

Interactive comment on “Measuring the snowpack depth with Unmanned Aerial System photogrammetry: comparison with manual probing and a 3D laser scanning over a sample plot” by Francesco Avanzi et al.

Anonymous Referee #2

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The authors compare the estimation of snow depth over a relatively small and homogeneous surface during a field survey carried out in April. The manuscript is clear and authors indicate the feasibility of using UAS for this purpose. As overall, I have liked the paper but, sincerely, I am not fully sure about the suitability of this research in a very high impact journal as The Cryosphere is (despite several works of similar characteristics to this one have been already published). My main concern is about to which extent the results are representative for other conditions or study sites. We already knew that UAS is able to provide useful information on snow distribution. Thus, I would

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have liked to see a paper on this topic based on more field campaigns, under different meteorological and light conditions and probably under a more variable terrain characteristics, which could allow to provide a more sound discussion about errors when using UAS for snow mapping. In addition, one of the strengths claimed by the authors is the density of manual measurements taken (that implies a considerable effort), but the results suggests that manual measurements are far to be the ground truth. Thus, this is not easy to know exactly the source of the observed errors (that indeed may be high as Figure 5a shows).

Said that, the paper is quite well written and I have only a few minor comments: - In the pdf the title only show the acronym "UAS" when it should be use the ful name of the technique. Similarly, it should not be used the acronym at the begining of the abstract. - I miss the paper (R. Marti et al.2016: Mapping snow depth from stereo satellite imagery, The Cryosphere) as they use also UAV data validated with manual measurements. - Were the images processed in order to remove the distortion from the lens? Agisoft has a tool for this purpose. - In Figure 4a it seems that residuals never exceed 0.2 meters, however in Figure 4b, it seems that much larger biases exist. - As I mentioned before, Figure 5a shows very large differences and it is difficult to know the source of the errors (which one is closer to ground truth?) - The analyses is conducted with snow data from April, and Figure 1 shows a snowpack pretty metamorphosed where obtaining common points is much more feasible than under fresh snow conditions, Thus the obtained error is very likely to be lower than in most of the time along the snow seasons. This should be clearly stated in the discussion, as well as other sources of error derived from ilumination, wind conditions, the effect of the shadows, etc.

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