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Interactive comment on "Brief Communication: Ice Sheet Elevation Measurements from the Sentinel-3A / 3B Tandem Phase" *by* Malcolm McMillan et al.

Anonymous Referee #1

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This "Brief Communication" paper follows validations of the Sentinel-3 over Antarctic performed by McMillan et al. (2019). It uses observation data of the tandem phase of S3A and S3B to cross-check both missions. The study is well structured, very focused and nicely illustrated. It summarizes that there are no significant differences between S3A and S3B. In principle I agree with that statement, however, some of the analysis made do not totally convince me. In Sect. 3 I would have expected some more data being analyzed and in Sect. 5 I miss the numeric results that prove the statements made. Before publication, I suggest some modifications of the analyses as described below.

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Discussion paper

Specific comments:

l.38 If the across-track control range is ±1km, why are the shots co-located within ∼150m?

l.62 I think it is well known that surface topography is a major factor for conventional pulse-limited waveforms and the repeat measurements are supposed to match very well (especially in absence of other factors as temporal changes in surface properties or track orientation). Nevertheless, this comparison is very important to show how well the Doppler-stacking works in complex terrain. However, in my opinion, such an investigation should include a larger amount of data, not only 8 waveform examples of one track. As you have tandem data for more than one cycle, could you maybe find a quantity for "how well the waveforms of S3A and S3B match" (as maybe a correlation coefficient) and show this quantity on a larger scale (maybe even all over Antarctica)? This would prove that the stacking is reliable all over the ice sheet, not only for this specific location of this track. It would be also very interesting if there are places (e.g. in mountainous terrain) where the waveforms do not match.

Fig. 2a) I suggest using a color with more contrast for the track.

l.82 If I understand that right, this assessment combined all measurements from S3A and S3B (of the selected track) to calculate a mean elevation profile and then compared the measurements of each mission separately to that mean profile. This, however, would include a possible small offset between the missions as well and interpret it as random measurement noise. I suggest to do this assessment for the 3 tracks of each satellite separately. This allows to compare the precision of each mission and could also identify a possible offset in comparing the mean profiles.

l.93 Could you provide some numeric results for the non significant differences? This would be an important quantity for an estimation of how significant obtained results could be. Moreover, I understand that this "Brief Communication" is just an update to McMillan et al. 2019 and that the investigation should, therefore, be similar to

this paper. However, the only accuracy result shown here is a single OIB-profile from 2013 as a reference. In McMillan et al. 2019 this profile (I guess it is the same at Dome-C) is the only reference which is studied in the interior (only) and provides a standard deviation below several meters. How well is this profile itself quality checked? For Lake Vostok, there exists a wealth of independent in situ GNSS profiles (https://tc.copernicus.org/articles/11/1111/2017/), covering several years and cross-controlled at many crossover locations. I suggest considering these profiles for such an accuracy assessment.

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