We thank the reviewer for the helpful feedback, these suggestions have significantly improved the text and figures, we are appreciative of the help and time.

We have addressed all the comments here, point by point responses to the comments are listed in BLUE.

Here we summarize the major revision in the revised manuscript:

According to the reviewers, additional filters (a 3-standard-deviation filter and a median filter) have been applied in the generated DEM to improve the DEM performance. The new DEM was also evaluated by comparing to the OIB and GNSS data, similar performances can be found (as listed in the Tables below). In particular, to account for the temporal difference between the DEM and OIB/GNSS data, when performing the comparisons we adjusted the ICESat-2 DEM elevations for the surface elevation changes between the acquisition periods of these two data. The adjustments were calculated by using the trend values derived from Smith et al. (2020) and we assumed the constant elevation change rates, these were applied for the DEM values in the locations of OIB/GNSS measurements. The related text, figures and tables have been accordingly revised, the same conclusions are derived.

The updated DEM map (including uncertainty map) can be downloaded from Google drive at https://drive.google.com/drive/folders/1h0-QxAkjGMSc-eqlBBigiqvgp0k-8iIB?usp=sharing at this stage, and we will replace the previous revision in the data storage (i.e., National Tibetan Plateau Data Center, Institute of Tibetan Plateau Research, Chinese Academy of Sciences) after the manuscript revision.

Table 4 (previous Table 3). Comparisons between the ICESat-2 DEM and OIB airborne elevation measurements (including data in areas of low elevation change from 2009 to 2017 and data in the Antarctica from 2018 to 2019) in observed and interpolated areas for individual regions (i.e., the ice sheet and ice shelves). MeD: median deviation, MeAD: median absolute deviation, SD: standard deviation, RMSD: root-mean-square deviation.

	Region	MeD (m)	MeAD (m)	SD (m)	RMSD (m)	Number of used OIB measurement points
Observed	Ice sheet	-0.17	1.21	9.25	9.26	3589087
	Ice shelves	0.59	2.53	14.07	14.09	191754
	Total	-0.15	1.26	9.56	9.57	3780841
Interpolated	Ice sheet	-0.52	2.63	13.30	13.36	1237416
	Ice shelves	0.44	3.00	15.16	15.21	185613
	Total	-0.41	2.67	13.58	13.62	1423029
Overall	Ice sheet	-0.22	1.47	10.44	10.47	4826503
	Ice shelves	0.53	2.75	14.62	14.65	377367
	Total	-0.19	1.54	10.81	10.83	5203870

Table 7 (previous Table 6). Comparisons between the ICESat-2 DEM, ICESat DEM, ICESat/ERS-1 DEM, Helm CryoSat-2 DEM, Slater CryoSat-2 DEM, REMA DEM, TanDEM PolarDEM and

GNSS elevation data in areas of low elevation change from 2001 to 2015.

	MeD (m)	MeAD (m)	SD (m)	RMSD (m)	Number of used GNSS measurement points
ICESat-2 DEM	0.02	0.50	1.59	1.60	
ICESat DEM	-3.79	4.30	10.99	13.10	
ICESat/ERS-1 DEM	-0.75	1.02	2.22	2.32	
Helm CryoSat-2 DEM	0.16	0.89	2.84	2.92	488963
Slater CryoSat-2 DEM	-0.12	0.61	2.41	2.43	
REMA DEM	0.06	0.30	0.78	0.78	
TanDEM PolarDEM	-4.03	4.03	1.52	4.34	

First of all, I would suggest a different paper title to reflect the scope of the ESSD, e.g. "A new digital elevation model (DEM) dataset of the entire Antarctica continent derived from ICESat-2"

Agree and accept.

This manuscript provides an Antarctic DEM data set based on NASA's new generation of ICESat-2 altimeter. The authors applied the spatiotemporal fitting method, so the data set covers both the ice sheet and ice shelves. This is not the first manuscript to tackle the DEM data set for the Antarctic. Nevertheless, the authors have demonstrated their product and evaluated it using the OIB and GNSS data under various surface conditions. As far as I understood, the ICESat-2-derived Antarctic DEM is not available. Considering the high-resolution and accurate measurements of ICESat-2, I expect this dataset could be valuable for Antarctic glacier research. For this reason, I would like to see this paper to be published.

