

Interactive comment on “Marie Byrd Land glacier change driven by inter-decadal climateocean variability” by Frazer D. W. Christie et al.

Anonymous Referee #3

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In this manuscript Christie and colleagues compare a newly developed product of grounding-line migration along the Marie Byrd Land sector with changes in surface elevation and discuss possible ocean forcing of the observed changes.

My limited knowledge doesn't allow me to comment on the quality of these products or on the method used to obtain them. However, I enjoyed reading the in depth analysis of possible ocean forcing and its mechanism. The authors computed the wind stress anomalies and the Ekman upwelling, looked at the configuration of the bottom topography, the location of the ACC and Antarctic slope current. This results in a very interesting investigation. However I think analysis could be made clearer. See here three examples to help doing it:

- The issue of why 33% of the grounding line retreated over the full 2003-2015 period
- C1

is not clear. This is reflected by the short and speculative section 4.1. I do not think this problem should be solved in this manuscript but a clear acknowledgment of the remaining unknowns seem necessary. Maybe stating clearly that the observation of long term grounding line retreat are probably linked to ocean forcing but this cannot be shown given the limited data available and the precise mechanism is unknown.

- In 4.2.1 the fact that grounding line retreat slow down during the 2010-2015 period but the shelf continued to thin is discussed. At the end different hypothesis are made to explain this apparent contradiction: “Possible confounding factors are surface mass balance processes, grounding zone bed geometry, and local-scale changes in ice dynamics.” These factors are discussed at length in the following sections so it would be interesting to have the answer to that contradiction in the conclusion.

- In 4.2.3 the authors say: “Until more comprehensive knowledge of Getz Ice Shelf's grounding zone bed structure exists, glacier/ice-stream- specific internal variability, moderated by bed conditions at the 2010-2015 grounding zone, cannot be reliably dismissed as an additional control on the slowdown of GL retreat rate during the CryoSat-2 era.” but then in the conclusion I read “We attribute the observed slowdown in Getz Ice Shelf's grounding-line retreat to a reduction in external climate-ocean forcing as inferred from climate reanalysis data.” This sounds contradictory, bed geometry might have played a role but the authors conclusion is still that ocean forcing is responsible for the slow down.

Minor comments:

The expression “climate-ocean” is strange, the ocean is part of the climate system, I think in most places it could be replaced by atmosphere-ocean or more explicitly “wind driven ocean”.

p.1 l.15: “33% of the grounding line underwent retreat”, how much underwent advance? It could help the reader by stating this here as well. I first thought this meant that 67% underwent advance.

p.6, l.28: f is the Coriolis parameter not the variations in the Coriolis parameter

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-263>, 2018.