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Interactive comment on "Brief Communication: Conventional assumptions involving the speed of radar waves in snow introduce systematic underestimates to sea ice thickness and seasonal growth rate estimates" *by* Robbie D. C. Mallett et al.

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Review of "Brief Communication: Conventional assumptions involving the speed of radar waves in snow introduce systematic underestimates to sea ice thickness and seasonal growth rate estimates" by Mallett et al.

General comments

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Discussion paper

The MS is a welcome contribution to the ongoing discussion of uncertainties in sea ice thickness estimates derived from satellite radar altimeter freeboards. Several groups are processing radar altimeter data for sea ice thickness using different procedures. However, the list of systematic uncertainties which are not or only partly corrected for in the estimation of ice thickness is long because the variables that we need for correction are not well constrained, e.g. snow depth, density, surface roughness, salinity, snow grain size and ice density, roughness, the water density (Tonboe et al., 2010; Nandan et al., 2017; Alexandrov et al., 2010). The sub-footprint spatial distribution of height and backscatter on the sea-ice floe leading to preferential sampling is also important (Tonboe et al., 2010). Some of these variables such as the snow depth is affecting the radar scattering horizon and the snow-ice interface in opposite directions so that the correction for one and not the other may lead to even larger errors than doing nothing. Here I see the correction of the range for the propagation speed of microwaves in the snow to be related to the scattering horizon depth variability.

However, the magnitude of the range correction described in this MS is probably over-estimated because there is evidence that the scattering horizon is not synonymous with the snow ice interface (Armitage and Ridout, 2015). The scattering horizon is more likely within the snowpack also on first-year ice because the first-year ice snow cover may be saline thus preventing penetration into the bottom snowpack (Nandan et al., 2017). I think that a short discussion of that should be included. Also today's snow depth compared to the modified Warren climatology which is used for estimating the magnitude of the range correction should be included in the discussion.

Specific comments

P1, L3: This implies that that the scattering horizon is synonymous with the snow-ice interface. However there is evidence that the scattering horizon is above the snow ice interface especially if the snow is saline. This depth (scat. horiz.) is not well known, so how to apply the correction? P1,L6: "winter ice" is sometimes synonymous with "first-year ice", move "in winter" to the end of the sentence to avoid confusion. P1, L18:

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less snow gives more potential for ice growth, increasing temperatures the opposite. This sentence is contradicting. P6, L135:The NP is normally not covered by satellites and so it is not a good spot for comparison or verification. P10, L197: How do you know the depth of penetration?

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