

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

**Anonymous Referee #1**

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Aykutlug and Dupont propose a sensitivity study of the response of outlet glaciers using a flowline shallow shelf model. Steady-state geometries are affected through annual and decadal perturbations of various boundary conditions and the model response is evaluated through changes in grounding line position and volume above floatation. In particular, the authors compare the respective response of outlet glaciers resting on a prograde and retrograde bed slope, highlighting a higher sensitivity of this latter.

To my opinion this work cannot be published in its current state for various reasons and particularly in reason of what I believe is a serious methodological flaw (last point below).

(i) Relevance of their results is poorly discussed in a broader context. What does this imply for actual glaciers? How important is it to investigate these cyclical changes, may

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these influence future projections of outlet glaciers dynamics, how?

(ii) Authors are careful in using a mesh resolution fine enough (250 m) to model grounding line dynamics in a consistent way. This is clearly highlighted in their convergence experiments shown in Figure 1. However, to my understanding, all the perturbations applied leads to very limited grounding line displacements, with seasonal oscillations of a couple of elements at maximum (see table 2). These variations are extremely small in comparison to observed seasonal changes. Then, one can question whether their perturbations are of significant amplitude, or if the processes investigated are at play? This is not discussed.

(iii) The discussion is essentially driven by the different responses between 2 glaciers, one resting on a prograde bed slope, the other on a retrograde one. When we refer to table 1 which presents the various flow parameters used, one can see that these two glaciers have nothing in common: basal friction, buttressing parameterization, accumulation and upstream prescribed fluxes are different (and therefore relative changes of xx % in perturbations of basal drag and accumulation are different from one geometry to the other). The motivation and relevance of these choices are not discussed at all! In the current presentation of their work the only firm conclusion that I would be able to draw is that different glaciers respond differently to different perturbations. So what?

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