Comment to TCD paper 'A simple stress-based cliff-calving law

Dear authors,
With interest we saw this TCD paper on a cliff-calving-law, in particular as it seems in its approach in many ways very close to our recent co-authored paper in The Cryospere (Mercenier et al 2018, https://doi.org/10.5194/tc-12-721-2018), further referred to as M18.
Both papers use the 2-dimensional full-Stokes stress-field (and scale it) on an idealized rectangular glacier geometry with variable water depth for scaling the location/extent of the stress maxima/critical stress and some failure time related to a damage approach; and both derive a calving 'relation' from that.

Despite its similarity we think this paper may provide a valuable additional contribution to the general development of new calving models as it differs in the details of formulation and expression, criterion and parameters used and in its focus on 'cliff'-calving.

However, we feel this paper lacks a clear and more detailed discussion of the proposed calving-law to other existing approaches and in particular to the similar approach in M18. It is currently not clear how similar the final calving-relationships and results of the proposed approach really is to M18 or in what way their results differ (the results are unfortunately plotted very differently).
In order to compare the relations I replotted both below in fig. 5 and fig. 7 (the M18 calving rates are from eqn 22 and the failure length from eqn 18 in M18).

These plots clearly quantify how different the two approaches are in their calving rate relationship (see calving rates in fig 7) and also shed some light on why this is so. According to fig 5 it seems to be the approximation of the choice of the failure length (and not the approximation of the failure time) which in this Schlemm-paper is based on the location of the threshold (1Mpa) whereas in M18 it is taken as the location of maximum tensile stress at the surface.
For low freeboards (that are actually observed in nature) this leads to a huge difference (see fig 5 and 7) and the models give only similar results for very high freeboards between 250 and 600m, which we do not think are observed in nature. Question: could one interpret from this that 'cliff'-calving rarely occurs in nature?

This difference for low (realistic) freeboards may also explain the reason why Jakobshavn calving rates are here in this Schlemm-paper strongly underestimated. The proposed calving relation seems to be developed for the 'cliff calving' case, and as stated for relatively high free-boards. But the issue is that such high freeboards (>200m) are rarely observed which questions somewhat the proposed model.

We do not want to claim that the M18 calving model is in anyway more realistic, and we acknowledge that this study (Schlemm et al) has a different focus/purpose, namely on the 'cliff calving'. But we think a more extensive discussion and comparison with M18 (and maybe other models such as Bassis (2011)) would be useful as the approaches are very close in many ways, but different in important points (maybe could also be clarified in the methods p. 7 around line 5).

For the same reason it would also help to better introduce the model of M18 in the introduction, currently it is simply introduced as one calving model within many others with no reference to the similarity in approach to this study.
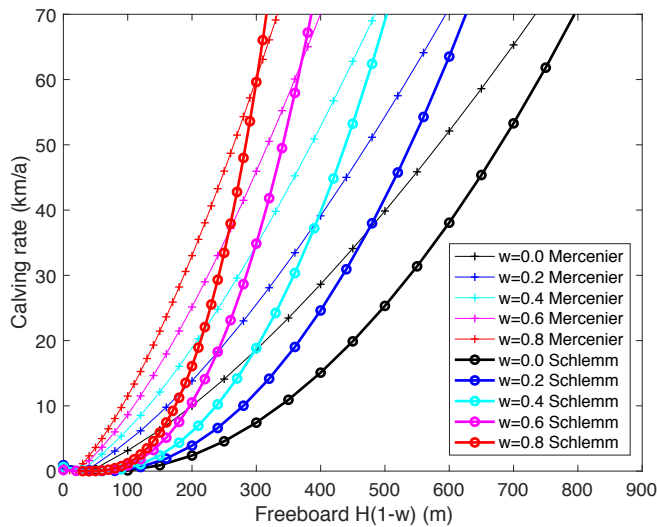

Fig 7 of Schlemm (TCD) redone: calving rate against freeboard for Schlemm (in review TCD) and M18.
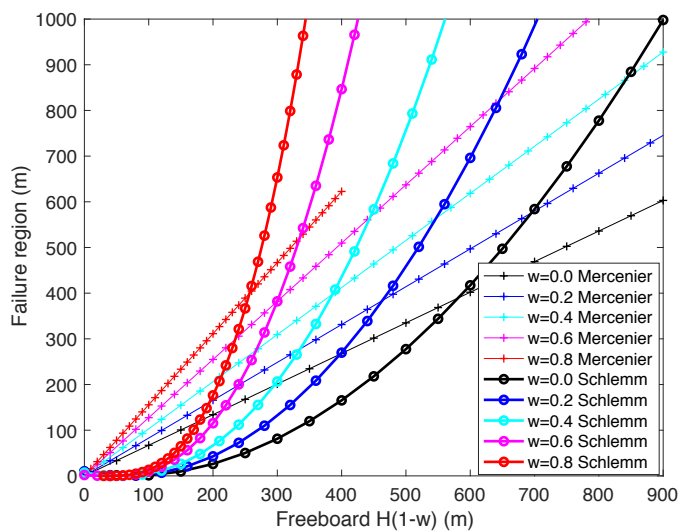

Fig 5 of Schlemm (TCD) redone: showing failure region length (behind front) against freeboard for Schlemm (in review TCD) and M18.

A few other minor editing issues we came across:

- p. 6 line 7: the last sentence missing something (not complete sentence).

- Eqs 15 and 23, it should probably be 0.356 rather than 35.6% to be consistent with figures
- The 'B' from eq 18 (the rate factor for damage evolution) and 21 (effective damage rate) are two different quantities, therefore their notations should be different to avoid confusion (see Eq 22 in M18)

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