In general, this paper is well written, and the structure is clear and easy to follow. It is an interesting topic and is worth to be published as ICESat-2 provides elevation measurements in much higher spatial-temporal resolutions. One weak point I can tell is that the authors provide just a 1-year data set. On the other hand, think of the entire Antarctic domain, one year data set is already quite comprehensive, in particular, authors have claimed that they can provide annual data sets in a sustainable way meaning the data set can be accumulated on an annual base.

Thank you very much for your positive feedback and advice.

I think the conclusion is rather short, I would like to see recommendations that authors could point out, e.g., a number of potential applications applying this data set or the forthcoming new DEM data sets generated by the methodology authors have applied. This improvement would strengthen this data paper.

Accept. One paragraph has been added in the Section Conclusions to point out the potential applications of our data set:'… *Here thirteen-months of ICESat-2 data are used to generate the Antarctic DEM and the evaluation result shows that the corresponding DEM is reasonable and valid. This means that the ICESat-2 DEM can be provided in a sustainable way, i.e., this DEM can be* *updated annually and thus accumulated on an annual base. Additionally, reasonable elevation-change rates can also be obtained when deriving the DEM. The combination of the derived DEMs and elevation-change rates can be further used for the references of fieldwork planning, ice motion tracking, numerical modelling of ice sheet and the mass balance estimation. More importantly, this data can be provided on an annual based, which has large application potential for Antarctic research especially under the warm climate.*'.

Some specific comments I hope authors may find useful:

Abstract: "Antarctic digital elevation models (DEMs) data sets are essential,,,"; "human fieldwork", is there any nonhuman fieldwork?

This has been changed to '… are essential for ~~human~~ fieldwork'.

Introduction: P3, L80: Do you apply any other quality control criteria than what you have mentioned here?

No, we only used the data quality flag in ATL06 data (i.e., the surface signal confidence metric) to filter the data with bad quality. Besides, a series of quality control criteria were applied for the DEM estimation, as shown in Table 2.

P3, L84: "Although the signal energies of strong and weak beams are different, all six beams provide centimetre-scale elevation measurements, and the biases of two beams in one pair are less than 2 cm (Brunt et al., 2019) and 5 cm (Shen et al., 2021) for flat and steep surfaces. Thus, the effect of elevations estimated from weak beams is negligible" Not very clear text, please explain more in detail.

We have revised this sentence to make a clear expression: '*Although the signal energies of strong and weak beams are different, all six beams provide centimetre-scale elevation measurements, and the biases of two beams in one pair* ***are less than 2 cm (Brunt et al., 2019) for flat regions and 5 cm (Shen et al., 2021) for steep surfaces****. Thus, the effect of elevations estimated from weak beams is negligible*'.

P4, L92: "Icessn" ?

IceBridge ATM L2 Icessn elevation, slope and roughness (V002) product (Studinger et al., 2014) is used here for DEM evaluation. According to Studinger et al. (2014), '… *the fundamental form of ATM topography data is a sequence of laser footprint locations acquired in a swath along the aircraft flight track. The* ***icessn program*** *condenses the ATM surface elevation measurements by fitting a plane to blocks of points selected at regular intervals along track and several across track. …*'.
Here, Icessn is a terminology.

Reference:

Studinger, M.: IceBridge ATM L2 Icessn Elevation, Slope, and Roughness, version 2. Boulder, Colorado USA: National Snow and Ice Data Center, Digital media, https://doi.org/10.5067/CPRXXK3F39RV, 2014.

P4, L95: What do you mean by 'the effect of interannual changes' here?

It means ***the effect of interannual changes of surface elevations***, and we have revised this in the revised manuscript.

P6, L137: this model-fitting method has been used in other papers (e.g., Slater et al., 2018). They have produced multi-annual data, while in this paper you have made just one year of data. Can you point out the differentiation between your work and theirs, e.g., does the length of data processing matter?

