

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

### **Anonymous Referee #1**

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The authors analyzed the glacier changes in Marie Byrd Land sector for the past 20 years. Using ICESat and CryoSat-2, they show that grounding line retreat reduced by 68% in CryoSat-2 era, which is caused by oceanic forcing. Although slowdown of grounding line retreat is an interesting and important finding, their argument that observed changes are caused by “reduced Ekman upwelling on and around the continental shelf” is not well supported. I recommend major revision. Very nice results, but some interpretations seem to me rather too speculative. More analyses and/or different interpretations are required.

Major comment :

#1 Very good job listing oceanic processes, which may impact the glacier retreat. Although authors are aware of many oceanic processes, authors conclude that “during

weaker offshore winds relative to the ICESat era reduced Ekman upwelling on and around the continental shelf, resulting in a decline in Circumpolar Deep Water intrusion to the sub Getz ice-shelf cavity”, which is not supported from any of the analyses conducted in the paper.

As authors are aware, oceanic conditions (e.g., large and small scale circulations, bathymetry, stratification, etc) are very much different in the Marie Byrd Land sector. Since there are many processes potentially controlling potential temperature in the ice shelf cavity and thus ice shelf melt rates and relative importance of these processes are likely regionally different, authors are not able to conclude that “reduced Ekman upwelling on and around the continental shelf” is the key process for this region, just based on the fact that they observe changes in Ekman upwelling. Cited papers such as Steig et al., 2012, Dutriex 2014, and St. Laurent et al., 2016 have conducted data analysis and/or modeling. Further analysis including data analysis and modeling is likely required to claim that “reduced Ekman upwelling on and around the continental shelf” is the reason for the observed changes.

#2 The title of this paper indicates that glacier change is driven by inter-decadal climate ocean variability, which is misleading. Authors do not show that the impact of other processes are small. There are other processes impacting glacier retreat (section 4.2) and these processes may possibly be more important (e.g., subsection 4.2.3).

Minor comment

Page 9 Lines 14-25 : It is clearer if authors can show spatial pattern of vertical Ekman velocity for each era (not just the difference as in Figure 5).

Page 11 Lines 10-11 : Even if it is fully synchronous, it is not convincing that “reduced Ekman upwelling on and around the continental shelf” changes the oceanic condition in the ice shelf cavity, reduces the melt rates, and slows down the grounding line retreat. As stated above, there are many processes and further analyses are required.

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Page 11 Lines 23-27 : Where do you mean ? Is there different polynya in near Getz region ? If so, are these responding similarly to the Amundsen Sea polynya?

Page 14 Lines 10-29 : “These longitudinal limits corresponds broadly with . . . Getz Ice Shelf”. These argument seems speculative. Need more clarification.

Page 15 Lines 22-Page 16 Line 12 : See major comments #1 and #2.

Figure 6 : This seems to be not accurate. Should circulation off the Marie Byrd Land sector be influenced by the Ross Gyre and CDW circulation be opposite ?

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

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