Answers to the Feedback by Reviewer #2 on the revised manuscript

Reviewer: Thanks for updated manuscript. I believe that the manuscript has been improved. I have still following comments which I hope that updates will make positive impact on the paper.

Authors: We thank the reviewer, Dr. Arslan, for reviewing the updated version of the manuscript. Thanks also for the additional suggestions to further improve our manuscript – please see our answers below.

Comment 1:

Reviewer: Is measurement data (in-situ) available publicly so that may be readers can be interested on them? Would be good to give links where the data is available!

Authors: As already mentioned in the 'Data availability' section at the end of the manuscript, we uploaded the data shown in the paper to the environmental data portal and repository EnviDat. The data can be found at https://doi.org/10.16904/envidat.1869.

In addition, we now also added the in-situ manual profiles to the repository. Moreover, in response to your second comment, we also uploaded some webcam images.

Comment 2:

Reviewer: There has been mentioned that camera images are available and stored. It would be good to give some images where different snowpack conditions at different elevations are visible. This can be also as Annex. There has been some manuscript published at the Cryosphere related retrieval of snowpack live snow cover and snow depth with webcam images and also comparison done with manual and other automatic measurement sensors recently. It would be good to comment on those emergence technologies like webcams and drones on the retrieval of snowpack parameters.

Authors: We now added to the publicly available data on the Envidat repository webcam images showing some typical differences in the snow conditions at the 4 sites for two time periods (14 to 18 March 2019 and 27 January to 11 February 2020). Both time periods include a precipitation event with partial rain-on-snow occurring at the lower locations.
Due to the relatively low quality of the images and the large amount of data, we find it excessive to add all pictures to the Envidat database. However, we mention in the file description that further webcam images can be made available to people interested in doing further analysis.

We agree with the reviewer that in general, webcams and drones are capable to increase our knowledge on snowpack properties. However, with webcam images, we cannot derive the GNSS-based bulk snow cover properties (SWE, HS, LWC), and therefore think there is no need to describe these optical approaches in the manuscript. In the Introduction section, we already mention numerous novel technologies including also references on drone- and satellite-based snow height derivations (please refer to lines 39-44).

Comment 3:

Reviewer: There has been work on the retrieval of snow depth using satellites like Sentinel-1. This will enable to estimate snow water equivalent in higher resolution. I believe it would be good to make some comments on that especially in discussions and conclusion.

Authors: We agree, and in fact already do mention these recent developments in Sentinal-1 based HS retrieval in the Introduction section. In the revised manuscript, we now added two additional references:

- Lievenset al. , 2021. Sentinel-1 snow depth retrieval at sub-kilometer resolution over the European Alps. The Cryosphere Discussions, pp.1-25.
- Tsang et al., 2021 Review Article: Global Monitoring of Snow Water Equivalent using High Frequency Radar Remote Sensing, The Cryosphere Discuss., 2021, 1-57).

Following your suggestion, we now also mention the novel approaches in satellite-based retrieval of SWE in the Discussion, in section 6.2, lines 570-572.

Comment 4:

Reviewer: I also think that it would be very good to have a comparison/summary table where different methods/measurement versus different snowpack parameters / conditions are visible. This will highlight the position of GNSS-based retrievals on different snowpack parameters and at different snowpack conditions.

Authors: We considered your suggestion, but we think that the relevant data and statistics are already shown in the manuscript quite extensively. We already show the detailed comparison of GNSS-derived SWE and HS and reference measurements in Table 2 and 4. For LWC, however, the accuracy of the reference data is quite low, and data are obviously available just for wet-snow conditions. For the specific condition 'rain-on-snow events' the available data are not sufficient to calculate proper statists as already mentioned. As also mentioned in the manuscript, we would like to collect more data, especially during rain-on-snow events, to come up with solid statistics for such conditions.