

The Cryosphere Discuss., referee comment RC1
<https://doi.org/10.5194/tc-2022-129-RC1>, 2022
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Comment on tc-2022-129

Pietro Milillo (Referee)

Referee comment on "Grounding line retreat and tide-modulated ocean channels at Moscow University and Totten Glacier ice shelves, East Antarctica" by Tian Li et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-129-RC1>, 2022

The Authors use Sentinel-1a/b Interferometry combines with ICESat-2 laser altimetry between 1996 and 2020 to monitor grounding line retreat over coherent parts of the Moscow University and Totten Glaciers. They combine bed topography, ice velocity maps, tidal information and historical grounding line position to map both long term grounding line retreats and tidally induced grounding line retreats. As stated in the conclusions, I would not consider this paper a "*comprehensive investigation of both short-term and long-term GL changes*", since the InSAR data are decorrelated over key areas (main trunk) over these two glaciers, but more a confirmation of the tidally induced grounding line migration dynamics.

Nevertheless, the paper is well written, fits the topic of the journal and I would like to see it published on The Cryosphere.

I have some recommendations before accepting this paper for publication:

1. The authors states that "*large uncertainties might exist for the MEaSURES GL in 1996 due to tidal amplitude variations*". I believe this sentence is not accurate because this is not about the measurement accuracy but measurement availability as a function of the tidal cycle. A single InSAR GL measurement can have accuracies between 100-200 meters. Hence, I would rephrase this with something like "*The 1996 GL MEaSURES dataset only provides one grounding line measurement which does not allow us to characterize the tidally induced grounding line variability*".
2. For some reasons the authors did not include these dataset in the tidal plots (Figure 3,7,9) The authors state that they did not reprocess the ERS dataset because of the "*lack of available Level1 ERS-1/2 SAR SLC data in this region*". Perhaps you could look at the Level0 raw data and check in the annotation files the acquisition time? This would enable

to put in context the 1996 grounding line as a function of tidal levels.

3. Lines 200-203: The authors find a high positive correlation with the absolute tidal range, I think it would be worth highlighting this goes against (Tsai and Gudmundsson 2015) theory indicating an asymmetric migration between high and low tides. Moreover, It is not clear to me why (as an example) to a negative low tide of 1 meter should correspond an inland retreat of the grounding line equal to a positive 1m high tide.

4. Lines 222-223 The authors find evidence of tidally modulated subglacial lakes, but do not show the bed potential that would accommodate the creation of these lakes.

5. Lines 259-260 Authors mention Points F and H but I was not able to locate them in the figures. Perhaps it would make sense to add them also in the Primary figures and not in the supplementary material.

6. The authors find no correlation between tides and GL migration over Totten East. I do not have enough elements to assess this result since no map showing where the CATS 2008 reference point has been taken is present in the manuscript. If the authors chose the same reference point for both glaciers then this could explain why one glacier is uncorrelated. The authors should display these info, describe them in the text and justify the reasons behind their choice.

Tsai, V. C., & Gudmundsson, G. H. (2015). An improved model for tidally modulated grounding-line migration. *Journal of Glaciology*, 61(226), 216-222.

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