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Discussions

Interactive comment on "A simple model of mélange buttressing for calving glaciers" *by* Tanja Schlemm and Anders Levermann

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We thank the reviewer for the thoughtful comments which will improve our manuscript greatly. In a revised manuscript will incorporate them in the following manner:

- Mélange thickness to prevent calving:
  We agree with the reviewer that mélange thickness is usually much less than glacier thickness and this is sufficient to prevent calving. Consequently it is probably more realistic to assume calving is inhibited when mélange thickness has reached some fraction $h = cH$, $0 < c < 1$ of the ice thickness. This introduces the factor c into equation (4) without changing the result qualitatively.
- Steady-state assumption:

We also agree with the reviewer that applying a steady-state solution to a scenario with calving front retreat is difficult. We will address this by repeating the idealized scenario experiments of section 4 with a time-dependent upper bound $C_{max} = a^{-1}$. The argument for applying such a quasi-equilibrium approach (without explicitly accounting for the time derivatives for example in the melange volume) will be given in a revised manuscript along the following line: Glacier retreat happens on a timescale of months to years while mélange equilibration is expected to happen much faster. This means that each retreat of the calving front leads to an updated mélange geometry which gives an updated C_{max}. In particular, keeping the position where mélange exits into the ocean fixed, the length of the mélange, L_{em}, increases when the calving front retreats, leading to smaller upper bounds C_{max}, i.e. slower glacier retreat.

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