We would like to thank the reviewer for the positive feedback and the useful comments.
Please find below our replies as inserted blue text.

Kind regards,
Nena Griessinger, Franziska Mohr and Tobias Jonas

Dear Editor, I have read carefully the paper from Griessinger et al., untitled "On measuring snow ablation rates in alpine terrain with a mobile GPR device", overall the paper is well written and easily understandable. The topic is very interesting and definitely have a strong interest for the scientific community. However some more precision needs to be added to this work, especially in term of GPR radargram quality, and snow density retrieved from GPR measurement. I would consider this paper for publication after major revision. I will be happy to re-read the corrected version.
General comments: Very interested study, very good experimental setup, very ingenious way to take measurement without affecting the snow compaction. My only concerns are related to your radargram quality and your way of retrieving the snow density/snow water equivalent from GPR:

- I think it would greatly ameliorate the paper by adding a radargram, and the picking of your reflection of interest.
Thank you for this suggestion, we will include a radargram with corresponding picks.

- I think it would greatly ameliorate the paper by explaining a bit more, how you did calibrated you GPR to infer SWE and Snow density, the paper of Gustafsson is a good example.
We will give more details on the calibration procedure in the methods section.

Other comments:
Page 2 Line 5: "Many applications of GPR to measure spatially distributed snow properties are generally conducted when dry snow conditions are present" Would that be helpful to the reader to define a bit dry snow conditions?
Bradford et al. (2009) give a classification of the wetness of snow. According to them, we define dry snow to have a volumetric water content of 0 %. We will clarify this in the manuscript.

"The sled was towed by two persons, one to the left and one to the right, so that it was not required to step on the transects." Very good
Thank you.

Page 4 line 4 "This way, the antennas were placed approximately 2 cm above the snow surface" Taking into account during the processing?

Yes, this offset was taken into account during the processing. We will add this information.

Page 4 line 7 "Traces were sampled at a frequency of 42 GHz, whereby individual traces were recorded every 5 cm along the transects." It would be helpful to know what was your time windows to have as well you time sampling, since you are looking at very fine velocity variations.

Recording was triggered using an odometer, so did not happen at fixed time intervals. Trace lengths were set to 744 samples per trace.

Page 4 line 8 "We used a MALA odometer to achieve the required high relative positioning accuracy" The wheel you have in your picture is made from Mala or handmade? Did you re-calibrate the odometer before each of your survey? Since the snow conditions can be different, the slippering of the wheel can be different.

Mala provides different types of odometers. For highest positioning accuracy, we used a hip chain odometer which measures the distance from a specialized thread that unwinds from a spool as the sled moves along the transect. This approach is independent of snow surface conditions and does not require recalibration before every survey. As a hip chain would not be visible in the image, we chose to present an image with a regular (custom-made) odometer wheel for illustration purposes. We will add this information to the manuscript.

Page 4 line 12 "Overpasses of exactly the same transects with the GPR were repeated several times during snowmelt periods without precipitation in between the measurements" From what I understand, you are passing on the same transect every time, what could you say about the impact of your repeated transect on the snow density?

Our fieldwork was carried out after clear, cold nights which guaranteed a crust on the snow surface (see Chapter 2.2). We are thus confident that we did not alter the snow density by the repeated measurements.

Page 4 line 21 " This required a snow pit which was dug sideways towards the center of the transect to minimize disturbances" Did you make a new one every-time you surveyed?

Yes, at every transect we dug a new snow pit for each survey because we expected the ablation rates to differ between a closed snow pack and a persisting snow pit due to radiation effects. We will clarify this.

Page 4 line 25 " First, a DC-shift was applied. This is a filter that removes an existing constant offset on each trace. Second, a gain filter was applied to amplify the signal as it attenuates within increasing travel time." Maybe would it be simpler to just say that you removed the lower frequency from the data, or "de-wowed"

them? Could you precise what was you gain applied? AGC, exponential ? And once again as already mentionned would be nice to see radargrams, before and after processing, and your picked reflection too?

We applied a manual y-gain filter where needed. The radargrams mostly showed a very clear signal so excessive filtering was not required. We will include an exemplary radargram to demonstrate this.

Page 4 line 27, " A Kirchhoff migration was further applied to all radargrams " You determined the velocity by the direct wave? from which Tx and Rx, the long or short spacing?

We used the snow pit data associated with the S3 transect to arrive at a radar velocity needed for the conversion within the migration procedure.

Page 5 Line 8, "Even if the two-way travel time is insensitive to potential errors in the direct wave velocity due to variable effects from the snow surface" Please could you rephrase, you are saying that it as no effect but since you are making a TWT calculation based on the direct wave it as effect, maybe you are implying that the impact of the near surface snow has no effect on the direct wave Travel Time, in this case, could you re-phrase in agreement with Line 5 and 6 of the same page?

Thank you, we will clarify the description.

Page 5 line 12, "Dielectric properties were estimated based on Tiuri et al. (1984)." Could you give a little bit more information on why you decided to use the model of Tiuri et al. ? In addition I think the paper is missing as little more complete explanation on the way you retrieved the SWE. I guess you used what was done in Gustavson et al., however the paper is missing your calibration parameter for the snow density (In Gustavson, page 4).

We compared the methods suggested by Frolov (Frolov at al., 1999), Tiuri (Tiuri et al., 1984) and Looyenga (Looyenga, 1965) and did not find considerable differences on the overall results. We used the parameterizations from Tiuri based on extended field tests at the Weissfluhjoch snow monitoring site (Davos Switzerland) by Koch et al. (2014). We agree that Section 2.3 should be extended, and we will provide more information in the updated manuscript.

Figure 4 -Can you please edits what are the points in the caption of the Figure.

The points display the position of the reference marker. Thank you, we will adapt the mentioned figure.

References:

Frolov, A. D. (1999). On dielectric properties of dry and wet snow. Hydrological processes, 13(12-13), 1755-1760.

Koch, F., Prasch, M., Schmid, L., Schweizer, J., & Mauser, W. (2014). Measuring snow liquid water content with low-cost GPS receivers. Sensors, 14(11), 20975-20999.

Looyenga, H. (1965). Dielectric constants of heterogeneous mixtures. Physica, 31(3), 401-406.

Tiuri, M., Sihvola, A., Nyfors, E., & Hallikaiken, M. (1984). The complex dielectric constant of snow at microwave frequencies. IEEE Journal of Oceanic Engineering, 9(5), 377-382.