

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2021-105

Anonymous Referee #2

Referee comment on "The instantaneous impact of calving and thinning on the Larsen C Ice Shelf" by Tom Mitcham et al., The Cryosphere Discuss.,
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This paper studies the impact of the recent large Larsen C 's calving event (iceberg A68) on the stability of the ice shelf and the ice velocity change both on the ice shelf and at the grounding line. This first simulation is followed by a series of synthetic perturbations of the ice shelf to study the potential effect of future calving event or large thinning.

The paper is well written and easy to read, with a sufficient amount of detail (generally). The paper is in line with a series of previous papers treating the buttressing effect of ice shelves: e.g., Fürst et al. (2016), Reese et al. (2018), Gudmundsson et al. (2019). In that sense, I think that the paper proposes a limited novelty in the field.

I think that the real case modeling of the A68 calving event and the comparison of the model velocity change with Sentinel-1 SAR observations is particularly well treated and gives a valuable and additional piece of information to the current literature on buttressing and the effect of calving events. Indeed, such processes are often treated only from an observation point of view or only from a model point of view. I really enjoyed the combination of the two here, although a previous and similar work has been conducted by Borstad et al. (2017), which is "acknowledged" by the authors.

However, I have some concerns about the significance of the instantaneous response of ice shelves and tributary glaciers to downstream ice mass loss. Since such steady modeling does not account for any transient, it seems only a good tool to simulate the effect of small variations for which the transients (ice thickness evolution, advection of the ice front post calving event, "degrounding" of grounding zones due to dynamic thinning, etc.) remain limited. I fear that the results obtained for the largest perturbations applied (thinning or calving of most of the ice shelf) are very theoretical (in the sense that they do not capture the entire physics of an ice-sheet evolution) and of limited value to assess the real effect of an entire (or substantial) collapse of the ice shelf. Also, community work such as the ABUMIP experiment (Sun et al., 2020) already focuses on the transient effects of similar events (ice shelf collapse).

I therefore think that some transient simulations, allowing the ice shelf and its tributary glaciers to evolve after a calving event would greatly improve this study, bringing more insights on the real impact of calving on Larsen C but also other ice shelves. It seems that the authors intend to do such work in the future (as they raise some questions at the end of the discussion) but maybe a part of this work should be included in the present publication.

I also have a few minor comments that are listed below.

Please also note the supplement to this comment:

<https://tc.copernicus.org/preprints/tc-2021-105/tc-2021-105-RC2-supplement.pdf>