The Cryosphere Discuss., 8, C1968–C1970, 2014
www.the-cryosphere-discuss.net/8/C1968/2014/

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

Anonymous Referee #3

Received and published: 6 October 2014

This paper presents a thorough assessment of the products of the new Pléiades sensor for assessing glacier changes using photogrammetry at high spatial resolution. The authors test the performance of DEMs against in-situ field data for several glacier sites with strongly differing characteristics and provide conclusions on the accuracy with or without the availability of ground-control points. Whereas the paper is mainly focussed on the evaluation of the accuracy and the investigation of the potential of the new product for deriving glacier surface elevation changes at high spatial (and temporal) resolution, the authors also provide a few applications and demonstrate selected results of DEM differencing.

The present article convincingly shows the considerable potential of this new sensor for glaciological research. The paper is well written and addresses a wide range of open

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questions. Although there are a few issues – mainly related to possible limitations of the Pléiades DEMs – this study is highly welcome and should be accepted once the few critical points are answered.

General comments:

- The most important limitations of this sensor should be stated as prominently as the potential. For example, I consider the need for clear-sky conditions and the possible data voids in the accumulation area as critical factors that require more discussion.

- Data voids can obviously not be avoided. But how are they treated if glacier-wide elevation changes are calculated? The authors should discuss their strategy (and the related uncertainties) for these applications as, in my understanding, a complete DEM is required to come up with a number for the volume change (be it seasonal or multi-annual).

- I do not have the impression that more results should be presented in the frame of this paper (as asked in one of the previous reviewer comments). It would blow up the content of the paper too much. However, the results of the most relevant glaciological application (long-term mass change) should be validated also with other independent data sources. I know that this is a difficult task but at least for Argentière a mass balance monitoring programme exists (glaciological method) that covers the investigated period.

- Structure: I was troubled by the structure of section 2 which mixes up the presentation of in-situ field data for the individual study sites and the generation of Pléiades DEMs. It would be more logical to keep a clear separation between (1) field data, (2) DEM generation and (3) the comparison of the DEM products and the in-situ data (for georeferencing etc).

Detailed comments:

- Page 4851, line 18: Surprisingly, the numbers for the mean mass balance of Mer de

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Glace and Argentière provided in the Abstract are more accurate than the results given in the body of the paper (see page 4865, line 28). The Results-section only yields a decimetre-accuracy and no specific value for each of the two glaciers.

- Page 4854, line 8: This is an important statement which seems reasonable. However, can this advantage be shown / quantified / put into perspective somehow?

- Page 4858, line 12: It is assumed that the LiDAR DEM is 100% percent correct if GCPs are extracted directly from the LiDAR DEM. Is this true? If yes, it should be mentioned.

- Page 4860, line 6: How accurately can the “real” terrain elevation for a point location (GCP) be extracted from a DEM with 40m-resolution? I would assume considerable differences between the grid cell elevation and a 1D-location just because of surface roughness within the cell.

- Page 4863, line 8: firn compaction is probablyless important in this case than snow compaction. It is mostly the winter snow (not yet to be called firn) that will be compacted over the summer season (with some contribution also from the underlying firn layers of course).

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