The method in Slater et al. (2018) was used here to generate the DEM from ICESat-2 data, both the elevation measurement data were used (CryoSat-2 in Slater et al. (2018) and ICESat-2 in this study). Additionally, as the CryoSat-2 radar signals may penetrate the snow layer, the elevation measurements from ICESat-2 tend to have less uncertainty than those from CryoSat-2 and hence ICESat-2 is expected to have better performance. However, we also notice the difference in the length of data in these two studies. We agree that the spatio-temporal fitting method may be more appropriate for longer time series of altimeter data. However, if this method can still separate temporal elevation changes with just one year of data, it still can be used for DEM generation. Hereafter we provide the map of elevation change rate estimated from this study, we also provide the estimation result from 2003 to 2019 in Smith et al. (2020) for a comparison. Overall, considering the time difference similar elevation change patterns can be found between the two figures. For example, larger elevation decreases can be found in the margin of West Antarctica, obvious elevation increases can be found in the interior of West Antarctica (red cycles in the figure). The elevation change pattern based on one-year ICESat-2 data is reasonable, which indicates that one year of data can give a reliable elevation change map and the elevation estimation is thus reliable. This may due to the much higher measurements density and accuracy of ICESat-2 than previous altimeters. In addition, ICESat-2 DEM has a comparable performance to other DEMs by comparing to the same airborne and GNSS data sets, which also proves the feasibility of the data and method.

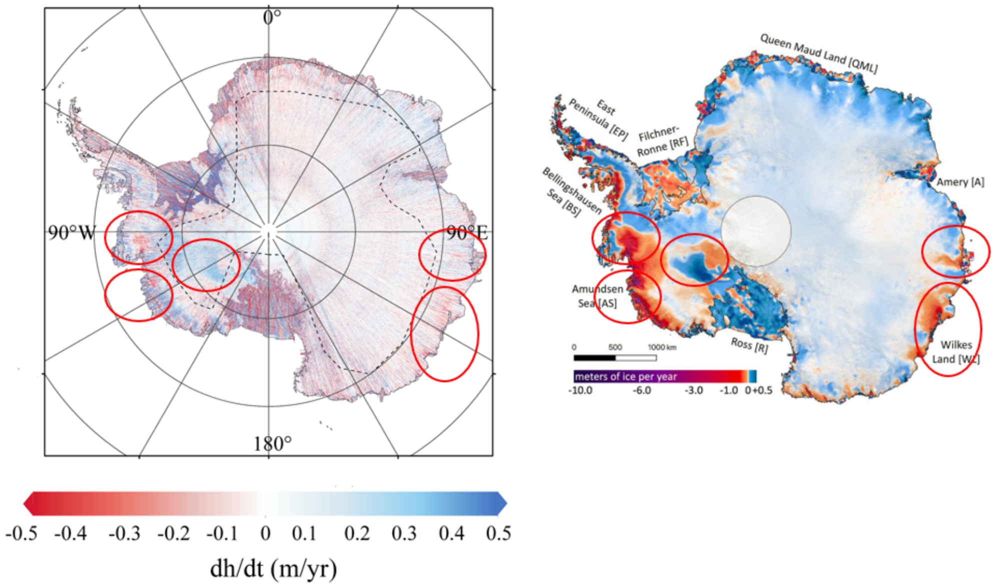


Figure. Map of elevation change rate in Antarctica derived from one year of ICESat-2 data in this study (left) and map of elevation change rate in Antarctica from 2003 to 2019 in Smith et al. (2020) (right).

One-year of satellite altimeter data have also been used to generate the DEM for Antarctica in previous studies. In Helm et al. (2014), one-year of CryoSat-2 data were used for the DEM generation. The DEM is in the spatial resolution of 1 km and the gaps were filled by using the ordinary kriging interpolation (also a series of processing scheme was included), a quite good performance can be found when comparing to the ICESat elevation data. ICESat-2 has much denser and larger coverage than CryoSat-2, hence it is also reasonable to derive the Antarctic DEM by using one-year of ICESat-2 data considering the performance of one-year CryoSat-2 data. In addition, approximately 4.69×10^9 ICESat-2 measurement points from November 2018 to November 2019 were used in this study, while 2.5×10^8 CryoSat-2 measurement points from July 2010 to July 2016 were used in Salter et al. (2018). Considering this, although only one year of ICESat-2 data were used the data density is still larger than seven years of CryoSat-2 data.

Considering the data density/coverage, method performance and DEM accuracy, the DEM generated by using spatio-temporal fitting method from one-year of ICESat-2 data is still reasonable and reliable.

