EGU22-11758
https://doi.org/10.5194/egusphere-egu22-11758
EGU General Assembly 2022
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# Idealized high resolution modelling of plume dynamics and basal melting at Ryder Glacier

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Using a two dimensional, high resolution, non-hydrostatic regional model, this study explores the melt induced circulation under the floating ice tongue of Ryder Glacier (RG) and the influence of different aspects of the simulation, like ambient water temperature and ice base geometry, on the circulation.

RG is located at the southern tip of Sherard Osborn Fjord (SOF) in the north of Greenland, which was for the first time surveyed oceanographically in 2019. Low grounding-line water temperatures, complex ice-tongue and sill geometries, and permanent sea-ice cover outside the fjord, potentially make the ice-ocean interactions in SOF rather different from those in the more well-studied nearby Petermann Fjord.

The control simulation uses 2019 hydrographic observations as initial conditions. A set of model experiments is conducted to analyze the dependency of the plume behavior on the slope of the ice base and the temperature forcing from the in-flowing Atlantic water.

The simulated circulation and melt rates are qualitatively similar to previous modelling studies of North Greenlandic fjords. Based on observed ice-thickness transects along RG, two idealized ice tongue profiles are examined: one steeper and one shallower. The simulations with shallower slopes have a greater net basal melt and a stronger overturning fjord circulation, even though the melt plume initially is faster on the steeper slope. The results further suggest a direct relationship between the thermal forcing and the melt rate and resulting overturning time scale.

Additionally we discuss the possible numerical and physical implications of these results for future model experiments targeting the influence of basal melt on fjord circulations.