Referee #1

*Thank you for the original review and the recommendations for minor revisions. We have provided detailed responses to the reviewer in **bold** following each of the reviewer's comments.*

Review comments on tc-2022-7 manuscript, entitled," Comparison of in-situ snow depth measurements and impacts on validation of unpiloted aerial system lidar over a mixed-use temperate forest landscape".

General comments:

The tc-2022-7 manuscript, entitled," Comparison of in-situ snow depth measurements and impacts on validation of unpiloted aerial system lidar over a mixed-use temperate forest landscape" presents validation of snow depth maps from an unpiloted aerial system (UAS) with an integrated Light 16 Detection and Ranging (lidar) sensor using snow depth 14 measurements from a magnaprobe automatic snow depth probe and a Federal snow tube.

The objectives of the presented work are

- to investigate effects of an ephemeral snow environment, land cover type and forest leaf litter on snow depth measurements using a magnaprobe and a Federal tube are significantly different in an ephemeral snow environment,
- to investigate impacts of validation UAS lidar with mangaprobe and a Federal tube snow measurements.

As general comment, the manuscript is designed and written well. It consists of all results and conclusions and objectives of the work planned.

Thank you.

The point I miss is how those results on the objectives would differ in case of deeper snowpack. It seems that the snowpack is very shallow like 10-15 cm. What happens if it varies up to 100 cm. The conclusions should be confined under limited snow depth conditions like up to 15 cm.

Investigating measurements of a shallow snowpack was the main goal of this research. We agree that it must be specified that the results of this research examined shallow snowpacks. The following sentence was added to the abstract "Shallow snowpacks are often difficult to estimate. Our study was conducted during periods of shallow snowfall to examine the biases both for in-situ field measurements and lidar based estimates." The following sentence will be added to the concluding paragraph in introduction which describes the study goals and hypothesis "While these biases between the two sampling techniques may be negligible in a deeper snowpack, their differences are more significant relative to a shallow snowpack." The shallow snowpack is also mentioned in line 488.

Because if snow depth is deeper then they may be some other challenges and errors can occur on the snow measurements by magnaprobe and snow tube. Please have a look at

López-Moreno, J. I., Leppänen, L., Luks, B., Holko, L., Picard, G., Sanmiguel-Vallelado, A., Alonso-González, E., Finger, D. C., Arslan, A. N., Gillemot, K., Sensoy, A., Sorman, A., Ertaş, M. C., Fassnacht, S. R., Fierz,

C., and Marty, C.: Intercomparison of measurements of bulk snow density and water equivalent of snow cover with snow core samplers: Instrumental bias and variability induced by observers, Hydrol. Process., 34, 3120–3133, https://doi.org/10.1002/hyp.13785, 2020.

Many thanks for pointing us to this reference. It is an interesting and unique article that all snow samplers should read. We plan to reference the article and its snow depth findings in the introduction and discussion as follows:

Introduction "Lopez-Moreno et al.'s (2020) comparison of nine snow core samplers found that snow depths were relatively consistent when taken over a paved surface. However over uneven ground, the snow depth differences between samplers was much greater and replicate snow depth measurements had a larger variability when compared to the snow density."

Discussion "We also agree with Lopez-Moreno et al.'s (2020) finding that it is important to understand the snowpack and conditions for which an individual sampler was designed in order to select the most appropriate sampler."

There is also a recent work published on retrieval of snow depth using webcam images in Cryosphere. It would be good to have look at it as well:

Bongio, M.; Arslan, A.N.; Tanis, C.M.; De Michele, C. Snow depth time series retrieval by time-lapse photography: Finnish and Italian case studies. Cryosphere 2021, 15, 369–387.

Thank you for another relevant reference. We plan to add information from the reference to the methods review in the introduction and the discussion section 4.2.

Introduction "Automated measurements that include ultrasonic methods, laser depth sensors, and time-lapse cameras utilizing a measuring rods are increasing in use (Kinar and Pomeroy 2015; Kopp et al. 2019 ; Bongio et al. 2021), in-situ measurements remain the mainstay of data collection for research and operations (Kinar and Pomeroy 2015; Pirazzini et al. 2018)."

Discussion "Emerging techniques such as automated snow depth retrievals from field cameras may offer improved validation for high resolution remote sensing observations of snow status when the field camera images are clear, and the camera and stake are properly aligned and not prone to movement (Bongio et al. 2021)."