

General

Lievens et al. (2019)'s work showed very good results for estimating snow, and had some debate in the snow community on why/how it works. This work is very valuable to verify the retrieval finding.

Major comments

The fact that they showed the results don't match well enough the LIDAR data is very important. However, the fact that the Hoppinen's snow depth results also differ from Lievens, is not a good sign and need to find the reason and maybe find A, B, C, they have used. On the other hand, I would like to see the same verification that Lievens did, i.e. comparing with in situ data. I think the authors can compare the estimated snow depth with WUS snow depth and see if they get the same results as Lievens or not. If they did not then it is safe that the results are not verified. If they do, it may be errors in LIDAR data in mountainous regions or something.

Here are some specific comments

Line 187: there should be more investigation of this much low correlation. I suspect even changing A, B, C parameters will change thing much.

Line 241/Figure 7: I think it is not a correct comparison, you need to use the S1 CR at in situ locations for comparing with measured snow depth

Figure 5: it is very misleading. The histograms should have the same normalized values. For instance, 5a blue and orange has almost the same maximum but blue is very narrow. I assume comparing mean and std of will give a better and more quantitative comparison. So, I suggest to generate the same plot for mean and std for different x-axis parameter. This way you can show the results for all sites in the same figure too.

Minor comments:

Line 61: "radar approaches are more directly related to SWE than depth" : the only radar approach that is directly related to SWE is InSAR whereas two frequency amplitude ones are related to snow depth. Need to correct this sentence.

Line 123: 2-6 days revisit for Sentinel-1 is too much. I guess it assumes both Sentinel-1 are on and making observation. We know that this is not the case everywhere and all the time. Need to fix this. Also it needs to be clarified if it used both ascending descending observations or just one direction.

Line 136: I am not sure what you did here. I assume you want to compensate the effect of incidence angle for overlaps. Could you please clarify what you exactly did here and how it is supposed to help you.

Line 189: remove extra data

Figure 2b x-axis should be snow depth, remove lidar

Figure 2b: it is not clear what dashed lines inside the histograms show.

Line 263: higher volume scattering and higher SNR: the SNR is not defined, and we suggest using another term, as SNR normally refers to radar received signal compared to received noise. I think you are using S and N with a different definition. If so, please use other term. Also, more volume scattering doesn't necessarily mean more depolarization, for instance for an isotropic volume it doesn't make it depolarized.

Line 284: need to provide a reference for east (more wind-deposit snow) and west (more direct solar radiation) facing comments.

Line 305: you need reference for this. I don't think orbital error/variation in ground/vegetation properties affect the "noise" (not snow backscattered power). Normally speckle noise is the part that gets improved by taking looks.

Line 352: remove extra be

Line 365 a should be an