Answer to S. Fassnacht

The authors would like to thank Steven Fassnacht for his review. We provide below a point-by-point response to his comments and we explain how we intend to modify the manuscript in order to take them into account.

This is an important paper as it presents the implementation of relatively new technology, stereo satellite imagery, to map snow. It provides the first comprehensive evaluation of a snow depth dataset derived from stereo satellite imagery by comparing it to an extensive lidar dataset (ASO). Overall the paper is presents important step towards better snow mapping.
The science is good and meaningful. The writing is not easy to read in many places.Specifically, the text could be more concise, and I recommend that the authors revisit how the paragraphs are structured and how sentences are written. While the English is not incorrect, the flow of the sentences makes it difficult to read. I acknowledge that the main authors are not native English speakers, but some of the 8 authors are native English speakers, and most of the authors have written extensively in English. I will use the Introduction as an example. It provides useful information, but is awkwardly written.The material reads partly like a stream of consciousness. There are new paragraphs that are a continuation of the previous paragraph. Please consider restructuring this section. For example, the text starting on lines 49-50 through line 73 presents the application of the stereoscopy using satellite imagery. Yet it starts in the middle of a paragraph with "The method was tested using two Pléiades stereo triplets over the Bassiès catchment in the Pyrenees (14.5 km²)." Then the authors tell us about what was done there. The next paragraph begins with "However" and is a continuation of the first paragraph. The last paragraph does present additional steps that will be seen in the rest of the paper. In restructuring the Introduction, end with objectives addressed or research questions posed so the reader knows where this paper is going.
There are various terms used that, while not incorrect, are awkward, such as on line 24 "deepen" in the context of a limited evaluation or on line 42 "decametric scale" total k about variability over 10s of meters. Similarly, some of the phrasing can be more succinct. For example, on lines 232-233 the authors state: "We evaluated the quality of the Pléiades HS maps over the area defined as the intersection of snow-covered terrain in Pléiades HS maps (snow mask) and ASO HS maps (HS greater than zero)."How about: "We evaluated the Pléiades HS maps for the area where both the Pléiades(snow mask) and ASO (HS greater than zero) HS maps had snow. This is stylistic, but some of the text is more complicated than it needs to be, and thus makes the paper more difficult to read.

We worked on improving the structure of the manuscript, paragraphs and sentences. We modified the introduction so that it fits in four well structured paragraph. We moved some parts of the Method to keep its progression logic. We structured the Discussion in more homogeneous parts. The text of the revised manuscript was also carefully proofread by one coauthor who is a native english speaker to deal with sentence structure and terminology.

Specific comments:

- Lines 77-78: "The snow-on Pléiades triplet was acquired 1st May 2017, the day before the ASO flight and close to the accumulation peak" How different is that snowpack overa day, i.e., how much does the snow depth vary between scene acquisitions?
We could not access to local appropriate dataset (e.g. local weather station, consecutive ASO HS maps) within the time frame of this review to answer this question. From DeWalle and Rango (2008) we can expect a likely snow depth decrease of 2 cm d^{-1} and a maximum of 8 cm d^{-1}.
Reference: D.R. DeWalle and A. Rango. 2008. Principles of snow hydrology. Cambridge, etc., Cambridge University Press. 410pp. ISBN 978-0-521-82362-3, hardback.

- Line 84 and after: I assume that the word “stable terrain” means a location that is snow free? This should be explicitly stated.

We tried to clarify this in the line above (L203):

“The co-registration vectors were calculated using the algorithm by Nuth and Kääb (2011) on areas where no elevation change is expected (i.e. stable terrain). The stable terrain areas, which are snow free terrain without trees, were determined by a supervised classification of the Pléiades multi-spectral images into a land cover map (see 4.1.5).”

- Lines 26 versus 103 and 118: the abstract says “a snow-covered area of 137 km2”while the Study site section says “a 280 km2subzone.” Which area is it? Line 141:what about the “excluded 25 km2” Line 306 states 138 km2

The footprint of the images is 280 km² which is a subzone of the Tuolumne bassin covered by the ASO campaign. Parts of the subzone were not covered with snow (stable terrain, forest terrain) and parts were excluded (lakes, persistent snow in summer, 25 km² with artifacts in ASO maps). This leaves about 215 km² of snow-covered terrain of which remains 138 km² after snow mask buffering.

Thanks for noting the mistake. The snow covered area is now correctly stated as 138 km².

