: I think this Figure can be deleted, as it is not really meaningful.

Figure 3 and 4: please insert geographic coordinates. Where are the glacier outlines from? Digitized from the Pléiades images? Please describe, maybe in the Methods section. Also the GCPs could be shown. Figure 3 and Figure 4 might be combined into one a b subplot. Why not show a hillshade of the Pléiades DEM in the background (at least in Figure 4?) this would give much more information about the DEM quality on the glacier.

Figure 5 and 6: maybe these Figures could also be combined into one a b subplot. Also geographic coordinates and GCPs should be included. Where are the glacier outlines from? Digitized from SPOT?

Figure 6: looking at this figure, I am assuming a linear ramp across the entire scene reaching from -5 m in the upper left corner to +5 m in the lower right corner (hard to tell at this color scale). This possible ramp need to be checked and if present also removed as it might have a significant impact on the results. It possibly originates from the SPOT DEM as it is not so obvious in Figure 5?

Also a hillshade of the Aqua Negra study site, the Mera study site and Astrolabe glacier (see general comments) would be interesting, including the GNSS data points, the GCPs (if available), glacier outlines and geographic coordinates. For Astrolabe a comparison with the SPIRIT DEM could be interesting.

Additional References:

Vaughan, D., Comiso, J., Allison, I., Carrasco, J., Kaser, G., Kwok, R., Mote, P., Murray, T., Paul, F., Ren, J., Rignot, E., Solomina, O., Steen, K., and Zhang, T. (2013). Observations: Cryosphere. In Stocker, T., Qin, D., Plattner, G., K., Tignor, M., Allen, S., Boschung, J., Nauels, A., Xia, Y., Bex, V., and Midgley, P., editors, Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University

CC BY

Press, Cambridge, United Kingdom and New York, NY, USA.

Interactive comment on The Cryosphere Discuss., 8, 4849, 2014.