

## ***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 their encouraging comments. We address the general comments below, and we will update the text to reflect all the changes suggested in minor comments by the referee.

- 1) We would like to thank the referee for suggesting this extended analysis. We will extend the discussion to include comparisons of area-averaged basal stress in addition to the changes in grounding line and volume above floatation.
- 2) As is pointed out by the referee, in our experiments the oscillations in basal melt rate around its mean value did not lead to a significant change in the grounding line or volume above floatation. The width of the response in Figure 4 does reflect the

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magnitude of oscillations, which are not significant. We will make this point more clear, and point this out earlier in the text as suggested by the referee. As we point out in Section 3, under the chosen configurations, our experiments suggest that even though the increase or decrease in sub-shelf melt can have significant effects, the modeled dynamics may not be as sensitive to the fast oscillations around the mean value over short period of times. Different configurations (e.g., dynamic calving, moving ice front), as well as including higher-order modeled dynamics could yield different results.

3) We agree with the referee that it is interesting that the decadal oscillations lead to a smaller net change compared to the annual oscillations. To investigate this point further, we will extend our analysis by including experiments where  $C_b$  experiences a perturbation on a 20-year period. We can also include experiments where  $C_b$  is set to its minimum or maximum value, to get insight into the limiting case where the period of oscillations are long enough for the dynamics to reach steady states at these limiting values. Regarding the velocity changes, we agree with the referee that the longer times could allow more time for the ice shelf to adjust to the changes. We also would like to point out that the ice front is held at a fixed position in our experiments, and future studies with more complicated models could possibly lead to more involved results.

Best Regards, E. Aykutlug

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