The related statements above have also been added into the revised manuscript (i.e., subsection 2.4.1):
'…*Additionally, the performance of the surface fit method also depends on the timespan of the input data, that is to say, it should be noted that whether one-year of ICESat-2 data can be used to obtain a satisfied fitting performance. Here we find that the elevation-change rate map based on one-year ICESat-2 data (i.e., a_5 in Eq.1) has a similar pattern with that from Smith et al. (2020), which estimated the elevation-change rate from 2003 to 2019 based on ICESat and ICESat-2 data, indicating that one-year of data can also provide the reasonable elevation change rates and thus the surface fit method used here is reliable.*'

In addition, in Section 4 we also add a paragraph to point out the differentiation between our work and other studies:

'… *Comparing to other DEMs, elevation change rate can be obtained when deriving the ICESat-2 DEM, which provides an additional reference for ice topography and mass balance estimation. Additionally, in previous studies several years of altimeter data are needed to derive the DEM in Antarctica. Due to the high-density measurements of ICESat-2, 13 months of ICESat-2 data can be used to generate a DEM for Antarctica and the performance is comparable to other DEMs, indicating that the ICESat-2 DEM can be updated annually. This study demonstrates the feasibility and reliability of using one-year ICESat-2 data to derive the Antarctic DEM, provides a reference for the processing scheme of DEM (e.g., in higher resolution, regularly updated) based on ICESat-2 in future.*'.

References:

Smith B, Fricker H A, Gardner A S, et al. Pervasive ice sheet mass loss reflects competing ocean and atmosphere processes. Science, 2020, 368(6496): 1239-1242.

Slater T, Shepherd A, McMillan M, et al. A new digital elevation model of Antarctica derived from CryoSat-2 altimetry. The Cryosphere, 2018, 12(4): 1551-1562.

Helm, V., Humbert, A., and Miller, H.: Elevation and elevation change of Greenland and Antarctica derived from CryoSat-2, The Cryosphere, 8, 1539-1559, https://doi.org/ 10.5194/tc-8-1539-2014, 2014.

Additionally, considering the higher coverage and spatial resolution of ICESat-2, applying a fitting model to ICESat-2 will resolve its finer observations which are not obtained by other satellite altimeters. Can you try to make use of all ICESat-2 data and apply the kriging interpolation directly, in this way you may obtain a more detailed and accurate elevation map, due to the higher resolution and accurate measurements of ICESat-2? The Authors should clearly state why this estimation method is suitable for ICESat-2 data.

A model fitting method used here is to separate the various contributions to the estimated elevations within each grid cell (Flament and Remy, 2012; McMillan et al., 2014), including local surface terrain and elevation change. This function is fitted in each grid cell by using an iterative least-squares fit to all the elevation measurements to minimize the impact of outliers. A quality control criterion is also used to reduce the effect of any poor fit. This method suits ICESat-2 orbit cycle, which samples dense ground tracks comparing to previous satellite radar altimeters, more measurement points are included in the grid cell and the estimated elevations are more robust. The resolutions of grid cells (i.e., 500 m and 1 km) are appropriate for the used ICESat-2 data in this study. Firstly, most elevations (72%) can be directly estimated based on this method. Secondly, it is possible for a quadratic form to model the topography at these scales and smaller elevation residuals can be found than using a simple linear fit (Flament and Remy, 2012).

Approximately 4.69×10^9 ICESat-2 measurement points are used for elevation estimation in this study, which has a coverage of 18% for the Antarctica. The direct application of kriging interpolation based on all valid measurements means the 72% elevations are estimated from interpolation. As the evaluation results shown in this study and also Slater et al. (2018), the bias of observed elevations is obviously smaller than that of interpolated elevations, hence the interpolation ratio should be reduced as possible. The model fitting method considers the various contributions to the estimated elevations by including all data acquired within each region, the interpolation ratio is reduced and the derived elevations can represent the elevation in each region well. In addition, model fitting method can provide the estimation of elevation change rate, and the estimate agrees well with accurate elevation change estimations from crossover-point method (Moholdt et al., 2010), which provides an addition reference for the research of ice dynamics and mass balance.

The map for the elevation-change rate (a_5) can also prove the reliability of the method, as shown in the comment above.

The above discussions have been listed in the manuscript (see subsections 2.4.1 and 2.4.2).

References:
Moholdt G, Nuth C, Hagen J O, et al. Recent elevation changes of Svalbard glaciers derived from ICESat laser altimetry. Remote Sensing of Environment, 2010, 114(11): 2756-2767.
Flament T, Rémy F. Dynamic thinning of Antarctic glaciers from along-track repeat radar altimetry. Journal of Glaciology, 2012, 58(211): 830-840.
McMillan M, Shepherd A, Sundal A, et al. Increased ice losses from Antarctica detected by CryoSat-2. Geophysical Research Letters, 2014, 41(11): 3899-3905.
Slater T, Shepherd A, McMillan M, et al. A new digital elevation model of Antarctica derived from CryoSat-2 altimetry. The Cryosphere, 2018, 12(4): 1551-1562.

