General comment

I want to thank the authors for having addressed most of my comments during their revisions. The current paper is nicely written and is well detailed. I also appreciate the new simulations they conducted in the Appendix to better emphasis some arguments from the main text.

Yet, my main concern (as for my first review) is the significance of the instantaneous response of ice flow to a mass loss and the lack of a proper treatment of the transient effects following such event. I still think that this drawback limits the interpretation of the experiments, especially in the case of large ice-shelf thinning experiments that should not be treated as an instantaneous event (i.e. large thinning would most likely occur over a long-time scale, giving time to the upstream flow and geometry to adapt).

As the authors argue in their response to reviewers, the aim of this work is to identify the principal buttressing points of Larsen C Ice Shelf and their impact on grounding line flux when this buttressing is released — and, in this regard, the paper is very nicely wrapped. I also understand that the authors are currently conducting transient simulations and that such work can take time. However, I think that the current paper brings only limited insight in comparison to published literature, e.g. Furst et al. (2016) Reese et al. (2018), Gudmundsson et al. (2019) and Zhang et al. (2020) for buttressing, and e.g. Borstad et al. (2017) for the calving of A68.

The main conclusion of the paper, except the quantification of the real calving event of A68, which nicely couples modeling and observations, is that only a small portion of the ice shelf (close to the GL) really matters to buttressing. While this conclusion is in line with pre-cited studies, it does not really bring new insights about buttressing and the methodology is very similar to Reese et al. (2018) and Gudmundsson et al. (2019).

In the current study, the effect of the ice rise seems much smaller than in previous studies. For example, Zhang et al. (2020) also addressed the same question with an adjoint sensitivity (more reproductible and computationally much cheaper, in my opinion) in the context of ocean-induced melting on LCIS. Their results (particularly Fig. 12a) generally agree with Furst et al. (2016). In this regard, the current study results are more in line with Borstad et al. (2013) that see only a small effect of the ice-rise loss on the GLF. However, they observe a 25% change in velocity on the shelf, that, in a transient model, could have important effect. If the authors do not go with transient simulations, I think that they should better relate their paper to the previous literature (comparing results, etc).

For all these reasons, I had a really hard time deciding what recommendation to give for the paper. To me, the lack of transient experiment and the lack of novelty with respect to the published literature are a bit redhibitory. I therefore really recommend to the authors to pursue their effort towards transient simulations and include them in this paper.

Minor comments

Title: I would change “ice-shelf thinning” for “thinning” only to avoid a repetition.

Line 48- 63: I think that I think that the ABUMIP paper from Sun et al. (2020) should be cited in the context of this study.

Line 55: I would change the sentence "*Gudmundsson et al. (2019) modelled the impact of an instantaneous perturbation to Antarctic ice-shelf thickness, the spatial pattern and amplitude of which was taken from observations*" for "*Gudmundsson et al. (2019) modelled the impact of an instantaneous thinning of Antarctic ice-shelf on the grounded ice and GLF, with a pattern and amplitude derived from observations*".

Line 58: change "*for the last 18 years*" for "*from 1994 to 2017*". I would also reorder the sentence *"[…] the instantaneous ice velocity response due to the observed ice-shelf thinning of the last 18 years, and the subsequent reduction in buttressing"* as follows *"[…] the instantaneous ice velocity response and the reduction in buttressing due to the cumulated observed ice-shelf thinning from 1994 to 2017"*.

Line 64 to 66: I thank the authors for clearly stating the "instantaneousity" of their experiments. I think that these two sentences could be reshaped in only one, more powerful sentence. For example, *"a series of diagnostic perturbation experiments of increasing magnitude"* is a bit vague and only gets clearer reading the second sentence. The literature they used to build their experiment is also not only related to LCIS (but the sentence seems to say the opposite, i.e. *"existing literature on the ice dynamics of the LCIS"*).

Line 70: correct the typo: *"alnd"*

Line 101: Thank you for the addition of Appendix E. Should this be Appendix A, as it is the first you reference in the main text? I do not know what are the referencing rules for Appendix.

Line 128: reformat the references in only one parenthesis?

Equation 7 and Appendix A: Why do you choose $\gamma_{s_{A/C}} = 10^3$? I agree that your modeled velocities nicely fit observations so that might be a bit picky but the L-curve in Fig A1. (a,b) seems to show that $\gamma_{s_{A/C}} = 10^4$ is a better value, *i.e.* with the smallest velocity misfit. Similarly, I would be tempted to say that $\gamma_{a_{A/C}} = 10$ is a better value than 1. It also seems that you treat your L-curves independently but I assume that the choice of one parameter impacts the choice of the others, why not going with a multi-dimension L-curve like in Furst et al. (2016).

Line 142: penalize deviations?

Line 193: Maybe precise why did you see such negative velocity change. Reorganization of the ice flow due to the change of geometry and buttressing?

Line 237: add a comma to *"[…] (of 1,500 m), the ice shelf […]"*.

Line 238-239: Precise that these metrics are before perturbation.

Line 320: space between "m" and "a^{-1}".

Line 320-324: I think that this is where the instantaneous approach really shows its limit. I don't think that these numbers are really meaningful. When making estimations of future state of the ice sheet, we really want to know what will be the total mass loss, which is not possible with the approach of this paper.