

Interactive comment on “Bathymetric Controls on Calving Processes at Pine Island Glacier” by Jan Erik Arndt et al.

Anonymous Referee #1

Received and published: 10 February 2018

The manuscript presents new, recently exposed bathymetry data from the Pine Island Bay that show a former ice shelf pinning point and links this pinning point to changes in calving, rifting and movement of the Pine Island Ice Shelf over the last 10-20 years. This is an important and timely paper because it demonstrates the importance of such shallow pinning points for an ice shelf and is contributing to the ongoing debate of ice shelf stability. The paper is well written and structured, and I have only some minor comments:

When discussing the implication of the ridge to ocean circulation and the history of unpinning from the ridge it would be good to also discuss, and maybe compare, the effect of the major ridge to the SE discovered by Jenkins et al. 2010 (Nature Geoscience) and related unpinning there described by Smith et al. (2016; doi:10.1038/nature20136).

C1

There is no discussion or analysis regarding the the impact of the unpinning on ice flow velocity of the ice shelf. This might be beyond the scope of this paper, but it might be interesting to see if there was a changes in ice flow velocities before and after the unpinning.

Detailed comments: page 2- line 15: rifts calving in 2015 occurred parallel to ‘R1’ and ‘R2’. Figure 1 only shows ‘R2’. Did the calving happen along rift ‘R1’, in which case the current ice front more or less represents ‘R1’? If yes, the text could state this. If not and ‘R1’ has not calved off yet, this should be mentioned as well and ‘R1’ should also be labeled in Fig 1.

page 3-line 12-16: Ice thickness data. An alternative or addition to using published ice thickness data could be to use Operation Icebridge data (<https://nsidc.org/data/icebridge/>). There seems to be ice thickness data for Pine Island Glacier and the ice shelf available from the ice bridge flights and they could help reducing the uncertainty mentioned in the text. The flights 2009 – 2016, although I am not sure, if for every year.

page4-line 117: the text states that there is “no indication of ice contact”. However, the fact that the iceberg in 2015 did not move away with the initial break off and was then turning around the pinning point suggest that the ice still had some contact with the shallowest part of the ridge. This is described later in the text on page 5-line25 and discussed on page 6 and 7. I suggest adding this here as well, e.g. along the line of “However, movement of a ground iceberg after the rifting suggest light or partial grounding on the shallowest part of the ridge”.

p6 -line 2/3 switch from ‘straight’ to ‘curved’ calving lines. It might be worth noting or stating more clearly that the most recent calving lines (2015, 2017) are straight again, but with a different orientation. The curved calving lines seem to be more a transitional stage as the calving front are reoriented.

p8-18: change “mat” to “m at”

C2

Figure 1 - The text mentions rift R1, R2, and R3, but only R2 is shown. I assume that R1 has already broken off and that R3 might not have formed yet (It's hardly visible in Fig 5). Still, it would be useful to mark the approximate position of R3 on the map for orientation, e.g. with an arrow. It could say: R3 position is approximate since R3 isn't really visible in the image yet. Some lighter/brighter colors for some of the ice front positions (e.g. the blue one) might make them more visible on the map.

Figure 2: I suggest adding the contour lines of the shoals to the legend.

Figure 3 Are the colors for the contours the same as in Fig 2 and 4?. The caption only states 400 m (red) and 450 m (blue), whereas the other figures have dark red, light red and blue. It would be good to have the same colors for all figures.

Figure 4: I suggest pointing out the curved carving line that is referred to in the text with an arrow and a label in fig 4b.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-262>, 2018.