

Originality

This study builds upon existing literature whereby frontal and submarine melting rates and calving rates were optimised through ensemble modelling to reproduce the observed retreat of Sermeq Kujalleq. This study employs a new calving rate parameterisation whereby the threshold stress which ultimately controls the calving rate changes linearly as a function of temperature. This is proposed as a simple modification to a tensile stress based calving law which accounts for seasonal and interannual variability of ice melange and its associated buttressing potential.

Scientific quality

The aims of the study are well defined and have benefitted from the manuscript update. The methodologies are well defined and the assumptions and limitations of the parameterisations relied upon are clearly stated. The results and conclusions are discussed in context of existing literature throughout.

Significance

Whilst the motivation for the study set out to disentangle the drivers of Sermeq Kujalleq's observed retreat between 1985 and 2018, and the results indicate a better understanding of these drivers, the study also illustrates the significant role that melange may play in buttressing glaciers and inhibiting calving. This is currently an aspect of ice sheet modelling with limited understanding and despite limitations in the approach taken in this study, the authors highlight how the community may benefit from future research in this area.

However, an aspect that is currently not discussed in the manuscript is the suitability of employing the tensile stress based calving law (or von Mises calving law (Morlighem et al 2016)). Although this calving law has been used relatively frequently in the literature over recent years, it is not so clear whether this calving law best parameterises the physical processes that drive calving. That is due to the dependence firstly on the tuning parameter (here the threshold stress parameter), and secondly the dependence of the derived calving rate on the ice flow velocity when the two are not necessarily related.

The reason for mentioning the specific calving law here is that it is unclear whether or not the conclusions of the study are robust. For example, if a different calving law was employed, would the melt and calving fluxes be reproduced in the same way discussed here and would such a dependence on the melange backstress be required to reproduce the observed calving rates. The purpose of the study was not to compare calving laws however, and considering ways to include parameterisations of melange backstress is an important feature of the study which may encourage further research in this area.

Presentation Quality

The methods, results and conclusions of the study are presented clearly and the manuscript flows well. The figures contribute well to the understanding of the study and on the whole can be interpreted easily. Some results and key findings of the study rely on results which are only presented in the supplementary data – for example, it is important to understand the near-terminus stresses in the glacier in the context of the varying stress threshold which controls the calving rate. The comparison of the change in flux due to melt and calving is nice, but has also been kept in the supplementary data. These figures being in the main text would add to the readers' interpretation of results.

Reviewer comments and manuscript updates

After consideration of reviewer comments, the authors have made significant modifications to the manuscript which have added greater clarity to the methodologies undertaken and interpretation of results within the context of current literature. The authors are open about the limitations of the study and highlight where simplified parameterisations have been employed to represent physical processes which are currently not well understood.