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Sensitivity of Greenland outlet glacier dynamics to submarine melting

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Over the last few decades Greenland ice mass loss has strongly increased due to surface melt and dynamic changes in marine-terminating outlet glaciers. A major reason for the retreat of these glaciers is believed to be related to increased submarine melting, which in turn is caused by surrounding ocean warming and the enhanced subglacial water discharge. These complex physical processes are not yet fully understood. Inspecting the sensitivities of submarine melting to model formulation and model parameters is crucial for investigations of outlet glacier response to future climate change.
Different approaches have been used to compute submarine melt rates of outlet glaciers using experimental data, numerical modelling and simplified analytical solutions. To model the process of submarine melting for a selection of Greenland outlet glaciers, a simple submarine melt parameterization is incorporated into a one-dimensional dynamic ice-flow model. The behaviour of this submarine melt parameterization is demonstrated by running a suite of simulations to investigate the sensitivity of submarine melt to changes in ocean properties and the amount and distribution of subglacial water discharge. A comparison of the simple parameterization with three-dimensional models and experimental data is conducted to assess the quality of parameterization and improve the parameterization of submarine melting.