P6, L144: I would like to see a figure for elevation change rate (a5), which can be used to evaluate the method performance. In addition, I have some concerns if one year of data is enough to estimate a reliable elevation change. Could you please provide the elevation change rate map (a5) to see if the method makes sense?

The figure for elevation change rate (a_5) and reasons why one-year of ICESat-2 data can still obtain reliable result have been listed in the comments above.

The related discussion has also been added in the Section 2.4.1:
'*… Additionally, the performance of the model fitting method also depends on the amount of the input data, that is to say, it should be noted that whether one-year of ICESat-2 data can be used to obtain a satisfied fitting performance. Here we find that the elevation-change rate map based on one-year ICESat-2 data (i.e., a_5 in Eq.1) has a similar pattern with that from Smith et al. (2020), which estimated the elevation-change rate from 2003 to 2019 based on ICESat and ICESat-2 data, indicating that one-year of data can also provide the reasonable elevation change rates and thus the surface fit method used here is reliable.*'.

P8, L185- 195: please explain clearly among those resolution numbers, What exactly number you have finally applied and why?

We have explained it in the subsection 2.4.2: '*The detailed variations in the spatial coverages of* *observed grid cells at different latitudes at variable spatial resolutions (250 m, 500 m and 1 km, which are usually applied in the Antarctic DEM) are shown in Fig. 4a. 500 m is a reliable grid size which makes denser spatial coverage of the observed elevations, but a single resolution cannot obtain ideal spatial coverage, especially in low-latitude areas. To increase the coverages of observed elevations as much as possible, referring to Slater et al. (2018), two spatial resolutions are used to estimate the surface elevations from ICESat-2.* ***That is, elevations are estimated at resolutions of 500 m and 1 km. The observation gaps in the 500 m DEM are filled by the resampled 1 km DEMs (resampled to the 500 m DEM). The addition of DEMs at 1 km greatly increases the observation coverage, the overall spatial coverage is approximately 74%, and the remaining gaps are filled using ordinary kriging interpolation.***'.

P9, L218: why do you use this method, why don't you resample the OIB to the DEM data and calculate the difference and its statistics?

The method (calculating a median or mean OIB elevation for each DEM grid cell) will certainly influence the evaluation results as the DEMs (including previously published DEMs) have different spatial resolutions. Additionally, OIB is the reference elevation and cannot be replaced by the median or mean values, because by calculating a median for each grid cell we assumed that the surface in the grid cell is flat, while in the Eq. 1 we assumed a quadratic surface.

The reason for the choice of this method has been added in the revised text (see subsection 2.4.3): '… *ICESat-2 DEM and previously published DEMs are resampled to the OIB/GNSS data locations and calculate the difference for evaluation,* ***to reduce the effect of resolution differences between various DEMs.***'.

Table 3: your uncertainty map shows values of < 2m, in this Table an SD of 15 m can be found, which means that the uncertainty map may not represent this, can you explain this? Additionally, the predicted uncertainty (i.e., uncertainty map) with the actual uncertainty (comparison with OIB and GNSS data) should be compared and discussed.

According to the Reviewer, we estimated the ICESat-2 DEM uncertainty based on another method, which is introduced in the below. The related comparisons and discussion about the predicted uncertainty and actual uncertainty has been revised in the Section 3.2:
'*Additionally, by comparing to the OIB or GNSS elevation data, we can estimate the actual ICESat-2 DEM uncertainty as the SD of the differences to OIB or GNSS elevation data. In the estimated uncertainty map (Fig. 5b), a median value of 5.84 ± 5.29 m can be found. The SD of differences to OIB data which obtained in the large scale shows a value of 10.44 m (Table 4, including plenty of measurements in ice sheet margin), while in the ice sheet interior a value of 3.26 m is found (Table 6). Considering the data coverage and surface-slope difference, the estimated uncertainty values can represent the SDs from what is given as OIB, which means that the provided uncertainty estimates are reliable. Small SD value of 1.59 m can be found when comparing to the GNSS data (Table 7) which were obtained in the regions of low slope, this may due to the resolution and measurement accuracy differences between airborne and GNSS data, hence the ICESat-2 DEM uncertainty map may be slightly overestimated and can be assumed as the upper limit.*'.

