

Comment on **essd-2021-425**

Veit Helm (Referee)

Referee comment on "A new digital elevation model (DEM) dataset of the entire Antarctic continent derived from ICESat-2" by Xiaoyi Shen et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-425-RC2>, 2022

Review:

A new digital elevation model of Antarctica derived from ICESat-2
Shen et.al. 2022

The study presents a new elevation model of Antarctica based on one-year of ICESat-2 observations. The authors provide a specific time-stamped DEM with a final pixel size of 500m, following the same approach as presented by Slater et.al. (2017).

The new DEM is validated against OIB and GNSS data and compared to existing Antarctic DEMs. Results show an improved accuracy compared to DEMs based on Radar altimetry but with less accuracy than DEMs based on Radar interferometry or Stereo-Photogrammetry.

In general, it is an interesting project and worth to be published as ICESat2 provides precise point information with high accuracy and good coverage. This large data base should be used to generate a gridded data product of high quality which is easily accessible and to be used in different applications. The authors did this approach in a comprehensible way. The paper was already submitted to TC and underwent a review process. Most of points of my former review were answered and corrected.

The paper is well structured, methods are explained and figures are of high quality. The validation against OIB and GNSS is clear and shows at least in numbers an improved DEM compared to other Altimeter based DEMs.

Data is accesible via the data link

Based on the paper I was now curious to have a look to the DEM itself.

However, after looking at the data I'm a bit dissapointed and have some question marks with respect of data quality and usability of the dataset. Attached are two screenshots of the DEM underlain by its hillshade. It can be seen that there are a lots of artefacts visible, even over the flat lake Vostok. Elevation differences at those erroneous pixels are in the order of meters to tenth of meters. In addition a grid like structure is visible in the hillshade or in a roughness image created from the DEM itself. Furthermore the uncertainty map makes absolutly no sense to me. One can see tracks with uncertainties of 0.01m and between those tracks the values jump to 30 / 50m or more.

I'm wondering why the erroneous pixels are not seen in the statistics of the validation. I think the authors should re-think their methodology in respect to outlier detection as well as the uncertainty . Where are the outliers come from? Why do you have such large jumps in the uncertainty map.

Based on the data set itself I cannot recommend a publication at the current stage as to my opinion this data set is not useful because there are too many erroneous pixles all over Antarctica.

Please also note the supplement to this comment:

<https://essd.copernicus.org/preprints/essd-2021-425/essd-2021-425-RC2-supplement.zip>