

## ***Interactive comment on “A sensitivity study of fast outlet glaciers to short timescale cyclical perturbations” by E. Aykutlug and T. K. Dupont***

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We would like to thank the referee for their time reviewing our paper, and raising the important points below. We address each of the referee points below to help clarify our discussion, and will update the text to emphasize these points further.

(i) Our main motivation for implementing short timescale cyclical perturbations was to investigate whether including fast variations around the mean value of parameters would lead to any non-trivial effects on the longer-term behavior of outlet glaciers. In particular, we analyze whether including fast variations around the mean values of certain parameters could yield a time-averaged difference, when compared to the response for which the same parameters are held constant in time. As we point out in the introduction, other studies have shown that including changes in environmental

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forcings on short timescales can have prominent effects. Complimentary to these studies, our objective was to investigate whether including the oscillations around the trend would contribute to the changes from a modeling perspective. We will modify the text to emphasize these points.

(ii) We agree with the referee that the changes in Table 1 are of limited nature. However, our objective was not to specifically model seasonal changes, but to investigate whether including fast variations in certain parameters around their mean values would lead to any change in outlet glaciers' longer-term behavior. The results summarized in Table 1 indicate that including fast oscillations in basal friction can make a difference, while changes to other parameters may not. We further expand our analysis in Section 4 to consider how these changes can become more important as the glaciers become closer to floatation. We will extend the discussions on these results to emphasize these points further.

(iii) We agree that these two glaciers have different reference parameter values, and only the amount of initial grounded-area at the reference configurations are similar. Our main objective was to show that short timescale oscillations in basal friction can lead to a significant change in the grounding line and volume above floatation for different scenarios. Our results indicate that the response under different scenarios can span a range of values from negligible to non-trivial. We did not intend the reader to compare the two reference configurations as similar in all aspects except for the bed slope. We would be happy to perform additional experiments to investigate the effects of bed slope alone by comparing two glaciers with different retrograde bedrock geometries. We can also accordingly update the experiments in Section 4 where we consider perturbations of basal friction as the glaciers become closer to floatation.

Best Regards, E. Aykutlug

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