DEM uncertainties are calculated based on the approach in Helm et al. (2014). The OIB elevation data are used as the reference and the elevation differences due to the time difference between OIB data and DEM are corrected based on the elevation-change rate from Smith et al. (2020). The DEM uncertainty is then calculated from surface slope, roughness, number of the used data points (N) and its elevation standard deviation (SD). Due to the method difference we calculate the DEM uncertainty for observed and interpolated grid cells respectively. The surface slope and roughness are directly derived from the ICESat-2 DEM, the slope in one grid cell is derived as the maximum rate of change in elevation from that cell to its eight neighbors, the roughness is derived from the elevation difference between DEM and the smoothed DEM (by applying a 3 by 3 median filter). For observed grid cells, N is the number of the data points in each grid cell used for elevation estimation; for interpolated grid cells, N is derived by counting all data points within a search radius of 10 km, which is the radius used for elevation interpolation. SD is the standard deviation of elevations of these data points. The differences between DEM and OIB elevations are calculated and firstly binned w.r.t surface slope. The slope is divided into 200 bins with an interval of 0.01° (from 0 to 2°), the median and standard deviation are calculated for each bin. This processing method is also applied for other three parameters, an interval of 0.05 m for surface roughness, 250/500 (observed/interpolated grid cells) for N and 0.25 m for SD. For each distribution a 2-order polynomial is fitted by using the different standard deviations of the elevation differences for each bin. The corresponding coefficients are listed in Table 3. This kind of polynomial order ensure a good and robust fitting performance, including for the small elevation differences in flat regions. Finally, the DEM uncertainty is calculated as follows:

$$u = \sum_{i=1}^{4} w_i u_i$$

$$w_i = \frac{1}{s_i \sum_{i=1}^{4} \frac{1}{s_i}}$$

$$s_i = \frac{\sigma_i}{\sum_{i=1}^{4} \sigma_i}$$

$$u_i = b_{i1} x^2 + b_{i2} x + b_{i3}$$

Where u is the DEM uncertainty, w_i is the weighting factor and u_i is the uncertainty for each uncertainty source. s_i is the scaling factor and σ is standard deviation of the difference between data and the polynomial fit. $b_{i\,0\text{-}3}$ are the coefficients for each polynomial fit (as listed in Table 3). When deriving the ICESat-2 DEM uncertainty estimation, the uncertainty from ICESat-2 measurements is not considered because the effect of ICESat-2 measurement bias is limited (< 5 cm, Brunt et al., 2019; < 14 cm, Shen et al., 2021).

Table 3. The fitting coefficients and weights used for the DEM uncertainty estimation

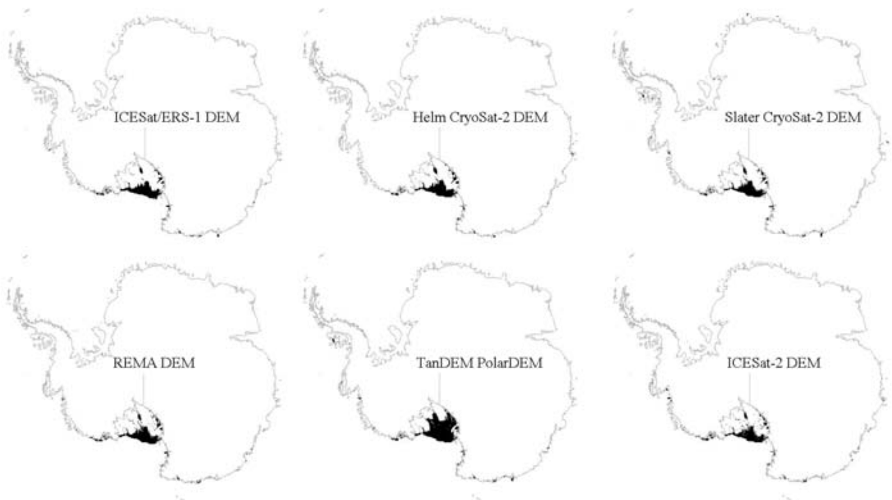
	Coefficient	Slope	Roughness	N	SD

Observed	b_1	0.13	-0.02	-1.53×10^{-9}	-0.01
	b_2	6.20	0.90	-5.02×10^{-5}	0.42
	b_3	3.37	4.37	12.13	4.85
	Weights	0.45	0.41	0.05	0.09
Interpolated	b_1	0.38	-0.02	2.96×10^{-9}	-4.98×10^{-3}
	b_2	5.04	0.76	-3.60×10^{-4}	0.30
	b_3	5.13	6.56	17.50	7.55
	Weights	0.49	0.37	0.06	0.08

Figure 7: I found some negative values in your DEM map in the boundary of ice shelves, can you explain them?

