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Interactive comment on "Thinning leads to calving-style changes at Bowdoin Glacier, Greenland" *by* Eef C. H. van Dongen et al.

Anonymous Referee #2

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In this paper van Dongen et al. undertake a detailed study of Bowdin Glacier, NW Greenland, utilising an impressive combination of remote sensing and field data. Utilising these data, they argue that there has been a change in calving style from submarine melt driven calving to buoyant flexure driven calving. Overall I'm convinced by the arguments presented in the paper, though have a few minor points outlined below. However, the article is generally very well written, and the authors should be congratulated on pulling together such a nice range of data.

L185-6 – a bit more explanation as to why figure 5 shows the vertical tidal modulation being significant would be beneficial. At present it's unclear why results are significant in panel b but no in panel c/d

L248 (& L155) – it's mentioned earlier on that Sentinel 1 data are analysed – how are

these processed to ensure comparability/homogeneity with optical data?

L263 – I would change "expect" to a phrasing that is a lot less definitive. Unless you have thickness information to demonstrate that thinning is sufficient to lead to the terminus becoming fully ungrounded, it would be more appropriate to say that the terminus is getting closer to floatation

L260 – I quite like the your intro to the discussion (just having now deleted my comment saying it wasn't needed!). For a data heavy paper like this it lines up and signposts the main points in the discussion nicely.

Section 5.1 – compelling case that the terminus was partially ungrounded.

L299 – are these crevasses visible from satellite or available time lapse imagery? I'm not 100% convinced that the photographs provided do actually give definitive evidence of calving being propagated from extensional rifts in 2015/17. It may be worth reiterating evidence from previous studies backing submarine melt undercutting as the mechanism. However, I agree that the GPS observations point towards a buoyant flexure style of calving in 2019.

L328-331 – figure 4 is very small, which makes clear identification of the small scale variability of thinning and also the location relative to the moraine. I suggest this figure be made larger and an extra panel showing a satellite image of the glacier (with centreline marked) that would allow clear identification of these. Regarding the dynamic thinning hypothesis I'm not entirely sure what you mean by this with respect to the shear zone. Similarly with the mechanism for shear forming basal channels beneath the depressions. This section would benefit from clarification.

Section 5.4 – showing panels for each year of the glacier terminus positions used to derive the calving event sizes would be useful to compliment figure 12, showing where and how each calving event occurred. It would also aid the discussion in this section (5.4) which is a bit tricky to follow. As it is, figure 1a showing ice front info is not especially useful/relevant to the study as it is annual and goes back to 1973, whereas the period under investigation is 2015-19.

More generally, I would say that the observations presented do not represent clear cut evidence of a transition from one calving style to the next. For example, given the stochastic nature of calving I would be a little cautious in ascribing too much meaning to a few individual events that happen pre/post initiation of melt, even though they may be substantial. What is more convincing for me is the combination of the previous studies (Jouvet et al., 2017; van Dongen et al., 2020a,b) identifying that large scale calving events occurred due to hydrofracture/melt undercut, the arguably circumstantial evidence presented here, and evidence for recent ungrounding combined with GPS data showing evidence of calving by buoyant flexure. I think the discussion would benefit if these lines of evidence were linked more strongly.

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