Review of paper by Mallet et al.

General Comments:

This brief communication focuses on two topics.

The first topic discusses the calculation of path length deviations (δ_p), in a snow layer of thickness, h_s, using the following equations:

$$\delta_p = h_s(1-\frac{c_s}{c}) \qquad (1)$$

$$\delta_p = h_s(\frac{c}{c_s}-1) \qquad (2)$$

where c and c_s are the speed of light in vacuo and speed of light in snow with a given bulk density. Equation (2), in the manuscript, is the proper way to calculate the simple quantity. Equation (1) was first introduced in Section 3b of *Kwok and Cunningham* [2015] – a transcription error – and corrected in subsequently publications that utilizes path length calculations: see *Kwok and Markus* [2017] and *Kwok and Kacimi* [2018].

While it is useful (for the community) to note the impact of using Equation (1), the reviewer (and author of *Kwok and Cunningham* [2015]) feels and requests that– if this article were to be published – it should be noted that the equations are correctly written in the subsequent publications listed above. Even though the induced errors are small, this brief communication should be useful to readers who were not aware of this error.

The second topic has to do with the impact of thickness retrievals from freeboard using a fixed bulk snow density rathan than a seasonally variable snow density (or simple densification over time in this case) on retrievals. The comparisons in thickness differences (and therefore growth rates) using the variable densities are interesting and useful illustrations, especially the separate analyses of first-year and multi-year ice. The authors neglected, however, to note that *Kwok and Cunningham* [2008] first discussed seasonally varying snow density, and have used a modified seasonally varying snow density model in all of their freeboard and thickness calculations from ICESat [*Kwok et al.*, 2009] and CryoSat-2 [*Kwok and Cunningham*, 2015] data sets. It is appreciated that the authors note that varying densities, though far from perfect, have been discussed though not in the same manner as that here, and are being used in thickness calculations.

I have no problem with the publication of this brief note after the minor revisions requested.

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References

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Kwok, R., and T. Markus (2017), Potential basin-scale estimates of Arctic snow depth with sea ice freeboards from CryoSat-2 and ICESat-2: An exploratory analysis, *Adv. Space Res.*, doi:10.1016/j.asr.2017.09.007.