- Lines 124-125 versus Table 1: The text states a resolution of 2 m, while Table 1 says 0.5 m, which is it?

In the text we make the difference between the pan-chromatic images at a resolution of 0.5 m (L112) and the multi-spectral images at a resolution of 2 m (L116). We added this precision in the Table 1 (PAN: 0.5 m MS: 2.0 m) (L136).

- The Methods are thorough. I suggest making sections 4.2 and 4.3 sub-sections of 4.1, as they are part of the overall Pléiades work-flow.- The authors evaluate snow covered (Pléiades snow mask HS maps versus ASO HS greater than zero HS maps), and stable terrain (snow free) areas. What about the omission and commission areas? At least provide the percent of the study area for each of these.

Following the reviewer suggestion we modified the Method organisation. 4.2 and 4.3 (initial manuscript) are now 4.1.2 (L156) and 4.1.3 (L184) respectively. Some sentences were also moved to 4.1.1 to keep these three parts consistent.

- Lines 240-260: it is unclear why these equations are presented here. The paragraph begins with “For hydrological applications, HS maps are often spatially aggregated, for example to calculate the amount of snow in a catchment or an elevation band.” Either change this sentence or add a sentence so we know what these equations are used for.

We inserted a sentence to clarify L243:

“The accuracy of HS maps is often discussed at (or close to) the highest resolution that is allowed by the sensor (e.g. Nolan et al. 2015, Marti et al., 2016). In practice however, HS maps may be subject to spatial averaging to assimilate in a snowpack model, to estimate catchment-scale HS or to compare with coarser satellite products and model output (Painter et al., 2016; Margulis et al., 2019; Shaw et al., 2019). The accuracy of the mean HS of a set of contiguous pixels is expected to be higher than a single pixel accuracy but depends on the spatial correlation of the errors (Rolstad et al., 2009). Hence, we performed an empirical assessment of the evolution of the accuracy of Pléiades HS as a function of resolution by aggregating the HS residual map to resolutions ranging between 3 m and 180 m (Berthier et al., 2016; Brun et al., 2017; Miles et al., 2018).”

- Lines 263-265: it is not necessary to foreshadow what is in the Results "We first present the results for the HS maps calculated with the SGM-binary option and differentimage geometries. Then, we focus on the impact of the configuration of ASP. The best set of options and geometry is then used to analyze the spatial distribution of the residuals and to evaluate a model of the HS error." State clear objectives or research questions at the end of the Introduction and the reader would know what is to come.
We removed these lines.

- Tables 2 and 3: What is STD?
We replaced STD with *"standard deviation"***.**

- Figure 4: I'm not sure if you mean corniche or cornice?
We replaced *"corniche"* **with** *"cornice"* **(L595).**

- Line 287: it should be "Artifacts." Also, the phrase: "Artifacts of typically 20 m x 20 m..." is unclear
We show examples of artifacts in the supplement and added a description L289:
"Patches of typically 20 m x 20 m with abnormally large HS (>10 m) compared to ASO (~3 m) are also observed with the Local-Search options around isolated trees. These artifacts are not visible with the SGM-binary or ternary options (Figure S1)."

- Lines 306-307: what does "after erosion of the Pléiades snow mask" mean?
Erosion is a term used in image morphology which can be indeed confusing. We replaced this sentence with (L221):
"The stable terrain and snow masks were shrunk (morphological erosion) with a radius of two pixels (4 m) and patches smaller than 30 pixels (270 m²) were removed."

- Figure 9: it is unclear what the units in the y-axis are. The caption states: "h is the distance"
We modified the axis labels and the caption of the figure:
*"**Figure 9**. (a) Semi-variogram or spatial autocorrelation (□) against lag distance of the HS residuals (empty circles) and Pléiades elevation difference over stable terrain (filled circle). (b) Semi-variogram of the HS residuals for large distances before (blue line) and after correcting the undulation pattern (red line), illustrating the reduction in spatial variance at greater lag distances due to this correction (Sect. 6.5)."*

- This is also stylistic, but some sentence that tell what is upcoming and can be removed. For example, line 301-302 begins with "Figure 4 illustrates..." The authors can just tell us the key point(s) in the Figure as the caption tells the reader what the figure is.
We simplified this sentence in (L302):
"The Pléiades HS map calculated with the selected image geometry and ASP configuration (front-nadir-back images, SGM-binary) compares well with the ASO HS map (Fig. 4)."