Negative elevation values are common for Ross ice shelf, these are also found in other DEMs, such as ICESat/ERS-1 DEM, Helm CryoSat-2 DEM, Slater CryoSat-2 DEM, REMA DEM and TanDEM PolarDEM (ICESat DEM does not have negative values, all its values ≥ 0). Here we show the spatial distributions of negative elevation values in six DEMs (in black, as shown in the figure below), the extents and distributions are overall matched well.

One sentence about the negative values in DEM is also added in Section 3.1 in the revised text: '…*Negative elevations can be found in the ice shelves, especially in the Ross Ice Shelf.*'.



P13, L268: Can you prove more evidence here to clarify why ice sheet elevations are more accurate than those estimated for ice shelves.

In order to find the explanation, we present the histograms of surface slope and roughness values (derived from OIB data) for ice sheet and ice shelves in below:

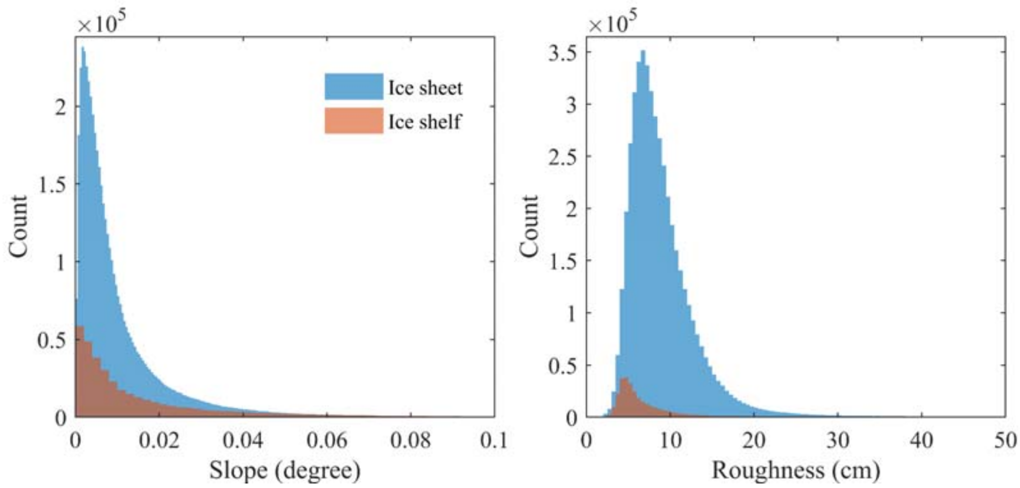


Figure. Histograms of the OIB-derived surface slope and roughness values for ice sheet and ice shelves.

As we can found in this figure, observed ice shelves have overall smaller surface roughness than ice sheet, but have a larger percentage of high-slope areas than ice sheet. For example, approximately 70% of the OIB measurement points which covered ice sheet have slope values of < 0.01°. In comparison, approximately 50% of the OIB measurement points which located in ice shelves have slope values of < 0.01°. Hence, observed ice shelves have a higher percentage of high-slope areas, which may cause larger elevation biases. To test this argument, standardized regression coefficients between surface slope/roughness and the elevation difference (i.e., mean absolute difference between ICESat-2 DEM and OIB elevations) are calculated here by using a multivariate linear regression model (this model is fitted by using an iterative least-squares fit). All OIB data in 2018 and 2019 are used. Standardized values of surface slope, roughness and elevation difference are used for a valid comparison. The regression coefficients for surface slope and roughness are 0.18 and -0.01. Larger regression coefficient indicates that the surface slope has greater effect on elevation difference than roughness. Hence, although ice shelves observed by OIB data have smaller surface roughness than ice sheet, a higher percentage of high-slope areas makes ice shelves have a slight worse DEM performance. This discussion has also been mentioned in Section 3.2: '*Ice sheet elevations are more accurate than those estimated for ice shelves, **which may due to a higher percentage of high-slope areas in ice shelves observed by OIB data than in ice sheet.***'.

Figure 9: I noticed that OIB elevations are near> 0 while your DEM has some elevations even less than -200 m, can you explain this?

Negative elevation values are common and these are also found in other DEMs, such as ICESat/ERS-1 DEM, Helm CryoSat-2 DEM, Slater CryoSat-2 DEM, REMA DEM and TanDEM PolarDEM (ICESat DEM does not have negative values, all its values ≥ 0). One sentence about the negative values in DEM is also added in Section 3.1 in the revised text: '*Negative elevations can be found in the ice shelves, especially in the Ross Ice Shelf.*'.

In the revised manuscript, to remove additional elevation outliers a 3-standard-deviation filter and a median filter were applied to the DEM, the generated DEM has been reevaluated based on the

OIB and GNSS data, this figure has also been changed and the results are more reasonable (without smaller negative elevation values).

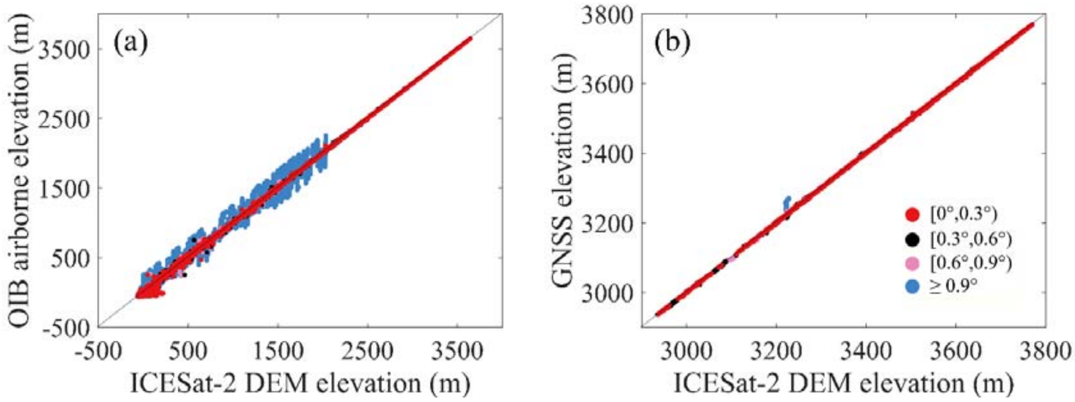


Figure 9. Scatter plots of ICESat-2 DEM elevation and OIB airborne elevation (a) and GNSS elevation (b), respectively. The surface slopes are distinguished in different colours, as shown in the figure legend.

Table 5: why the number of used OIB measurement points in this table is different from that in Table 4.

Here OIB airborne elevation measurements in areas of low elevation change from 2009 to 2019 were used, while in Table 4 (now Table 5 in the revised text) OIB airborne elevation measurements in areas of low elevation change from 2009 to 2017 and in the whole Antarctica from 2018 to 2019 were used.

Table 5: here you compared the other DEM and your DEM to OIB data, as the same OIB data were used, but the timestamps of DEMs are different, do you consider this effect or how to reduce it?

Yes, we have considered this effect as listed in Section 2.2 in the previous manuscript, OIB and GNSS data in the low elevation-change areas and OIB data with small time-difference (< one year) comparing to ICESat-2 DEM are used for DEM evaluation. However, the effect of time difference between the DEM and evaluation data still needs to be considered. In the revised manuscript, we adjust the changes of ICESat-2 DEM elevation values which occur during the time difference between these two data by using the trend values derived from Smith et al. (2020) and we assume the constant elevation change rates, the corresponding adjustments are then calculated and applied for ICESat-2 DEM in the locations of OIB/GNSS measurements. The related text, figures and tables have been revised, the same conclusions are derived (as shown in the very beginning).

This part has been added in Section 2.2 in the revised text: '*Although OIB and GNSS data in the low elevation-change areas and OIB data with small time-difference (< one year) comparing to ICESat-2 DEM are used for DEM evaluation, the effect of time difference between the DEM and evaluation data still needs to be considered. Here, we adjust the changes of ICESat-2 DEM elevation values which occur during the time difference between these two data, the trend values are derived from Smith et al. (2020) and we assume the constant elevation change rates, the corresponding* *adjustments are calculated and applied for the DEM values in the locations of OIB/GNSS measurements before comparisons.*'.

P19, L385: Again, please provide an elevation change rate map to evaluate the elevation estimation performance.

This has been responded in the comment above.

Please make a revision of the manuscript accordingly, I recommend this manuscript be considered as an ESSD publication after a revision.

Thank you for your recommendation, we have revised the manuscript accordingly based on the comments above.

Regards,